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**ABSTRACT BOOK**



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# **A-0001** EVALUATING THE DISTAL EXTENT OF VISUALIZATION IN VOLAR APPROACHES FOR DISTAL RADIUS FRACTURE FIXATION

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## INTRODUCTION

With the rise in utilization of volar locking plates, there is increased attention on volar approaches to the distal radius. Described approaches include the Henry approach and its modifications, the flexor carpi radialis (FCR) approach and the extended FCR approach (EFCR). Distal radius fractures may include the difficult to treat fracture of the volar ulnar corner - colloquially termed the critical corner. These fragments are problematic because they are often missed and fixation is difficult. Small size, thick periosteal coverage and remote location complicate their detection. Also, treatment is challenging due to fragment size, vascularity and tendon proximity to the volar rim.

Improved visualization and access to the volar ulnar corner of the distal radius can facilitate detection and fixation of these fragments, which is crucial for mitigating complication. We aimed to evaluate the extent of distal visualization of the volar surface of the distal radius using the classic Henry approach and the extended flexor carpi radialis approach.

## METHODS

Thirteen (13) matched pair specimens were randomized to receive either a Henry approach or an EFCR approach to the volar distal radius. A small Weitlaner retractor was placed proximally and opened to a maximum width to standardize the initial retraction. A mini Hohmann retractor provided distal retraction at the level of the volar ulnar corner, abutting the volar distal radioulnar joint capsule.

The angle of retraction by the Hohmann was standardized at 60 degrees. The force needed to attain 60 degrees of retraction was measured with a force gauge. At 60 degrees of retraction, a 0.062mm Kirschner wire was placed at the most distal and most ulnar point that was visible from a position directly above the incision. A digital caliper was used to measure the distance from the pin hole to the articular margin of the lunate fossa. This distance was measured along a line that was parallel to the long axis of the radius. Measurements were taken in triplicate by 3 authors.

## RESULTS

The EFCR approach resulted in a mean distance from the pin to the articular margin of  $2.94\text{mm} \pm 1.69\text{mm}$ . The Henry approach resulted in a mean distance from the pin to the articular margin of  $9.70\text{mm} \pm 2.70\text{mm}$ . The pin was significantly closer to the articular margin in the EFCR approach compared to the Henry approach ( $p=0.001$ ). Pearson's R correlation between the 3 observers was 0.997, 0.959 and 0.954 ( $p<0.0001$ ). The mean moment of retraction was not significantly different ( $p=0.22$ ) between the 2 groups.

## DISCUSSION

The morphology of the volar rim of the distal radius and the loading distribution across the articular surface yield predictive fracture fragmentation. Recent understanding of these variables has increased awareness of fracture of the volar ulnar corner. Our results demonstrate a significantly more distal visualization of the volar distal radius with the extended flexor carpi radialis approach compared to the Henry approach. Complete visualization of the volar ulnar corner improves the surgeon's ability to detect and fixate fracture fragmentation.

## **A-0004** A DISTAL RADIUS FRACTURE CLASSIFICATION PREDICTIVE OF ULNAR SIDED WRIST INJURY

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### Introduction

Distal radius fracture classifications are numerous with focus on fracture location, number of fragments, and fracture displacement. There is currently a lack of evidence to classify the potential for altered forearm kinematics due to distal radius fracture pattern. The Orbay Classification, introduced in 2010, stratifies fractures based on concomitant injury to the soft tissue stabilizers of the distal radioulnar joint (DRUJ), as determined by plain radiography. Our objective were (1) to determine the reproducibility of the the Orbay Classification and (2) to quantify the maximum allowable radiographic ulnar variance in Type I distal radius fracture.

### Methods

Three fellowship-trained hand surgeons classified 300 distal radius fracture radiographs as either Type I (intact TFCC and DIOLC); Type II (disrupted TFCC with intact DIOLC); or Type III (disrupted TFCC and DIOLC). Type II injuries were subtypes into IIa (disrupted TFCC with intact ulnar styloid), IIb (disrupted TFCC with ulnar styloid fracture) and IIc (disrupted TFCC with ulna fracture proximal to the styloid). Fleiss' kappa test was calculated for reliability. Maximum translation allowed by an intact TFCC was evaluated using an AO Type A2 extraarticular distal radius fracture in a cadaveric model. Proximal translation of the distal radius was measured in an unloaded position and then with axial loading to stress the intact TFCC.

### Results

Inter-observer reliability was excellent (kappa 0.926). Intra-observer reliability had a categorical score of good or excellent for each evaluator (evaluator 1 - kappa 0.731, evaluator 2 - kappa 0.764, evaluator 3 - kappa 0.851). Mean displacement of the distal radius fragment with maximal load to an intact TFCC was 2 mm (0.63 to 3.9 mm).

### Conclusion

Reliable inferences can be made from radiography of distal radius fracture for concomitant soft tissue injury which may alert the surgeon to underlying instability. Type I fractures maintain an intact TFCC and DIOLC and are therefore stable. Our results suggest that up to 2mm of proximal displacement of the radius under axial loading may occur with an intact TFCC. In Type II fractures, if the near anatomical alignment of the distal radius can be maintained, the TFCC may heal at a normal length and tension, restoring forearm kinematics. Type III injuries have disruption of the TFCC and DIOLC and nearly always require operative fixation in order to restore native forearm kinematics. By prioritizing associated soft tissue stabilizer injury in evaluation of distal radius fractures, surgeons are better able to stratify fractures that may benefit from operative fixation and to predict which injuries may require stabilization of the DRUJ after fracture fixation.

## **A-0008** TRENDS IN OPEN VS ENDOSCOPIC CARPAL TUNNEL RELEASE: A COM-PREHENSIVE SURVEY IN JAPAN

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We analyzed trends in open and endoscopic carpal tunnel release (CTR) from 2014 to 2019 using the National Database of Health Insurance Claims and Specific Health Checkups of Japan (NDB). Japan has a universal health insurance system and more than 95% of all claims are searchable in the NDB open data repository.

The results revealed that nearly 40,000 CTRs were performed annually in Japan, and open CTR was performed almost 4 times more often than endoscopic CTR. The average annual incidence of CTR in the general population among people 20 years of age or older was 32.2 per 100,000. The incidence of open CTR peaked in the 80–84 age range in both males and females. The incidence of endoscopic CTR peaked at 80–84 years in females and 75–79 years in males. There was a mild correlation coefficient for endoscopic CTRs and the number of hand surgery specialists by prefecture per population ( $r = 0.32$ ,  $p = 0.04$ ). However, the number of hand surgeons per capita by region and open CTR per capita was not correlated ( $r = 0.06$ ,  $p = 0.67$ ). In terms of population ratio, there was a tendency for surgery to be performed more often in rural than urban areas. During the study period, outpatient surgery increased compared to inpatient surgery, and was approximately twice as common. Nevertheless, inpatient surgery is still relied upon more frequently in Japan than in other countries. The findings from this study will help to develop future healthcare strategies for CTS.

## **A-0009** THE VOLAR APPROACH IN DISTAL FRACTURES OF THE RADIUS AND FLEXOR CARPI RADIALIS. REGIONAL AND NATIONAL SURVEY

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### Introduction

Different volar approaches have been described for distal radius fracture osteosynthesis. Some of them access through the sheath of the flexor carpi radialis (FCR) (FCR Approach), while others avoid opening it (Henry Approach). We have not been able to find studies comparing differences between them in the current literature. Our hypothesis is that, despite this, surgeons treating these fractures have different opinions regarding how to manage FCR sheath when operating these fractures.

### Material and Methods

An online survey was carried out among the members of the Catalan Society of Orthopedic Surgery and Traumatology (SCCOT) and members of the Spanish Society of Hand Surgery (SECMA) through an anonymous questionnaire using the SurveyMonkey platform (Momentive Inc., San Mateo, California, USA [www.momentive.ai](http://www.momentive.ai)) in order to assess their preferences regarding FCR tendon sheath management during distal radius fracture surgery. The analysis was carried out through tables and cross tabulations using the software of the same program.

### Results

From October 2020-2021, 99 responses were obtained, 55 upper extremity or hand surgeons and 41 general orthopedic surgeons. 72.72% open the FCR sheath, 63% believe that this facilitates their surgery. 21.21% prefer to respect the tendon sheath and 53% think that preserving it decreases the risk of complications, being the excess of fibrosis and iatrogenic injury of neurovascular structures the most feared.

### Conclusions

We believe that there is a discrepancy of opinions regarding the management of the FCR tendon sheath when performing distal radius fracture open reduction through a volar approach. Given the high incidence of these fractures and the absence of previous clinical analyses, the results obtained in this survey could serve as a basis for clinical trials in the future.

## **A-0011** THE VOLAR APPROACH IN DISTAL FRACTURES OF THE RADIUS AND FLEXOR CARPI RADIALIS. COMPARISON BETWEEN TWO DIFFERENT APPROACHES

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### Objectives

Different volar approaches have been described for distal radius fracture osteosynthesis. Some of these access through the sheath of the flexor carpi radialis (FCR) (FCR Approach), while others avoid violating it (Henry Approach). We did not find any studies in the literature comparing both approaches. Despite this, we know that there is discrepancy of opinion and preference among surgeons who operate these fractures. The aim of our study was to assess whether there are any relevant differences between them.

### Material and methods

A case series study of patients that had been operated on distal radius fractures (DRF) in our hospital (2015-2019), either using a Henry or FCR approach were compared. Clinical repercussion (pain or FCR tendinopathy, alteration of the palmar cutaneous branch symptoms and ROM), structural changes (FCR width, tendinopathy signs) and long-term complications were assessed. Data was collected by two external observers through clinical history, physical examination, ultrasound (US) and X-rays.

### Results

51 patients, 38 operated with Henry approach and 13 with FCR approach. Demographics, ROM, clinical signs of the palmar cutaneous branch injury and consolidation rates were similar. In the first group, 7.89% (3/38) patients presented tinel around the scar at some point of their postoperative follow up, 2.6% (1/38) localized pain in FCR, 2.6% (1/38) pain with provocative tests for FCR tendinopathy. In the second, 15.4% (2/13) presented tinel around the scar, 15.4% (2/13) pain in FCR (p 0.09163) and 38.46% (5/13) discomfort with tendinopathy provocative test (p 0.000538). US findings in Henry approach group were 10.6% (4/38) FCR thickening, with a mean difference between the operated FCR size and the healthy one of 1 mm. In the FCR approach group, 76.92% (10/13) presented an increase in tendon width with a mean difference of 6 mm (p 0.016). However, there was no relationship between width and pain in the FCR (p 0.486). Neither neovascularization around the tendon or radial artery abnormalities were observed in any patient under Doppler US. Of the complications that could be directly related to the approach, there were 2/13 patients with scar adhesions in the immediate postoperative period and 2/13 complex regional pain syndrome (CRPS) in the FCR approach group, 3/38 CRPS in the Henry approach.

### Conclusions

The FCR approach may produce structural changes with thickening of the tendon in the long term; however this has not showed to have any evident clinical repercussion. In our study, this approach seems to be related to the persistence of symptoms when performing provocative test for FCR tendinopathy and an increased risk of scar adhesion. In spite of that, we believe that studies with a larger sample sizes and better level of evidence need to be done to be able to draw conclusions.

## **A-0012** PSYCHOMETRIC PROPERTIES OF PATIENT-REPORTED OUTCOME MEASURES (PROMS) IN WRIST OSTEOARTHRITIS: TEST-RETEST RELIABILITY AND CONSTRUCT VALIDITY

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**Background:** Patient-reported outcome measures (PROMs) are frequently used to assess the effects of treatments in patients with wrist osteoarthritis (OA), but their psychometric properties have not been evaluated in this group of patients. Our aim was to evaluate the psychometric properties of the Numeric Rating Scale (NRS pain at rest, pain on motion without load, and pain on load), the Disabilities of the Arm, Shoulder and Hand (DASH) and the Patient Rated Wrist Evaluation (PRWE) questionnaires in patients with wrist OA regarding test-retest reliability and construct validity.

**Methods:** The NRS, DASH and PRWE were self-administered by 50 patients (40 men and 10 women, mean age 66 years) in a postal survey on two occasions, two weeks apart. Test-retest reliability was evaluated by Kappa statistics and the Spearman rank correlation coefficients ( $\rho$ ) were calculated to evaluate construct validity.

**Results:** The Kappa coefficients for DASH, PRWE and NRS pain on motion without load and NRS pain on load were  $> 0.90$ , 95% CI ranging from 0.84 to 0.98, while NRS pain at rest was 0.83, 95% CI 0.73-0.92. The construct validity of the PROMs was confirmed by three formulated hypotheses: a higher correlation between PRWE and NRS ( $\rho$  0.80-0.91,  $p < 0.001$ ) was found, compared to DASH and NRS ( $\rho$  0.68-0.80,  $p < 0.001$ ); the NRS pain on motion without load and NRS pain on load correlated more strongly to PRWE and DASH ( $\rho$  0.71-0.91,  $p < 0.001$ ) compared to NRS pain at rest ( $\rho$  0.68-0.80) and a high correlation between PRWE and DASH was found ( $\rho$  0.86,  $p < 0.001$ ).

**Conclusions:** The NRS, DASH and PRWE demonstrate excellent test-retest reliability and moderate to high construct validity in patients with wrist OA. These PROMs are highly related, but they also differ. Therefore, they complement each other in ensuring a comprehensive evaluation of perceived disability in wrist OA. As PRWE showed the highest test-retest reliability and the highest relation to the other PROMs, the sole use of the PRWE can be recommended in clinical practice.

## **A-0014** MOTOR BRANCH OF ULNAR NERVE INJURY DURING CARPAL TUNNEL SURGERY: ANATOMICAL STUDY AND REPORT OF A RARE CASE

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### **Background**

Motor branch of ulnar nerve (MUN) injury during carpal tunnel surgery is extremely rare. However, this injury can cause severe hand function regression and morbidities to the patient. This occurrence occurred in our institution. In consequence, we conducted an anatomical study of this nerve and report this rare case to urge the awareness of this injury and hope to help prevent the replication of this complication.

### **Method**

We dissected 34 fresh cadaver upper extremities. According to landmarks in carpal tunnel surgery, the motor branch of the Ulnar nerve was located. Mechanisms of injury were determined along the dissection. We also report a rare case of this incidence and emphasize the importance of relevant history, physical examination, and management.

## Results

The MUN turned toward the thumb just distal to hook of hamate. It then ran on the floor of the palm which was formed by intrinsic hand muscles under flexor tendons. The motor branch could have been injured during carpal tunnel surgery in the area between the central-axis of ring finger to the central-axis of middle finger. The nerve located at  $29.39 \pm 7.41$ ,  $35.01 \pm 3.14$  and  $38.79 \pm 4.03$  mm (Mean  $\pm$  SD) in the central-axis of ring finger, the radial border of ring finger and the central-axis of middle finger respectively. The most dangerous area was the nerve's turning point,  $10.9 \pm 2.63$  mm distal to the center of hook of hamate where it lies just below the level of the transverse carpal ligament.

## Conclusion

The ulnar side of the carpal tunnel deserves the same awareness as the radial side during carpal tunnel release. MUN vulnerable area is at its turning point. MUN can also be injured by dissecting or passing any instrument on the floor of palm, under flexor tendons. Surgeons should be well aware of the nerve's location.

## **A-0015** SELF-ASSESSMENT VERSUS PEER-ASSESSMENT IN MICROSURGERY LEARNING: A COMPARATIVE RETROSPECTIVE STUDY IN A SURGERY RESIDENTS COHORT

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## INTRODUCTION

In surgical learning, self-assessment allows the physician to identify and improve his strong and weak points. But its scientific validity has yet to be demonstrated. The aim of this study was to analyze if there is a link between self-assessment and improvement in microsurgery skills. We make the hypothesis that a good self-assessment allows a greater improvement.

## MATERIAL AND METHOD

Between 2019 and 2021, volunteer's surgery residents took part into a microsurgery program. During two weeks, students performed anastomosis training on inert material and living anesthetized rats under microscope. Training was alternatively supervised by five qualified hand surgeons. Each student was evaluated during the workshop by the senior surgeon on 10 items: movement stability and fluidity, instrument manipulation, needles, dissection, clamp setting, vessel manipulation, suture, checking before clamp removal, checking after clamp removal, permeability test. Self-assessment was performed by the student with the same grid, at the end of the workshop. Student's and teacher's evaluations were double-blind. We retrospectively analyzed and compared results of objective assessment and self-assessment.

The measures of the continuous quantitative variables are expressed by their means and standard deviations, while the qualitative variables are expressed by their numbers and percentages.

## RESULTS

Twenty-five students were included and analyzed, 14 were female (56%) and 11 were male (44%). The mean age was  $29 \text{ y} \pm 1.76$ . Surgical specialties were orthopedics (44%), maxillofacial surgery (45.4%), neurosurgery (12%), ENT (8%), gynecology (4%) and vascular surgery (4%). According to Cohen's kappa coefficient, 14 students (56%) underestimated themselves, 7 (28%) were concordant with peer-assessment and 4 (16%) overestimated themselves. The multivariate analysis shows that the group was related to the progression for items "dexterity: needles" ( $p=0.048$ ), "anastomosis: suture" ( $p=0.042$ ) and "analysis: permeability to clamp setting" ( $p=0.025$ ). Confounding factors were surgical specialty, experience and laterality.

## DISCUSSION

We did not confirm the hypothesis that good self-assessment allows greater improvement but we demonstrated a link between self-assessment and improvement for objective microsurgery technical skills. Most of the students underestimated themselves, which is concordant with previous reports. Surgical specialty and experience explained the objective item “permeability to clamp lifting”. The small number of students, the heterogeneity of the assessors and the increasing difficulty are the principal limitations.

## **A-0018** FORCE SENSING RESISTOR TESTING OF HAND FORCES AND GRASPS DURING ACTIVITIES OF DAILY LIVING TASKS

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### Introduction

Scientific evidence on the hand forces and the types of grasps used during activities of daily living (ADL) are lacking, leaving a gap in the field of hand rehabilitation. Measuring grasp forces and types produced by individual fingers during ADL task adds valuable information and rehabilitation grading for second to fifth metacarpal fractures.

### Methodology

A cross-sectional study investigated six healthy adults aged 20 to 59 years, male and female participants' hand forces during 105 ADL tasks. The tasks were categorised into five sections, personal care, transport and moving around, home environment inside, gardening and outside, and other. The researcher identified the predominant grasp during ADL guided by Feix et al, 2016's GRASP Taxonomy. Grasp forces were measured with Flexiforce 13mm force sensing resistors glued onto a glove attached to each of the dominant and non-dominant hand's individual fingers. Grip strength measurements with a Jamar dynamometer prior to testing and after every 25 ADL tasks were taken to avoid fatigue and ensure reliability in testing. The amount of metacarpophalangeal joint (MCPJ) range of motion per grasp type was observed and documented to guide and progress rehabilitation.

### Results

Predominant grasps observed during 105 tasks and the frequency were, adducted thumb (17), prismatic three fingers (12), lateral tripod (10), small diameter (9), prismatic two fingers (9), medium wrap (7), fixed hook (5), sphere four fingers (4), palmar (4), parallel extension (4), index finger extension (3), distal (3), tripod (2), quadpod (2), prismatic four fingers (2), lateral (2), large diameter (2), ventral (2), power sphere (1), precision sphere (1), palmar pinch (1), light tool (1), inferior pincher (1), and writing tripod (1). Range of forces applied per category, personal care (1-25N), transport and moving around (1-9 N), home environment inside (1-41N), gardening and outside (1-26.5N), and office (1-20N). Grasps where the MCPJ is flexed minimally may be used as a start to mobilise the affected second to fifth metacarpal fractures when the affected MCPJ joint may be moved. The grasps permitted are, Light Tool, Prismatic Two Fingers, Power Disc, Precision Disc, Fixed Hook, Lateral, Index Finger Extension (for index finger fractures), Extension Type, Adduction Grip, Sphere Four Fingers, Sphere Three Fingers, Ventral (for index finger fractures), Inferior Pincher. A progression to grasp types where the injured MCPJ is flexed up to 45° would include, Large Diameter, Medium Wrap, Adducted Thumb, Prismatic Four Fingers, Prismatic Three Fingers, Palmar Pinch, Tripod, Tripod variation, Tip Pinch, and Ring Index Finger grasps. A further progression to grasps where the injured MCPJ is flexed in excess of 45° would include, Small Diameter, Power Sphere, Precision Sphere,

Index Finger Extension (for middle, ring and little- finger fractures), Distal, Writing Tripod, Parallel Extension, Lateral Tripod, Quadpod, Stick, Palmar, Ventral (for middle, ring and little finger fractures).

Conclusion

Scientific measurements of finger forces with careful consideration to types of grasps during ADL should guide rehabilitation practices to ensure a safe return to full pre-injured performance and occupation.

Keywords

Activities of daily living (ADL), Force sensing resistors, Grasps, Hand forces, Metacarpal fractures

## **A-0019** MICROSURGICAL VASCULARIZED FREE FIBULA TRANSFER AS AN OPTIMAL METHOD FOR CLOSING EXTENSIVE BONE DEFECTS IN CHILDREN WITH NEUROFIBROMATOSIS

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Objective. Vascularized free fibula transfer is the ideal material for long bone reconstruction in children with pseudoarthrosis based on neurofibromatosis with a good long-term result. The pseudoarthrosis and bone defects in children with neurofibromatosis is one of the leading factors in the disability of patients and can reach 70 percent. To provide the patient with a functional extremity, vascularized free fibula transfer has become the best type for bony reconstruction. Patients and methods. This is a retrospective study of 23 pediatric patients who underwent reconstruction of bony defects with a vascularized fibula flap from 2017 to 2021. The etiology of bone defect in all patient was neurofibromatosis. Perioperative and long-term complications were noted. Functional outcomes were analyzed. We used fibula free fibula transfer to reconstruction 16 shin, 7 forearm. The defects of the tibia and ulna were averaged 12-15 cm. The median follow-up was 60 months.

Results Overall, survival of free fibula was 100 percent. In two case we had a pseudoarthrosis of distal part free fibula and recipient side (one on the shin, one on the forearm), who required bone grafting. The overall union rate was 95 percent. The median time to union was 9 months.

Conclusion.

- Microsurgical vascularized free fibula transfer is the ideal material for long bone reconstruction in children with pseudoarthrosis based on neurofibromatosis with a definitive result.
- Microsurgical vascularized free fibula allows children with children with neurofibromatosis provides good functional results
- Defects of the tibia and ulna in children with neurofibromatosis more than 5 cm are an indication for use free fibula transfer

## **A-0020** WRIST – A STEPWISE INTRAOPERATIVE PROTOCOL TO MINIMIZE COMPLICATIONS IN DISTAL RADIAL FRACTURE OSTEOSYNTHESIS USING A VOLAR LOCKING PLATE

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Although outcome of volar plating is generally good, care should be taken to avoid specific iatrogenic and preventable complications, with an incidence reporting averaging 15%. Flexor tendon rupture due to a prominent plate, extensor tendon rupture due to a dorsal protruding screw tips, cartilage lesions due to intraarticular screw placement, loss of

reduction due to insufficient stability and persisting ulnar pain with distal radioulnar joint instability due to unstable triangulofibro-cartilaginous complex (TFCC) lesions or unstable ulnar styloid base fractures all have been described. We believe that a majority of these complications can be prevented by meticulous assessment of several intraoperative parameters during volar plating. Therefore, we introduce the WRIST protocol that combines multiple fluoroscopic measurements to guide intraoperative decision making.

W = Wrist anatomy

Radial anatomy, radial inclination, volar tilt, ulnar variance and articular congruency should be assessed and properly restored. These parameters can be assessed intraoperatively on a lateral and AP wrist view using fluoroscopy.

R = Range of motion

Smooth and complete passive range of motion including flexion/extension, radial/ulnar deviation and pronosupination, should be obtained after fixation and tested under dynamic fluoroscopy if needed. If passive mobility is limited, active mobility will also be impaired. When crepitation or clicking is encountered, intra-articular screw position should be excluded.

I = Instability

Static fluoroscopic assessment might fail to unveil residual instability. Fracture fixation stability can be tested using provocative mobilization manoeuvres under dynamic fluoroscopy. If a fracture fragment displaces under passive loading, there is insufficient plate or screw fixation stability.

S = Soong classification

Soong et al. described how plate design, implant prominence and inappropriate plate positioning might result in delayed flexor tendon rupture. We advocate not only to assess the volar prominent plate edge projection, but also dorsal screw tip extrusion, with possible extensor tendon conflict, on the lateral view and the skyline view.

T = TFCC

As final assessment, the distal ulna and the stability of the distal radioulnar joint should be carefully monitored. A highly unstable ballottement test suggests instability of the DRUJ. Ulnar styloid base fractures are considered unstable if the displacement is > 2 mm. Especially, in combination with a positive ballottement test, ulnar styloid base fractures should be fixed to prevent persistent DRUJ instability and/or non-union of the ulnar styloid base which may become symptomatic. Other associated lesions like scapholunate lesions can also be assessed, but it is difficult to differentiate between acute and chronic scapholunate lesions, especially in the elderly. Wrist arthroscopy enhances diagnostic accuracy.

Large prospective studies of the "WRIST" protocol are needed for validation. But in conclusion we believe that it may help surgeons to optimize surgical technique, functional and radiographic outcome and prevent complications when treating distal radial fractures.

## **A-0021** A SINGLE THERAPY UNIT EXPERIENCE OF PATIENT PERCEPTION OF BALANCE AND CONFIDENCE FOLLOWING DISTAL RADIUS FRACTURE OPEN REDUCTION INTERNAL FIXATION (ORIF)

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Distal radius fractures (DRFs) are one of the most common UK bony injuries, estimated at 71,000 per year: 17.5% of all fractures annually. The majority of distal radius fractures can be considered fragility fractures and are commonly the first fractures to occur in postmenopausal women. Distal radius fractures have been reported to result in increased morbidity,

with long-term functional impairment, pain and deformity.<sup>1, 2</sup> Therefore the importance of recognising the underlying pathology (bone health), and the cause (falling) is an essential part of the treatment to prevent future, more debilitating fall injuries such as vertebral or hip fractures, which are further associated with significant morbidity and mortality.

The impact of a distal radius fracture on balance and confidence is unknown in younger patients. It was hypothesised that fear of falling, loss of confidence, balance and socialisation may develop and persist longer than expected in all age groups after fracture. The goal of this piece of work was primarily to identify whether confidence, balance and social recovery levels improved with routine therapy treatment.

The authors noted reluctance in some of this patient group to return to pre-injury social activities, this reluctance was often associated with a voiced apprehension related to certain simple activities and situations. Initial simple questions were included in their subjective assessment to try and establish the patient perception of their confidence: "Have you avoided social situations because of your injury?" "Do you feel less confident because of your injury?" Over time, further experience highlighted therapists to the awareness of other apparent limitations, resulting in the inclusion of additional questions: "Do you feel that your balance is affected because of your injury?" and "Are you apprehensive in crowds because of your injury?" This iterative process continued to include questions about aspects of functional balance during assessment. 10 final balance/confidence questions were scored from 0-4 (0 = not at all, 1= slightly, 2 = moderately, 3= quite a bit, 4 = extremely.)

Results: 43 patients (convenience sample; ORIF distal radius fracture treated at a University Teaching Hospital) were included in this scoping exercise; age range 25-86 years, 76% were female. They were questioned at assessment, 6 weeks and 12 weeks. Approximately 61% of patients who completed questionnaires reported persistent loss of balance, confidence and socialisation at 12 weeks, this was independent of age.

The authors propose that DRF is a predictor of loss of confidence, balance and socialisation and suggest further study to establish the long-term impact of DRF and the development of a validated assessment tool and treatment methods that can be practically included in therapy settings.

DRF may present the opportunity to help prevent future fall injuries and this may not be age dependent. The potential importance of this is supported by the National Institute for Health and Care Excellence (NICE) and professional groups including the British Orthopaedic Association (BOA) who state that "once a patient presents with a fragility fracture a proactive approach to secondary prevention is vital – treat the first fracture, prevent the second".

## **A-0022** LONG-LASTING EFFECTS SIX YEARS AFTER SPASTICITY-CORRECTING SURGERY - A PROSPECTIVE STUDY IN 19 ADULT PATIENTS

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### Objective

Spasticity is common in patients with upper motor neuron injuries, with a prevalence reported between 30 to 90% in adult patients with stroke, traumatic brain injury, incomplete spinal cord injury and cerebral palsy. However well-described, surgical procedures remain fairly uncommon in adults with spasticity and few studies have investigated the long-term effects of these procedures. The objective of this prospective cohort study was to evaluate the long-term outcomes of spasticity-reducing surgery in the upper extremity.

## Methods

This is a six-year follow-up of a prospective cohort trial in thirty patients suffering from spasticity in the upper extremity who underwent surgery between March 2015 and January 2017. The patients were operated by a tailored set of procedures including lengthening of tendons, tenotomies and correction of deformities. Active motion exercises were initiated the first day postoperatively with splints used between exercises for three weeks, and patients were also taught a home-training program. The primary outcome was the composite modified Ashworth Score (MAS), secondary outcome measures included Canadian Occupational Performance Measure (COPM), general hand function as measured by VAS-scale and grip strength. The one-year results have been published and showed significant improvement in all outcome measures.

## Results

Of the original 30 patients, eight were deceased and three declined examinations, leaving 19 patients available for long-term follow-up. Spasticity as measured by the modified Ashworth scale (0-5) was still reduced significantly from 3.3 preoperatively to 1.2 after six years ( $p<0.001$ ). General hand function (as measured by VAS-scale) was still improved by 1.5 ( $p<0.05$ ) and the patients prioritized activity as measured by COPM was also increased significantly ( $p<0.02$ ). Sixteen of 19 patients answered that they would undergo the treatment again, eighteen of 19 answered that they would recommend the treatment to others.

## Conclusion

The results from this study confirm that the benefits of surgical treatment for disabling spasticity in the upper limb are maintained after six years. The long-lasting durability of surgical treatment is an advantage that should be considered in comparison to Botulinum Toxin injections, which need to be repeated over time.

## **A-0023** PREPACKED REDUCING THE NUMBER OF OPIOID PRESCRIPTIONS FOR PATIENTS IN THE CLINIC OF HAND SURGERY AT THE UNIVERSITY HOSPITAL OF ÖREBRO

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### Background and objectives:

Postoperative pain is the main complication after day surgery. Good pain management is essential for maintaining a good quality of life and patient satisfaction after surgery. To reduce the risk of long-term opioid use after surgery we tried pre-packed analgesics as an alternative to opioid prescribing. We used 2 different bags a small and a large which contains 24 tablets paracetamol, 3 tablets etoricoxib and 7 immediate-release capsules oxycodone in the small analgesic bag. 7 prolonged-release tablets oxycodone were added for those who received large analgesic bags. We used the bags for fracture surgery, including radius fracture, ligament reconstruction and radiocarpal and carpal arthrodesis.

### Materials and Methods:

The cost of each bag was 1.1€ and 1.48€ for the small and large bag respectively. Patients was followed up with a questionnaire regarding how they rated their pain (VAS-scale 0-10) and satisfaction (0-5) after the surgery. We compared the results from the pharmacy sales data for two equal-sized groups before and after the introduction of the bags. A total of 48.94% of the studied population underwent open reposition of hand fracture, 18.6% underwent osteosynthesis of hand fracture with plate, 11.63% underwent osteosynthesis of hand fracture with pin, 11.63% had extraction of osteosynthesis material, 6.98% underwent ligament reconstruction and 2.33% underwent radio carpal arthrodesis. 69.7% of the total population received large analgesic bags and 30.3% received small ones. Results: The overall VAS mean for day 1 and 2 was 3.5. Mean value for patients' satisfaction was 4.58, as 77% had satisfaction level 5. Of the total tablets distributed to

the patients 76% paracetamol, 52% etoricoxib, 28% immediate-release oxycodone capsules and 60% prolonged-release oxycodone tablets were consumed. Results from the pharmacy sales data showed a significant reduction in the total amount of prescribed opioids by 71 %, (19 915 tablets compared to 5 770 tablets respectively).

Conclusion: There was a decreased amount of opioids prescribed, high satisfaction level, low post-surgical VAS estimation and low opioid consumption after the intervention using analgesic bags.

### **A-0024** DO TRIANGULAR FIBROCARILAGE COMPLEX FOVEAL INJURIES AFFECT THE CLINICAL OUTCOME OF ULNAR SHORTENING OSTEOTOMY FOR ULNAR IMPACTION SYNDROME?

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Background: Ulnar shortening osteotomy (USO), as its name implies, is used to shorten the ulna. It subsequently tightens the triangular fibrocartilage complex (TFCC) and ulnar wrist. TFCC foveal insertion is a primary stabilizer of the distal radioulnar joint (DRUJ). It is unclear whether USO is effective in TFCC foveal injuries. The purpose of this study was to review the clinical outcomes of ulnar shortening osteotomies with and without TFCC foveal injuries.

Methods: We retrospectively reviewed patients with ulnar wrist pain treated with USO and wrist arthroscopy including the DRUJ. Sixty-five patients were included in this study. An algorithm was used to guide surgical decision-making. After arthroscopic confirmation of ulnar impaction syndrome, we performed USO with a locking compression plate (mean length of shortening, 2.7 mm; range, 1-7.5 mm). The flattened TFCC disc due to ulnar shortening was confirmed arthroscopically. If the DRUJ was unstable after USO, we repaired the TFCC foveal insertion.

Results: There were 32 post-traumatic and 33 idiopathic cases. We detected TFCC disc injuries in 34 wrists and TFCC foveal injuries in 33 wrists; both types were found in 15 wrists. TFCC foveal injuries were not significantly correlated with patient age, history of trauma, or clinical outcome. Most patients showed good clinical outcomes; 31 of 65 patients had preoperative DRUJ instability, with a significant number having foveal but not disc injuries.

Conclusion: USO achieved reasonable outcomes, even in patients with TFCC foveal injuries. In cases demonstrating ulnar impaction, USO should be prioritized over TFCC repair.

### **A-0026** SCREW ONLY OR PLATING FOR SPIRAL FRACTURE OF THE METACARPAL?

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#### Purpose

Interfragmentary screw fixation is the technique of choice for spiral fracture of the metacarpal as it can provide compression for bony stability with the use of minimal implant. However, it involves significant soft tissue dissection and may not provide sufficient stability for early motion. A biomechanical study was performed to compare the stability with other fixation techniques: an addition of a neutralizing plate to the interfragmentary screw, and with the newer generation locking plate construct.

#### Methodology

18 cadaveric metacarpal bones were harvested and divided into 3 groups. The bones were potted into PMMA bone

cement and mounted onto a customized jig. A spiral fracture was created using a mechanical tester and the failure strength was determined as the native torque of the bone. Next, the bones were grouped into 3 groups each utilizing 3 different techniques: lag screw (A), neutralizing plate (B), and locking plate (C). The repaired bones were loaded to failure to measure the ultimate torque strength and the mode of failure was also studied.

#### Results

Of the 18 specimens, 1 specimen was excluded due to extensive comminution. The mean value of native torque strength for group A (n=6) is 258.32 Nmm and post-repair strength is 196.23Nmm, demonstrating a diminutive strength of 24.03%. For Group B (n=5) native torque strength is 291.97Nmm and the post-repair strength is 278.64 Nmm, showing a reduction of 4.56%. For Group C (n=6), the native strength is 289.71 Nmm and post repair strength is 187.32 Nmm, showing 35.34% reduce in strength. There is a mixed mode of failure, however catastrophic failure of plate and screw pull out is most common seen in the locking plate construct.

#### Conclusion

The neutralizing plate technique confers a post-repair torque strength that is similar to native bone strength. This suggest that it can provide the best torque resistance, which is ideal for early range of motion exercises.

### **A-0027** WHETHER FAMILIAL MEDITERRANEAN FEVER (FMF) CAUSE CARPAL TUNNEL SYNDROM (CTS): STATISTIC DATA IN ARMENIA

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**Purpose:** Familial Mediterranean Fever (FMF) is a genetic autoinflammatory disorder that causes recurrent fevers and painful inflammation of abdomen, lungs and joints. The natural carries of this disease mainly are from Greece, Israel, Turkey, countries of Middle East and North Africa. Armenia is also an endemic country of FMF.

**Clinical manifestation of CTS** is connected with medial nerve compression under the indurated Flexor Carpal Retinaculum (FCR). Our main goal of the prospective study was to find some correlation between Carpal Tunnel Syndrome (CTS) and FMF.

**Methods and Materials:** We performed a prospective analysis of 150 patients, with 54.4 average age, who were hospitalized from Dec. 2019 to Mar. 2022 in Department of Plastic and Reconstructive Surgery, Heratsi Hospital Complex. According to the studies, the vast majority of patients were women 82.6% (n=124), from which 79.03% (n=98) were in phase of menopause.

Patients suffering with FMF were examined in order to find out the correlation between FMF and CTS.

**Results:** According to the collected data, patients with CTS (average age 52.25) , who were also diagnosed FMF (N.B. FMF was diagnosed before puberty), 90% (n=16) of those patients is taking Colchicine since the diagnosis of disease. The other 10% (n=2) is not taking any antifibrotic treatments, including Colchicine. Related to our study, patients taking Colchicine (n=16) have mild and moderate severity of CTS and in majority of those cases, manifestation was limited in only one extremity. In contrast to them, the other 10% (n=2) have severe clinical manifestation (both extremities were affected). Patients who don't take Colchicine or any other antifibrotic treatments, in addition to FMF, suffer with chronic kidney disease, particularly AA amyloidosis (Stage 2 GFR classification-GFR=89-60 and albuminuria- A2 moderately increased 18 mg/mmol).

Conclusion: Based on our study FMF has direct influence in severity of CTS. The induration of the retinaculum can have different forms of histological changes. Our study shows that one of the forms of developing of CTS severe manifestation could be amyloid accumulation in carpal tunnel caused by FMF. We suggest to perform pathohistological examination of FCR for understanding the origin of CTS developing among patients with AA amyloidosis.

## **A-0028** PATIENT-REPORTED RECOVERY AFTER TRIGGER DIGIT SURGERY- A PROSPECTIVE PARALLEL GROUP STUDY COMPARING OPEN VERSUS PERCUTANEOUS RELEASE IN 41 PATIENTS

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**OBJECTIVES:** Trigger finger is a common condition that can be treated surgically either by open (OR) or percutaneous release (PCTR) of the A1 pulley. Even though the results after these procedures are known to be excellent, little is known about the detailed time span in which the symptoms are resolved. This study was designed to compare patient reported outcomes between the two methods by day-to-day self-assessment. The hypothesis was that patients treated by PCTR would report a more rapid recovery after surgery.

**METHODS:** Forty-one patients were included and assigned to two groups; open release (OR n=21) or percutaneous release (PCTR n=20). Inclusion criteria were trigger phenomenon, stiffness and pain or tenderness over A1 pulley/metacarpophalangeal joint, and all patients were treated by a senior hand surgeon. The participants completed the patient questionnaire HQ-8 (arm/hand) of the Swedish national quality register for hand surgery and Quick-DASH questionnaire along with self-assessment of pain, stiffness and frequency of triggering using VAS-scales. After treatment, the patients registered VAS-score for these symptoms day-to-day at home until complete recovery, at which they completed the HQ8 questionnaire and Quick-DASH and mailed them along with records of the daily VAS-score.

**RESULTS:** Nineteen (90%) of the patients in the OR group and sixteen (80%) in the PCTR group completed their records. 84 % of the responders in the OR group (n=16) and 56% in the PCTR group (n=9) reported complete relief of symptoms after the intervention according to self-assessed follow-up. The mean number of days to full symptom relief for OR/PCTR were: 17/15 regarding pain, 22/18 regarding stiffness and 2/1 regarding triggering. The mean change in Quick-DASH score was 14 for patients in the OR group and 9 for patients in the PCTR group. Additional surgery was performed in 37% (n=7) of the patients in the PCTR group and additional corticosteroid injection was given in 26% of the patients in the OR group. **CONCLUSION:** This study showed that the mean time to full symptom relief regarding pain, stiffness and triggering is shorter for patients successfully treated by PCTR, but also that almost one third of the patients in the PCTR group and one fourth in the OR group required additional procedures. This may suggest that the percutaneous procedure requires more training and the risk for incomplete release is higher than open procedure. Furthermore, this study provides new insights regarding the time frame and pace in which symptoms are alleviated after trigger digit surgery.

## **A-0029** ANTERIOR PLATING TECHNIQUE FOR DISTAL RADIUS: COMPARING PERFORMANCE AFTER LEARNING THROUGH NAIVE VERSUS DELIBERATE PRACTICE

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### Background:

Surgical teaching is most often carried out in the operating theatre through mentorship and the performance of surgical procedures is rarely measured.

The objective of this article is to compare the progression in learning curves of junior surgeons trained in the anterior plating technique for the distal radius on a non-biological model according to three different methods.

### Methods:

The materials comprised 12 junior surgeons of level 1 or 2 (as per Tang and Giddins) divided into three groups: control (G1), naive practice (G2) and deliberate practice (G3).

The three groups watched a demonstration video of a level 5 expert. The four G1 surgeons (two level 1 and two level 2) saw the video only once and each inserted five plates. The four G2 surgeons (two level 1 and two level 2) inserted five plates and watched the video before each time. The four G3 surgeons (two level 1 and two level 2) saw the video before the first plate insertion. Before posing the subsequent four plates, the four G3 surgeons watched their own video and the expert indicated their errors and how to avoid them next time.

A 12-criteria OSATS defined on the basis of the 60 videos, each graded from 1 (min.) to 5 (max.) was used to measure the objective surgical performance per plating (min. 12; max. 60) and per series of five plate fixations (min. 60, max. 300).

### Results:

The total average objective performance of G1 was 44.73, of G2 was 50.57 and of G3 was 54.35. Change in objective performance was better for G3 (13.25) than G2 (5) or G1 (3.75). For all groups, the progression in objective performance was better amongst Level 1 surgeons (9) than Level 2 surgeons (5.6).

### Conclusion:

Surgical teaching is based on mentorship and experience. However, since “see one, practice many, do one” has started to replace “see one, do one, teach one”, learning techniques have increasingly relied on procedure simulators. Against this background, few studies have looked at measuring performance of surgical procedures and improved learning curves. Our results appear to suggest that deliberate practice, when used in addition to mentorship, is the best option for shortening the growth phase of the learning curve and improving performance.

The results of this study need to be confirmed by a next study using the same OSATS, the same video and the same groups of surgeons by simply changing the synthetic radius models in a first step by anatomical subjects' wrists and then in a second step by surgeries performed in the operating room under the observation of their mentors.

Deliberate practice is a learning technique for surgical procedures that is complementary to mentorship and experience which it allows the growth phase of the learning curve to be shortened and the objective performance of junior surgeons to be improved.

### **A-0030** PAIN REDUCTION FOR CRPS II: SCALENE BLOCK WITH DEXAMETHASONE PERINEURAL FOR VERIFYING THE DIAGNOSIS AND TREATMENT OF THE THORACIC OUTLET SYNDROME

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**Introduction:** The Complex Regional Pain Syndrome II (CRPS II), based on a Thoracic Outlet Syndrome (TOS), represents the maximum variant of a peripheral nerve compression syndrome. Until now, the identification and management of TOS create a highly difficult challenge. According to the Cochrane Library 2017, it is proven that injections of Dexamethasone perineural prolong the duration of the local anesthetic used for brachial plexus nerve blocks. However, the assumption that Dexamethasone perineural leads to pain relief is not yet scientifically proven but highly presumable. This ongoing prospective study wants to demonstrate that a scalene block with Dexamethasone perineural contributes to a significant pain relief for the patients with neurogenic TOS. The primary objectives are to measure the extent and the duration of the pain reduction.

**Methods:** The patient collective consists of 21 patients (3 male, 18 female, mean age 34 years, IQR 22 - 45) who are suffering from true or disputed neurogenic TOS. For verifying the diagnosis or pain treatment a scalene nerve block with 20 ml Naropin and 6 ml Dexamethasone was carried out ultrasound-guided. The follow-up examinations took place after 2, 6, 12 and 24 weeks. The current pain level was documented with the Numeric Pain Rating Scale (NRS). The questionnaire QUICK-DASH was used for evaluation of the disability of the arm, shoulder and hand.

**Results:** Before the intervention, the statistical mean of the NRS in relaxed position was 4.5 (n = 21), after 2 weeks 2.0 (n = 21), after 6 weeks 2.1 (n = 21) and after 12 weeks 1.1 (n = 12). The mean of the NRS under stress before the intervention was 8.1 (n = 21), after 2 weeks 4.3 (n = 21), after 6 weeks 4.0 (n = 21) and after 12 weeks 3.6 (n = 12). The mean value of the QUICK-DASH before the intervention was at 53.8 points (n = 21), after 2 weeks at 39.8 points (n = 21) after 6 weeks at 32.6 points (n = 21) and after 12 weeks at 26.4 points (n = 12). The reduced patient collective after 12 weeks can be explained by the patients who are still part of the study (n = 10) and by the patients who are dropped out due to surgery (n = 6).

**Discussion:** The combined nerve block with a local anesthetic and Dexamethasone seems to represent a targeted and adequate treatment for patients with neurogenic TOS. The results reveal, that the pain level was significantly reduced compared with the pain level before the intervention. Therefore, this method might be appropriate for verifying the diagnosis of a disputed neurogenic TOS, as well as a temporary bridging from the diagnosis to surgery and for long-term pain reduction therapy. However, as it is an ongoing study, the examination time is not yet finished to provide definitive results.

### **A-0032** USE OF VOLAR DISTAL RADIUS PLATE DORSALLY FOR WRIST ARTHRODESIS IN PATIENTS WITH UPPER LIMB SPASTICITY: REDUCING COMPLICATIONS AND IMPROVING COMPLIANCE

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**Aim:**

To evaluate whether volar distal radius plates have higher patient satisfaction, better outcomes and lower complication rates when used for wrist fusion in patients with upper limb spasticity

#### Methods:

Wrists in the Intervention Group that were fused using Medartis® variable angle volar locking plate on the dorsum and wrists fused in the Control group were retrospectively reviewed. The technique regarding use of distal radius plates and initial outcomes have been reported previously.<sup>1</sup> Visual analog scale and House Score were used to assess patient reported outcomes including overall satisfaction and change in function. <sup>2,3</sup>

#### Results:

17 wrist arthrodeses were performed over a period of 4 years in fifteen patients. There were ten and 7 cases respectively in the Intervention and Control Groups with the mean ages of 24.7 and 26 years. The patients were followed up for 15 months in the Intervention Group and for 37 months in the Control Group. Indications for surgery were hyperflexed wrist position in limb spasticity patients producing difficulty in daily cares and maintenance of hygiene.

There were no complaints of implant prominence, implant or tendon irritation, metacarpal prominence or increased extension requiring any intervention in the intervention group. Control Group had a 57% implant removal rate that is comparable to reports in the literature (46%).<sup>2</sup> Both groups reported significant improvement in hygiene and wrist position on VAS.

#### Conclusion:

Medartis® distal radius variable angle volar locking plates appear to be safe, have superior patient compliance and low complication rates when used dorsally for wrist arthrodeses in patients with upper limb spasticity. Implant can be considered superior to available standard fusion plates on account of profile and size. Comparable overall satisfaction rates were reported in relation to literature reports and other plates in this study.

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## **A-0033** TARGETED MUSCLE REINNERVATION FOR SYMPTOMATIC PERIPHERAL SENSORY NEUROMAS IN THE HAND AND WRIST

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Injury to peripheral sensory nerves in the hand is common, it can lead to debilitating neuromas and significantly impair patients' quality of life. Different surgical modalities for treating painful neuromas were described but all remain controversial with various chances of recurrence. Despite the current surgical strategies that aim to inhibit neuroma formation or treat existing neuromas, they are unpredictable and frequently unsatisfactory. However, Targeted Muscle Reinnervation (TMR) represents the ultimate and most effective therapy for treating neuromas that can achieve meaningful clinical improvement. Treatment of a painful sensory neuroma of the hand by TMR was previously reported in one case report. The aim of the study was to present a variety of other surgical techniques for dorsal digital, radial sensory, and palmar cutaneous branches of the median nerves post-traumatic neuromas in hand for patients with intractable pain, following failed previous surgical attempts. Case 1: A 33-year-old female, presented with a painful neuroma of the Palmar

Cutaneous Branch of Median nerve (PCBMN) of the right hand one year after volar wrist ganglion excision. She had severe pain and electrical shooting at the distal wrist to the palm, her daily activities were limited, and she had sleep disturbance because of the pain. US confirmed the existence of PCBMN neuroma in close vicinity to the previous surgical scar. Upon exploration, a 4 cm neuroma of the PCBMN was identified at the exact location of the painful Tinel sign. The terminal AIN was dissected proximally and divided distal to its branches to the FPL, and the neuroma of PCBMN was excised. Coaptation of the distal end of AIN with PCBMN was achieved without tension deep in the forearm. Case 2: A 54-year-old female, presented with severe pain in the radial aspect of right wrist that was affecting her quality of life. She had her first dorsal extensor compartment release six months prior to her recent presentation. She was diagnosed with neuroma of the Sensory radial nerve (SRN) by the US. On exploration, a large neuroma was excised, and the proximal stump of SRN was coapted in an end-to-end fashion to distal AIN. Case 3: A 48-year-old female presented with a recurrent right thumb radial dorsal digital nerve neuroma. Two previous attempts for excisions of neuroma by different surgeons failed to resolve the patient's symptoms. She was complaining of excruciating and intolerable pain limiting her daily activities. On exploration, distal neuroma at radial dorsal nerve was excised, and end to side coaptation of proximal radial to the ulnar digital nerve. All three patients had continued to do well for more than 8,11, and 12 months respectively. They have complete resolution of symptoms, with a full range of function and they are back to normal life activities, and no recurrence of pain or hypersensitivity. This report demonstrates the ability to perform TMR within the hand with good results when used for the treatment of symptomatic neuromas. TMR is a viable surgical option for treating symptomatic neuromas, particularly in those patients who have previously failed prior neuroma excisions.

### **A-0034** ULNAR NERVE INJURY DURING TREATMENT OF 4TH AND 5TH METACARPAL FRACTURES: A CASE REPORT AND ANATOMICAL REVIEW

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#### Background:

The deep branch of the ulnar nerve (DBUN) is a pure motor nerve. It passes through a hypothenar fibromuscular tunnel and courses radially on the interosseous surface. DBUN is not frequently considered during hand surgery, given that the anatomical course of the nerve in close relation to the carpal and metacarpal bones makes it vulnerable to penetrating injury and may be injured during hand surgery fixations. In this article, we describe a case of DBUN injury after percutaneous pinning of the fourth and fifth metacarpal bone fractures complicated by intrinsic muscle wasting of the hand that was treated with neuroma excision and sural nerve graft.

#### Case report:

We present the case of a 36-year-old male, who had fracture base of 4th&5th metacarpal bones, which was treated with multiple K-wires. A few months later, the patient presented with weak abduction/adduction of the three ulnar fingers and prominent wasting in the intrinsic muscles of the hand. On hand exploration, a 2 cm neuroma was found along the course of the DBUN distal to the hypothenar fibromuscular tunnel, which was treated by neuroma excision and nerve grafting.

#### Conclusions:

Fractures of the 4th&5th metacarpals and carpometacarpal dislocations are very common and are often treated surgically. To fix these fractures, awareness of the DBUN course in the hand and its proximity to the carpal and metacarpal bones is important. An area that hand surgeons don't encounter commonly. High caution should be taken during percutaneous

pinning by inserting K-wires under radiological guidance, minimizing pinning attempts, and, if necessary, checking their correct placement through fluoroscopic imaging.

**A-0035** A 60-YEAR-OLD WOMAN WITH SYMPTOMS OF COMBINED CARPAL TUNNEL SYNDROME AND CUBITAL TUNNEL SYNDROME DUE TO AN ELASTOFIBROMA CAUSING COMPRESSION OF THE MEDIAN AND ULNAR NERVES

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**Background:**

Cubital tunnel syndrome results from pressure or stretching of the ulnar nerve, and carpal tunnel syndrome involves the median nerve. Elastofibroma is a rare, benign, slow-growing soft tissue tumor that commonly occurs as a bilateral infrascapular tumor in elderly women. This report is of a 60-year-old woman who presented with combined carpal tunnel syndrome and cubital tunnel syndrome due to an elastofibroma causing compression of the median and ulnar nerves.

**Case report:**

We report the case of a 66-year-old lady who complained of left-hand numbness, tingling along the fingers, sleep disturbance, and weakness in pinching or holding objects for an extended period. Clinical examination and nerve conduction studies established the diagnosis of Combined Carpal tunnel syndrome (CTS) and Cubital tunnel syndrome (CuTs) complicated by intrinsic muscle wasting. The patient underwent left carpal, and cubital tunnels release surgery and end-to-side anterior interosseous nerve transfer to the motor component of the ulnar nerve. Pathologic evaluation of the entire specimen showed collagen bundles alternate with refractive cylinders stained with Veroeff-van Gieson elastic stain.

**Conclusions:**

This report is a rare case of a histologically confirmed single, peripheral, benign elastofibroma involving compression of the ulnar and median nerves. This case highlights the importance of histopathology in diagnosing rare soft tissue tumors arising at an uncommon site and presenting with rare symptoms.

**A-0037** COVID-19 HAND - SEQUELAE OF COVID-19 IN THE HAND & WRIST SYSTEMATIC LITERATURE REVIEW

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**Introduction**

Patients have been attending clinics with hand pathologies after contracting Covid-19 or receiving the vaccination. We postulate whether the virus stimulates a systemic inflammatory response that triggers these pathologies. We identified 5765 studies from EMBASE and MEDLINE. Thirty-nine publications were included for this review.

**Myositis**

Three studies (1-3) identified an inflammatory response with inflammatory mediators and biopsies, to skeletal muscles following infection. This could be the initial trigger for chronic tendonitis seen in common tendinopathies.

**Arthritides**

Several case reports of reactive arthritis post infection were identified with genetic and immunological factors being

postulated (4-7). The conditions ambiguity maybe due to the regularly updated diagnostic criteria (8-10) and the similar presenting features to other conditions.

Two case reports (11,12) highlighting a new diagnosis of rheumatoid arthritis post infection were identified that suggested that COVID-19 had increased the presence of inflammatory mediators in synovial joints causing a subsequent cytokine storm. One case report (13) had described an acute flare up of CA in the wrist post covid-19 vaccination, whereby contents of the vaccine could have led to activation of the innate immune system (14).

#### Peripheral Neuropathies

Two cases (15) had shown an increase in carpal tunnel syndrome (CTS) symptoms post COVID-19 infection. We postulate that CTS could be caused by nerve microvascular ischaemia, seen in many reports of peripheral neuropathies following COVID-19 infection.

#### Conclusion

There is a current paucity in published scientific material regarding COVID-19 sequelae in the hand. This review aims to stimulate discussion in how a virus can induce pathological processes causing common hand pathologies.

## **A-0039** TREATMENT OF BONE DEFECTS IN HAND AND UPPER EXTREMITY USING THE INDUCED MEMBRANE TECHNIQUE

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**HYPOTHESIS:** Non-vascularized autografts require a well-perfused recipient site for successful implantation, and there is an inherent potential for resorption with grafts longer than a few centimeters. Autologous bone grafting within induced granulation tissue membranes known as the Induced Membrane technique (IMT) is a relatively simple method of treating segmental bone defects in the upper extremity. The technique is applicable to both aseptic and septic conditions and requires no advanced skills in microvascular surgery. There are few reports of managing bone defects in the upper extremities by using MIT, supporting our observation that this approach has not become widely used by upper extremity surgeons. The aim of this case series is to study the efficacy of applying MIT for segmental bone loss in hand injuries.

**METHODS:** Data were collected retrospectively from the medical records at Kleinert Kutz Institute, patients with segmental bone loss in upper extremity treated by (IMT) were included in the study. Two reviewers assessed Post-op X rays for callous formation and bone union. Patients were also evaluated by Visual analog scale (VAS) upon their follow up at their 2nd week after 1st stage of surgery, and (2nd, 6th and 8th weeks) after 2nd stage of surgery. **RESULTS** We are presenting 23 patients, males were 15 (65%) and females 8 (34.8%). Table saw injury is the leading cause (32%), followed by machinery injuries (25%) and fell down (21%). Mean time for follow up 39.4 months and the mean time interval between the first and stage was 4.8 weeks. Bone defects within the hand reported in (16 patients), and one patient in the following Radius, ulna, humerus, and elbow. Bone defects in the joints reported in 4 cases (PIP in 2 cases, CMC, and MCP) in these cases joint fusion was performed by applying IMT technique to preserve length. One reported case of MIT failure in elbow fracture was treated by a vascularized bone graft. No relations were found between the severity of the injury, or the defect size and the time required for bone union. **SUMMARY** • IMT is a simple and effective method that can be used to treat traumatic bone loss in upper extremity, thus avoiding amputation and limb shortening while preserving limb function. • By using this technique bone length can be maintained until a definitive reconstruction and fixation is performed based on a scaffold of biological membrane without scarring and fibrous tissue formation in the defect.

## **A-0043** THE PERFORATOR EVALUATION AND DESIGN OF ANTEROLATERAL THIGH FLAP BASED ON SUBCUTANEOUS PERFORATOR

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**Objective** To explore the preoperative perforator evaluation and intraoperative flap eccentric design of anterolateral thigh flap (ALTF) based on superficial fascia perforator.

**Methods** 12 patients with oral and maxillofacial tumors and 10 patients with skin and soft tissue defect wounds in upper limb were hospitalized in our hospital from January 2021 to July 2022. The modified CT angiography of anterolateral thigh flap area was performed before operation, and data of CT angiography were sent to GE AW 4.7 workstation, to establish the visual models by volume rendering for the whole perforator evaluation. According to the measurement results of the visual models, the informations of the perforator and descending branch of lateral circumflex femoral artery (dLCFA) were marked on the body surface before operation, and the target perforator was preselected. According to the area and shape need, to design the "eccentric" flap with the subcutaneous perforator as the axis during the operation, and the data of intraoperative observation was compared with the visual models. The size of flaps the needed ranged from 4.0cm×4.0cm~23.0cm×13.0cm. **Results** Twenty-two visual models of anterolateral thigh flap area were established. The course, type, location of perforator, and the caliber, branches of the dLCFA measured during the operation, which were consistent with preoperative visual models. Twenty-two ALTFs were all survived without vascular crisis and necrosis. Both doner and recipient sites healed in primary union without hernation and infection. During follow-up of 1 to 12 months, all flaps survived with satisfactory blood supply. The functions of oral, maxillofacial and upper limbs were normal. Only a linear scar remained in the doner site without dysfunction. **Conclusions** The whole perforator can be evaluated, the course, type, location of perforator, and the caliber, branches of the dLCFA can be determined by means of the visual reconstruction by the modified CT angiography of anterolateral thigh flap area. The "eccentric" design of anterolateral thigh flap based on subcutaneous perforator was realized, which has strong practical guiding value.

## **A-0047** CT-BASED MICROMOTION ANALYSIS OF FRACTURE FRAGMENT MIGRATION AFTER LOCKING PLATE FIXATION OF AO TYPE C DISTAL RADIUS FRACTURES

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### **Background**

Volar locking plate fixation is the most common method for operative fixation of distal radius fracture (DRF), and has shown good results for AO type C DRF. However, the dorsal ulnar corner (DUC) can be difficult to capture with a volar plate, as the fragment is small and is not exposed when using the volar approach. The purpose of this study was to study fracture fragment migration after fixation with a volar locking plate after AO type C DRF, using a volume registration technique of paired CT scans with special focus on the DUC fragment.

### **Methods**

This pilot study included ten patients with AO type C DRF, all operated with a volar locking plate. The primary outcome was radiographic outcome. Secondary outcome measures included visual analog scale (VAS) pain score, hand grip strength,

wrist range of motion (ROM), Patient-Rated Wrist Evaluation (PRWE) score, and Quick Disabilities of the Arm, Shoulder, and Hand (QuickDASH) score. CT examination was performed preoperatively, postoperatively, and at 6 weeks, 3 months, and 1 year postoperatively. Postoperative and 1-year scans were compared and analyzed. Fragment migration was assessed with CT-based micromotion analysis (CTMA), a software technique used for volume registration of paired CT scans.

#### Results

There was no case with articular incongruence >1 mm postoperatively. All plates were stable over time. Two patients showed signs of screw movement (0.2–0.35 mm and 0.35–>1 mm respectively). Postoperative reduction was maintained, and there was no fragment migration at the 1-year follow-up except for one case with increased dorsal tilt. The DUC fragment was found in 8/10 cases, fixated in 7/8 cases, and not dislocated in any case at the 1-year follow-up. Patient-reported outcome measures were satisfactory. Hardware removal was performed in one patient due to suspicion of intra-articular screw penetration.

#### Conclusions

The CTMA results indicate that variable angle volar locking plate fixation after AO type C DRF can yield and maintain a stable reduction of the fracture fragments. The DUC fragment remained stable regardless of the number of screws through the fragment. CT volume registration can be a valuable tool in the detailed assessment of fracture fragment migration following volar plate fixation of DRFs.

### **A-0048** TOTAL TRAPEZIECTOMY, PARTIAL TRAPEZOIDECTOMY, PYROCARBON INTERPOSITION IMPLANT AND ADDITIONAL STABILIZATION BY A MINI ANCHOR FOR TRAPEZIOMETACARPAL JOINT OSTEOARTHRITIS, A NEW PROCEDURE: SURGICAL TECHNIQUE AND MID-TERM RESULTS

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**Purpose:** we report our preliminary results with a new surgical technique after a minimum of 5 years follow-up in treatment of advanced trapeziometacarpal osteoarthritis (Eaton stage II or III). The procedure includes a total trapeziectomy, a partial lateral trapezoidectomy and pyrocarbon interpositional arthroplasty (Pyrodisk®), which is additionally stabilized by a mini-QUICKANCHOR®.

**Methods:** it is a continuous prospective series, initiated in September 2010. We performed 75 consecutive Pyrodisk® interposition arthroplasty to this day. All procedures were carried out by one single skilled hand surgeon. The 50 first pyrocarbon implants, whose last review follow-up of at least 5-year were included in this study. All these patients were clinically evaluated at follow-up using the quick-DASH questionnaire, PRWE score, Visual analog scale (VAS) pain scores, grip and pinch strength, Kapandji scores to quantify thumb opposition and retropulsion, MCP range of motion (flexion, extension) and M1-M2 angle. Satisfaction was also evaluated. Radiographic changes (metacarpal shortening, periprosthetic lucency and subluxation) were evaluated on the radiographs and CT-scan of thumb basal joints.

**Results:** the mean age was 69 years (range, 59-79). All patients were reviewed at a mean follow-up of 72 months (range, 60-84 months). Forty patients were females and 10 males. The right side was involved in 41 cases (82%) and the left in 9 (18%), which 40 (80%) were dominant hands. The mean QuickDASH score increased from 60/100 (range, 0-68) to 15/100 at last follow-up assessment ( $p < 0,001$ ), with 68,8% of improvement compared to preoperative scores. Mean overall PRWE score at last follow-up was 17/100 (range, 0-63) ( $p < 0,001$ ), showing 77,5 % of improvement. Pain was evaluated at a mean 7,5/10 (range, 6-10) preoperatively, versus 1,6 (range, 0-4) at last follow-up, for an improvement of 78,2% ( $p < 0,001$ ).

Grip strength improved by 52% and attained 78% of the contralateral side ( $p < 0,01$ ). Pinch strength has been improved by 43% ( $p < 0,01$ ). At the last review, 96% of patients reported no pain, and no signs of instability of the implant. One dislocation occurred. Seventy five percent of patients (75%) regret that they have not been operated earlier. Radiological results at 5 years, showed well positioning of the implant in 98% of cases (49/50), with remodeling mainly in the proximal pole of the scaphoid surface in 60 % of cases (30/50). Revision surgery was needed in only one case of dislocation. Progression of lucency did not predict implant loosening or failure at 5 years.

Conclusions: total trapeziectomy with pyrocarbon arthroplasty type Pyrodisk® associated to a partial trapezoidectomy and a stabilization by a mini QUICKANCHOR® may prove to be a successful option for the surgical treatment of trapeziometacarpal joint osteoarthritis, on Eaton's stage II and III. It provides good pain relief, range of motion, pinch and grasp strength, and stable results at more than five-years of follow-up. A longer follow-up is necessary to confirm these encouraging preliminary results.

### **A-0049** NEW TECHNIQUE: USING CADAVERIC TENDON GRAFT TO STABILIZE MIDCARPAL INSTABILITY IN EHLERS-DANLOS SYNDROME

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#### Abstract:

Ehlers-Danlos syndrome (EDS) is a group of hereditary disorders that involve collagen synthesis. In the wrist, pain and midcarpal laxity may affect 70% of EDS patients. The mainstay treatment of midcarpal instability in patients with ligamentous injury but not EDS are orthotics, physiotherapy, and activity modification. These methods of conservative treatment may be unsuccessful in controlling instability in the longer term. Using autologous tendon for reconstructing midcarpal instability in patients with EDS carries the risk of loosening over time because of intrinsic abnormalities of collagen metabolism. In this paper, we present a novel surgical technique described by the senior author using cadaveric tendon graft for stabilizing bilateral midcarpal instability in EDS patients. A triangular ligament reconstruction from the base of the third metacarpal to lunate and triquetrum was designed to treat midcarpal instability.

Outcome: This procedure was carried out on an 18-year-old female, a known case of EDS. She presented with bilateral midcarpal instability, which was treated by triangular ligament reconstruction using two different cadaveric tendon grafts: semi-tendinosis graft for the right wrist, and gracilis graft for the left wrist. Postoperatively, early total active range of motion (TAROM) exercise of the fingers, including the metacarpophalangeal joints, is encouraged. Two weeks later, the splint is removed, and a vigorous rehabilitation program is initiated. Besides TAROM exercises of the wrist and isometric muscle strengthening to improve proprioceptive stability of the wrist through neuromuscular control. After 8 weeks of follow-up, the patient has improved in terms of grip strength, AROM, pain control, and daily function compared to preoperative measures.

Indication: This technique is indicated for midcarpal instability in patients with EDS. Using the cadaveric graft is superior to autograft because the low quality of the tendon and ligaments in EDS cause stretching and loosening. In contrast, the cadaveric tendon graft has normal tendon structure and quality which stays strong in holding bones together as well as maintaining midcarpal stability in patients with EDS.

In conclusion, this technique provides a novel surgical solution to recurrent midcarpal instability in patients with EDS by using a cadaveric tendon graft.

## **A-0050** A LASER CUTTING MACHINE ALLOWS MAKING ALL KIND OF SPLINTS FROM DIFFERENT TYPE OF MATERIALS

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**Objective:** The aim of this study is to prove that the laser cutting machine enables to make a bigger number of splints from a thermoplastic plate than the amount of splints that can be hand-made from such plate. It also aims to prove that the use of such machine considerably decreases the amount of time, and waste, that one has to devote to the splints' making process.

**Methods:** We conducted a 2-month period pilot study. On the one hand, a hand therapist drew and designed (based on the 'Whale design') splints for osteoarthritis of the thumb through a computer program known as AutoCAD. The information needed to produce the splints was entered into the laser cutting machine Motocono model ML-300. The splints were made out of a thermoplastic plate ORFIT COLORS NS SONIC SILVER 450x600x2mm. micro. On the other hand, splints were made by hand following the same design (Whale design) and using a thermoplastic plate of the same characteristics mentioned above. The main variables considered were time measured by a stopwatch and the total number of splints that could be made from one thermoplastic plate.

**Results:** Using the laser cutting machine and one thermoplastic plate ORFIT COLORS NS SONIC SILVER 450x600x2mm micro, 15 splints (Whale design) with a perfect cut were made. By hand, using scissors, it was possible to produce only 12 splints. The average time for making a splint with the laser cutting machine was 90 (0) seconds, whilst making a splint by hand took on average 168.42 seconds (9.98), being the result statistically significant (T-Test for 2 independent means;  $p < 0.001$ ).

**Conclusions:** The laser cutting machine might be a good alternative to make any kind of splint for the upper limb, given that not only there is less waste of material and the manufacturing time is shortened but it allows for the splint to have a perfect cut regardless of who uses the machine and his skills. Moreover, in the long term, it could reduce overuse injuries on the therapists since they would not have to make the splints by hand.

## **A-0051** VIRTUAL REALITY IN UPPER LIMB REHABILITATION: AN OVERVIEW AND MY EXPERIENCE ABOUT

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### Background

Virtual reality (VR) represents a simulation of the real world environments with which the person interacts through a "human-machine interface" (Aran et. al., 2017). During the last years, also thanks to the pandemic Covid-19, usage of VR become widespread in the medical field, including rehabilitation. In the present literature, the role of VR is examined in stroke rehabilitation for what concerning upper limb functional recovery, with the evidence that VR interventions can yield an average of 200-300 functional movements per hour (Brunner et. al., 2016). The purpose of this paper is to investigate the impact of VR in hand conditions.

### Methods

A comprehensive search of Pubmed, Cochrane Library, Google Scholar and OT Seeker for all relevant studies of the last decade was undertaken. Studies using virtual reality for the rehabilitation of hand and wrist function were included. Studies analyzing VR in neurological conditions (such as stroke, multiple sclerosis, Parkinson's disease), pediatrics interventions or with the use of robotics and exoskeletons were excluded. Five studies were included.

## Results

Among of all the included studies, only one treats immersive virtual reality, simulating ADL environ The authors examined VR in burns, CRPS and traumatic hand surgery. In all the cases improvements in pain were registered and in CRPS there was an improvement in functional movements too. Nica et al. proposed a new VR instrument that could assess grip strenght and ROM in addition to VR therapy, with positive changes in perceveid disability. Even if not included, the study conducted by Goršič et al (2017) demonstrated that VR competitive games improved motivation and exercise intensity in the studied population.

After a biref overview of litterature I decided to expose my personal work experience with immersive VR and head mounted set in hand rehabilitation. In particular, we use VR reproducing ADL by using hand tracking in tasks that are familiar for the patient. In this way it is possible to involve the patient in meaning occupation and training ROM in the first days after flexor tendon repair because no loads are required during the activity. We can also use it to try splints and their function and comfort during specific acitivity that the patient will replicate in real life. In particular, some applications permit a complete customization of the functional pattern of the hand. Not least, we can use VR to train fine motor skills and proprioception.

## Conclusion

VR is widespreading in rehabilitation field and studies confirmed it in stroke and neurological rehabilitation. In preliminary studies VR has a beneficial role in hand rehabilitation too, in particular in pain management, either acute or chronic. Nonetheless, its role in functional rehabilitation (strenght, ROM, function of the hand, dexterity) and after hand injury are poorly examined. For the future the recommendation is investigate its role in hand rehabilitation (a clinical trial is already approved and will be ready in 2024) using objective assessment with the possibility to standardize VR exercises for different diseases.

## **A-0052** SHOULDER EXTERNAL ROTATION RECOVERY IN OBSTETRICAL BRACHIAL PLEXUS PALSY: SURGICAL STRATEGY, LONG TERM FOLLOW UP AND DECISIONAL ALGORITHM

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## INTRODUCTION

Shoulder intra-rotation contracture, secondary to muscle imbalance and glenohumeral dysplasia, is the main complication affecting the shoulder girdle in obstetrical brachial plexus palsy (OBPP).

Many strategies have been proposed both to achieve muscle recovery and reduce the risk of bone dysplasia.

A retrospective analysis of a cohort of children treated using the accessory spinal nerve (XI) connected to the suprascapular nerve (SSC), both as an isolated surgery and in combination with muscle-skeletal procedures, has been carried out.

The purpose of this paper is to demonstrate that late nerve transfers, promoting early recovery of external rotator muscles, can prevent or minimize shoulder dysplasia.

## METHODS

A retrospective analysis of 56 children treated between 2007 and 2019 has been performed, taking into account some inclusion criteria :

- Age at the time of surgery > 9 months

- No primary reconstruction of the brachial plexus
- Children that were seen late, without chances for a primary reconstruction
- 2 years of minimal follow up

Considering the time of surgery, children have been divided into 2 groups, whether they were younger (group I) or older (group II) than 18 months of age.

Taking into account the kind of procedures carried out along with nerve transfers, the sample was further subdivided into 4 groups:

1. Isolated XI to SSC nerve transfer (12.5 %)
2. XI to SSC nerve transfer associated with subscapularis release (58.9 %)
3. XI to SSC nerve transfer associated with coraco humeral ligament release (17.9 %)
4. Multiple nerve transfers (10.7 %)

Results:

Modified Mallet Score (MS) has been adopted for results analysis.

At minimal 2 years of follow-up, 4% of patients scored MS II, 32 % MS III, 52% MS IV and 12% MS V

The trend of results seems to be positive up to 5 years after surgery, then the outcome tends to stabilize.

Comparison by age (landmark 18 months) has not shown a significance (P value=0.64), however, MS was slightly higher in Group II. Similarly, no significance was detected between types of intervention and types of paralysis. Groups of isolated nerve transfer (INT) and nerve transfer associated with coraco humeral ligament release (CO) showed slightly better scores than Subscapularis muscle sliding (SC) and multiple transfers (MN+). Thus, it seems that SC and MN+ are likely followed by further palliative procedures. With minimal differences, Scores appeared better in upper palsy.

The comparison between the different classes of surgical procedures of nerve transfer (INT, SC, CO, and MN+) and the number of palliative procedures needed during growth did not show significance.

Conclusions

The transfer of the XI nerve to SSC is a reliable procedure for re-innervating external rotator muscles. In the stiff and palsied shoulder, nerve transfer requires muscle or ligament release, allowing the surgeon to correct both mechanical shoulder limitation and neurological deficit.

Considering the limited approach and muscle sparing, CO is a lower-risk procedure compared to SC. In our opinion, when treating a stiff palsied shoulder in young children with OBPP sequelae, nerve transfer and CO should be the first choice procedure.

## **A-0053** CORRECTIVE PROCEDURE FOR FLEXION CONTRACTURE OF THE ELBOW IN NEONATAL PALSY SEQUELAE: LONG-TERM FOLLOW-UP

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Introduction

Aim of this paper is to validate a procedure for correcting elbow flexion contracture in patients suffering from brachial plexus neonatal palsy sequelae during their teens. Elbow flexion contracture represents an unsolved problem in the natural history of obstetric brachial plexus palsy (OBPP) because of the consistent deformity recurrence. Following a

previous paper, in which an original technique was proposed in a small sample of patients, the authors show the possible correction of the deformity in a larger group of patients.

#### Methods

The procedure includes a combination of a posterior approach to the elbow with olecranon tip section and an anterior one with capsulotomy and soft tissue release to improve elbow range of motion. A series of 26 patients, who underwent the procedure, were checked out in medium and long term. Collected data were age, type of brachial plexus palsy, length of hospitalization, duration of surgery, preoperative and postoperative elbow range of motion, preoperative and postoperative DASH scores and satisfaction scores. Explaining further details about the procedure, the Authors report their results, including a statistical analysis.

#### Results

At the final follow-up, the mean increase of elbow extension was about 22°. Functional outcomes were successful as well, with a mean increase of 10 points of DASH score. Over 75% of patients were fully satisfied with their outcome.

#### Conclusions

The outcome has confirmed the good efficacy of the procedure in increasing elbow extension but also in improving cosmetic appearance in adolescents suffering from flexed elbow in OBPP sequelae.

### **A-0054** CONGENITAL DISLOCATION OF THE SHOULDER

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Congenital dislocation of the shoulder (CDS) is a rare condition, often misdiagnosed due to their rarity.

The first description date back to Stimson who, in 1888, reported of three children affected by shoulder dislocation related to brachial plexus injuries: however, there is the case described by Scudder two years later which must be considered as the first report of a true congenital shoulder dislocation.

The combination of glenoid hypoplasia and soft tissues laxity seem to be the main reason which force the joint to dislocate. Children affected by a true CDS present with a painless restriction of shoulder movements, an alteration of the normal shoulder profile, commonly associated with a deep crease in the area normally inhabited by the humeral head.

On the contrary, if the dislocation is secondary to birth trauma, the reduction in motion can be associated with swelling and pain during the attempt of passive movement.

A neurological examination of the entire upper limb is mandatory to rule out the presence of a brachial plexus palsy.

X Rays must be taken to assess the relationship between the humeral head and shoulder blade; ultrasounds, showing the epiphyseal plate and the humeral head, can help to better identify a dislocation secondary to birth trauma.

There are not any shared protocols of treatment for CDS due to the low number of cases described.

Early reduction and containment of the humeral head in the glenoid socket should be achieved to obtain a spontaneous bone remodeling while in patients with late presentation, closed reduction might not be achievable, forcing the operator to use an open procedure.

CDS promptly diagnosed and treated can achieve a good outcome both functionally and cosmetically.

Conversely, cases with late presentation might not have the same outcome forcing to use salvage procedures as shoulder arthrodesis or resection arthroplasty

## **A-0055** FRAGMENTED PROXIMAL POLE SCAPHOID NONUNION TREATED WITH COSTO-OSTEOCHONDRAL AUTOGRAFT REFERRING TO 3-DIMENSIONAL SCAPHOID BONE MODEL

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**Introduction:** The primary treatment for scaphoid nonunion is osteosynthesis using an autologous bone graft. However, partial arthrodesis and proximal carpal row carpectomy are carried out as a salvage procedure for scaphoid nonunion case in which the proximal portion is fragmented and osteosynthesis is difficult. We used a three-dimensional scaphoid bone model and reconstructed an anatomically appropriate form of proximal scaphoid by costo-osteochondral replacement arthroplasty.

**Methods:** For two patients with a proximal pole of scaphoid deemed preoperatively to be not suitable for bone grafting due to fragmentation, the proximal portion of scaphoid was constructed by computer simulation using mirror image of the unaffected side, and the bone model was made using a 3D printer. The fragmented proximal portion was removed, and the rib bone/cartilage autograft was shaved in the same shape as the three-dimensional bone model, and it was grafted into the defect. Range of motion, grip strength, Hand20 (a patient-rated outcome), numerical pain rating scale (NPRS), and radiological evaluation were assessed.

**Results:** The follow-up periods were more than 3 years, and bone union was confirmed by CT examination in both cases. Each showed improved in grip strength, Hand20, NPRS, carpal height ratio, and radiolunate angle.

**Conclusion:** Reconstruction of the proximal scaphoid using costo-osteochondral graft is best suited for young people, and good results have been reported. However, an osteochondral graft of the appropriate shape and size is necessary in order to normalize the carpal alignment and acquire stable wrist joint. It is not easy to estimate the scaphoid morphology and defect length from the proximal fragments during surgery. And, there is the possibility of damaging the osteochondral junction by repeatedly confirming the fitting. By shaving the grafted cartilage referring to the three-dimensional bone model made by the 3D printer during surgery, the proximal portion of scaphoid was reconstructed in an anatomical form close to the unaffected side.

## **A-0056** AUTOLOGOUS NERVE GRAFT FOR INTRANEURAL PERINEURIOMA OF THE UPPER EXTREMITY IN FOUR CASES

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**Introduction:** Intraneural perineurioma is an extremely rare neurogenic tumor with localized proliferation of perineurial cells in the peripheral nerves. Approximately 150 cases have been reported to occur within major peripheral nerves or their branches. We report four cases of perineurioma with motor paralysis requiring surgical treatment. **Methods:** This study included patients with neurogenic tumors who underwent tumor resection between 2001 and 2021 and were diagnosed as perineuriomas by histopathological findings. By immunohistochemical staining, a tumor in which epithelial membrane antigen (EMA) -positive and S-100 protein-negative perineurial cells grew around axons and Schwann cells was diagnosed as a perineurioma. **Results:** There were 2 males and 2 females with a mean age of 23 years (range 6-48 years) and a mean follow-up period of 33 months. The location of the tumor was the radial nerve in 3 cases and the ulnar nerve in 1 case. In the MRI examination, the lesions were isointense on T1-weighted imaging and iso to hyperintense on T2-weighted imaging, and the peripheral nerves were expanded in the fusiform. Since slowly progressive motor

paralyses were observed, autologous nerve graft using sural nerve or lateral antebrachial cutaneous nerve was performed for the nerve defects (average 7 cm) after tumor resections. With the exception of 1 patient who was followed up for less than 1 year, there was no recurrence of the tumor and improvement of motor paralysis was observed in 3 patients. Conclusion: Conservative treatment, complete resection with nerve graft, and tendon transfer have been reported as treatments. In previous systematic reviews, the median age at onset of symptoms was relatively young (14 years), and it has been reported that peripheral neuropathy with motor weakness predominates and progresses slowly. Therefore, it is necessary to carefully compare the degree of neuropathy caused by perineurioma with the expected recovery of function based on the length of the nerve defect after tumor resection, and choose a treatment method. Diffuse proliferation of perineurial cells in the affected nerves makes enucleation or tumor resection with sparing intact nerve fascicles difficult. In our case, neurolysis as an entrapment neuropathy had been performed without the suspicion of neoplastic lesion. When fusiform swelling disproportionate to the location of the entrapment was observed without obvious signal change on MRI examination, it is necessary to treat with consideration of perineurioma.

## **A-0057** OUTCOMES OF EPIPHYSIODESIS ABOUT THE DISTAL RADIUS AND DISTAL ULNA

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### Introduction:

Wrist fractures comprise nearly 30% of all fractures in children. Fractures that damage the distal radius and/or the distal ulnar growth plates may require epiphysiodesis to prevent skeletal deformity and/or length discrepancy amongst the forearm bones. Epiphysiodesis is commonly used to correct leg-length discrepancies in children but has not been extensively studied for its use on the distal radius and ulna. The purpose of this study is to present the outcomes of epiphysiodesis procedures about the distal radius and/or distal ulna.

### Methods:

A retrospective review was performed to identify pediatric patients aged under 17 years who were treated with a distal radius and/or distal ulna epiphysiodesis over a twelve-year period. Data collection included patient demographics, mechanism of injury, etiology of the physal arrest, and technique of the epiphysiodesis. Outcomes of interest included time from epiphysiodesis to complete physal closure, return to activities, and complications. Associations between patient characteristics and outcomes were determined using logistic regressions.

### Results:

Thirty-four patients with an average age of 13 years (Range: 10-16 years) were identified. Initial physal arrest was caused by a fracture in 30 (88%) patients, a Madelung deformity in 3 (8.8%) patients, and an osteochondroma in 1 (2.9%) patient. Subsequently, 17 (38%) epiphysiodesis procedures were performed in the distal ulna, 2 (5.9%) were performed in the distal radius, and 15 (44%) were performed in the distal radius and distal ulna. The median time to physal closure was 8.4 weeks (IQR: 7.1,10.9 weeks). Four patients experienced transient complications after distal ulnar epiphysiodesis, including 2 (5.9%) patients with tenderness to palpation in the TFCC region, 1 (2.9%) patient with pain on the ulnar side of the wrist and tendonitis, and 1 (2.9%) patient with finger flexor tightness and mildly decreased sensation of the ulnar nerve. No complications were identified following distal radius epiphysiodesis. All physes closed completely following the epiphysiodesis procedures. There was no significant difference in outcomes based on sex, traumatic etiology, and treatment timeline.

#### Discussion:

Epiphysiodesis of the distal radius and/or distal ulna is a well-tolerated, beneficial procedure. The physis completely closes by around 8 weeks following the procedure. Distal radius epiphysiodesis procedures are safe and distal ulna epiphysiodesis procedures have a low complication rate, mainly persistent pain on the ulnar aspect of the wrist that resolves with time. This series did not identify any cases that required a return to the operating room due to an incomplete closure of the physis.

### **A-0058** RE-FRACTURE RATE OF PEDIATRIC AND ADOLESCENT 5TH METACARPAL NECK FRACTURES

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#### Introduction:

Fractures of the 5th metacarpal neck, commonly referred to as boxer's fractures, typically occur following direct trauma to a clenched fist. In adults, previous literature suggests that the intentional and aggressive nature of these behaviors (fistfights and punching) leads to a high rate of recurrent fracture at the 5th metacarpal neck, however, there is a paucity of literature within the pediatric and adolescent populations pertaining to the recurrence rate. The purpose of this study is to examine the epidemiology, treatment, and outcomes of 5th metacarpal neck fractures and any recurrent fractures to determine if there are any factors that indicate an increased likelihood of recurrence and to establish a rate of recurrence within the pediatric and adolescent populations.

#### Methods:

A retrospective review was performed to identify all pediatric patients aged under 17 years who were treated for a 5th metacarpal neck fracture over a twelve-year period. Data collection included patient demographics, mechanism of injury, course of treatment, return to activity, complications, and fracture recurrence. Associations between patient characteristics and outcomes were explored using univariate and multivariate logistic regression.

#### Results:

Three hundred ninety-seven patients with a median age of 13 years (IQR: 11,15, Range: 1,16 years) were identified. Of these patients, 328 (83%) were male. 158 (42%) patients were injured through intentional or aggressive behaviors including fist fighting or punching. Patients were treated non-operatively (N=353,89%) with immobilization, or operatively with a closed reduction and percutaneous pinning (N=32, 8.1%) or open reduction and internal fixation (N=12, 3.0%). The average time to return to activity was 37 days (SD:19 days). The incidence of refracture in the pediatric and adolescent population was 1.3% (N=5). 80% (N=4) of refractures occurred in male patients and 100% (N=5) occurred through intentional or aggressive behaviors. Following reinjury, the average time to return to activity was 31 days (SD: 7 days). There was no significant association between fracture recurrence and patient and/or injury characteristics.

#### Discussion:

The refracture rate of 5th metacarpal neck fractures in the pediatric and adolescent population is quite low at 1.3%. The initial fractures and refractures are most commonly seen in males. All patients with recurrent injuries had them caused by intentional or aggressive behaviors. Additional education is warranted to alert children and adolescents and their parents about the potential for refracture with intentional and aggressive behaviors.

## **A-0059** FACTORS SURROUNDING TRAVELING TO APPOINTMENTS FOR PEDIATRIC ORTHOPAEDIC SURGEONS: UNACCEPTABLE LENGTHS?

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### Introduction:

A major aspect in the delivery of healthcare involves access to specialists, which introduces a number of difficulties for patients and families who are underinsured or live in areas with limited access to specialized healthcare. The purpose of this study is to determine which travel logistics may inhibit access to the availability of specialists.

### Methods:

Two hundred pediatric orthopaedic patients seen at an urban/suburban outpatient setting were prospectively surveyed. The survey assessed logistic travel factors to determine the primary reason for selecting our institution. Simple statistics were performed to analyze the data.

### Results:

43% of patients picked office location as the primary reason for going to a particular outpatient setting while appointment availability was the second most important factor (31%). On average, patients traveled 21 miles (1-175) and spent 31 minutes each way (3-250). If proximity was their main reason to travel to an office, the average distance to the appointment was 16 miles but when appointment availability was their priority the average increased to 23 miles. 95% of patients traveled by car while the remainder utilized a bus or medical mobility. Among bus riders, an average of 50 minutes to travel only eight miles was needed. Most patients used vacation time to come to an appointment and 25% of families lost wages, at an average cost of \$380.

### Discussion:

Location is the primary reason why patients choose to see a pediatric orthopaedic surgeon at a particular facility, unless the problem was deemed more acute by the parents, therefore the families were more willing to travel longer distances. Location, travel distance, public transportation, and loss of vacation time or wages present more difficulties to families needing to access specialized healthcare.

## **A-0060** COMPETENCY IN PEDIATRIC CAST PLACEMENT AND REMOVAL BASED ON EXPERIENCE AND EDUCATION LEVEL

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### Introduction:

Casts are commonly used to immobilize fractures to promote proper alignment, decrease pain and protect from additional injury while a fracture is healing. It is imperative that all healthcare team members that apply and remove casts can do so safely and effectively. The purpose of this study is to determine whether one's experience and/or education level influences the competency of cast placement and removal abilities.

### Methods:

A prospective observational study was conducted to examine cast placement and removal by various healthcare providers. Researchers observed the procedures and completed a checklist to assess competency based on a previously published cast application/removal assessment. To assess competency, cast placements were scored out of 6 and cast removals

were scored out of 3 akin to the previously published scoring system. Simple statistics were performed.

Results:

One hundred fifty-two cast placements and removals were observed. During cast placement, the average scores for orthopedic technicians, medical assistants, advanced practice providers and residents were 95.51%, 91.51%, 93.33%, and 95.0%, respectively without a significant difference between groups ( $p$ -value = 0.54). Average scores for cast removal for orthopedic technicians, medical assistants, advanced practice providers and residents were 90.52%, 65.48%, 100%, and N/A ( $N=0$ ), respectively with a  $p$ -value of 0.00002 demonstrating a statistically significant difference between groups.

Discussion:

Cast placement scores were similar across all healthcare providers, however, cast removal scores were greater amongst orthopedic technicians and advanced practice providers compared with medical assistants. These results demonstrate that quality improvement initiatives and future training and educational programs to improve casting application and removal are necessary until one is sufficiently proficient.

## **A-0061** PEDIATRIC DISTAL ULNA FRACTURES: EPIDEMIOLOGY, OUTCOMES, AND COMPLICATIONS

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Introduction:

Distal forearm fractures are the most common fracture in the pediatric population, accounting for about 30–40% of all fractures. Previous literature has focused on treatment and outcomes of pediatric distal radius fractures, but literature surrounding pediatric distal ulna fractures is limited. The purpose of the study is to evaluate the epidemiology, treatment, outcomes, and complications of pediatric distal ulna fractures.

Methods:

A retrospective chart review was performed of pediatric and adolescent patients treated for a distal ulna fracture over a 13-year period. Patient demographics, mechanisms of injury, fracture pattern, immobilization type, immobilization length, length of follow-up, patient outcomes, and complications were recorded. Simple statistical analysis was performed.

Results:

20 patients with an average age of 6.4 years (SD: 3.1; Range: 0–13) were identified. The most common mechanism of injury was a fall ( $N=17$ ). The average time from the injury to the initial evaluation was 9.4 days (SD: 9.5 days). The most common fracture types were buckle fractures ( $N=9$ ), salter harris fractures ( $N=6$ ) and extraphyseal fractures ( $N=4$ ). All 20 patients had a concomitant distal radius fracture. Two (10%) patients had their distal radius fractures treated surgically, however, all 20 distal ulna fractures were treated non-operatively with immobilization alone. Twelve (60%) patients were immobilized with a long arm cast. The average length of immobilization was 32.1 days (SD: 15.1 days). No complications were reported. The average time to return to activities was 66.4 days (SD: 46.3 days).

Discussion:

Pediatric and adolescent distal ulna fractures occur concomitantly with distal radius fractures. The vast majority of these fractures may be successfully managed non-operatively through immobilization alone.

## **A-0062** RISK PREDICTION MODEL FOR UNSUCCESSFUL ELBOW FLEXION RECOVERY AFTER NERVE TRANSFER SURGERY IN BRACHIAL PLEXUS INJURY PATIENTS

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**Objective:** Nerve transfer surgery has been a mainstay for the treatment of brachial plexus injury with varying success rates. Patients with an unsuccessful operation were afflicted with a useless limb for at least 2 years. Preoperative success rate prediction has become a topic of interest to avoid an unsuccessful operation but without much accuracy. This study aimed to find the strong predictive factors and develop a prediction model for unsuccessful functional elbow flexion recovery after 2 years of a nerve transfer surgery in patients with brachial plexus injury.

**Methods:** This retrospective study reviewed the medical records of 987 patients with traumatic brachial plexus injury who underwent brachial plexus surgery by five hand and microsurgery surgeons at a single tertiary care referral center from December 2001 to July 2018. 433 patients were eligible for analysis. Patient demographic data, factors for injury, surgical details, and postoperative factors were collected. Multivariable logistic regression was used to identify strong prognostic factors for unsuccessful nerve transfer surgery for elbow flexion. A simplified model was developed by rounding the coefficient to the nearest 0.5 score or an integer. Both original and simplified models were validated using the Hosmer–Lemeshow goodness-of-fit test and bootstrapping.

**Results:** A full final prognostic model from a stepwise backward logistic regression consisted of a body mass index of  $>23$  kg/m<sup>2</sup> ( $p = 0.015$ ), smoking ( $p = 0.046$ ), total arm type ( $p = 0.033$ ), donor nerve ( $p < 0.001$ ), associated upper extremity fracture ( $p = 0.013$ ), and associated ipsilateral vascular injury ( $p = 0.095$ ). The area under the receiver operating characteristic of the final and simplified models is 0.765 and 0.766, respectively. Hosmer–Lemeshow goodness-of-fit test showed good predicted and observed probability agreement of the final ( $p = 0.49$ ) and simplified models ( $p = 0.19$ ). Bootstrapping estimated the moderate optimism (1.9%) in the final model and minimal optimism (0.1%) in the simplified model.

**Conclusions:** The prediction model for failed elbow flexion recovery after nerve transfer surgery in traumatic brachial plexus injury was developed with good predictive value and internal validity. An alternative treatment, i.e., primary free functioning muscle transfer, should be offered in preoperative counseling in case of a very high risk of failure.

## **A-0063** PEDIATRIC THUMB PROXIMAL PHALANGEAL FRACTURES: EPIDEMIOLOGY, OUTCOMES, AND COMPLICATIONS

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**Introduction:** Hand fractures are the most common fractures in the pediatric population. Previous literature has evaluated proximal phalangeal thumb fractures in adult populations, but the literature surrounding pediatric thumb proximal phalangeal fractures is limited. The purpose of this study is to describe the epidemiology, treatment, and outcomes of pediatric thumb proximal phalangeal fractures.

**Methods:** A retrospective review was performed of pediatric and adolescent patients treated for a thumb proximal phalangeal fracture over a 13-year period. Patient demographics, mechanisms of injury, fracture pattern, immobilization type, immobilization length, length of follow-up, patient outcomes, and complications were recorded. Simple statistical analysis was performed.

Results: 14 patients with an average age of 9.9 years (SD: 4.5 years) were identified. 78.6% of patients were male. The most common mechanism of injury was sports participation (N=7), followed by a jammed finger (N=2), and a fall (N=2). The average time from initial injury to evaluation was 5.6 days (SD: 3.3 days). The most common fracture type was a Salter Harris fracture (N=6), followed by a shaft fracture (N=3). One (7.1%) patient had a concomitant injury of a soft tissue calcification. 10 (71.4%) patients were treated nonoperatively with immobilization in a short arm thumb spica cast for an average of 19.8 days (4.7 days). Four (2.9%) patients were treated operatively with a closed reduction and percutaneous pinning. The average time from initial evaluation to surgery was 3.5 days (SD: 2.2 days). 75% (N=3) of patients had 2 pins placed across the fracture site, while 25% (N=1) of patients had 3 pins placed across the fracture site. Following the procedure, patients were immobilized on average of 27.8 days (SD: 2.5 days). The average time from surgery to removal of hardware was 27.8 days (SD: 2.5 days). There were no complications reported. The average time to return to activity was 37 days (14.5 days).

Discussion: Pediatric thumb proximal phalangeal fractures can be successfully managed with minimal complications. Further study with a larger sample size assessing thumb proximal phalangeal fractures in the pediatric population, the surgical interventions utilized, and their outcomes is warranted.

## **A-0064** PEDIATRIC AND ADOLESCENT 1ST METACARPAL FRACTURES: EPIDEMIOLOGY, OUTCOMES, AND COMPLICATIONS

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Introduction: The treatment and outcomes surrounding first metacarpal fractures have been well documented in adults but there is limited literature pertaining to these fractures in the pediatric population. The purpose of this study was to assess the epidemiology, treatment, and outcomes of pediatric and adolescent first metacarpal fractures.

Methods: A retrospective review was performed to identify all pediatric and adolescent patients treated for a first metacarpal fracture over a 13-year period. Patient demographics, mechanisms of injury, fracture pattern, immobilization type, immobilization length, length of follow-up, patient outcomes, and complications were recorded. Simple statistical analysis was performed.

Results: 58 patients with an average age of 11.9 years (SD: 3.1 Range: 1-17 years) were identified. 72% (N=42) of patients were male. The most common mechanism of injury was sports participation (N=20), followed by a fall (N=16), and an altercation (N=11). The average time from initial injury to evaluation was 8.1 days (SD: 8.7; Range:1-42 days). The most common fracture location was the metacarpal base (N=22; 38%) and 13 (22.4%) patients had concomitant injuries. Of the 58 patients, 53 (91.4%) were treated non-operatively with immobilization for an average of 29.9 days (SD: 8.0). Five (8.6%) patients were treated operatively, three with a CRPP and two with ORIF. The average time to removal of hardware was 30.6 days (SD: 1.8). Of the 55 patients with sufficient follow-up data, one (1.8%) patient was noted to have a complication which was persistent thenar pain that resolved with formal therapy. The average time to return to activity was 31.2 days (SD:10.8).

Discussion: The vast majority of pediatric and adolescent first metacarpal fractures can be successfully managed through non-operative means with minimal complications expected. When surgical intervention is warranted, excellent outcomes can be expected. Further studies assessing pediatric first metacarpal fractures treated operatively and their associated complications are warranted.

## **A-0065** PEDIATRIC AND ADOLESCENT PROXIMAL HUMERUS FRACTURES: EPIDEMIOLOGY, OUTCOMES, AND COMPLICATIONS

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### Introduction:

Proximal humerus fractures account for 2-5% of all pediatric fractures. Most of these fractures may be managed conservatively with minimal complications, however, there are some studies that have suggested surgical intervention is warranted for certain fractures. The purpose of this study is to assess the epidemiology, treatment, and outcomes of pediatric proximal humerus fractures.

### Methods:

A retrospective chart review was performed to identify all pediatric and adolescent patients treated for a proximal humerus fracture over a 13-year period. Patient demographics, mechanisms of injury, fracture pattern, treatment type, immobilization length, length of follow-up, patient outcomes, and complications were recorded. Simple statistical analysis was performed.

### Results:

49 patients with an average age of 8.2 years (SD: 4.1, Range: 0.3-16 years) were identified. 53% of the patients were male. The most common mechanism of injury was a fall (N=33), followed by sports participation (N=9), and a collision (N=6). 35 (71.4%) fractures were classified as extraphyseal fractures, and 14 (28.6%) fractures were physeal fractures. The median time from initial injury to evaluation was 4 days (Range: 0-154 days). Four (8.2%) patients had concomitant injuries including 1 distal radius fracture, 1 radial neck fracture, 1 phalangeal tuft fracture, and 1 lateral condyle fracture. 44 (89.8%) patients were treated non-operatively with immobilization alone. The average time of non-operative immobilization was 28.4 days (SD: 11.9 days). Five (10.2%) patients were treated operatively, with ORIF (N=3), IMN (N=1), or curettage and grafting (N=1). The average time from initial evaluation to surgery was 16.8 days (SD: 18.5 days). The average number of pins used was 2.2 pins (SD: 1.3 pins). Of the 35 patients with sufficient follow-up, 4 (11.4%) patients had associated complications, including 3 with pain that resolved with therapy and anti-inflammatories and 1 with a loss of reduction. The average time to return to activities was 64.0 days (SD:42.9 days).

### Discussion:

The vast majority of pediatric and adolescent proximal humerus fractures can be treated with immobilization alone with a low complication rate expected. Further research is warranted to determine which fractures need surgical management as well as the optimal amount of needed immobilization.

## **A-0068** A DEEP LEARNING BASED APPROACH FOR AUTOMATIC SEGMENTATION OF CARPAL BONES IN FOUR-DIMENSIONAL COMPUTED TOMOGRAPHY SCANS

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Background: Four-dimensional Computed Tomography (4DCT) is a recently emerging diagnostic imaging technique for joint pathologies. In the wrist, 4DCT has shown its potential in diagnosing ligament lesions causing dynamic instability.

However, as each 4DCT dataset consists of one static scan and over one hundred dynamic scans, manual analysis is labor-intensive and time-consuming. Therefore, automatic analysis is recommended, which consists of three steps. The first step is segmentation, in which all voxels belonging to one bone are labeled. After that, registration is necessary to transform segmented bones of the static scan onto their dynamic positions. Third, motion analysis is performed on the registered bones to quantify carpal kinematics. This study is focused on the first step: automatic segmentation. The aim is to develop and assess the performance of a deep-learning algorithm for segmentation of the radius, ulna, and carpal bones from 4DCT scans.

**Methods:** A deep-learning algorithm based on a 3D U-net architecture was trained to segment and label the radius, ulna, and eight carpal bones from 4DCT datasets. Both static and dynamic scans were manually segmented to serve as reference. Several data augmentation strategies, such as scaling, Gaussian noise, random rotations, and blurring were applied to increase the robustness of the algorithm. In an iterative process, this data was used to train the algorithm. Its performance was evaluated by calculating the Dice similarity coefficient (DSC) and average surface distance (ASD) of the test set, which consisted of five scans (one static CT scan, and four dynamic 4DCT scans). The goal was to achieve a DSC of at least 90% and an ASD smaller than 0.34 mm, which is the smallest voxel size of our data, to produce accurate segmentations.

**Results:** Six static CT scans and eight dynamic 4DCT scans were needed to train the deep-learning algorithm to segment the radius, ulna, and carpal bones accurately. Of these fourteen scans, eight were from wrists with a suspected ligament injury and six were from uninjured wrists. The algorithm segmented and labeled all bones in the test set correctly and performance evaluation resulted in an average DSC of  $95.9 \pm 2.1\%$  and an average ASD of  $0.14 \pm 0.07$  mm.

**Conclusion:** The presented algorithm showed that the radius, ulna, and eight carpal bones can be automatically segmented and labeled in 4DCT scans with excellent performance. Implementation of this algorithm is the first step towards a fully automatic analysis of 4DCT scans of the wrist. This can improve the clinical usability of 4DCT analysis, which can become a user and patient-friendly diagnostic tool for wrist pathology.

**Keywords:** Artificial Intelligence, Deep Learning, Automatic Segmentation, 4DCT, Carpal Bones

## **A-0069** A NOVEL METHOD FOR AUTOMATIC THREE-DIMENSIONAL (3D) MEASUREMENTS OF THE SCAPHOLUNATE DISTANCE IN FOUR-DIMENSIONAL COMPUTED TOMOGRAPHY (4DCT) DATASETS

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**Background:** Four-Dimensional Computed Tomography (4DCT) is a recently emerging imaging technique for diagnosing wrist injuries. Using 4DCT, wrist kinematics can be quantified non-invasively and dynamically, as multiple 3D CT scans are generated per second. Although still in its infancy, 4DCT has shown its potential in providing early diagnosis of scapholunate interosseous ligament (SLIL) injuries. An important parameter associated with SLIL injury is the scapholunate (SL) distance. Current methods to calculate this parameter are based on manual 2D measurements on X-ray or coronal CT images. However, manual assessment of 4DCT datasets is not feasible considering the large amount of generated data (144 dynamic scans per dataset), yet the high number of frames per second can provide valuable information on wrist kinematics. Therefore, we propose an automatic method for 3D measurements of the SL distance in 4DCT datasets.

**Methods:** The dominant wrist of 31 healthy volunteers (age 20 – 40 years) was scanned. The 4DCT scanning protocol included a conventional static CT scan of the forearm and wrist, followed by two dynamic imaging runs during which radial to ulnar deviation (RUD) and flexion to extension (FE) of the wrist were performed, resulting in 144 dynamic CT scans (72 per wrist movement). Post-processing steps included automatic segmentation of carpal bones and registration of bones from the static scan onto corresponding dynamic positions. The SL distance was automatically calculated using these registered meshes of the scaphoid and lunate in all dynamic positions. First, the center point of the articulating surface of the lunate was automatically identified in a neutral wrist position. Subsequently, the SL distance was calculated as the shortest distance from this center point to the surface of the scaphoid in each dynamic wrist position. Means and standard deviations of the SL distance and range (maximum-minimum SL distance) were calculated per wrist movement. To validate the proposed method, the results are currently being compared to manually performed measurements of the SL distance. **Results:** 31 volunteers (16 females, 52%) were included in this study, of which 29 right wrists (94%) were scanned. In one volunteer the FE run was missing, which resulted in a total of 31 wrists for RUD analysis and 30 wrists for FE analysis. The average SL distance was  $0.96 \pm 0.30$  mm during RUD and  $1.05 \pm 0.31$  mm during FE. The average range was  $0.51 \pm 0.27$  mm during RUD and  $0.92 \pm 0.48$  mm during FE. The validation results are currently being processed.

**Conclusion:** We developed a novel 3D method to measure the SL distance automatically in 4DCT datasets. All healthy wrists had an average SL distance below 2 mm, which is consistent with literature indicating that an SL distance greater than 3 mm is associated with SLIL injury. Implementation of this method in clinical practice can improve 4DCT processing time and enhance the value of 4DCT for early diagnosis of SLIL injuries.

**Keywords:** scapholunate interosseous ligament, 4DCT, scapholunate dissociation, automatic analysis

## **A-0070** WRIST ARTHROPLASTY AS A SOLUTION TO POST-TRAUMATIC OSTEOARTHRITIS OR FAILED PARTIAL ARTHRODESIS: A CASE SERIES

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**Background:** Differentiated from arthrodesis, total wrist arthroplasty allows maintaining a range of functional movement in patients operated on for radiocarpal arthrosis of different causes. The evolution of implants has made it possible to achieve a greater success rate by reducing relatively frequent complications such as the component loosening. This study aims to provide knowledge of the functional results and the rates of complications in a series of cases operated with the Motec® implant by a single surgeon.

**-Methods:** This is a retrospective study of 14 patients undergoing total wrist arthroplasty with the Motec® system operated between 2018 and 2022 and evaluated pre and post-operatively with the Mayo Wrist Score and pain VAS. A review of clinical histories was carried out in June 2022 and a statistical analysis was done with a paired t test considering a significant value of  $p < 0.05$ .

**-Results:** Thirteen men and one woman underwent surgery, with an average age of 64.8 years (DE=7.5) and the average follow-up time was 25.1 months (DE=10.9). There were three patients previously submitted to proximal row carpectomy, two four-corner arthrodesis, one lunocapitate arthrodesis, one SNAC wrist, two SLAC wrists, four distal radius fractures and one idiopathic osteoarthritis. The Mayo Wrist Score score presented a preoperative mean of 23.2 (DE=8.9) and a postoperative mean of 82.8 (DE=7) besides the preoperative pain VAS with an average of 7.6 (DE=1.1) and the postoperative

period was 1 (DE=1.2). The differences in the pre and postoperative results of the Mayo Wrist Score and EVA were statistically significant with  $p < 0.001$ .

-Conclusion: As demonstrated in our series, the functional and pain improvements were important, there was no major complications during the evaluated time period, and the prosthesis was a valid alternative as a treatment for the rescue of failed partial carpal arthrodesis. Patients should be followed up for longer, but with the certainty that, in the event of failure, a surgical rescue in the form of total wrist arthrodesis can be performed.

### **A-0071** TOTAL WRIST ARTHRODESIS USING A LOW-PROFILE, VARIABLE-ANGLE LOCKED DORSAL PLATE: CONSOLIDATION RATE AND COMPLICATIONS OF 85 CONSECUTIVE CASES

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Background: Wrist arthrodesis has evolved over time with the growing use of a more rigid implant, and a resultant increase in healing rates. However, complications such as irritation of the extensor tendons have led to the development and introduction of improved low-profile implants in recent years. This study aimed to examine the factors that influence the healing of total wrist arthrodesis and the frequency of complications using a low profile plate from the same manufacturer.

Methods: This is a cross-sectional study analyzing the medical records and radiographs of patients who underwent wrist arthrodesis using a long or short Aptus<sup>®</sup> 2.5 Trilock Wrist Fusion Plate (Medartis AG, Basel, Switzerland) between 2015 and 2021. Epidemiological and clinical variables were analyzed. The Chi-square test or Fischer's Exact Test were used to compare proportions and the results, with a  $p$ -value  $\leq 0.05$  being considered statistically significant.

Results: Of the 85 wrist arthrodesis performed, 100% consolidation was observed in an average of 4.6 months after surgery. Most patients were non-smokers (80%) men (69.4%) with a mean age of 50.7 years. In three cases patients had pain in the ulnar side of the wrist following surgery and underwent a further operation using the Darrach procedure an average of 10 months after the first procedure. There was one case of surgical site infection which was resolved with mechanosurgical lavage and administration of intravenous antibiotic therapy. One patient was submitted to removal of the plate 12 months after the procedure due to discomfort generated by the plate. One patient suffered periprosthetic fracture 10 months after the procedure, with arthrodesis already consolidated, and the solution was the proximal slipping of the plate (Figures 3 and 4). In another case, the release of two distal screws was observed in the metacarpal 1 month after the procedure, being quickly resolved with a screw change and healing in 4 months. In one patient (SNAC wrist) submitted to arthrodesis with a short plate, loosening of the screws in the carpal at 2 months was observed, and was resolved with a replacement with a long plate was, with healing in 8 months (Figures 5 and 6). The complication rate, therefore, was 9.4% (8 cases). The mean time of consolidation in smokers was 5.8 months and in non-smokers 4.2 months ( $p=0.03$ ). The mean time of consolidation following the long plate procedures was slightly shorter than with the use of short plate, but was without statistical significance.

Conclusion: The wrist arthrodesis in the present study had a consolidation rate of 100% with a low the rate of complications and without differences in results regarding graft placement, carpometacarpal joint fusion or the demographic profiles of the patients. Smoking was associated with increased consolidation time, but did not lead to nonunion.

## **A-0072** NEUROMUSCULAR AND PROPRIOCEPTIVE REEDUCATION AFTER PROXIMAL ROW CARPECTOMY: A CASE SERIES

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Previously published studies have extensively analyzed the proprioceptive system of the wrist and the role of the carpal ligaments on the wrist sensorimotor control process, being a fundamental aspect in the complex biomechanics of the carpus. Proximal row carpectomy is a surgical intervention that creates a series of anatomical and biomechanical alterations in the carpus that seem to alter the proprioception of the wrist. Despite the fact that this intervention has been described since the 1940's, treatment protocols in hand therapy are practically nonexistent and the scarce management indicated in the literature describe a late management that does not take into account neuromuscular control.

The purpose of this presentation is to propose an intervention protocol for proximal row carpectomy based on an early proprioceptive carpal reeducation approach through a retrospective analysis of a case series of 3 patients treated with this protocol after proximal row carpectomy. Patients participated in early treatment based on neuromuscular and proprioceptive re-education, initiated 2 weeks after surgery, for 30 sessions over 10 weeks and were evaluated at sessions 1, 15 and 30 using the Numerical Rating Scale (NRS), goniometry, test of Joint Position Sense (JPS), grip dynamometry and the Quick Dash and PRWE functional scales in order to quantify their evolution.

After the proposed intervention marked improvements in pain, ROM, proprioception, grip strength and function were reported, being equal or superior to those reported in the literature in a considerably shorter time. The patients were medical discharged after the 10 weeks and even 2 of them returned to competitive motorcycling and cycling.

Although a systematic review is needed to adequately determine its effectiveness, this research provides a novel baseline protocol and rationale for use with patients who have undergone carpal row carpectomy and suggests that applying these management principles through early rehabilitation, avoiding unnecessary immobilization and emphasizing on proprioceptive aspects appears to be safe and effective in order to achieve a successful rehabilitation.

## **A-0073** RESULTS OF THE OBERLIN PROCEDURE FOR ELBOW FLEXION DISORDERS FROM CERVICAL SPINE DISEASES

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**Background:** There have been many reports on the Oberlin procedure for traumatic brachial nerve injury, but few reports for cervical spine diseases.

**Objective:** To investigate the postoperative course and results of the Oberlin procedure for elbow flexion disorders derived from cervical spine disease in our hospital.

**Materials and Method:** The subjects of this study were four cases of the Oberlin procedure performed at our hospital after 2009, in which the cause was derived from cervical spine disease. All patients were male, three right and one left, with a mean age of 63.8 years. The cervical spine diseases were cervical spondylotic amyotrophy in one case, cervical cord hourglass tumor after resection in one case, and C5 palsy after cervical spine surgery in two cases. The Oberlin procedure was performed according to the original method in all cases. The postoperative follow-up period was 3.25 years (1-4.5

years). Postoperative complications, elbow range of motion before and after surgery, MMT of the biceps brachii, and final results were reviewed in these patients.

Results: All patients had a good range of motion of the elbow joint. Numbness and discomfort in the ulnar nerve area were observed as postoperative complications, but all patients improved during the course of the study. Preoperative MMT averaged 1.8, but improved to an average MMT of 3.8 after surgery. At least MMT 3 was achieved, ease of force application improved, and all patients were highly satisfied with the results.

Discussion: The Oberlin procedure for elbow flexion disorders caused by cervical spine disease at our hospital was reviewed. The results of elbow flexion function reconstruction by the Oberlin procedure were comparable to those reported in the past, even if cervical spine disease was the cause. However, a case of cervical spondylotic amyotrophy should be carefully monitored for future exacerbation of the underlying disease.

## **A-0074** ARTHROSCOPICAL ROUND-BLOCK CAPSULO-LIGAMENTOPLASTY FOR DYNAMIC SCAPHOLUNATE INSTABILITY. AN ANATOMICAL STUDY AND CASE SERIES

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Several treatment options exist for the management of symptomatic dynamic scapholunate (SL) instability. Challenge remains to adequately treat this condition, before irreversible changes appear. We performed an anatomical study and evaluated the results of a series of patients treated with the arthroscopic “round-block” capsulo-ligamentoplasty technique, developed by the senior author (AA).

Technique: in order to stabilize the SL interval, a 2.0 Fiberwire is used to create a purse-string suture around the dorsal aspect of the proximal row, following the course of dorsal intercarpal ligament (DICL). The suture travels between the radiocarpal and midcarpal space, piercing the scaphoid and triquetrum attachments of the DICL. The suture tightening produces also an extension lever correcting the scaphoid flexion. Moreover, the Fiberwire suture induces a fibrotic healing that reinforces the dorso-capsule scapholunate septum (DCSS).

In this study, all procedure and assessment was performed by the first author (CKG).

In 4 fresh frozen cadavers, an EWAS 3B SL dissociation was created, then the “round-block” technique was performed. In all specimens, the SL interval was reduced to EWAS 1.

In a clinical prospective setting, 20 patients were selected, 6 male/ 14 female, mean age 40,6 years (range 23-63 years) with dynamic SL instability, which was diagnosed with normal and stress radiographs and MRI. Mean onset of symptoms was 11,2 months (range 3-36 months). Arthroscopy revealed 8 EWAS type 3B, 12 EWAS type 3C, which were all treated. Mean follow-up after surgery was 6,2 months (range 3-9 months). Mean VAS pain decreased by 87%, mean flexion by 19%, mean extension by 17%, mean quickDASH by 84%. Mean grip strength increased by 10%. Mean satisfaction was 9/10 and all would do the procedure again. Normal activities were restarted after mean 2,5 months (range 2-5 months). No major complications occurred. Mean preoperative SL distance was 2,3 mm on normal radiograph and 3,1 mm on clenched fist radiograph. Mean SL distance after surgery was 1,6 mm. Arthroscopically, SL stability improved to EWAS 1 or 2. Mean SL angle reduced from 55° to 51°, while the radiolunate (8°) and capitolunate (9°) angle remained unchanged. The “round-block” technique, which is indicated for dynamic SL instability, resulted in a satisfactory clinical, arthroscopic and radiological outcome. Compared to other capsulodesis technique, the all-inside suturing, without additional damage

to the SL complex, is theoretically likely to produce less stiffness. In higher grade of SL instability, other arthroscopic techniques can possibly be added to achieve sufficient SL stability, or it may be converted into more invasive techniques. Finally, the wrist remains practically undamaged after surgery: no bone tunnels, bone anchors or tendon grafts are required, thus enabling all possible secondary procedures.

Will this satisfactory outcome persist on the longterm? Is the advancement to higher grades of SL dysfunction with osteoarthritic changes, delayed by this plasty or not? Longterm studies are needed.

## **A-0075 SHOCK WAVES ROLE IN SOFT TISSUE REGENERATION**

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Since 1991 high energy shock waves (ESWT) have been used for the treatment of several musculoskeletal conditions, like soft tissue calcifications and fractures non union. In more recent years a regenerative power of ESWT on soft tissues has been recognized. Material and Method

From 2012 to 2021 54 patients (46 M, 8 F, age range 4-74 Y) affected by soft tissue conditions in the hand (46 fingertip injuries, 5 complicated traumatic wounds, 2 complicated post-surgical wounds after procedures for Dupuytren in diabetic patients, 1 retracted scar after local flap) have been treated with high energy shock waves with the Othogold 100 System. Treatment was carried on for a period from 3 to 6 weeks.

Results

Shock Waves showed in All cases:

Regeneration of the skin and subcutaneous tissue

Pain relief

Inflammation reduction

Serous and fibrinous discharge reduction

More extensible, soft and sensitive skin

Less stiffness

Rapid range of motion recovery

Discussion

All the patients treated in this series recovered completely without need of further treatments. Minimal bone and tendons exposure did not affect the efficacy of the treatment. Regenerated soft tissues and skin showed a better quality compared with natural scar tissue.

Conclusion

Shock Waves are Simple, Effective, Cheap and Minimally invasive.

Choosing the right cases, as patients with partial bone tissue exposure, shock waves for soft tissue regeneration treatment is a good option and there's always the possibility to convert it into a surgical treatment.

## **A-0076** TMRPNI: COMBINING TWO PERIPHERAL NERVE MANAGEMENT TECHNIQUES FOR MISMATCHED NERVE COAPTATION

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Targeted muscle reinnervation (TMR) and regenerative peripheral nerve interface (RPNI) represent the ultimate and most effective therapy for the treatment of phantom limb pain, residual limb pain, and neuroma pain can achieve meaningful clinical improvement. However, when performing TMR from a large nerve into a smaller branch, size mismatch is inevitable, and it is likely that many regenerating axons will escape the target nerve and aberrantly sprout into the adjacent area. resulting in axons growing into empty space that by default becomes scar tissue and leads to the classic mechanism for a painful neuroma. We describe a technical adaptation that combines TMR and RPNI for the treatment of a peripheral neuroma. The advantage of this technique is 1) to provide a neuromuscular target for the transected peripheral nerves that might escape the mismatched nerve endings in TMR, and 2) for wrapping the traditional TMR nerve transfer coaptation with an autologous free muscle graft. In this report, we present two different applications for utilizing the TMRpni concept. Case 1:A 45-year-old, male who had above knee amputation that was complicated by excruciating pain and phantom limb pain. We decided to apply the adapted technique, given the idea of the mismatching between transected large peripheral nerves in the lower limb and the small recipient nerves. On exploration, the saphenous nerve was coapted to a motor branch to semimembranosus, and the coaptation was wrapped with a 3 cm × 1 cm free muscle graft. In addition, the common peroneal component of the sciatic nerve was dissected and coapted to a motor branch to biceps femoris and the tibial nerve component of the sciatic nerve coapted to a motor branch to semimembranosus. Both coaptations were wrapped with a 3 cm × 1 cm free muscle graft. The patient has a complete resolution of symptoms and no recurrence of pain or hypersensitivity. The patient has stopped taking painkiller medications and he has a better quality of life. Case 2:A 33-year-old, who had a suicidal attempt 7 years ago by cutting her left wrist and severing many structures including median nerve which was sutured primarily. ever since she never got sensation back, and she got wasting of the thenar muscles. However, her major concern was the severe pain in the wrist and electrical shooting. We explored patient's wrist and found median nerve was completely severed with neuroma at the proximal end.TMRpni was applied by coaptation of the proximal end of the median nerve to AIN which was wrapped by a free muscle graft around the repair area. Post-operatively, the patient has fully recovered. In conclusion: The described technique includes performing the traditional TMR nerve transfer coaptation and then wrapping the coaptation with an autologous free muscle graft. It has the advantage of providing a neuromuscular target for the transected peripheral nerves that might escape the mismatched nerve endings in TMR, and the free muscle graft will act as an autologous nerve wrap at the coaptation area. We suggest utilizing TMRpni in mismatch nerves and TMR failure.

## **A-0077** INTRAMEDULLARY COMPRESSION SCREW FIXATION IN METACARPAL AND PHALANGEAL FRACTURES: A 4 YEAR SINGLE-CENTER RETROSPECTIVE STUDY

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Hand fractures account for approximately 20% of all fractures. Metacarpals and phalanges are most frequently involved, with a prevalence of 59% and 33%, respectively. Although most extra-articular fractures can be safely treated non-

operatively, unstable fractures of the metacarpal or phalangeal shaft require surgical treatment. Many surgical options are described. Percutaneous intramedullary Kirschner (k) wires are known for short operating time and minimal exposure but the literature reports complications including pin infection, pin loosening and nonunion. Fixation with plates and screws has been reported to have complications, such as metacarpophalangeal joint stiffness requiring teno-arthrolysis and implant removal. Recent studies have indicated that intramedullary fixation with compression screws (IMCS) could represent a reliable and effective option for the treatment of unstable extra-articular fractures of the metacarpals and phalanges.

The purpose of this retrospective study is to report and analyze the clinical outcomes and effectiveness of IMCS in metacarpal and phalangeal fractures.

In this study 64 consecutive fractures of metacarpals and phalanges treated with IMCS between July 2018 and February 2022 have been retrospectively re-evaluated. All fractures were assessed as primarily unstable. Seven patients had associated fractures treated with k wires in the same hand, one patient with plates and k wires. There were 59 metacarpal fractures and 5 fractures of the proximal phalanx. For all patients the intramedullary screws used for fractures fixation were BSS Mikai (Mikai S.p.A., Genova, Italy). An accurate choice of screw size was based on the dimensions of the intramedullary isthmus diameter. The percutaneous surgical technique was used in all cases, except in the case of open fracture. All patients underwent a radiological follow up at 15, 30, 90, 180 days and 1 year after surgery. Patients were recalled for evaluation after treatment: pain was assessed using Visual Analogue Scale (VAS) and the DASH (Disabilities of the Arm, Shoulder, and Hand) questionnaire was administered to all patients to assess disability and symptoms. During the clinical evaluation range of motion (ROM), the presence of rotational deformities and extension lag were determined. The mean follow up is 17,6 months. No cases of malunion, nonunion or infection have been reported, all fractures were both clinically and radiographically healed at the follow-up. The mean active ROM of the metacarpophalangeal joints and proximal interphalangeal joints at the follow up was 129.1°. We reported one case of rotational deformity (1.5%) and no cases of extension lag. One case of screw protrusion from fifth metacarpals head has been described. At the clinical evaluation the mean VAS was 1.5 and patients were shown to return to almost complete hand use without disability, with an average DASH score of 5.6.

The treatment of unstable extra-articular fractures of the metacarpals and phalanges with IMCS allows a minimally invasive fixation and good control of pain and has shown good results in terms of functional recovery: the possibility of early mobilization reduces the risk of postoperative stiffness, the scarce invasiveness limits risk of infections and the screws have proved to be well tolerated by the patients.

## **A-0078** TITANIUM CUSTOM-MADE 3D-PRINTED PROSTHESIS AND RECONSTRUCTION OF SCAPHOLUNATE INTEROSSEOUS LIGAMENT IN THE TREATMENT OF SCAPHOID NONUNION: A SINGLE CENTER RETROSPECTIVE STUDY

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Scaphoid nonunion is a common sequela of scaphoid fractures with a rate around 10% to 15% despite appropriate treatment. The difficulty of its management is well known, in long term period, unstable scaphoid nonunion can cause scaphoid nonunion advanced collapse (SNAC), a pattern of progressive degenerative wrist arthritis. Among the available surgical options, total titanium scaphoid replacement in our experience represents a reasonable choice in the treatment

of this condition. Recently custom-made prostheses using 3D printing technology have been introduced. The aim of this retrospective study is to evaluate the clinical-functional and radiographic results of the wrists treated with total scaphoid titanium custom-made 3D-printed prostheses and reconstruction of scapholunate ligament (SL). In this study eleven patients with diagnosis of scaphoid nonunion with necrosis were treated between March 2018 and August 2021 with total scaphoid replacement using custom-made 3D implants (Adler Ortho). All the patients had good wrist stability, no SNAC wrist condition and absence of STT arthritis. The surgical technique consisted of a dorsal approach. To reconstruct the SL, Arthrex™ labral tape was inserted into the lunate with an anchor. Patients have been clinically evaluated before and after treatment with DASH score and PRWE score. Wrist range of motion (ROM), strength (grip and pinch) and VAS have been assessed. Patients x-rays before and after treatment have been re-evaluated to assess the good positioning of the implant and to detect any changes in the carpal bones: carpal height ratio, radioscaphoid angle and scapholunate distance have been calculated. The mean follow up is 35,6 months. At the follow up VAS decreased of 69,8%, DASH score decreased of 66,2% and PRWE of 40% from preoperative. ROM (flexion-extension) of the wrist increased about 19,8 %, radial deviation increased of 30.7% and ulnar deviation of 83 %. The grip strength improved from pre-operative of 47%, the pinch strength of 41%. Radiographically, we reported no changes in carpal height and scapholunate distance. The radioscaphoid angle decreased of 45,4% from pre operative. Of the total implants we reported one failure which was a dislocation at 1 year of follow up, and it was necessary to remove the implant and perform a carpal stabilization with ligamentoplasty. A total scaphoid replacement should be considered in patients with specific indications. The main advantage of the technique is the restoration of wrist anatomy with close-to-normal biomechanics. 3D-printed prosthetics provide also a full anatomical restoration with a system for SL reconstruction which allows greater stability. In case of failure, salvage procedures could still be performed. In our experience titanium custom-made 3D-printed implants may offer a good surgical solution for patients requiring total scaphoid replacement.

## **A-0079** FACTORS AFFECTING CONTRALATERAL WRIST SURGERY AFTER CARPAL TUNNEL RELEASE IN BILATERAL CARPAL TUNNEL SYNDROME

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Carpal tunnel syndrome (CTS) can be bilateral, with varying incidence. Carpal tunnel release (CTR) in one wrist may relieve the symptoms of the contralateral wrist, avoiding the need for second surgery; conversely, the symptoms may persist or worsen, requiring contralateral surgery in some cases. The present study investigated whether surgical treatment was finally required for the non-operated CTS wrist, and in what cases non-operative treatment was possible. We compared baseline characteristics, risk factors and electrodiagnostic data between CTS patients who underwent only unilateral CTR and those who subsequently underwent bilateral surgery at various time intervals. This single-center retrospective study included 188 patients with bilateral CTS managed between 2010 and 2020; 137 patients (group 1, 73%) underwent only unilateral CTR, and 51 (group 2, 27%) subsequently underwent contralateral CTR. In group 1, contralateral CTS symptoms were assessed in 4 categories and compared to the presenting symptoms in the index wrist. There were no significant differences in age, gender, preoperative symptom duration, body status, addictive behavior, electrodiagnostic study or comorbidities, other than a higher rate of dialysis in group 2. The contralateral wrist showed partial or complete symptom

relief in 57% of patients undergoing unilateral CTR. High BMI and history of diabetes were risk factors for persistent severe CTS or subsequent contralateral CTR

Keywords: Wrist; Carpal tunnel syndrome; Bilateral manifestation; Carpal tunnel release

## **A-0080** OUTCOME OF ARTHRODESIS FOR THE EATON LITTLER STAGE III DEGENERATIVE TRAPEZIOMETACARPAL ARTHRITIS

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**Introduction:** Trapeziometacarpal(TM) Joint is one of the common arthritis in the hand and its degenerative change often requires surgical intervention. In this paper, we reviewed clinical outcomes of patients who performed arthrodesis surgery for the TM arthritis with Eaton-Littler stage III, and discuss the necessity and importance

**Materials and Methods:** Patients with Eaton-Littler stage III degenerative TM arthritis who had surgery between 2009 and 2020 were analyzed. All procedures were done by single surgeon. After applying exclusion criteria, 20 patients with 23 hands (3 patients had both surgery) were collected. There were 4 male and 16 female patients and average age at surgery was  $61.4 \pm 9.7$  years old. Mean follow-up duration was  $12.7 \pm 14.4$  months. Among 23 hands, 8 were right and 15 were left. Surgical procedures were slightly different among patients, from K-wire to headless compression screw (HCS). Majority was used 23G cerclage wire and some patients were done with only screw fixation. The principle applied to all patients is that they are fixed in a functional position with 30-40 degree of palmar abduction, 20-30 degree of radial abduction and pronation of the thumb. Visual Analogue Scales (VAS) were measured from 0 to 10 degree range, grip and pinch strength of the hand were also measured. In addition, the Disabilities of the Arm, Shoulder and Hand (DASH) score were measured. Wilcoxon signed rank test was used for statistical analysis with SPSS software package (version 26.0, SPSS Inc., Chicago, IL, USA) and P-values < 0.05 were considered statistically significant.

**Results:** Preoperative mean VAS score was  $2.73 \pm 1.14$  and it were improved to  $1.57 \pm 1.57$  ( $p=0.031$ ) at postoperative outpatient follow-up period. DASH score was also decreased from  $43.90 \pm 22.55$  to  $16.71 \pm 12.44$  ( $p=0.002$ ). In addition, mean grip and pinch strength were  $9.93 \pm 6.20$  kg and  $3.23 \pm 3.05$  kg, respectively and it increased after the surgery. Postoperative mean grip and pinch strength were  $15.04 \pm 9.14$  kg ( $p=0.011$ ) and  $2.63 \pm 1.80$  kg ( $p=0.007$ ). At the time of the study data collection, the subjective satisfaction score of the surgery was  $4.16 \pm 0.76$  out of 5. Average length of period to reach TM joint union was  $2.78 \pm 2.10$  months. Nonunion was observed in 2 cases but the treatment was terminated since there's no more pain or discomfort. Complication was reported in 2 cases including thumb IPJ flexion weakness and tenosynovitis.

**Conclusion:** For most patients included in this study, positive outcomes were derived from the TM arthrodesis. It could be an effective surgery for patients with degenerative TM arthritis with severe pain and discomfort in daily lives.

Keywords: Trapeziometacarpal arthritis, Arthrodesis, k-wire, wire cerclage, headless compression screw

## **A-0081** PATIENT EXPERIENCES OF MUSCULOSKELETAL DISORDERS AND WORK: A QUALITATIVE EVALUATION

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### **BACKGROUND:**

Supporting people to return to or remain in work following injury or other musculoskeletal disorder is a key role of hand therapists. In the UK, the Allied Health Professionals (AHP) Health and Work Report was developed to enable AHPs, such as hand therapists, to provide tailored work advice for their patients. In addition, there was a legislative change in July 2022 to allow nurses and AHPs to complete the standard Fit Note, which was previously only accessible to clinical doctors. The aim of this project was to explore the experiences of patients attending outpatient hand therapy or physiotherapy services. In particular, to uncover how work advice was provided, whether this met the needs of the individual patients, and to identify suggested improvements in the provision of work recommendations for patients.

### **METHODS:**

We developed a qualitative service evaluation using semi-structured 1:1 interviews and aimed to recruit 8-12 participants. Approval and governance were provided through departmental review (reference 681). Participants were recruited from the hand therapy and physiotherapy outpatient department of a large UK teaching hospital. Eligibility criteria were aged >18 years and working in any paid role, including those off work because of their musculoskeletal condition. All interviewees provided informed written consent and interviews were audio recorded and transcribed verbatim. Transcripts were analysed using reflective thematic analysis.

### **RESULTS:**

10 interviews were conducted with a median interview duration of 24 minutes (range 15-45 minutes). There was an even distribution of men and women, and a range of occupations and ethnicities.

Interview content was illustrated in three themes. In theme 1 'managing musculoskeletal disorders in work' interviewees recalled how work was not discussed as part of their therapy appointments. Interviewees desired more guidance and reported that hand therapists and physiotherapists were well placed, and trusted, to provide this advice. None of the participants were aware of the AHP Health and Work Report or the changes in Fit Note legislation.

In theme 2 'managing rehabilitation and work' interviewees described their difficulties in carrying out regular exercises and attending appointments while at work. For several individuals, this was a reason for not carrying out their prescribed exercises.

Theme 3 explored 'recovery expectations'. Interviewees had different perspectives about their condition and the impacts on work and function. Expectations appeared to be driven by a combination of information from the therapist and past experiences.

### **DISCUSSION:**

Hand therapists and physiotherapists are well placed to provide individualised work-related advice for their patients; however, our service evaluation indicates that this may not be occurring in practice. Barriers to therapists providing work-related advice have been reported in other settings. Interestingly, interviewees in the current study were not aware that their therapist could provide formal, written sickness certification or work recommendations for their employers. The findings from this service evaluation are being used to inform the development of local guidance for discussions and information provision regarding health and work. This may also be applicable for broader work and health messaging.

## **A-0082** NGLICTED UPPER-EXTREMITY FRACTURES AT A SEVERE TRAUMA CENTER IN REPUBLIC OF KOREA

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**Introduction:** A missed injury and delayed diagnosis are likely when diagnosing patients with severe trauma. This research aims to investigate the incidence of missed fractures in the upper extremities by analyzing retrospectively factors leading to overlooked diagnosis.

**Methods:** We retrospectively investigated patients hospitalized with newly diagnosed upper-extremity fractures after an initial diagnosis was assigned at the Pusan National University Severe Trauma Center. We analyzed the accompanying injuries, injury severity score (ISS), reasons for missed diagnosis, and treatment results.

**Result:** Twenty-four patients and 27 cases were identified. The incidence of fracture was 0.4%, and the average diagnostic period was 33 days. The mean ISS was 24.3 points. Among the neglected fracture sites, 11 were radial or ulnar forearm fractures and 8 were carpus or metacarpal fractures. Twenty-one patients were not diagnosed at the time of initial treatment in the emergency room, and 3 patients did not continue treatment despite being initially diagnosed. Eleven of 20 patients had ipsilateral extremity fractures, and 8 of 11 patients had ipsilateral upper-extremity fractures. At final follow-up, 14 patients exhibited movement of <50% of the injured area.

**Conclusion:** A neglected upper-extremity fracture can result in missing the proper surgery window and rehabilitation period, culminating in poor results. Whole-body computed tomography or bone scanning is not effective in diagnosing missed fractures in severe trauma patients. Therefore, an orthopedic surgeon must conduct repeated diagnoses, and careful physical examination is necessary in consideration of the injury mechanisms

## **A-0083** HOW CAN WE REDUCE THE ISCHEMIC TIME FOR FOREARM REPLANTATION? USE OF A 2-STAGE BONE-FIXATION TECHNIQUE

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**Purpose:** The ischemia time is important key to achieve satisfactory functional results after forearm replantation. In this study, we described “two-stage bone fixation technique” with our detailed surgical technique to reduce the ischemic time.

**Methods:** From June 2007 to June 2017, we performed a retrospective study of 20 patients who underwent forearm replantation. Eighteen cases were male patients, and their mean age was 46 years. The mechanism of injury was roller injuries in 5 cases, power saw injuries in 3 cases, traffic accident in 7 cases, rope injuries in 2 cases, machinery injuries in 2 cases, and crushing injuries by rebar beam in 1 case.

**Results:** A total of 20 replantation cases were survived. According to injury level, there were 3 cases of the proximal type, 11 cases of the middle type, and 6 cases of the distal type. The average time to revascularization was 331 min. The total operation time was, on average, 5.73 hr. In the rest of the 18 cases, two-stage bone fixation technique were performed,

and the average time required for bone shortening and plate fixation was 38.3 min.

Conclusions: A 2-stage bone-fixation technique can reduce the initial bone surgical operation to <30 min, and it does not have many complications and can be used as definitive surgery. It can be considered as one of the available methods for bone fixation to actively reduce the operation time during major forearm amputation.

#### **A-0084** CLINICAL OUTCOMES AFTER MINI-HOOK PLATE FIXATION FOR SMALL AVULSION FRACTURES AROUND INTERPHALANGEAL OR METACARPOPHALANGEAL JOINTS OF THE HAND

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Background: Mini-hook plate has been described for the treatment of various small avulsion fragments in the hand. This retrospective study aimed to evaluate clinical outcomes after mini-hook plate fixation in patients with an avulsion fracture around the interphalangeal or metacarpophalangeal joints of the hand.

Methods: Nineteen patients with avulsion fractures around the interphalangeal or metacarpophalangeal joints of the hand were included in this study. Seven patients had a mallet fracture, and 12 patients had other phalangeal avulsion fractures including central slip, collateral ligament, volar plate, and flexor avulsion fractures. The osseous union and functional outcomes, including finger joint motion, joint stability, pinching strength, and the disabilities of the arm, shoulder, and hand score, were evaluated.

Results: The mean duration of follow-up was 33.8 months. All patients in mallet and other phalangeal avulsion fractures achieved osseous union between the avulsion fragment and phalangeal bone, and there was no joint subluxation. There were no significant differences in the disabilities of the arm, shoulder, and hand scores. However, the patients with mallet fracture have lower mean percentage values of the total active range of motion and pinching strength than other phalangeal avulsion fractures. We abandoned this procedure in mallet fractures because the early results after mini-hook plate fixation in mallet fractures appeared unfavorable.

Conclusion: These results suggest that the mini-hook plate fixation can provide sufficient stability and good clinical outcomes in those with phalangeal avulsion fractures. However, the outcomes for mallet fractures were not as good as those for other phalangeal avulsion fractures.

#### **A-0085** CLEMASTINE IMPROVES ELECTROPHYSIOLOGIC AND HISTOMORPHOMETRIC CHANGES THROUGH PROMOTING MYELIN REPAIR IN A MURINE MODEL OF COMPRESSION NEUROPATHY

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Introduction: Compression neuropathies, such as carpal tunnel syndrome, are common and debilitating conditions that result in variable functional recovery after surgical decompression. Recent drug repurposing studies have verified that clemastine promotes functional recovery through enhancement of myelin repair in demyelinating brain disease. We investigated the utility of clemastine as a treatment for compression neuropathy using a validated murine model of compression neuropathy encircling the compression tube around the sciatic nerve.

**Methods & Materials:** The murine model of compression neuropathy in this study consists of two phases: compression and decompression. Ten-week-old female C57BL/6J mice underwent peripheral nerve compressive surgery in which a compressive tube was placed on the right sciatic nerve. The compressive tubes were left in place for a compressive phase of 6 weeks, after which decompression surgery was performed to mitigate the compression tube. Mice received PBS or clemastine solution for compressive phase (6 weeks) or decompressive phase (2 weeks). Electrodiagnostic, immunofluorescence analysis of cross-sectioned nerve, histomorphometric analysis of nerve, and Western immunoblotting analyses were performed to verify the effects of clemastine.

**Results:** Electrodiagnostic studies revealed that mice treated with clemastine had significantly decreased latency and increased amplitude compared to control mice that received PBS. Immunofluorescence and histomorphometric analyses showed that mice treated with clemastine had significantly higher proportions of myelinated axons, thicker myelin, and a higher G-ratio. The expression levels of myelin proteins, including myelin protein zero and myelin associated glycoprotein, were higher in mice treated with clemastine. However, after surgical decompression of the compressed nerve, these improvements were observed regardless of clemastine treatment.

**Conclusions:** Mice treated with clemastine during compression of the sciatic nerve demonstrated that clemastine treatment attenuated electrophysiologic and histomorphometric changes caused by compression through promoting myelin repair.

## **A-0086** MOTION ANALYSIS OF WRIST AND FINGER JOINTS IN SPORT CLIMBING USING AN OPTOELECTRONIC MOTION CAPTURE SYSTEM

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Finger flexor tendon pulley ruptures are among the most common injuries in sport climbing. However, current knowledge about the kinematics of the fingers in climbing is still very limited. This pilot study aimed to investigate the practicability of measuring finger joint movements during sport climbing with an optoelectronic motion capture system and to gain first insights into its biomechanics. Eleven sport climbers performed climbing moves using common grip positions. Two handholds were instrumented with load cells. An optoelectronic motion capture system simultaneously recorded the movements of the finger joints and wrists. With the help of the kinetic data, we subdivided the handhold contact period into a grabbing, holding and releasing phase. Time normalisation of each phase was necessary for comparison and analysis of joint motion. In combination with the instrumented holds, the optoelectronic motion capture system proved to be a practicable tool for 3D motion analysis of the hands during sport climbing. Joint angles were observed to remain stable during the holding phase, allowing direct force transmission on the wall. Eccentric finger joint motion during high loads, notably a risk factor for pulley injuries, was not observed and presumably only occurs unintentionally. Two different open-hand grip methods could be observed, differing in whether the little finger was used or not. This results in more flexed or extended middle and ring fingers. Instruction not to use the little finger for the open-hand grip is important after pulley rupture to keep the load on the convalescent pulley as low as possible.

## **A-0087** IS THERE A DART-THROWING MOTION DURING ACTIVITIES OF DAILY LIVING?

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The dart-throwing motion (DTM) is a wrist motion along an oblique plane from radial extension to ulnar flexion. We recorded 2020 the DTM in healthy volunteers and patients following radioscapholunate (RSL) fusion and midcarpal (MC) fusion with three-dimensional motion capture system in vivo, using digital infrared cameras to track the movement of reflective skin markers on the hand and forearm. The aim of this study was to confirm the DTM to be the major movement plane during four activities of daily living (ADL): hammering and opening a jar, a bottle and a yoghurt. Twenty healthy volunteers and patients who had been treated by RSL (n=7) or MC fusion (n=6) were recorded with a 3D motion capture system during the performance of four ADL's: hammering, opening a jar, bottle and yoghurt. The wrist joint angles were calculated and the plane of the DTM was defined by fitting a linear trend line of best fit to the plotted data of the flexion-extension angle against the radial-ulnar deviation angle for each DTM and ADL trial. The angle of this regression line to the flexion axis was then calculated using standard trigonometric functions. Overall, wrist motion has been approximated to the DTM (24°) when hammering (35°) and opening a yoghurt (28°), but not during opening a bottle (-35°) or a jar (-31°). There was no significant difference of the calculated angle of the linear trend line between patients after RSL and MC fusion ( $p>0.25$ ) or between healthy subjects and RSL ( $p>0.08$ ) or MC ( $p>0.25$ ) patients' group. Furthermore, motion patterns were inconsistent among the group in the jar and yoghurt opening tasks. Despite DTM was confirmed for opening a yoghurt, two healthy and one RSL patient did move in a plane oblique to the DTM plane. For opening a jar, wrist motion has been approximated to the DTM in seven healthy subjects and one RSL patient, while the other participants moved from ulnar-flexion to radial-extension. During opening a bottle, most participants executed a circular movement in the wrist that could not be represented by fitting a linear trend line. The DTM was confirmed in 50% of the examined ADL's in the healthy group and patients after RSL and MC fusion. The range of motion of the patients after RSL fusion was in ADL's with and without confirmed DTM significantly reduced compared to the patients after MC fusion. RSL fusion allow not better wrist function during ADL's by preserving the DTM.

## **A-0088** BTM (BIODEGRADABLE TEMPORISING MATRIX): THE RISING STAR IN SYNTHETIC SKIN SUBSTITUTES FOR THE HAND?

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**Introduction:** Treatment of skin defects on the hand after severe trauma, infections or burns can be challenging. The use of BTM (Biodegradable Temporising Matrix, NovoSorb®, Polymedics) may serve as a new soft tissue cover alternative if skin grafts alone do not heal and flaps are not an option. The soft tissue defect is closed with a temporary, non-biodegradable layer that limits loss of moisture while providing a better barrier against bacteria than other synthetic skin substitutes.

**Method:** Between December 2021 und September 2022, 19 patients were treated with BTM. In 13 cases (68%) the soft tissue defect was caused by a severe trauma, in five patients (26%) there was a skin defect because of an infection and in another patient due to a tumor (5%). 63% of the patients were male, the median age was 52 years (IQR 12-77 years). The dorsum of the hand was affected in five cases (26%). Three patients (16%) suffered from an amputation of a finger,

nine patients (47%) had a substance defect at the dorsum of one or two fingers and one patient each had a defect at the thenar or palmar surface. Following a debridement, BTM was applied to the wound. A cellular migration into the matrix leads to new blood vessel formation and production of collagen. After the granulation tissue has formed and fully integrated into the BTM layer, the sealing membrane is removed and a new, vascularized dermal layer emerges. A split-thickness skin graft was then applied to the vascularized layer followed by a vacuum-therapy or compressing bandage for five days. During this time, a splint protected the wound and immobilized the hand.

Results: The size of the skin defect ranged from 4 cm<sup>2</sup> to 20 cm<sup>2</sup>. The average time from trauma or diagnosis of infection to the application of BTM was 6 days (range 0-27). In six trauma cases, the soft tissue defect was immediately covered with BTM on the date of the accident. On average, the delay between covering the soft tissue defect with BTM and the application of a split-thickness skin graft was 36 days (range 21-111). The BTM was applied in nine cases on exposed extensor tendon, in four cases on muscle or soft tissue, in three cases on bone, in two cases on the neurovascular bundle and in one case on exposed flexor tendon. No infection was observed. The split-thickness graft was well integrated after five days. The soft tissue cover in one patient over the bony stump was found to be vulnerable 8 weeks after skin-grafting. The average ROM on the fingers was: Flexion/Extension MCP 73-7-0°, PIP 75-5-0°, DIP 48-4-0° and at the thumb: Flexion/Extension MCP 30-0-0°, IP 27-0-0°, Opposition 8/10.

Conclusion: The use of BTM is an alternative option with good healing potential, especially in multimorbid patients, who do not qualify for a vascularized free or pedicled flap and who have reduced mobility requirements. However, the development of a gliding layer over tendons remains questionable as well as the use to cover bony stumps.

## **A-0091** DENSIFIED WOOD AS A POTENTIAL BIOMATERIAL FOR BONE IMPLANTS

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Introduction. Bone implants have been extensively studied in both material and medicine science for decades. Although metal-based implants are dominant, demand for non-metallic implant materials is growing rapidly, not only because of metal implants damage bone over time due to loosening and biocorrosion, but also because of the increased use of modern medical diagnostic systems, e.g., magnetic resonance. Materials such as calcium phosphate, calcium carbonate and calcium sulphate are mainly studied as potential bone substitutes. Materials obtained directly from nature are also being studied, e.g., corals. At the same time, wood as a natural material for bone implants has been studied insufficiently. The main advantage of wood as a bone implant biomaterial is its structural similarity to bone structure. Internal structural similarity also leads to similar properties, e.g., density, anisotropy and fluid transport in cells. Previous studies with minimally pre-treated wood have shown that wood has good biocompatibility and osteoconductivity with no toxicity. However, there are still several problems that prevent wood from using in bone implants. The main aspects - wood has a variable density and composition depending on age, species and growing conditions; the density of wood is less than bones. These problems could be prevented by partial delignification and subsequent compression of wood leading to increased density and improved physical-mechanical properties.

Materials and methods. A novel wood processing technique has been used on juniper wood to obtain a natural, high-performance material. Sulphate cooking of juniper wood has been used in the preliminary study for partial delignification at the temperature of 165°C for different residence times (0-40 min) followed by thermal compression for densification under a pressure of about 5 MPa at different temperatures (100-140°C) and time (30-60min), then letting cool for 1 day

under pressure. The densified and natural juniper wood samples were characterized by chemical composition, mechanical properties and swelling in saline.

Results. The density of densified juniper wood was increased by 96-127% reaching the value of 1170 kg/m<sup>3</sup> which is similar to conventional bone implants (1090 kg/m<sup>3</sup>). Modulus of rupture and modulus of elasticity of densified juniper wood was increased by 85% and 621%.

Conclusions. Mechanical testing of the novel biomaterial has demonstrated a great potential for creating bone implants. Further studies on biocompatibility and osteoconductivity are required to develop this biomaterial.

## **A-0095** CURRENT TRENDS IN THUMB CMC REVISION SURGERY: RESULTS OF A WORLDWIDE DELPHI STUDY

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Background: To date, there are still no clear guidelines available on how to continue treating patients with residual symptoms after thumb carpometacarpal (CMC) resection arthroplasty. Therefore, the FaiTh (Failed Thumb carpometacarpal resection arthroplasty) study was launched to develop such guidelines. One part of this project comprised a Delphi study to determine current worldwide trends in the treatment of failed thumb CMC resection arthroplasty.

Methods: The project is directed by the FaiTh steering committee consisting of nine experienced hand surgeons from Europe, America, and Asia as well as two methodologists. In an initial Delphi round, an electronic survey was sent to 181 hand surgeons worldwide. Questions included sociodemographic data and the participants' practice in cases of failed thumb CMC resection arthroplasty.

Results: Delphi participants returned 110 completed surveys (61%) and had a mean experience of 22 years (SD 7) as hand surgeons. Seventy-five percent were working in Europe, 14% in North America, 5% in Asia, 4% in South America, and 2% in Africa. The main indications for performing thumb CMC revision surgery were reported as "persistent pain" (85%), "remaining scaphotrapezoidal (ST) osteoarthritis" (54%), "instability of the thumb metacarpophalangeal joint" (46%), and "subsidence of the first metacarpal bone" (39%). Participants mentioned 25 different techniques for revision surgery; the most frequent techniques were revision of the existing interposition using an autologous tendon (62%), resection of the ST joint (56%), suspension with a Mini TightRope® (29%), and arthrodesis between the first and second metacarpal (18%). Most surgeons (67%) indicated that they would wait at least 1 year before performing revision surgery, while 28% would do a revision between 6 and 12 months postoperatively, and 5% even earlier.

Conclusion: The treatment strategies for failed thumb CMC resection arthroplasty differ widely among experienced hand surgeons. Based on the results of this first survey, we are currently running a second survey to further specify treatment strategies. A third survey will help us to finalize guidelines for the treatment of failed thumb CMC resection arthroplasty.

## **A-0096** IMPROVEMENT IN THE RANGE OF MOTION OF AMPUTATED TAMAI ZONE 4 FINGERS AFTER REHABILITATION AND FLEXOR TENOLYSIS WITHOUT JOINT CONTRACTURE

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[Object] The range of motion (ROM) of amputated Tamai zone 4 fingers after replantation remains poor. We investigated the effect of secondary tenotomy on patients who underwent Tamai zone 4 amputation at our institution and evaluated methods for improving the ROM.

[Methods and Patients] We retrospectively investigated nine fingers of eight patients treated for Tamai zone 4 finger amputation at our center from 2011 to 2022 who underwent passive joint arthroplasty or tenolysis during the second stage after successful replantation. The average follow-up period was 22.7 months (range, 10-54 months). The following aspects were investigated: the osteosynthesis method used for replantation, the presence or absence of preoperative joint contracture, tenolysis, and capsular release performed on each finger. We divided the nine fingers into two groups based on the presence or absence of severe proximal interphalangeal (PIP) joint contracture and compared the total active motion (TAM) prior to tendonectomy and at the final follow-up.

[Results] Osteosynthesis involved plate fixation in six cases, screw fixation in one case, and steel wire fixation in two cases. Severe PIP joint contracture requiring capsular release with tenolysis was observed in six cases (four cases with plate fixation and two with steel wire fixation). Three cases did not have severe PIP joint contracture (plate fixation in two cases and screw fixation in one case) and therefore, did not require capsular release. The average TAM before and after capsular release and tenolysis of the six fingers in the group with PIP joint contracture improved from 98.3° to 137.5°, whereas that before and after tenolysis in the three fingers in the group without PIP joint contracture improved from 116.7° to 233.3°.

[Discussion] We have recently implemented the following three methods to improve the ROM of amputated Tamai zone 4 fingers: (1) strong internal fixation and tendon suturing that does not limit the ROM of the finger; (2) rehabilitation to minimize joint contracture, and (3) secondary tenolysis. If joint contracture and extension lag is absent, the active flexion angle can be improved through flexor tenolysis using the volar approach in two stages, and the TAM of the amputated fingers can be >200°.

## **A-0097** LONG-TERM OUTCOME OF THE SAUVÉ-KAPANDJI PROCEDURE IN PATIENTS WITH POSTTRAUMATIC DISORDERS OF THE DISTAL RADIOULNAR JOINT

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### Introduction:

Distal radioulnar joint disorders such as (posttraumatic) osteoarthritis or instability can lead to chronic wrist pain, weakness and limitation of motion and may lead to serious disability and impairment in daily life.

The Sauvé-Kapandji procedure (SKP), being a distal radioulnar joint (DRUJ) arthrodesis combined with an ulnar resection-osteotomy, is currently used for treating several pathologic conditions that impair the natural function of the DRUJ. Previous studies have reported significant postoperative pain relief and associated improvement of wrist motion. However, concerning long term outcome, available evidence in current literature is lacking and consensus is missing regarding the usefulness of this procedure due to anecdotal reports of adverse events such as ulnar stump instability, pseudoarthrosis of the arthrodesis and radioulnar convergence.

The objective of this study is to retrospectively assess the occurrence of severe adverse events or need for secondary wrist procedures at long-term follow-up in a patient cohort in our tertiary referral hospital, treated with a SKP for posttraumatic DRUJ pathology.

Methods:

Institutional review board approval was obtained to retrospectively review all patients where a Sauvé-Kapandji procedure was performed for distal radioulnar joint pathology in our center.

All patients who underwent this procedure in our center with a minimum follow-up of 1 year postoperatively were screened out and approached for participation in this study.

Baseline characteristics, operation history, operative details, pre-operative function, potential peri-/postoperative complications and potential secondary procedures were retrospectively extracted from hospital medical charts. Quick DASH and PRWHE questionnaires were retrieved from all included patients.

Results:

A total of 30 patients who underwent SKP between January 1st 2008 and September 1st 2021 were included in this study with a median follow-up of 72 months (IQR 44; range 16-146). Mean age of the patients was 50 years (SD18; range 20-85) and 53% was male. Main indications for SKP were persistent DRUJ instability after correction of distal radius malunion (44%) and secondary posttraumatic arthritis of the DRUJ after a previous distal radius fracture (33%).

At final follow-up, secondary surgical procedures for postoperative complications were performed in 7/30 (23%) patients. Symptomatic proximal ulnar stump instability was the most frequently reported complication for which surgical reintervention was deemed necessary (4/30, 13%). The most frequently performed secondary surgical procedure was implantation of a semi-constrained DRUJ prosthesis. (4/30, 13%)

At final follow-up, patients reported a mean PRWHE score of 34,5 (SD 20,8; range 2-70) and a mean QuickDASH score of 31,2 (SD 20,7; 0-72,7).

Discussion:

Data on long term outcome of SKP for posttraumatic DRUJ pathology is sparse and consensus regarding usefulness of this procedure is lacking. This study shows that, contrary to anecdotal reports in literature, long term outcome of this procedure is fairly good and procedural failure on long term happens infrequently. As such, SKP for treatment of posttraumatic DRUJ pathology is a safe, effective and durable method for treatment in specific patients with posttraumatic DRUJ pathology and should still be considered as a viable option.

## **A-0098** LONG-TERM OUTCOME OF VOLAR PLATE FIXATION FOR SCAPHOID NONUNION

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Introduction:

Fixation of scaphoid nonunion with a volar locking plate and cancellous bone grafting has been proven to be a successful method. Nonetheless, few mid-term and long-term outcomes have been described in literature. Therefore, the aim of this study was to assess the mid-term and long-term functional, patient reported and radiological outcomes for scaphoid nonunion treated with volar locking plate and autologous cancellous bone graft in a large prospective cohort.

Methods:

In this single center, prospective cohort study, all patients who presented to our tertiary referral center between November

2013 and March 2022 with a clearly established scaphoid nonunion and a proximal pole fragment large enough to accommodate at least 2 locking screws were considered for inclusion. A total of 117 patients were considered for inclusion. 86 patients with 87 nonunions completed the minimum duration of 1-year post-operative follow-up and were analysed. Surgical procedure consisted of extensive debridement of the nonunion, correction of carpal alignment, internal fixation using a precontoured 1.5 mm miniplate and autologous cancellous bone graft from the ipsilateral iliac crest. Patients were assigned to a three-monthly interval follow-up consisting of functional assessment (range of motion, grip strength), assessment of patient reported outcomes (patient rated wrist-hand evaluation (PRWHE) questionnaire) and radiological assessment using multiplanar reconstruction CT scans until union was observed

#### Results:

87 nonunions in 86 consecutive patients (93% male), with a mean age of 30 years (16 to 76) and a mean duration of nonunion of 41 months (4 to 216), were enrolled in this cohort. 19 patients (22%) had previous surgery for nonunion. Complete bony union was achieved in 79 patients (91%) on follow-up CT-scan. The mean time to full union was 5.8 months (2 to 34). The plate was removed in 42 patients due to impingement of the plate against the volar rim of the distal radius, functional deficits, or pain. The mean duration of follow-up was 50.6 months (12 to 108). The ROM improved significantly from 114° (SD 32) preoperatively to 133° (SD 27) at final follow-up ( $p = 0.015$ ). Also, grip strength improved significantly from 66% (SD 25) preoperatively to 72% (SD 21) at final follow-up ( $p = 0.001$ ). PRWHE outcomes significantly improved from 65 points (SD 30) preoperatively to 18 points (SD 22) at mid-term follow-up (<3 yr,  $p = 0.008$ ), and 12 points (SD 12) at long-term follow-up (>5 yr,  $p = 0.028$ ). Hardware removal also showed an improvement in mean ROM (28°,  $p < 0.001$ ) and mean grip strength (14%,  $p = 0.026$ ).

#### Discussion:

Volar plate fixation combined with cancellous bone grafting is an effective and safe technique for treatment of complex and long-lasting scaphoid nonunions. Functional outcomes improve substantially over time and even more after hardware removal. Mid-term and long-term outcomes are promising and are not influenced by previously considered unfavourable factors for healing such as long lasting nonunion or previous scaphoid surgery.

## **A-0099** WIDE-AWAKE LOCAL ANESTHESIA WITHOUT TOURNIQUET (WALANT) FOR CAMITZ TRANSFER

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### Background

WALANT, with the benefit of simplicity and a low complication rate, is a well-recognized procedure in orthopedic surgery. To date, there is no report using WALANT technique with the Camitz transfer procedure.

### Methods

Between January 2012 and January 2018, thirty-six patients (8 males and 28 females) who underwent the Camitz transfer procedure as day surgery under the WALANT technique at the Thammasat University Hospital were included. The patients suffered from severe carpal tunnel syndrome (CTS) with thenar muscle atrophy. With the WALANT technique, 10 ml of prepared anesthesia was injected into the area around the palmaris longus tendon from 5 cm proximal to the distal wrist crease to the distal palmar crease, while an additional 10 ml was injected from the radial side of the metacarpophalangeal joint of the thumb to the distal wrist crease before the operation. Upon completion of the operation, the patient's hand was placed in a thumb spica splint. Operative data, visual analog scale (VAS) pain scores, and complications were recorded.

## Results

Patients underwent the procedure without any complications. The average age of the patients was 65.9 (37-87) year-old. The average operative time was 27.06 (17-47) minutes. The average VAS score during the anesthetic injection was 6.22 (5-8). The average VAS pain score during the operation was 0.52 (0-3). The mean intraoperative blood loss was 3 (2.4-6.8) ml.

## Conclusions

The WALANT technique is safe and can be used as alternative anesthesia for the Camitz transfer.

## **A-0100** 2-YEAR OUTCOMES OF THUMB CARPOMETACARPAL IMPLANT ARTHROPLASTY

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**Objective:** The aim was to analyze 2-year outcomes after thumb carpometacarpal (CMC I) implant arthroplasty with the focus on revisions and complications.

**Methods:** Patients who were treated with an CMC I implant (Touch®, KeriMedical, Switzerland) and prospectively documented in a registry were included. Revisions and complications were recorded up to 2 years post-surgery. Before surgery (baseline) and 2 years thereafter, all patients had their hand function assessed with the brief Michigan Hand Outcomes Questionnaire (MHQ, score 0-100) and rated their pain during daily activities on a Numeric Rating Scale (NRS; 0-10). Key pinch strength was measured with a pinch gauge. Two-year implant survival was estimated using the Kaplan–Meier method. We used a two-sided t-test to analyze differences between the baseline and 2-year time points.

**Results:** Currently, we have data from a total of 268 CMC I implants in our registry, 105 of which were fitted 2 years ago or earlier and eligible for this analysis. Four of the 105 implants had to be revised between 1 and 24 months after implantation, which is equivalent to an estimated 2-year survival rate of 95% (95% Confidence Interval [CI]:88% to 98%). The reasons for revision were cup loosening (n=1), mispositioning of the cup (n=1), impingement due to suboptimal cup positioning and a too short head/neck component (n=1) and head dislocation in the fourth case. Further complications that required additional conservative therapy and/or steroid injection and/or soft-tissue surgery were de Quervain tenosynovitis (n=5), trigger finger at the operated thumb (n=4), connective tissue nodule at the extensor pollicis longus tendon (n=1), intraoperative trapezium fracture (n=1), thumb stiffness (n=1), carpal tunnel syndrome (n=1) and painful cup migration after trauma (n=1).

At two years, 81 patients were available for follow-up. The mean baseline brief MHQ score increased from 46 (CI:43 to 50) to 89 (CI:85 to 92) at 2 years ( $p \leq 0.001$ ) and mean baseline pain during activities decreased from 7.5 (CI:7.0 to 7.9) to 1.3 (CI:0.8 to 1.7) at 2 years ( $p \leq 0.001$ ). Key pinch strength was 5.0 kg (CI:4.3 to 5.7) before surgery and 7.2 kg (CI:6.6 to 7.8) at final follow-up ( $p \leq 0.001$ ).

**Conclusions:** The 2-year survival rate of 95% of the Touch® implant is acceptable and better compared to other currently available CMC I implants. Clinical and patient-reported outcomes are very good with notably high key pinch strength. Also, the fast rehabilitation in contrast to resection arthroplasty is astonishing. Most implant failures arose from insufficiencies in technical skill. Therefore, careful planning and execution of the surgical technique, particularly of cup placement, is necessary; the learning curve of the surgeon also needs to be considered.

## **A-0101** THUMB CARPOMETACARPAL IMPLANT ARTHROPLASTY: THE FAST TRACK BACK TO WORK

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**Objective:** The aim was to investigate whether patients treated with thumb carpometacarpal (CMC I) implant arthroplasty recover significantly faster than patients after resection-suspension-interposition (RSI) arthroplasty, particularly regarding the number of days required to return to work.

**Methods:** This study comprised two cohorts: (1) Patients treated with a CMC I implant (Touch®, KeriMedical, Switzerland) who were prospectively documented in a registry and (2) RSI patients from a previous clinical trial. At the 3-month and 1-year postoperative follow-ups, all patients noted the number of days until they returned to work. Hand function was assessed with the brief Michigan Hand Outcomes Questionnaire (MHQ, score 0-100) and pain during daily activities was measured on a Numeric Rating Scale (NRS; 0-10). Key pinch strength was measured with a pinch gauge. Between-group differences of continuous outcomes were analysed with an independent two-sided t-test and ordinal data were compared using Fisher's Exact test.

**Results:** In the implant group, 147 patients with a mean age of 63 ( $\pm 8$ ) years were available and their 1-year outcomes were compared to 127 RSI patients with a mean age of 65 years ( $\pm 9$ ). In the implant group, 80 patients were employed and 39 in the RSI group. After implant arthroplasty, patients returned to work after a mean time of 44 days (95% confidence interval [CI]:29-59), which was significantly faster than the mean time of 84 days (CI:50-117) for the RSI group ( $p \leq 0.01$ ). Moreover, patients with an implant had a significantly better 3-month postoperative brief MHQ score (82, CI:80-85) than those after RSI (69, CI:65-72) ( $p \leq 0.001$ ). Pain at 3 months was also significantly lower in the implant than RSI group (2.0 (CI:1.7-2.4) versus 3.2 (CI:2.9-3.6),  $p \leq 0.001$ ). Key pinch at three months was significantly higher in the implant than RSI group (6.8 kg (CI:6.2-7.4) versus 3.1 kg (CI:2.8-3.4),  $p \leq 0.001$ ). At one year, both groups had similar outcomes of function and pain, although key pinch remained significantly higher in the implant group (7.0 kg versus 3.9 kg). One implant and 2 RSI joints had to be revised in the first postoperative year ( $p = 0.59$ ). Other complications included significantly more cases of de Quervain tenosynovitis in the implant group ( $n = 8$  vs.  $n = 0$ ,  $p \leq 0.01$ ) and a significantly higher incidence of complex regional pain syndrome ( $n = 0$  vs.  $n = 7$ ,  $p \leq 0.01$ ) and tendinitis or rupture of the flexor carpi radialis tendon ( $n = 0$  vs.  $n = 5$ ,  $p = 0.02$ ) in the RSI group.

**Conclusion:** Patients after CMC I implant arthroplasty return almost twice as fast to work and their hand function recovers significantly faster over patients after RSI. One year after the surgery, both implant and RSI arthroplasty patients do achieve similar outcomes, yet the former continue to have greater pinch strength.

## **A-0102** COMPUTER-AIDED MEASUREMENT OF RADIOGRAPHIC PARAMETERS IN DISTAL RADIUS FRACTURES

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**Background:** Distal radius fracture characterization and management are based on radiographic parameters. Manual measurements demonstrate substantial variability and are prone to inaccuracies. Radiographic parameters are traditionally assessed on plain radiographs, but the use of computed tomography (CT) is becoming more common especially in cases with articular involvement. Cone-beam CT in the evaluation of wrist injuries has the benefits of high spatial resolution

and relatively low radiation dose compared to conventional CT. Recently, a computer-aided CT analysis technique based on segmentation of CT images and numerical modelling has been developed for automatic measurement of radiographic parameters of distal radius.

**Objective:** We aimed to investigate the validity and reliability of computer-aided CT analysis for measurement of extra-articular radiographic parameters of distal radius fractures. We compared the results with manual measurements performed by hand surgeons.

**Methods:** A CT analytics software (Boneologic, Disior Ltd, Helsinki, Finland) was used to define the longitudinal axis and six anatomical landmarks (the tip of the radial styloid process, the volar and dorsal ulnar corner of the radius, the most distal point on the volar rim of the radial facet, the most distal point on the dorsal rim of the radial facet, the most distal point of the ulnar head) on 45 cone-beam CT scans with a distal radius fracture. As a reference, the same landmarks were manually marked independently in a blinded fashion by five hand surgeons. Based on these landmarks, the software calculated the radial inclination, the dorsal tilt and the ulnar variance. Intra class correlation coefficient (ICC) was used to assess intra- and interobserver reliabilities.

**Results:** There was a modeling failure in three of 45 cases due to major fracture comminution and displacement. Excluding these images, the interobserver reliabilities between the observers and the computer-aided CT analysis were excellent (ICC > 0.9) for all measurements. The mean differences between the parameters measured by the software and by hand surgeons were 1-2° for angular parameters and 0.2 mm for ulnar variance.

**Conclusions:** Computer-aided CT analysis offers a reliable and accurate method for assessment of the distal radius fracture alignment. However, in fractures with major comminution or displacement the software may fail to capture the bone surface. Automatic image interpretation may reduce diagnostic errors in assessment of the fracture displacement.

## **A-0103** COMPARISON OF PRIMARY AND REVISION RECONSTRUCTION OF THE SCAPHOID USING PATIENT-SPECIFIC GUIDES

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### **Purpose**

To compare the clinical outcome of computer assisted 3D-reconstructions of the scaphoid using patient-specific guides for primary and revision reconstructions of scaphoid nonunions.

### **Material and Methods**

From 2010 to 2019, a total of 65 patients were treated with patient-specific guides. 50 patients (43 male, 7 female; 26 right and 24 left wrists; mean age 29) were surgically treated with primary scaphoid nonunions in the middle third or the junction between the middle and proximal third. 15 patients with nonunion after previous screw fixation of the scaphoid with or without reconstruction using autologous bone grafts or vascularized grafts (15 male; 10 right and 5 left wrists; mean age 28) were also surgically treated using 3D-planned patient-specific guides and the clinical and radiologic outcomes were compared.

### **Results**

Patients had a postoperative wrist motion of flexion/ extension 59°/ 62° and radial-/ ulnar deviation 18° / 36° in the primary group and flexion/ extension 52°/51° and radial-/ ulnar deviation 15/35° in the revision group. The average grip strength of the operated hand was 37 kg, 84% of the healthy contralateral hand, in the primary group and 39 kg, 85% in

the revision group. Consolidation was observed in 46/50 patients (92%) in the primary group after  $146 \pm 299$  days and in 12/15 patients (80%) in the revision group after  $144 \pm 67$  days.

A statistically significant difference was only found for wrist extension, all other measured clinical outcome parameters were comparable.

#### Discussion

Revision surgery of the scaphoid after previous reconstruction has many obstacles with difficult tenuous vascularity, old screws from previous operations still in place and limited exposure. 3D-planned reconstruction has previously been shown to result in more accurate reduction and allows for precise screw positioning. It now has been shown to result in similar postoperative wrist mobility and grip strength, only wrist extension was reduced compared to primary reconstructions.

### **A-0105** A RANDOMIZED CONTROL TRIAL COMPARING TWO MODERN WRIST ARTHROPLASTIES; IMPROVED FUNCTION BUT HIGH COMPLICATION RATES AT TWO YEARS

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#### Objective:

Few prospective and no randomized control trials have been performed with total wrist arthroplasties (TWAs). Our aim was to compare the two best documented TWAs with regards to function, migration and periprosthetic bone.

#### Methods:

40 patients suffering from non-rheumatoid wrist arthritis were randomized to receive either the ReMotion or Motec TWA. Patient rated and functional outcomes, blood metal ion levels, migration measured with model-based radiostereometric analysis (RSA), periprosthetic bone mineral density (BMD) measured with dual-energy x-ray absorptiometry (DXA), osteolysis, complications, loosening and revision rates at two years were compared. Patients and examining physiotherapists were blinded. P-values < 0.05 were considered significant.

#### Results:

At two years follow-up there were no difference in function between the two groups. Patient rated wrist and hand evaluation (PRWHE) score (58 vs 21 and 61 vs 27), Quick disabilities of the arm, shoulder and hand (quick-DASH) score (44 vs 22 and 47 vs 23), radial sided wrist pain at activity (VAS 69 vs 33 and 64 vs 26) and rest (VAS 34 vs 11 and 41 vs 18) and ulnar sided wrist pain at activity (VAS 52 vs 19 and 45 vs 17) and rest (VAS 25 vs 5 and 28 vs 12) improved significantly in the ReMotion and Motec group, respectively. Active range of motion (flexion + extension + ulnar deviation + radial deviation) improved significantly in the Motec wrists only ( $99^\circ$  vs  $130^\circ$ ), while forearm rotation improved significantly in the ReMotion group only ( $148^\circ$  vs  $162^\circ$ ). Grip and key pinch strength did not change. Co and Cr blood levels were significantly higher in the metal-on-metal (MoM) Motec than metal-on-polyethylene (MoP) ReMotion group. Migration measured with RSA was low, and negligible in the second postoperative year, meaning that the radial and carpal/metacarpal components of both arthroplasties were stable on group level. Osteolysis which occurred most frequently near the joint was observed in 17 ReMotion and 15 Motec wrists. BMD which could only be measured around the radial and not the carpal/metacarpal components never returned to baseline. Six patients in each group were reoperated due to complications. Two ReMotion implants were revised to Motec due to carpal component loosening. Three Motec MoM articulations were revised to metal-on-PEEK due to painful synovitis.

## Conclusions

Pain and function improved in both groups, and both implants were stable. Complication rates were high. TWA surgery should be limited to few specialist centres publishing their results, until the role of this procedure is clarified.

### **A-0106** RETROSPECTIVE STUDY OF ISHIGURO'S TECHNIQUE FOR MALLET BONE FINGER IN CHILDREN: LONG-TERM FOLLOW-UP AND ANALYSIS OF PREDICTORS IN OUTCOMES

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**Aims.** The current reviews show that there is no high-level of evidence supporting the superiority of surgery over orthosis for mallet bone finger. However, there is no consensus regarding the optimal treatment because of heterogeneity of the populations, small number of patients and relevant risks of bias, but above all no studies are available in children. The Ishiguro's technique is simple and less invasive and the treatment with K-wire fixation appeared to provide better outcomes according to extension lag in mallet bone finger in literature. Comprehensive reports as well as the effectiveness and safety of this method have not been proven as yet for children. A retrospective cohort study with a long-term follow-up was performed to strictly evaluate the effectiveness of this method in children. The pre-operative and intra-operative predictors for poor or good outcomes were investigated.

**Methods.** A large series of ninety-five children underwent extension K-wire block from 2002 to 2012. Eighty-four (26 females and 58 males, mean age 14 years and 9 months at surgery, and 27 years and 2 months at the follow-up) were available for an average 12 years and 6 months (from 8 years to 18 years) long-term follow-up. Clinical and radiographic features were evaluated. Pain and functional outcomes were assessed according to Crawford's criteria, Range of Motion at the distal interphalangeal joint, extension loss, and Vas scale.

**Results.** Bone union and pain relief were obtained in all cases. There were no complaints about disturbance in growth or nail deformities. Two pin infections and one arthritis were recorded. The 82,1% had excellent (65 cases) and good (4 cases) results. Fifteen patients (17,9%) had fair results. No poor results were recorded.

**Conclusions.** Despite the currently no significant differences provided in mallet finger treatment outcomes between surgery and orthosis, the Ishiguro's method is an effective technique in children. High percentage of excellent and good outcomes were achieved in the present study, and no epiphyseal damage or nail deformity were reported. Strong and significant correlation was found between the worse results and both delayed time of treatment and excess flexed fixation angle. The relevant better outcomes and compliance in younger patients, the shorter immobilization period and the safe technique showed the K-wire extension block pinning an optimal treatment in children.

## **A-0107** ANATOMIC PATTERN OF PERFORATING ARTERIES FROM PROPER DIGITAL ARTERIES IN HUMAN TRIPHALANGEAL DIGITS

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**Introduction:** The localization of the perforating artery for the performance of digital artery perforator (DAP) flaps poses a challenge. This study aims to describe the anatomical pattern of the perforating arteries originating from the proper digital artery in fresh cadaveric triphalangeal digits and to use this pattern as a point of reference for performing these flaps.

**Material and method:** We performed a descriptive anatomical study on 28 fresh cadaveric hands (14 male, 14 female; 10 right hands, 18 left hands) after injecting the arterial system with latex. Digital photographs were taken of each specimen after dissection and the number of perforating arteries in each finger (second to fifth), phalanx (proximal, middle and distal) and finger edge (radial or ulnar) were obtained by analysis in Adobe Photoshop CS6.

**Results:** We obtained statistically significant results when comparing the means of the number of perforating arteries between fingers, phalanx, finger edge, gender and laterality. When analyzing the number of perforating arteries in each phalanx third in each finger, we found that more than 75% of specimens had at least one perforating artery in the two distal thirds of the proximal phalanx (PP) and the three-thirds of the middle phalanx (MP) and more than 50% had at least one in the proximal third of the distal phalanx (DP).

**Conclusions:** We present a homogeneous perforating-artery anatomic pattern, by finger, phalanx, finger edge, gender and laterality, consisting of a high density of perforating arteries in the distal PP region, throughout the MP and in the proximal DP region, which would be the areas of greatest certainty to help predict the favorable evolution of a digital artery perforator flap in the fingers.

## **A-0108** ARTHROSCOPIC OSTEOSYTHESIS WITH DBM AND BMAC FOR NONUNION OF SCAPHOID

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The purpose of this study was to analyze the clinical follow-up results (minimum, 2 years) in patients with nonunions of the scaphoid with minimal sclerosis treated with arthroscopically assisted percutaneous internal fixation augmented by injection of demineralized bone matrix (DBM) and bone marrow aspirated concentration (BMAC). From January 2021 through November 2022, a consecutive series of 17 patients with fibrous union or nonunion of a carpal scaphoid fracture with sclerosis or resorption at the nonunion site were treated with arthroscopic osteosynthesis with DBM and BMAC combine percutaneous internal. Preoperative and postoperative evaluations included measurement of clinical (grip strength and range of motion), radiographic, and functional (Mayo Modified Wrist Score) parameters, as well as satisfaction. The sample included 15 men and 2 women with a mean age of 30.5 years (range, 20 to 45 years). We recorded union and return to activity and analyzed data with regular clinical follow-up at a mean of 26 months (range, 24 to 30 months). We confirmed union in 15 of 17 patients (88%) at a mean of 15.4 weeks according to clinical examinations and standard radiography. For the Mayo Modified Wrist Score, there were 11 excellent and 4 good results. A total of 15 of 17 patients (88%) returned to work or sports activities at their preinjury level. **Conclusions:** Arthroscopic osteosynthesis with DBM and BMAC with percutaneous internal fixation is a reliable and minimally invasive method to achieve union and scaphoid healing.

## **A-0109** OPERATIVE MANAGEMENT OF POST-TRAUMATIC EXTENSOR CARPI ULNARIS INSTABILITY – A SYSTEMATIC REVIEW OF OUTCOMES AND COMPLICATIONS

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Post-traumatic extensor carpi ulnaris (ECU) instability is an increasingly recognized cause of ulnar sided wrist pain that occurs when the ECU subsheath is disrupted. We conducted a systematic review of studies assessing the operative outcomes of ECU instability. Eight retrospective studies met the inclusion criteria with a total of 97 wrists.

Patients underwent either primary repair (40%) using sutures and anchors, or reconstruction (60%) using extensor retinaculum flaps. One study performed deepening of the osseous ulnar groove. Two studies compared preoperative and postoperative values. They both reported a significant improvement in pain scores, functional scoring instruments, satisfaction and grip strength. The rest of the studies reported similarly favourable outcomes across the same outcomes. Concomitant pathologies were identified in 66% of the study population.

Complications occurred in 9% of the sample size, including ECU tendinitis, ulnar sensory nerve irritation, and reintervention for concomitant pathology. None of the studies reported recurrence or re-ruptures. However, five patients (6.7%) did not return to their previous activity level.

Patients can expect favourable outcomes with a potentially low complication rate. Nevertheless, the heterogeneity of the sample population, operative techniques and outcome measures warrant further standardised studies.

## **A-0112** LONG-TERM FOLLOW-UP FOLLOWING PROXIMAL INTERPHALANGEAL (PIP) JOINT ARTHROPLASTY

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**Background:** Previous research mainly focused on short-term outcomes after proximal interphalangeal (PIP) joint arthroplasty. However, long-term outcomes are lacking. Therefore, we evaluated patient-reported outcomes and complications after a follow-up of at least five years following PIP joint arthroplasty.

**Methods:** We used prospectively gathered data of patients undergoing PIP joint arthroplasty in our multicenter institution in the Netherlands. We sent online questionnaires to all patients who were treated at least five years ago. The primary outcome was patient satisfaction with the treatment outcome, measured using a validated 5-point Likert scale. Secondary outcomes included whether patients would undergo the same surgery again under similar circumstances, the assessment of factors associated with (dis)satisfaction, the Michigan Hand outcomes Questionnaire (MHQ), and complications.

**Results:** We were able to include 74 patients in this study. Patient satisfaction was excellent in 14 (19%), good in 17 (23%), reasonable in 18 (24%), moderate in 10 (14%), and poor in 15 (20%) patients. Seventy-three percent of patients (n=54) would undergo the same procedure again. We found no factors associated with (dis)satisfaction. All MHQ scores improved significantly in the first year after surgery and did not deteriorate afterward. Fourteen (19%) patients underwent reoperation, of whom 3 (4%) needed a revision.

**Conclusion:** After a minimum follow-up of five years, 66% of patients are satisfied with the result of the treatment and

73% would undergo the same procedure again. MHQ scores improved initially and did not deteriorate from one year to five years after surgery.

### **A-0113** ELUCIDATING THE ROLE OF DENTAL PULP STEM CELLS IN POLYLACTIC GLYCOLIC ACID (PLGA) FIBRE CONDUIT IN PERIPHERAL NERVE INJURY; AN ANIMAL STUDY

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**Introduction:** Traumatic peripheral nerve injuries may cause debilitating with a reported incidence of 2.6%. Nerve conduits, as an alternative to autograft, are vital in bridging a nerve gap and guide axonal regeneration and are currently commercially available. Mesenchymal stem cells (MSCs) are multipotent cells characterized by self-renewal, production of clonal cell populations, and multilineage differentiation. Human dental pulp stem cells DPSCs are ectoderm-derived stem cells possess MSC properties. A major benefit of DPSCs is that they can be isolated during routine dental procedures in a simple and autologous fashion without ethical concerns. The objective of this study is to elucidate the role of aligned poly(lactic glycolic acid) (PLGA) nanofibres seeded with DPSC in improvement of neurologic recovery.

**Materials and Methods:** To obtain aligned PLGA nanofibres electrospinning method was used. Electrospinning setting including using a 1ml syringe (diameter 4.6909mm) with a blunted 21G needle loaded with PLGA solvent under the following parameters: flow rate of 0.10 ml/hour, voltage of 18-20 kV, needle tip to mandrel distance of 34.5cm and mandrel rotation speed of 1400 rpm (maximum). Collagen mat was placed on a 25cmx8cm aluminium foil and anchored with tape and the aluminium foil was placed on the mandrel. Electrospinning was done for 2 hours to produce a thin membrane of aligned nanofibres at the rotating mandrel. Dental pulp tissue was harvested and underwent cell culturing and neurogenic induction of MSC. It was then seeded onto aligned poly(lactic glycolic acid) (PLGA) nanofibres nerve conduits. The *in vivo* phase involved 18 adult Sprague Dawley rats, divided into 3 groups which were conduit with stem cells (Group A), conduit without stem cells (Group B) and control group without conduit (Group C). A 10mm sciatic nerve defect was created and grafted with a nerve conduit for group A and B. Electrophysiological studies and foot print analysis was performed at 2, 4, 8 and 12 weeks after surgery. Data from each group of rats was collected and analysed with adjusted Epsilon method with Greenhouse Geisser variation.

**Results:** For electrophysiological studies, the mean amplitude at week 4 seen for group A and group B is 3.2mV and 3.9mV, respectively. At week 12 the mean amplitude for group A and group B was 13.9mV and 6.0mV, respectively. The difference was significant at both readings. The mean conduction velocity at week 4 for group A and B was 72.5m/s and 58.50m/s but was not significantly different. For the footprint analysis, group A and group B had longer stride length and wider stride width but was found to be not statistically significant

**Conclusion:** This study suggests that the presence of DPSCs in nerve conduits can improve neurologic recovery in PNI with segmental defect.

**Keywords:** dental pulp stem cells, electrospinning, mesenchymal stem cells, nanofibres, peripheral nerve injuries

## **A-0115** PATIENT INITIATED FOLLOW-UP IMPROVES PATIENT SATISFACTION, REDUCES WAITING LIST BURDEN AND SAVES MONEY

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### Aims

The United Kingdom National Health Service (NHS) operational planning guidance 2022/23 recommends the use of patient initiated follow-up (PIFU) in order to personalise patient care and reduce outpatient follow-ups. The aim of this study is to assess clinical effectiveness, cost and patient satisfaction of a PIFU pathway in a district general hospital outpatient hand clinic.

### Methods

Retrospective data was taken from our patient administration system for outpatient fracture and elective hand clinics. We compared data for 513 patients on the PIFU pathway with 2855 on a traditional follow-up pathway between August 2021 and July 2022. We obtained outpatient appointment costs from our finance department. We conducted a telephone satisfaction survey for patients who had utilised the PIFU pathway.

### Results

58 (11.3%) of patients on the PIFU pathway had booked a follow-up appointment. The number of appointments not attended was 3 (5%) in the PIFU cohort compared with 353 (12%) in the non-PIFU cohort. The cost of a follow-up outpatient appointment was £298. 41 patients undertook a telephone interview. 100% of patients interviewed said they preferred PIFU to traditional follow-up. 72% patients were seen within 3 weeks of requesting an appointment.

### Conclusions

The benefit of PIFU is threefold: for patients, it offers more control and flexibility with their appointments. For clinicians, it reduces outpatient waiting lists and avoids unnecessary routine appointments. For the NHS financial department, PIFU reduces overall expenditure on outpatient services. Reducing the rate of unattended appointments from 12 to 5% equates to a saving of more than £70,000 over one year in a clinic this size.

## **A-0116** ARTHROSCOPIC VERSUS OPEN SURGERY IN PERILUNATE DISLOCATIONS

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### Introduction

Perilunate dislocations are severe pan-carpal wrist injuries. In recent years, arthroscopic surgery (AS) has emerged as less invasive treatment method to potentially reach more favorable clinical outcomes than open reduction and internal fixation (ORIF). This study aims to present preliminary results of this novel technique compared to those of ORIF performed at the University Hospital of Bern, Switzerland.

### Methods

A retrospective cohort study was conducted assessing all patients undergoing surgery for an acute perilunate dislocation between 01/01/2012 and 31/12/2021. Exclusion criteria were age under 16 years, pre-existing degenerative conditions and history of surgery on the affected or contralateral wrist, severe concomitant injuries that prevent standardized follow-up, and time from trauma to surgery over 21 days. Propensity scores including potential confounding factors were calculated on all

included patients using binary logistic regression followed by random 1:1 nearest-neighbour matching to create two treatment groups: AS and ORIF. Functional, radiographic and patient-reported outcomes were compared between the two groups.

#### Results

A total of 58 patients were operated in the aforementioned timeframe. After assessing exclusion criteria and propensity score matching, 22 patients were included for data analysis (11 in the AS group, 11 in the ORIF group). Baseline characteristics were comparable in both treatment groups. Mean age was 35.6 years (SD 13.3 years) and time from trauma to surgery amounted to 3.2 days (SD 4.1 days). Clinical outcomes were analyzed at two time points: at early and final follow-up corresponding to 6.5 months (SD 1.7 months) and 15.3 months (SD 9.7 months), respectively. Patients undergoing AS had a significantly higher Mayo Wrist Score at final follow-up (75.9% vs. 60.5%, mean difference 15.4%, 95% confidence interval [1.8, 29.1],  $p = 0.028$ ). Wrist range of motion, grip strength, scapholunate angle, lunocapitate angle and complication rate were comparable in both groups throughout both follow-up periods.

#### Conclusion

AS tends to produce better clinical outcomes in terms of a higher Mayo Wrist score than ORIF in patients with perilunate dislocations at final follow-up. However, high quality prospective comparative studies with long-term follow-up are needed to confirm this claim.

### **A-0118** MICRO-ENGINEERED FREE FLAPS FOR COMPLEX RECONSTRUCTION IN THE UPPER LIMB

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Current microsurgery permits transfer of multiple tissues from several autologous donor sites then reconnection of vessels as small as 0.3 mm in diameter to revascularize the transfers. This allows for engineering of complex reconstructions. Three examples of this concept are presented.

In one case we prepared a cortico-periosteal tissue transfer from the femur that was combined on the operating table with a second transfer of very thin skin from the groin, to reconstruct and enhance an hypoplastic sclerotic clavicle after repeated fractures and replace the damaged overlying skin. A similar micro-engineered flap, including an osteochondral component from the femur joined on the table with a flap from the groin, was used in two cases to reconstruct an osteochondral defect in a scaphoid and the overlying skin. After revascularizing the transfer, the skin acted to monitor the viability of the bone transfer. These cases exemplify the promise for such an approach to tissue reconstruction.

### **A-0122** SMARTPHONE-BASED MACHINE LEARNING ALGORITHM FOR DISEASE SCREENING WITH THE 10-S GRIP-AND-RELEASE TEST

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Objective: Hand motion in patients with cervical myelopathy (CM) is characteristic and the 10-s grip-and-release test is often used in clinical practice.

Early detection and intervention are essential for the mitigation of CM. However, because the progress of CM is relatively slow, most patients did not unaware that they have CM, and did not recognize change of their hand motion. This study investigated the viability of a CM-screening method based on the 10-s grip-and-release test using a machine learning algorithm and a smartphone equipped with a camera to facilitate a simple screening system.

**Methods:** Twenty-two participants comprising a group of CM patients and 17 comprising a control group participated in this study. A spine surgeon diagnosed the presence of CM. Patients performing the 10-s grip-and-release test were filmed, and the videos were analyzed. The probability of the presence of CM was estimated using a support vector machine algorithm, and the sensitivity, specificity, and area under the curve (AUC) were calculated. Two assessments of the correlation between estimated scores were conducted. The first used a random forest regression model and the Japanese Orthopaedic Association Cervical Myelopathy Evaluation Questionnaire (C-JOA). The second assessment used a different model, random forest regression, and the Disabilities of the Arm, Shoulder, and Hand (DASH) questionnaire. **Results:** The final classification model had a sensitivity of 90.9%, specificity of 88.2%, and AUC of 0.93. The correlations between each estimated score and the C-JOA and DASH scores were 0.79 and 0.67, respectively.

**Conclusions:** The proposed model could be a helpful screening tool for CM as it showed excellent performance and high usability for community-dwelling people.

## **A-0123** NONOPERATIVE VERSUS OPERATIVE TREATMENT FOR DISPLACED FINGER METACARPAL SHAFT FRACTURES: A PROSPECTIVE, NONINFERIORITY, RANDOMIZED CONTROLLED TRIAL

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### Abstract

#### Background

Finger metacarpal fractures represent up to 31% of all hand fractures and most can be treated nonoperatively. Whether operative is superior to nonoperative treatment in oblique/spiral finger metacarpal shaft fractures (MSFs) is unknown.

#### Methods

Forty-two patients with displaced oblique/spiral finger MSFs were randomized to nonoperative treatment with unrestricted mobilization or operative treatment with screw fixation. The primary outcome was grip strength in the injured hand compared to the uninjured hand at 1-year follow-up. Secondary outcomes were the Disabilities of the Arm, Shoulder and Hand Score, range of motion, metacarpal shortening, complications, sick leave duration, patient satisfaction and costs.

#### Results

All patients attended 1-year follow-up. Mean grip strength in the nonoperative group was 104% (95% CI 89-120%) of the contralateral hand and 96% (95% CI 89-103%) in the operative group ( $P=0.34$ ). Mean metacarpal shortening was 5.3 (95% CI 4.2-6.4) mm in the nonoperative group and 2.3 (95% CI 0.8-3.9) mm in the operative group. In the nonoperative group one minor complication was observed; in the operative group four minor complications and three reoperations. Costs for nonoperative treatment were estimated at 1,347 USD (95% CI 1,347-1,347) compared to 3,834 USD (95% CI 3,540-4,122) for operative treatment ( $P<0.001$ ). Sick leave duration was significantly shorter in the nonoperative group (12 days 95% CI 5-21 vs. 35 days 95% CI 20-54) ( $P=0.008$ ).

## Conclusion

When treated with unrestricted mobilization, patients with single displaced spiral/oblique finger MSFs have comparable outcomes to those treated operatively, despite metacarpal shortening. Costs and sick leave are significantly higher in the operative group.

## **A-0124** PIP SURFACE REPLACEMENT FOR POST-TRAUMATIC OSTEOARTHRITIS: ARE THE OUTCOMES SIMILAR TO PATIENTS WITH DEGENERATIVE OSTEOARTHRITIS?

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**Objective:** The aim was to analyze the outcomes after proximal interphalangeal (PIP) joint surface replacement in patients with post-traumatic osteoarthritis (OA) versus patients with degenerative OA. We hypothesized that post-traumatic patients have better overall hand function than degenerative OA patients because they are generally younger and most often have only 1 affected finger. Furthermore, we hypothesized that post-traumatic patients have less PIP range of motion (ROM) in the affected joint one year postoperatively because they usually have more severe soft-tissue injuries and previous surgeries than OA patients.

**Methods:** Based on our prospective registry, patients who received a primary single surface replacing PIP arthroplasty (CapFlex-PIP, KLS Martin, Germany) between May 2010 and September 2021 were included in this analysis. Patients completed the brief Michigan Hand Questionnaire (MHQ) and rated their pain during daily activities on a numeric rating scale (0-10) preoperatively (baseline) and 1 year after surgery. Active ROM of the PIP joint was measured at the same time points. Pre- and postoperative measurements were compared with the Wilcoxon signed-rank test. Each patient with post-traumatic OA was matched to 5 patients with degenerative OA regarding baseline PIP ROM and brief MHQ score using propensity score matching. Between-group results were evaluated with the Mann-Whitney U Test.

**Results:** We included 22 post-traumatic OA patients with a mean age of 49 years (range 15-70). In the degenerative OA group, 201 patients with a mean age of 70 years (range 45-89) were included. Both patient groups showed significant improvements in the brief MHQ score, pain and ROM between baseline and 1 year ( $p \leq 0.01$ ). After matching, the post-traumatic group had a mean baseline ROM of 44° (95% Confidence Interval [CI]: 33-54) and the degenerative group, 43° (CI: 39-48). At follow-up, post-traumatic OA patients had a ROM of 55° (CI: 45-65), which was not significantly lower than the ROM of 62° (CI: 58-67) for the degenerative OA patients ( $p=0.18$ ). The mean baseline brief MHQ score was 56 for both groups. At follow-up, this score was higher for the post-traumatic (85, CI: 77-92) than degenerative group (78, CI: 73-83), but this difference was not statistically significant ( $p=0.42$ ).

**Conclusion:** PIP joint surface replacement for post-traumatic OA led to significant improvements in patient-reported and clinical outcomes. Our hypothesis that post-traumatic patients have better hand function, but less ROM one year postoperatively could not be confirmed. Both groups seem to have similar outcomes. Therefore, we recommend a surface replacing PIP arthroplasty for patients with post-traumatic OA. Nonetheless, caution must be taken in considering the validity of our study, particularly in light of the low test group sample size.

## **A-0126** NEUROPATHIC PAIN IN THE DONOR-SITE FOLLOWING FREE FIBULA FLAP HARVEST: A MULTICENTER STUDY ON INCIDENCE, PROGNOSTIC FACTORS AND QUALITY OF LIFE

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### Background

The free fibula flap (FFF) is widely used and considered the workhorse flap for osteocutaneous head and neck reconstruction. However, the potential for significant donor-site morbidity remains a drawback. Although donor-site morbidities including sensory deficits and chronic pain have been reported, the incidence of neuropathic pain remains unclear. This study aimed to identify the incidence and prognostic factors of neuropathic pain in the donor-site following FFF harvest, and to investigate its impact on leg function and quality of life.

### Methods

In this multicenter, cross-sectional study, 150 patients who underwent FFF surgery between 2010-2020 were included. Baseline characteristics were collected. All patients received questionnaires to measure patient's pain (Doleur Neuropathique 4 and VAS Pain), leg function (Lower Extremity Functional Scale) and quality of life (EuroQol-5D). Multivariable regression analysis was used to identify prognostic factors associated with outcomes.

### Results

A total of 82 patients completed the questionnaires. Neuropathic pain was present in 21% of all patients. Donor-site complications ( $p=0.025$ ) and a younger age ( $p=0.003$ ) were independently associated with neuropathic pain in the multivariable analysis. No difference in neuropathic pain incidence was found between primary closure or skin graft closure ( $p=0.54$ ). Patients who have neuropathic pain showed a significant poorer quality of life ( $p=0.01$ ).

### Conclusion

One-fifth of all patients experiences neuropathic pain in the donor-site following FFF harvest. Younger patients and patients with donor-site morbidities are more prone to develop neuropathic pain. Future research should focus on analyzing surgical factors and wound care optimization to reduce incidence of neuropathic pain.

## **A-0127** OUR RESULTS WITH SCAPHOLUNATE RECONSTRUCTION USING 360 DEGREES FCR TENODESIS

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**Objective:** Chronic scapholunate (SL) ligament injuries can be treated with ligament reconstructions before osteoarthritic changes develop. A half of the Flexor Carpi Radialis (FCR) tendon is passed through the scaphoid for the reconstruction. There are several modifications of this Brunelli technique, and the most commonly used and best documented being the Three-Ligament Tenodesis (3LT). Publications show good pain relief but redislocation is a common problem. We assumed that a more stable fixation of the tendon to the bone could prevent this, therefore we began to use a 360 degrees reconstruction with the FCR graft being passed through both the scaphoid and lunate, fixed with small tenodesis screws. We carried out this tenodesis first open (Henry technique), later with arthroscopic assistance (Corella Technique). The aim of this study was to evaluate the results retrospectively.

Methods: Patients operated with either Henry or Corella technique for painful chronic SL instability between 2013 and 2018 were included. Flexion-extension range of motion (ROM), grip strength, QuickDASH, PRWHE, Mayo Wrist Score, pain VAS score were registered preoperatively and at last follow up. SL gap, SL and CL angle were measured on the X-rays preoperatively immediately after operation and at last follow up.

Results: Eleven patients were operated with Henry and ten with Corella technique, thirteen men and eight women. The mean age was 21 years (19-59). Eleven right and ten left wrist were operated. The SL injury was grade 3C in five, grade 4 in eight and grade 5 in eight cases, according to IWAS classification. The mean follow up was 19,4 months (6-47). The ROM decreased from a mean (SD) 142 (29) to 119 (30) degrees. The grip strength increased insignificantly from 31,7 (18,8) to 35,3 (14,6) kg. Mayo Wrist Score increased from 60,7 (22,4) to 69,6 (15,6), QuickDASH decreased from 43,8 (20) to 19,7 (13,6), PRWHE from 54,1 (19,2) to 25,4 (17,3) and VAS from 4,8 (2,5) to 2 (2). All of these improvements in the patient reported outcome measures were statistically significant. SL gap values were 3,2 (1,5), 1,8 (0,7) and 3 (1,4) mm, SL angle 70 (12), 57 (8) and 68 (11) degrees and the CL angle 1 (12), 1 (6) and 1 (9) degrees preoperatively, postoperatively and at the follow up, respectively. The radiological parameters improved right after the operation, however there was not any difference between the preoperative and the follow up values. Subgroup analysis did not find difference in any outcome variables between the open and the arthroscopic techniques. Recurrence of the deformity was observed in all grade 5 cases and three cases developed significant arthritic changes. Seven patients were reoperated, three new arthroscopic procedures, two carpal tunnel releases and two salvage procedures were carried out.

Conclusions: Our results with 360 degrees FCR tenodesis are comparable with the published results of 3LT. Fixation of the tendon with tenodesis screws did not improved the radiological results and could not prevent recurrence of the deformity, however, most of the patients experienced subjective improvement.

## **A-0128** COLD ABLATION ROBOT-GUIDED LASER OSTEOTOMY IN HAND, WRIST AND FOREARM SURGERY – A FEASIBILITY STUDY

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### Purpose

Bone surgery is associated with direct contact of instruments with the bone causing friction, heat and pressure and hence, damaging the bone and surrounding soft tissues. We introduce the technology of navigated cold ablation robot-guided laser osteotomy, present potential applications, and preliminary pre-clinical cadaver test results in the field of hand-, wrist- and forearm surgery.

### Methods

#### Technique

CARLO<sup>®</sup> is a miniaturized ablation laser with an optical system controlled by a navigation system. The system uses Yttrium Aluminum Garnet doped with Erbium (Er:YAG), with a wavelength of 2943 nm, which corresponds to peak absorption coefficient for water and hydroxyapatite. The energy of a laser pulse hitting the bone tissue heats up the water content of the bone and vaporizes it. The increase in local pressure causes 'micro-explosions', breaking up the bone structure.

The debris is being expelled immediately and at high velocity, providing a clean-cut line with preservation of the bone structure. CARLO® also has an Optical Coherence Tomography (OCT)- based depth control system to visualize the current cutting level and avoid soft-tissue damage.

#### Cadaver tests

We first evaluated if laser-osteotomies in long bones were possible. CARLO® was then used for corrective osteotomies of the distal metaphyseal radius, ulna as well of the metacarpal one (Wilson's Osteotomy). Standard surgical approaches were carried out and the navigation device mounted at the end of the surgical field. Different cutting patterns were applied and tested for precision and primary stability. The osteotomies were stabilized using lag screws only. Pre- and postoperative CT-scans were taken to compare the virtual surgical planning with the post-operative results.

#### Results

Laserosteotomies in long bones were feasible using the OCT. Best cutting patterns were sine and sawtooth in terms of primary stability and precision. Multiple plane cuts were performed to allow for corrections in the x, y, z plane. The bone cuts in dia-, meta and epiphyseal regions did not show any carbonisation. The lag screws provided good compression and stability.

#### Conclusion

First cadaveric results are promising. New bone cutting patterns are feasible which are not possible to carry out manually. CARLO® allows to perform corrective osteotomies without the use of patient-specific guides with high precision and probably less hardware. Future steps are stability testing of the osteosynthesis and application in smaller bones (carpal, metacarpal and digital bones) followed by certification and first use in patients.

## **A-0129** RAIMBEAU PROCEDURE COMBINED WITH LIMITED FASCIECTOMY IN SEVERE RECURRENT DUPUYTREN'S DISEASE

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#### Objective

The management of recurrent Dupuytren's disease of the little finger is challenging. Multiple treatment modalities have been proposed, such as external fixation, the application of local skin flaps, dermofasciectomy and even amputation. An alternative surgical technique was introduced by Raimbeau et al., consisting of resection of the middle phalanx and fusion of the shortened finger by proximodistal interphalangeal arthrodesis. We modified the described technique by systematically combining the arthrodesis with a limited fasciectomy of the abductor cord and/or pretendinous cord in the fifth ray. Combining a dorsal approach, as in a classical Raimbeau's procedure, with a limited volar approach, is safe in terms of vascularisation of the little finger. Furthermore it improves outcome, cosmesis and function.

#### Methods

Patients who were treated with proximodistal interphalangeal arthrodesis of the little finger combined with a limited fasciectomy for advanced Dupuytren's disease between 2019 and 2021 were evaluated. All patients experienced severe recurrent Dupuytren's disease in the little finger (Tubiana stage III / IV). The range of motion of the affected little finger was assessed preoperatively and postoperatively. The degree of residual abduction of the little finger postoperatively, was registered as well. The QuickDASH score was obtained to determine overall function. Pain was objectified by a visual analogue scale. Radiographic evaluation consisted of standard finger x-rays at six weeks and three months postoperatively.

## Results

A total of eleven patients underwent the surgical procedure. The male to female ratio was 8:3. The mean patient age was 69 years (range 49 - 87). Seven patients were diagnosed with a Tubiana stage III Dupuytren's disease, four patients were stage IV. No complications were registered: no postoperative infections, wound healing problems, neurovascular injury, phantom pain or postoperative cold intolerance were seen in this series. Radiographic consolidation was obtained after a mean of 58 days (range 27-97). In all but two patients, full extension of the MP joint could be obtained. A mean active flexion of 94 degrees was measured (range 90-100). In all but one patient, full adduction of the little finger was obtained. QuickDASH scores decreased from 18 to 12 after surgery. Pain scores were low and remained equal pre- and postoperatively. All except one patient judged the surgical procedure as satisfactory.

## Conclusions

Recurrence after surgery for severe Dupuytren's disease is a common condition and the management is challenging. The proximodistal arthrodesis as described by Raimbeau et al., is a straightforward procedure with better functional and cosmetic outcomes compared to other salvage procedures like the fifth ray amputation. By combining it with a limited fasciectomy through a volar approach, finger extension improved even more and the fixed abduction is coped with as well. The combination of a dorsal and a volar incision did not induce vascular compromise, nor other complications. The systematic use of headless compression screws instead of the less stable K-wires, early mobilization and physiotherapy added to a very high patient satisfaction.

## **A-0130** ISCHEMIC NECROSIS OF THE FIRST TWO RAYS OF THE HAND FOLLOWING RADIAL ARTERY CANNULATION. A RARE COMPLICATION, TREATED WITH THE PEDICLED GROIN FLAP TECHNIQUE

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Radial artery cannulation is a relatively safe procedure with an incidence of permanent ischemic complications of 0.09%. It is a common catheterization site due to the consistent anatomy of the vessel and the ease of cannulation. Despite their variable anatomy, the superficial and deep palmar arches provide adequate perfusion to the hand in the event of radial artery thrombosis. However, an incomplete superficial palmar arch renders the first two rays of the hand vulnerable to ischemic stresses.

A 57 year old patient was referred to our institution due to dry gangrene of the first and second ray of the right hand. A week ago, she had been admitted to the intensive care unit due to diabetic coma, where a radial artery catheterization was performed. Three days after the catheter insertion, ischemic changes were observed on the first two rays of the hand. The catheter was removed two days later and the patient was referred for further orthopedic evaluation. A CT angiography was performed which revealed the absence of the superficial palmar arch and no perfusion distal to the catheter insertion site. The patient was brought to the operation room where a surgical debridement was performed. The large defect was covered with a pedicled groin flap based on the superficial circumflex iliac artery.

The flap division was done three weeks postoperatively. The patient presented for regular follow ups on the 3rd, 6th and 12th week. The healing was uncomplicated with no signs of ischemia or infection.

Multiple complications have been reported in literature following radial artery cannulation. However permanent hand ischemic damage occurs with a low incidence of 0.09%. The adequate perfusion of the hand is achieved through the superficial and deep palmar arch. The superficial palmar arch of the hand is normally formed by the anastomosis of the

terminal branch of the ulnar artery and the superficial volar branch of the radial artery. When the superficial palmar arch is incomplete (variation present in 15% of the population), an obstructed blood flow of the radial artery renders the radial aspect of the hand vulnerable to ischemia (mostly the thumb and index finger). Especially if there are concomitant risk factors, as in the case presented (ICU admission, SIRS, macroangiopathy due to DM), the lack of this anastomosis can have detrimental effects for the hand, leading in rare cases to amputation. The groin flap can still provide a reliable solution for the coverage of large defects in a low perfusion environment.

### **A-0131** DELAYED DIAGNOSIS OF DISLOCATION OF ALL FOUR ULNAR CARPOMETACARPAL JOINTS. SURGICAL TREATMENT STRATEGY AND CHALLENGES

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Carpometacarpal dislocations are rare injuries whose diagnosis is often missed on initial presentation (< 1% of all hand injuries). These injuries can be treated conservatively, as long as an anatomical closed reduction is achieved. However, in most cases, open reduction followed by internal or external fixation is necessary to reach a stable anatomical reduction. A 32 year old male was referred to our institution due to excess swelling of his right hand, two months after a motorcycle crash he sustained. He had been admitted in the ICU and had been operated for lower limb fractures in another institution. During our radiological work up with x-rays and a CT scan of the hand, a dorsal carpometacarpal dislocation of all four ulnar metacarpals was found accompanied by a fracture of the base of the fifth metacarpal. An open reduction was achieved using K-w and a small plate for stabilization of the base of the fifth metacarpal. The postoperative follow up was performed on the 3rd, 6th, 12th month and it was uncomplicated. The range of motion and grip strength was satisfactory on the 3rd month and almost full on the 6th month compared to the unaffected side. Carpometacarpal dislocations are rare hand injuries. They are often the result of a high energy injury and their diagnosis is usually delayed or missed. The main reasons are the excessive pain and swelling of the hand which make the initial clinical examination difficult and the overlapping of the metacarpals on the x-ray, which make the radiological diagnosis challenging. A delayed diagnosis needs urgent open surgical treatment to achieve an anatomical reduction due to the interposition of soft tissue, bony fragments and newly formed callus. Diagnosis and treatment of these injuries demands a high clinical suspicion from the traumatologist. The role of the CT scan is invaluable and open reduction is the mainstay of treatment for the cases that are diagnosed late.

### **A-0133** MICROVASCULAR FREE FLAP RECONSTRUCTION IN PEDIATRIC EXTREMITY TRAUMA - A GODINA PARADIGM COMPLEMENT

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Background: In 1986 Godina revolutionized approaches to adult traumatic extremity management and reconstruction. In his report on 532 adult patients he advocated for thorough wound debridement with free tissue coverage within 72 hours from the time of injury. Since 1986 some adjustments to traumatic wound management have been made with the advent of negative pressure wound therapy. In 2005, the first report on pediatric lower extremity trauma reconstruction

of 26 patients showed an increased complication rate if reconstruction is performed after 7 days. With minimal data published on the pediatric trauma population regarding microsurgical limb salvage reconstruction, we would like to present the outcomes of 50 free tissue transfers in traumatic pediatric extremity reconstruction over the last 14 years. Methods: A retrospective chart review of patients undergoing free flap reconstruction after trauma was done from 2008–2022. Charts were analyzed for demographic data, etiology of injury, number of debridement and days between injury and reconstruction, flap selection, recipient cite, and overall surgical outcomes with a minimum of 60 day follow up. Results: A total of 46 patients who underwent 50 free flap reconstructions for traumatic injury were identified. Age ranged between 4 and 17 years with 42.2% female and 57.8% male. Forty (80%) free flap reconstructions were secondary to a motor vehicle accident, with twenty-six (52%) attributed to ATVs. The median number of debridements prior to free flap reconstruction was 4. The median number of days from the date of injury to flap reconstruction was 7.5 (with a range from 1 day to over 6 months). Lower extremity reconstruction was done in 37 (74%) cases, while upper extremity reconstruction was done in 12 (24%) of the cases. Free muscle flaps comprised 35 (70%) versus 15 (30%) for fasciocutaneous free flap reconstruction. Six (12%) flaps had an acute complication requiring an arterial and/or venous thrombectomy, with 2 total flap losses in the setting of superimposed Candida infection resulting in limb loss and arterial and venous thrombosis with limb salvage. Conclusion: After an acute traumatic injury a successful flap transfer can reliably be performed after 72 hours. With adequate debridement the median amount of time from the day of injury to flap reconstruction was 7.5 days. In our case series of 50 free flaps we found a 96% and 98% success rate for flap transfer and limb salvage respectively.

#### **A-0134** OPEN PROCEDURE VERSUS ARTHROSCOPIC DEBRIDEMENT FOR CHRONIC MEDIAL EPICONDYLITIS

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Purpose: This retrospective study compared the outcomes after open and arthroscopic treatment of chronic medial epicondylitis (ME).

Methods: The study included 44 elbows in 38 patients: 25 (29–72 years) in the open group and 19 (27–70 years) in the arthroscopy group. The indications for ME surgery were failed conservative therapy for more than 3 months, symptom duration exceeding 6 months, and persistent severe pain. We used radiography, ultrasonography, and magnetic resonance imaging assessments. The clinical assessment included operating time, range of motion (ROM), grip strength, a visual analog scale (VAS), Disability of the Arm, Shoulder, and Hand (DASH) score, and complications.

Results: The mean follow-up was 20.2 (12–58) months. The mean operating time was significantly longer in the arthroscopy group (32.5 vs. 23.5 min;  $P=0.029$ ). In both groups, all outcome measures improved significantly after surgery and there were no significant differences between the DASH scores (preoperative 44.8 vs. 43.9, postoperative 12.5 vs. 13.2), grip strength (preoperative 72.2 vs. 66.8, postoperative 84.8 vs. 83.6), and VAS scores (preoperative 8.5 vs. 8.2, postoperative 1.0 vs. 1.1) in the open and arthroscopy groups. The outcomes were excellent or good in 20 patients (80%) in the open group and 16 (84%) in the arthroscopy group. The only complication was one case of transient ulnar neuropathy in the open group.

Conclusion: Open and arthroscopic techniques were very effective and comparable for treating chronic ME. The surgeon can choose either technique for treating chronic ME.

Level of evidence: Level IV, therapeutic case series

Keywords: medial epicondylitis; golfer's elbow; tendinopathy; sports injury; open techniques; arthroscopic techniques

## **A-0136** ENDOSCOPIC VERSUS OPEN IN SITU DECOMPRESSION FOR THE MANAGEMENT OF CUBITAL TUNNEL SYNDROME

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**Purpose:** This study aimed to compare the results of endoscopic in situ decompression versus open in situ decompression in the management of cubital tunnel syndrome (CUTS).

**Methods:** In this retrospective study, 35 patients who underwent either endoscopic in situ decompression or open in situ decompression for the treatment of CUTS between 2011 and 2021 were identified and divided into one of the two groups: Group I consisted of 16 patients undergoing endoscopic in situ decompression and group II consisted of 19 patients receiving open in situ decompression. Patients were queried regarding the presence of preoperative and postoperative paresthesia. Electromyography (EMG) was performed on all patients preoperatively. Preoperative and postoperative pain with palpation were evaluated over the cubital tunnel. The Dellon classification, DASH and pain VAS was used for preoperative evaluation of patient symptoms, and the Bishop classification and DASH was used for postoperative evaluation. At the preoperative and postoperative final follow-up, the key pinches and 2 point discrimination were measured with a pinchmeter and 2 point discriminator. The surgical incision length was measured. The operation time was recorded.

**Results:** The mean follow-up was 21 (12–121) months. The overall mean age was 42 (range; 21 to 70) years. Ten patients were female, and 25 patients were male. The mean operating time was longer in the endoscopy group (43 vs. 22min). Overall, 30.8%(12case) of the patients were Dellon II and 69.2%(27case) were Dellon III. According to the Bishop score, excellent and good results were obtained in 75% of the patients in endoscopy group and 78.9% of the patients in open in situ group. The final follow-up examination found continued paresthesia in 8 (22.9%) patients. In both groups, all outcome measures improved after surgery with the DASH scores (preoperative 37.6 vs. 30.6, postoperative 20.2 vs. 22.4), VAS scores (preoperative 8 vs. 7, postoperative 4 vs. 4), pinch strength (preoperative 74 vs. 66, postoperative 93 vs. 84), and 2 point discrimination(preoperative 5.6 vs. 6.6, postoperative 4.9 vs. 4.5) in the endoscopy and open in situ groups.

**Conclusion:** No significant difference was found between the two techniques. A prospective randomized trial will be necessary to clarify the advantages and disadvantages of the endoscopic techniques for treating CUTS.

## **A-0137** FIRST EXPERIENCES WITH THE FEELING HAND PROSTHESIS (FEELIX) AFTER TSR SURGERY FOR PREVENTION AND TREATMENT OF PHANTOM LIMB PAIN AND NEUROPATHIC PAIN

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**Introduction:**

The loss of the hand can lead to a considerable reduction in personal and professional quality of life for affected patients and often inevitably to psychological consequences. Currently, myoelectric prostheses can restore many of the normal activities of the hand, with the exception of tactile sensitivity. Based on our successful experience with TSR (Targeted Sensory Reinnervation) surgery on the lower limb, we have extended and further developed the technique to the upper

limb. The indications for TSR are primarily phantom pain and/or neuropathic pain that cannot be controlled by conservative therapy or, in the case of elective amputation, its prevention.

#### Material and Methods:

Between October 2020 and February 2021, we performed TSR in 3 patients. Two patients underwent TSR at the same time as elective hand amputation. In one patient, TSR was performed secondarily after a failed replantation attempt. The technique involves neuroorrhaphy of the median and ulnar nerves with the lateral and medial cutaneous antebrachii nerves to reinnervate the skin of the amputation stump. In one patient, the coaptation sites (n=3) were treated with shock wave immediately after surgery to check whether the reinnervation time could be shortened. Postoperatively, EEG and nerve conduction tests were performed. All patients underwent a rigorous rehabilitation program.

#### Results:

There was no phantom pain in the electively amputated patients, and in the patient who underwent secondary TSR, the pain decreased significantly or disappeared completely. In all patients, "sensimappings" of all five fingers at the level of the amputation stump could be regularly visualized. In addition, the patients can distinguish between hot and cold or wet and moist. Somatosensory evoked potentials (SEPs) in electroencephalography (EEG) and sensory nerve action potentials (SNAPs) in nerve conduction study (NCS) could be derived as a clear reinnervation sign.

#### Conclusions:

By redirecting the median and ulnar nerves to the medial and lateral antebrachial cutaneous nerves, the original hand is reactivated as a transmitter of pressure sensation through the prosthetic glove. As a result, patients authentically feel the hand on the amputation stump via this special vibrotactile glove (FEELIX), which can be fitted over any type of prosthesis. The phantom pain is clearly to completely interrupted or, in the case of elective amputations, not caused at all.

## **A-0140** CENTRAL SLIP VS LUMBRICALS - WHO EXTENDS WHOM? NEWS FROM THE EXTENSOR APPARATUS

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### Introduction

The extension of fingers is a highly complex movement that has not yet been fully described, which results from various parallel movements of different tendons, some of which interlock and some of which function independently of one another. Impaired interaction of central slip and the lateral band after injuries or illnesses lead to different movement restrictions. Although considerably studies on the strains or biomechanical modeling of the extensor mechanism have been carried out, a comprehensive analysis of the extension trajectory and the knowledge of interaction between the central slip and the lateral band in a physiological extension are insufficiently explored. Most of the reconstruction techniques described so far focus on restoring the central slip to restore the ability to stretch and neglect the lateral band. However, a precise understanding of the occurring tension and the resulting finger posture is important for treatment of extension deformities. These relationships were examined in the present study.

### Methods

Finger extension was analyzed as a result of the central slip displacement using 15 human fresh-frozen finger specimen in a material testing machine, measuring the necessary force. The flexor tendons were statically loaded with 0.3 N. Loads of 1) 0.25 N and 2) 1.5 N were applied on the lumbrical tendons. The central slip was pulled with constant-speed in 3 cycles up to a force of 7 N. The angles of the joints were recorded at ten equidistant points with a 3D measuring arm. A

statistical analysis was carried out using two-sample t-test ( $\alpha = 0.05$ ) with MATLAB.

## Results

The total displacement of the central slip for 7 N tension was 29.4 mm in average and independent on the lumbrical loads. From a displacement of 6.5 mm on, a significantly greater extension of the metacarpophalangeal joint (MCP) was demonstrated and fully extension was reached earlier with a load of 0.25 N on the lumbricals than with a load of 1.5 N. On the other hand, with a load of 0.25 N, there was a significantly lower PIP extension from a displacement of 9.8 mm. The load of 1.5 N caused a local maximum in traction force of 4.3 N, indicating resistance in the extensor apparatus at an MCP angle of 53°. This force curve was significantly less pronounced with a load of 0.25 N and a plateau was reached from an MCP angle of 45° to 0°.

## Discussion

The physiological extension movement of the finger is made possible by a precise interaction of the lateral bands and central slips. In addition to the extension of the DIP, the lateral bands are also significantly involved in the extension of the PIP, but counteract a stretching of the MCP. Reconstructions of the extensor apparatus should take into account the lateral bands in addition to the central slip in order to achieve functionally better results. Additional insights might be gained by actively controlling each tendon for more complex trajectories.

**A-0141** WIDE AWAKE LOCAL ANAESTHESIA WITH NO TOURNIQUET (WALANT) FOR FLEXOR TENDON REPAIRS IN A PROCEDURE ROOM SETTING: A COMPARISON OF OUTCOMES TO REGIONAL AND GENERAL ANAESTHESIA IN THE OR  
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## Introduction

During the COVID-19 pandemic, due to lack of operating theatre capacity and anaesthetists, all flexor tendon repairs were performed under Wide Awake Local Anaesthesia No Tourniquet (WALANT) in a clinic-based outpatient procedure room (15 air changes/hour, patient fully clothed, field sterility). Active flexion was assessed intra-operatively to assess gapping, glide and need for further pulley venting. We compared this cohort to patients who had undergone flexor tendon repair performed under regional/general anaesthesia (RA/GA) in a dedicated operating room (25 air changes/hour, patient gowned, full sterility), which is the traditional setting for treatment of this injury. In this setting, only passive flexion can be assessed intra-operatively. Outcomes included rupture rate, infection, secondary tenolysis and return to work.

## Methods

A retrospective review of all flexor tendon injuries during the COVID-19 pandemic between March 2020 - March 2021 (utilising WALANT in an outpatient procedure room setting) were compared to those between March 2017 - March 2018 (pre-pandemic) under RA/GA in an operating theatre department. Data collection consisted of patient demographics, injury characteristics, anaesthetic, total active range of motion (TAM), number of hand therapy appointments, length of follow up, complications and re-operation.

## Results

130 patients with 260 tendon injuries in 169 digits were divided into WALANT (n=56), RA/GA (n=74) sub-groups, which demonstrate comparable baseline and injury characteristics. The mean TAM at the DIPJ and PIPJ on discharge was not statistically significant between the two groups. The incidence of infection was significantly lower in the WALANT group, all of which were performed in an outpatient procedure room: 1 (1.8%) versus 8 (11%) p=0.003, despite reduced air

changes and less sterility compared to the operating theatre. Rupture rates were also significantly lower in this group 1 (1.03%) versus 11 (6.7%),  $p=0.010$  as was secondary tenolysis 5 (8.9%) versus 9 (12.2%). The mean follow-up period was significantly lower in the WALANT group (11 vs 23 weeks,  $p=0.001$ ) indicating quicker return to normal daily activities.

#### Discussion

Flexor tendon repairs can be safely performed under WALANT in a clinic-based procedure room setting. In our study we have shown superior outcomes with a decreased incidence of infection, rupture rates and need for secondary tenolysis, and a quicker return to daily activities with early discharge. We attribute this to the surgeon's visualisation of intra-operative active flexion and testing of the repair, allowing for identification of gapping, good tendon glide and more liberal pulley venting. These positive outcomes also lead to a reduced financial burden to the hospital treating these injuries, and by operating in an outpatient setting, also frees up theatre capacity for more complex cases and managing long waiting lists.

### **A-0142** RESORBABLE VS NON-RESORBABLE SUTURES IN OPEN CLINIC HAND SURGERY

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All surgical wounds need to be closed and usually some kind of suture is used. In hand surgery one usually use non absorbable sutures mainly because absorbable sutures have been associated with an immunogenic response during the postoperative period which can lead to healing problems. The only exception from this rule being hand surgery on children where avoiding suture removal has been valued higher than the risk of inflammation and local reactions around sutures. Previous studies on comparison between different sutures in hand surgery have been small, around 50 patients, most studies are on carpal tunnel syndrome operations from different aspects and have low level of evidence.

#### Materials and Methods

We performed a prospective comparative study of a total of 270 patients operated at the open clinic OR at the department of Hand Surgery at Södersjukhuset, Stockholm, Sweden. The study received ethical approval from the Clinical Research Ethics Committee. The patients were scanned for eligibility on the day of surgery.

Inclusion criteria were all patients > 18 years of age undergoing planned or emergency surgery. Exclusion criteria were age <18, patients with existing skinhealing problems such as burnscars or ongoing treatment with cortisone, patients that underwent surgery where a skintransplant was taken and patients with acute injuries with the presence of a traumatic wound or laceration that could theoretically increase the risk of infection. Patients were included after informed consent. All procedures were performed under local anaesthesia. The cases were performed by any surgeon in the clinic. Wound closure was with interrupted sutures, interrupted mattress sutures or continuous sutures. No intracutaneous or subcuticular sutures were used.

Patients operated on weeks with an uneven number in the calendar were sutured using absorbable sutures (Vicryl) and patients operated on weeks with an even number in the calendar were sutured with a non-absorbable suture (Ethilon). Patients underwent suture removal and wound inspection 2 weeks postoperatively in the outpatient clinic. They were assessed with a visual analogue scale relating to the discomfort during wound dressing and or suture removal, the presence of wound infection and or wound rupture were assessed and the measurement of time consumed during wound inspection, dressing and suture removal were counted in minutes.

Statistics Patients were assessed with a visual analogue pain score (VAS). Numerical ordinal values were compared with Mann Whitney U-test. The result of the rate of infection and wound rupture were analyzed with Chi2-analysis. The time

consumed was also analyzed with a Mann Whitney U-test. Data were compiled using SPSS. All results are not analyzed yet but will all be done in January 2023. The results might have a great impact in health economics.

#### **A-0144** SURGICAL TREATMENT OF THE TRIGGER FINGER: COMPARATIVE STUDY OF A1 PULLEY OPENING VERSUS ULNAR BAND RESECTION OF THE SUPERFICIAL FLEXOR OF THE FINGERS

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The trigger finger is a frequent cause for consultation. The opening of the A0 and A1 pulleys remains the most used surgical technique, however, it appears to be limited by its poor efficacy on proximal interphalangeal joint flexion. Resection of the ulnar band of the flexor digitorum superficialis is considered a validated surgical option in the surgery of the trigger finger with proximal interphalangeal joint stiffness. The aim of this study was to compare the clinical outcomes of the two techniques in trigger finger surgery.

This was a retrospective, single-center, single-operator, comparative cohort study. The series consisted of 127 patients operated over a two-year period between January 1, 2018, and December 31, 2019, for trigger finger surgery. Resection of the ulnar band of the FCS was performed for the 72 patients operated on in 2018 (group 1). In 2019, for the next 55 cases (group 2), an opening of the A0 and A1 pulleys was performed. The evaluation was based on patient characteristics, range of motion, measurement of proximal interphalangeal flexion, Quick-DASH and PRWE scores, as well as overall satisfaction and whether a rehabilitation protocol was used at the 1-month and 1-year follow-up.

The two groups were comparable preoperatively, except for the number of infiltrations performed. Post-operatively, both groups showed a significant improvement in the various scores compared to the pre-operative data. There were no significant differences between the two groups on the Quick-DASH and PRWE scores, regardless of the technique. Flexion correction was also better in group 1 (100%) compared to group 2 (88%) but was not significant.

Our results showed that resection of the ulnar band of the superficial finger flexor in the surgery of trigger fingers gives as good results as with pulley openings. This procedure could be further generalized due to its better reproducibility and influence on flexion.

#### **A-0145** MODELIZATION AND CONCEPTS OF THE MALINGUE PLASTY COMPARED TO THE Z-PLASTY

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The MALINGUE plasty is a random skin plasty derived from the "Z" plasty. This technique is an alternative treatment for DUPUYTREN disease by aponeurotomy. The main objective of this study was to investigate the topographical and anatomical differences between the Z-plasty and the MALINGUE plasty in cadaveric and experimental models and to analyse the geometrical differences based on their modelling in order to determine the length gain of these plasty procedures. The study was carried out in two stages, the first anatomical stage on a cadaveric model, allowing the study of vascularisation, and the second stage using latex and cadaveric glove models to study the mechanical behaviour of the flaps. Based on these findings, we analysed the differences between these two plasty procedures in terms of length gain after transposition using Euclidean and non-Euclidean geometry.

Isolated flaps during a MALINGUE plasty have a greater vascular richness than the “Z” plasty. Experimental models on cadavers and latex gloves show a gain in length of 50% to 60% on a MALINGUE plasty compared to 33.3% to 40% on a Z-plasty. This gain decreases in multiple plasty by attenuation effect. The analysis in Euclidean plane geometry does not explain such results. On the other hand, the three-dimensional analysis in non-Euclidean geometry allows us to explain a greater elongation effect in the MALINGUE plasty due to a flattening effect specific to this plasty.

The MALINGUE plasty is an interesting option in all cases where a significant lengthening may be necessary, especially when the indication of the “Z” plasty does not seem appropriate.

## **A-0147** SURGICAL MANAGEMENT OF RADIATION-INDUCED BRACHIAL PLEXOPATHY: A REVIEW OF LITERATURE

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### INTRODUCTION

Radiation-induced brachial plexopathy (RIBP) is a rare but devastating long-term complication of radiation therapy, often causing significant reduction in quality of life for affected patients. While a standard of treatment for RIBP is yet to be established, management consists mostly of symptom management through the use of medications. However, options remain limited with a lack of discussion surrounding the efficacy of surgical treatment. This review of existing literature explores the treatment options available to those affected by RIBP with a focus on the role of surgery.

### MATERIALS & METHODS

A review of literature discussing management of brachial plexopathy secondary to radiation therapy was conducted.

### RESULTS

A search of the PubMed database revealed few publications referencing surgery in the setting of RIBP. Omentoplasty, a commonly discussed option, was found to be effective in eliminating neuropathic pain while leaving motor function the same or worse[1]. Myocutaneous and adipofascial flaps have also been used to relieve pain with particularly improved results seen in cases of concomitant neurolysis[2,3]. However, no significant improvement to motor function was observed. One publication detailed a promising procedure involving a free functioning gracilis muscle transfer which resulted in recovery of elbow flexion as well as wrist and finger extension in a patient with RIBP[4]. Moreover, there have only been two reported instances in which nerve transfer was used to treat RIBP. The cases involved fascicular transfers of median and/or ulnar nerves to the affected nerves resulting in the complete resolution of severe neuropathic pain with significant improvement of strength observed in the affected muscles[5,6].

### CONCLUSIONS

While limited, existing literature reveals promising surgical interventions such as nerve transfers for relief of neuropathic pain associated with RIBP as well as restoration of motor function in select patients. Further research on the benefits and indications for such procedures is warranted.

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## **A-0148** ELECTROPHYSIOLOGICAL VALIDATION OF THE BRACHIALIS AND BICEPS BRACHII FUNCTIONS IN DYNAMIC ELBOW FLEXION

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### [INTRODUCTION]

Since the brachialis (BR) and biceps brachii (BB) muscles are primarily responsible for elbow flexion, their correct functioning is a key factor in improving elbow utility following injury. However, electrophysiological evidence in the literature is currently a lack for the respective roles of BB and BR in elbow flexion. The aim of this study investigated dynamic changes in the BR and BB muscle activities and validated their roles using electrophysiology.

### [MATERIALS & METHODES]

Twenty healthy men performed isotonic elbow flexion under different speed (30 and 60 °/s) and load (with or without) conditions. Muscle activities of the BR and BB were measured by surface electromyography. Elbow flexion was divided into four phases for every 30° ranges from 10 to 130° of the elbow flexion, and were compared for response to different angle-phase, speed, and load conditions for each muscle.

### [RESULTS]

Activity of the BR increased progressively with the elbow flexion angle, whereas that of the BB increased immediately and then remained constant. Additionally, BR muscle activity was increased in the latest angles at 30 °/s, while the BB muscle activity plateaued after an initial increase in the earliest phase at 60 °/s.

### [CONCLUSION]

These results indicate that the BB could play a role throughout elbow flexion, and the BR could play a role specifically in the terminal phase of movement. These results would provide clinicians and researchers with electrophysiological evidence for reconstruction of both BR and BB and would assist in the development of a targeted rehabilitation programs for elbow dysfunction.

## **A-0150** FABRICATION OF ALIGNED COLLAGEN COATED POLYGLYCOLIC ACID (PLGA) NANOFIBRES WITH DENTAL PULP STEM CELLS (DPSCS) NERVE CONDUIT FOR TREATMENT OF PERIPHERAL NERVE INJURY

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**Background:** In managing peripheral nerve injury (PNI) with segmental defect, biodegradable synthetic nerve conduit is a potential substitute to nerve autograft with similar or even better efficacy in nerve functional recovery. Well aligned nanofibres produced through electrospinning technique have been shown to improve cell attachment, proliferation and differentiation. The objective of our study was firstly, to fabricate collagen-coated polyglycolic acid (PLGA) nanofibres seeded with dental pulp stem cells (DPSCs) and secondly, to elucidate the role of aligned nano-structure of nerve conduits seeded with DPSCs in nerve recovery in a sciatic nerve defect rat model.

**Materials and Methods:**

One gram PLGA 85:15 crystal was mixed with dichloromethane (DCM) and dimethylformamide (DMF) with a ratio of 4:1 as the electrospinning solvents. PLGA nanofibres was electrospun on the collagen mat which was processed from ovine tendon. Electrospinning was performed for 2 hours to produce a thin sheet of aligned nanofibres collected on a rotating mandrel. Each hour of electrospinning was done using a 1ml syringe (diameter 4.6909mm) with a blunted 21G needle loaded with solution under the following parameters: flow rate of 0.10 ml/hour, voltage of 18-20 kV, needle tip to mandrel distance of 34.5cm and mandrel rotation speed of 1400 rpm. The electrospun PLGA nanofibre membrane on collagen mat was then crosslinked with 0.5% genipin for 6 hours. The flat nerve conduit was rolled into nerve guidance conduit with 1.4mm stainless steel rod and sutured with Prolene 7/0. For random nanofibres, fibres were collected on a static drum. Dental pulp tissue was harvested and underwent cell culturing and neurogenic induction of stem cells. Stem cells were seeded onto aligned and random collagen coated PLGA nanofibres.

A 10mm sciatic nerve defect was created in 18 adult Sprague Dawley rats. There were divided into 3 groups. Group A received aligned aligned conduit with DPSCs; Group B received random conduit with DPSCs; Group C was control without conduit. Electrophysiological studies and foot print analysis were performed at week 2,4,8 and 12.

**Results:** The mean amplitude measured at the popliteal fossa at 12 weeks for group A, B and C were 15.2s, 6.17s and 0s, respectively, and was significant. Similarly, there was significant difference in mean conduction velocity measuring 45.17m/s, 16.33m/s and 0 for group A, B and C, respectively. Although overall group A had wider stride width and longer stride length, there was no significant difference between the three groups for footprint analysis. At 2 weeks, an ulceration developed over the right toes and some of the toes were missing for group B and C. No defects were seen in group A.

**Conclusion:** This study suggests that well aligned PLGA nanofibres seeded with DPSCs has a potential role in peripheral nerve recovery. Further studies are required to elucidate pain mechanism during recovery that can affect functional outcome.

**Keywords:** collagen, dental pulp stem cells, electrospinning, nanofibres, PLGA

## **A-0151** THE ART OF 'SURTHRIVAL': LEARNING FROM THE EXPERIENCES OF NOVICE OCCUPATIONAL THERAPISTS DELIVERING HAND REHABILITATION IN SOUTH AFRICA

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**Background:** Hand rehabilitation delivered to rural and underserved communities in South Africa is commonly delivered by novice, generalist occupational therapists. These therapists are deployed by the government for a year of compulsory Community Service after graduation before they are able to register and practice independently. Research has established that this group of therapists typically work with limited support, supervision and resources but little is known about how these therapists should be supported in order to strengthen the services that they deliver. This project thus sought to understand how these occupational therapists describe their experience of delivering hand rehabilitation during their community service in order to identify their support and development needs.

**Methods:** A qualitative case study design was used. Nine Community Service occupational therapists participated in an online Community of Practice utilised for data collection (July 2021 – March 2022). Microsoft Teams and WhatsApp were used to facilitate meetings and communication. Photo elicitation, facilitated reflection and case discussions were used as the main data collection techniques. Cross-case analysis was prioritised with reflexive thematic analysis (RTA) being used to analyse all transcribed meetings, group activities, and WhatsApp discussions. Strategies to strengthen rigour included the researcher exploring her positionality and its possible impact on the study, prolonged engagement with participants, triangulation of data collection techniques, robust member checking and an audit trail undertaken by a senior researcher. All necessary ethical permissions were obtained (HREC: M2002235).

**Results:** Three themes were constructed from analysis: 'Submerged' was the first theme that captured participants' experience as being saturated by various contextual realities. These realities included pervasive poverty, a strained health care system, poor basic management of hand injuries, a sense of insurmountable need, and the joys and challenges connecting with patients across language and cultural difference. The second theme, 'Starting somewhere', captured participants' journey of treating patients with hand injuries. An initial sense of having 'no idea' was replaced with the experience of having 'some idea'. They shared the challenge of developing clinical reasoning when no diagnoses were available or diagnoses were unfamiliar. Traditional approaches to therapy were often inadequate to due contextual features and participants described being sparsely equipped for these realities. Despite this, participants grew in their appreciation of the value and necessity of occupation-focused intervention for patients with hand injuries. The final theme, 'Dynamics of 'surthrive'' captured elements that influenced participants either thriving, or merely surviving their hand rehabilitation experience. These included being driven by demand, their own agency and various resources and supports.

**Conclusion:** Hand rehabilitation is frequently, by necessity, delivered by novice or generalist therapists. The needs and proposed strategies to address the support and developments need that emerged from this study include interventions focused on systems and health services, opportunities to develop the necessary knowledge, skill and professional behaviours, appropriate resources, and emotional supports. Beyond application to the South African context, these strategies may be considered for supporting generalist therapists in LMICs in Europe and the rest of the world.

## **A-0153** IS PIP SURFACE REPLACEMENT RECOMMENDED IN PATIENTS WITH SEVERE PREOPERATIVE LONGITUDINAL JOINT AXIS DEVIATION?

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**Objective:** The aim was to compare the outcomes after proximal interphalangeal (PIP) joint surface replacement in joints with more than 15° preoperative deviation to the longitudinal finger axis versus joints without any preoperative deviation. **Methods:** Between May 2010 and September 2020, we documented 216 fingers that received a primary single surface replacing PIP arthroplasty (CapFlex PIP, KLS Martin, Germany). Longitudinal finger axis deviation at the PIP joint level was measured before surgery and two years later. Deformity was classified as: no deviation (<5° deviation to the longitudinal finger axis), moderate deviation (5°-15°) or severe deviation (>15°). Active range of motion (ROM) of the PIP joint and grip strength were measured. Patients completed the brief Michigan Hand Questionnaire (MHQ) and rated their pain during daily activities on a Numeric Rating Scale (0-10). Two-year outcomes between patients with and without deviations were compared with the Mann-Whitney U test.

**Results:** Of 184 patients available for this analysis, 47 had a severe deviation before surgery and 39 had no preoperative deviation. At the 2-year follow-up, only 4 of the 47 patients still had a severe axis deviation; all remaining fingers could be corrected to a deviation of less than 15°. There were no differences in baseline and 2-year outcomes between patients with severe and without deviation ( $p>0.1$  for all outcomes). At 2 years, patients with severe and without deviation had a mean ROM of 63° (95% Confidence Interval [CI]: 58-68) and 59° (CI: 52-65), respectively. In addition, the respective mean outcomes of grip strength were 25 kg (CI: 22-29) and 20 kg (CI: 17-23), pain scores were 2.1 (CI: 1.4-2.8) and 1.7 (CI: 1.2-2.2), and the brief MHQ scores were 72 (CI: 66-79) and 75 (CI: 71-80).

From 216 fingers initially included in the registry, there were 7 that required revision surgery. Four fingers had severe axis deviation before surgery and 3 were classified with moderate deviation. The reasons for revision were stiffness ( $n=4$ ), suspected metal intolerance ( $n=1$ ), late low-grade infection ( $n=1$ ), and luxation of the implant components ( $n=1$ ).

**Conclusion:** Clinical and patient-reported outcomes at 2 years were similar between patients with severe and without preoperative axis deviation, and the joint axis could be corrected with a surface replacing implant in most cases. The incidence of PIP joint revision surgeries was higher when there was a preoperative longitudinal joint axis deviation, yet the reasons for revision cannot be directly related to this factor. The main reason of stiffness could be indirectly related to axis deviation, as these joints were immobilized longer after surgery than straight fingers. We recommend a surface replacing implant to correct severe axis deviations, but the risk of revision surgery needs to be considered.

## **A-0154** A NEW GRIP STRENGTH MEASUREMENT DEVICE TO ANALYSE GRIP FORCE FOR DIFFERENT DIAMETERS AND FOREARM ROTATION

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### **Introduction:**

Grip strength measurement with dynamometers (such as the Jamar) are considered the clinical standard and have proven reliable and valid. However, usually only peak force in neutral position is reported and the specific geometry of its handles require a grip position that is rarely found during daily activities.

Our newly developed cylindrical hand grip strength measurement device (HGS) in different diameters now allows the investigation of continuous grip strength in conditions close to the most often used grip type during daily activities in different forearm rotations. Furthermore, the HGS allow to extract more in-depth aspects of the grip, such as loading rates and location of the centre-of-pressure.

With regard to clinical application, the aim of this study was to test reliability and validity of the HGS and investigate the impact of three different handle diameters and forearm rotations.

Methods:

In total, 25 healthy participants were examined with the HGS during maximum effort trials in a test-retest study. Three different handle diameters, namely 30mm (HGS-S), 60mm (HGS-M) and 100mm (HGS-L), as well as three different forearm rotations (neutral, pronated, supinated) were analysed.

Concurrent validity to the clinical standard (Jamar) was established. Maximum force was compared between conditions and the minimal detectable difference (MDD) between two measurements was evaluated.

Results:

The reliability of the HGS was found to be excellent (mean ICC =.96, range [.90, .99]) for all observed conditions. Concurrent validity and device correlation were found to be excellent (mean  $r$  =.91 range [.71, .99]). Between-session MDD were 83.6N, 85.5N and 32.5N for the HGS-S, -M, -L device, respectively, which constitutes of 12.1-16.0% of measured force.

Significant differences in measured maximal forces were found between different handle diameters ( $p < 0.0001$ ) and different forearm rotations ( $p < 0.0003$ ). Across all forearm rotations, the smaller the diameter, the larger the observed maximal gripping force. Interestingly, the grip force with HGS-S was larger in supination than in the neutral position while using HGS-M, the highest grip force was reached in the neutral position, followed by supination.

Conclusion:

The reliability of the new HGS was similar or better compared to the clinical standard.

Measured grip strength significantly depends on the diameter of the handle and the forearm rotation. We therefore point out the necessity to investigate non-neutral positions and different handle diameters in order to understand healthy and pathological power grip force and its implication on daily activities. As known from the ulnar impaction syndrome, pathologies can have an increased influence on grip strength in different wrist positions. Therefore, force measurements under different conditions should be monitored to understand whether pathologies associated with e.g. limited finger ROM or wrist involvement might have an accentuated influence on grip strength at certain object diameters or forearm positions. The presented HGS with its cylindrical design in relevant diameters for daily activities are mobile, easy to use, and now proved to be reliable and valid to be used in a clinical setting. They now allow advanced analysis of grip force characteristics to get a more in-depth understanding of grip force characteristics in different pathologies.

## **A-0155** QUANTITATIVE STIFFNESS ANALYSIS AFTER PROXIMAL INTERPHALANGEAL JOINT REPLACEMENT

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Introduction

One of the most challenging problems of hand surgery is the treatment (and prevention) of proximal interphalangeal (PIP) joint stiffness. No method has yet been established for quantifying stiffness, which would help to better compare results and follow them up after treatment. At present, functional outcome measures are mostly based on range-of-

motion (ROM) in the finger joints.

We propose a method for the assessment of PIP joint stiffness and evaluated the stiffness in patients after PIP joint replacement surgery.

#### Methods

Seven patients with a minimum follow-up period of 1 year since PIP joint arthroplasty (Swanson or CapFlex prosthesis) in context of osteoarthritis (OA) were included. The PIP joint stiffness of all long fingers in both hands was measured, using a newly developed finger stiffness measurement device (FSMD). The FSMD passively moves the tested finger and registers the exerted torque during a preset angle sequence, while the finger is kept fixed in the device. The slope of the recorded torque-angle curves represents joint stiffness.

Each PIP was assigned to the following four categories: healthy, Swanson, CapFlex, and symptomatic OA. The joint stiffness is reported as mean (SD) for small ( $10^{\circ}$ - $30^{\circ}$ ), medium ( $40^{\circ}$ - $60^{\circ}$ ) and large ( $70^{\circ}$ - $90^{\circ}$ ) flexion angles. Furthermore, the angle position with the lowest stiffness is calculated.

#### Results

Among a total number of 56 PIP joints, 12 were healthy, 3 were replaced with a Swanson prosthesis, 19 with a CapFlex prosthesis, 8 were symptomatic with known OA.

In a more extended finger position (flexion angles  $<30^{\circ}$ ), in healthy joints a stiffness of 0.0024Nm (0.0011Nm) was recorded and in PIP joint with a Swanson prosthesis 0.0017Nm (0.0007Nm). PIP joints with a CapFlex prosthesis showed highest stiffness: 0.0066Nm (0.0042Nm). Two fingers with a CapFlex prosthesis were not able to reach the small flexion positions. Towards large flexion positions, PIP stiffness was 0.0024Nm (0.0010Nm), 0.0071Nm (0.0013Nm) and 0.0045Nm (0.0021Nm) for the healthy, Swanson and CapFlex categorized PIPs. In medium flexed positions, all lie within the range of 0.0013-0.0024Nm. The flexion position with the lowest recorded joint stiffness was  $44^{\circ}$  for the healthy PIPs, while it was  $33^{\circ}$  for Swanson and  $52^{\circ}$  for CapFlex treated PIPs.

#### Conclusion

Measurement with the FSMD provides torque-angle data, which enables calculation of joint stiffness throughout the ROM of a finger's PIP joint. We present the results in a small number of patients, offering preliminary data for the chosen, specific subgroup after PIP joint replacement surgery.

PIP joints with a Swanson prosthesis tend to be less stiff in more extended positions and become significantly stiffer at finger flexion angles  $>60^{\circ}$ .

PIP joints with a CapFlex prosthesis tend to be particularly stiffer in more extended positions. Furthermore, this group showed a large variance for stiffness in the extended positions, i.e. while some could not even reach flexion angles of  $<30^{\circ}$ , others delivered values equal to healthy joints.

In a future perspective, measurement and a systematic analysis in a larger number of patients is required for the introduction of this novel method to assess and quantify finger joint stiffness.

## **A-0156** HUMAN TREE SYNDROME: A CASE REPORT AND TREATMENT PROTOCOL

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Human Tree Syndrome, first described in 1922, is an extremely rare condition in which the skin of a susceptible individual becomes overwhelmed by HPV infection, resulting in extensive deformity and severe disability. There is no known cure

for this highly debilitating condition.

We report a case in which aggressive treatment was able to restore virtually full function and allow the patient to resume a normal life, free of deformity. He remains disease free three years following treatment.

Referred to our institution in 2017, he presented with verrucous lesions and bark like growths involving his entire body, but most prominently affecting his hands. He became reclusive, was unable to work, suffered from chronic pain, and was functionally severely limited.

Evaluation included dermatologic and immunologic assessment as well as genetic testing. Despite travel constraints dictated by security issues, we were able to bring him to our hospital on 5 separate occasions over a 3 year period for inpatient surgical treatment. The goal was to radically reduce the viral load in an effort to allow his compromised immune system to overcome severe HPV proliferation.

Over the course of his 5 procedures, all of the visible lesions affecting his body were surgically removed, addressing the upper and lower extremities, face, scalp, head, neck, trunk and genitalia. All of the involved skin of the hands was removed, and replaced with skin grafts. On each of his successive procedures, contracture releases and further grafting were performed as needed in conjunction with ongoing excisions.

Although he was lost to follow up following his last procedure in 2019, we were finally able to locate him in late 2022.

In summary, an aggressive surgical approach to the treatment of Human Tree Syndrome can lead to long term relief from this potentially devastating condition.

## **A-0158** CARPAL TUNNEL RELEASE DESPITE NORMAL NERVE CONDUCTION STUDIES IN CARPAL TUNNEL SYNDROME PATIENTS

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**Purpose:** Carpal tunnel syndrome (CTS) is a common entrapment neuropathy, often requiring carpal tunnel release (CTR) surgery. Often, a nerve conduction study (NCS) is performed before CTR; however, there are various reports questioning the sensitivity of NCS, and some patients do undergo CTR despite normal NCS results. We had the following purposes: (1) to report clinical outcome of CTS patients who undergo CTR despite normal NCS, (2) to identify the characteristics and compare those with abnormal NCS patients in terms of basic features and risk factors, and (3) to analyze and compare normal and abnormal NCS results.

**Materials and methods:** Medical records of 546 CTS (30 normal NCS and 516 abnormal NCS) patients were retrospectively reviewed. Of 30 normal NCS patients, 7 were excluded, leaving 23 patients in the experimental group. We investigated the influence of age, sex, operative arm, and body mass index, as well as medical conditions known to be risk factors for CTS. In normal NCS patients, as a functional score, we investigated Boston carpal tunnel scores before and after CTR. The NCS results were compared in terms of median motor and median sensory testing. In normal NCS patients, NCS data were compared with that of the contralateral nonoperated wrists.

**Results:** There were 18 women and 5 men in the normal NCS group (mean age 43.7 years). On physical examination, 22 (94.7%) patients showed a positive Tinel test, 19 (82.6%) showed a positive Phalen test, 8 (34.8%) complained of nocturnal paresthesia, and only 1 (4.3%) presented with thenar atrophy. In 19 of 23 patients, the Boston CTS scores showed significant improvement after CTR. Normal NCS patients were significantly younger and significantly heavier

and more likely to be a current smoker. In NCS analysis of normal NCS patients, the operated wrists were closer to the reference values than nonoperated wrists.

Conclusions: Surgeons should evaluate the possibility of other combined lesions before CTR in normal NCS patients. Normal NCS can be present with a CTS diagnosis, especially in younger patients. Nevertheless, CTR after failed conservative management, despite normal NCS, could relieve subjective symptoms and function.

## **A-0159** SURGICAL TREATMENT OF EARLY ONE-STAGE CURETTAGE AND AUTOGENOUS BONE GRAFT FOR ENCHONDROMA WITH PATHOLOGICAL FRACTURE

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Introduction: Enchondroma is a benign bone tumor composed of hyaline cartilage. It most commonly occurs in the hand. Due to its asymptomatic growth, diagnosis is often delayed. In many cases, it is found as a pathologic fracture following trivial activities or low-energy injuries. However, the optimal timing of treatment for pathologic fracture with enchondroma remains unclear. Recently, several reports have presented the satisfactory surgical outcome of early one stage surgery for symptomatic pathologic fracture with enchondroma. Also, in case of displaced pathologic fracture need to be fixed with plate or pinning. But nondisplaced or minimally displaced pathologic fractures of enchondroma could be treated by autologous bone graft without fixation device. In this study we analyzed the results of patients who underwent treatment with early surgical treatment of curettage of the tumor and autogenous bone graft without fixation performed simultaneously instead of delayed operation.

Method: In this retrospective study, we enroll 24 patients diagnosed with enchondroma of the hand with pathologic fracture from January 2008 to December 2020 at single university hospital. They all underwent early surgical treatment of curettage of the tumor and autogenous bone graft performed simultaneously. Patients who underwent additional internal fixation such as pin or plate fixation were excluded from the study. Also cases that follow up less than 1 year and diagnosis to other tumor from biopsy were excluded. In the analysis of results, radiologic bony union, and tumor recurrence were confirmed. Clinically, total active motion, VAS, and DASH scores and presence of complications were analyzed at the final follow-up.

Results: The study included 24 patients, 12 males and 12 females and everyone show pathologic fracture on CT evaluation. 13 originated in the right hand while the rest originated in left hand. The average age was 33.6 years. The originating sites of enchondroma were as follows: 4 metacarpals, 10 proximal phalanges, 6 intermediate phalanges, 4 distal phalanges. Every 24 patients had a pain and tenderness on affected site preoperatively and 16 patients showed limited ROM due to pain at pre op evaluation. On radiographs, it took an average of 10.5 weeks for bone union and 12 weeks for return to daily life. At the final follow-up, the average value of DASH score was 5.90, with an average of 249.5 degrees for total active motion and a good prognosis for the lowest total active motion at 220 degrees. In addition, there was no recurrence of the tumor, and there were no cases of infection or stiffness.

Conclusion: In this study, satisfactory results were obtained with early surgical treatment of curettage of the tumor and autogenous bone graft performed simultaneously in the patients with pathologic fractures of enchondroma. This non-fixative technique could be useful surgical option that could shorten the treatment period and reduce implant related morbidity.

## **A-0161** PRIMARY TOTAL ELBOW ARTHROPLASTY FOR INTRA-ARTICULAR DISTAL HUMERUS FRACTURES IN ELDERLY: MID TO LONG TERM RESULTS

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**Background:** The treatment of intra-articular distal humerus fractures is often challenging in osteoporotic elderly patients. Total elbow arthroplasty (TEA) is a salvage option for non-reconstructable fractures. The purpose of this study was to evaluate the mid to long term outcomes and complications after primary TEA for intra-articular distal humerus fractures in patients older than 75 years.

**Methods:** Patients who underwent TEA for intra-articular distal humerus fracture between May 2007 and April 2017 were reviewed. 19 patients were over 75years and able to be followed up for more than 4 years. According to the AO classification, there were 8 C2, 11 C3 type fractures. Range of motion, Mayo Elbow Performance Score (MEPS), Disabilities of the Arm, Shoulder, and Hand (DASH) score, radiologic outcomes, and surgical complications were evaluated at the final follow-up visit.

**Results :** The mean age was 81.2 years(range, 75-88 years) and mean follow-up period was 67.2 months (range, 49-124 months). The average arc of flexion–extension was  $92^{\circ}\pm 19^{\circ}$ . Mean supination angle was  $79^{\circ}\pm 9^{\circ}$ , and mean pronation angle was  $86^{\circ}\pm 5^{\circ}$ . The mean Mayo Elbow Performance score was  $81\pm 27$ , and mean DASH score was  $47\pm 28$ . Of the 19 patients, only 1 required revision arthroplasty.

**Conclusions :** TEA is an effective and reliable procedure for the treatment of intra-articular distal humeral fractures in the elderly patient. For the majority of these patients, a well-performed TEA will give them a well-functioning elbow for life and will be the last elbow procedure required.

## **A-0162** VOLAR LOCKING PLATE FIXATION FOR OSTEOPOROTIC DISTAL RADIUS FRACTURES: COMPARISON OF CLINICAL AND RADIOLOGICAL OUTCOMES BASED ON AGE 70

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**Introduction:** Distal radius fracture(DRF) is the most common fracture of the upper extremities.

Over 65 years old and low demands patients can tolerate a higher degree of anatomical mal-alignment while maintaining a good functional outcome. So traditionally conservative treatment was good option within the elderly patients.

But, recently, elderly population is hard to accept clinical deformity and sports activity such as golf is still high. And Surgical instruments and techniques is getting advanced. So, needs of operation is gradually increasing.

Volar locking plate (VLP) is the most popular treatment option because it has the advantage of providing firmer fixation and subchondral support to osteoporotic bone, thus enabling early ROM.

However, there is insufficient studies comparing the degree of bone union and clinical outcome of the high elderly patients(over 70 years old) who underwent volar locking plate fixation for osteoporotic distal radius fracture.

Therefore, we planned a retrospective study on this.

**Methods :** 239 patients that underwent open reduction & internal fixation using volar locking plate to treat distal radius fracture and also had the T-score lower than -2.5 as a result of the bone marrow density test were recruited from March, 2012 to December, 2021. We divided these patients in 2 groups based on the age of 70 and compared clinical and radiologic

outcome including bone union of these patients.

As clinical outcomes, ROM, VAS scale, Mayo Wrist Score, and DASH score were evaluated, and as radiologic outcomes, radial inclination, Volar tilt, radial length, and bone union period were evaluated.

Results : There were no significant differences in clinical and radiologic outcomes between the two groups.

Conclusion : We can expect an excellent clinical and radiological outcome even in elderly osteoporotic distal radius fracture patient over than 70 years-old when performed an open reduction and internal fixation using volar locking plate.

### **A-0163** FOREARM BOTH BONE FRACTURE IN KLIPPEL–TRENAUNAY SYNDROME PATIENT

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Klippel-trenaunay syndrome(KTS) is a rare disease that was first observed in 1900 by French doctors Klippel and trenaunay. This disease characterized by abnormal development of soft tissues, lymphatic system, and blood vessels. Major features include tissue and bone overgrowth, vein malformation, and port-wine stains with or without lymphatic abnormalities. There have been several case reports of fractures in the femoral neck in KTS patients. However, there are few reports of fractures in the upper extremities. We present the case of a 61-year-old male patient eventually diagnosed with KTS while treating forearm both bone shaft fracture. We report about pre- and post-operative management and surgical method of KTS. A 61-year-old male patient, with a past history of diabetes and tuberculosis completely cured 10 years ago, visited the emergency room with pain in the left forearm caused by hitting a pipe five days before. Spots and edema of the left arm and chest, hypertrophy of vein and capillary malformation were observed. To treat forearm both bone fracture, several operation methods were discussed. IM nail was impossible because of the bowing and hypotrophy of radius due to history of radius shaft fracture when the patient was child. Open reduction & internal fixation was prepared because there were several reports that bone union was delayed in the case of the patients with KTS. We apply pneumatic tourniquet on the upper extremity and inflated to 250 mmHg. About 10cm incision was performed and carefully dissected the soft tissue, fascia and muscle. After reduction, we used cortical screw and locking screw with plate to maintain reduction state. We used Demineralized Bone Matrix to promote union of bone. . The surgery was finished without problems. We followed up the bone union state in out patient office by x-ray. Reduction state of bone was stable and bone union was in process after 2 months. There were many concerns about the management before and after surgery, but the results were satisfactory.

### **A-0168** ADOPTING A STANDARDISED GONIOMETRY GUIDELINE IN A HOSPITAL OUTPATIENT HAND THERAPY CLINIC: EXPLORING THERAPIST ATTITUDES AND PERCEPTIONS

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Goniometry is widely used in hand therapy practice to assess and document joint range of motion. Variation in assessment technique and documentation style affects inter-rater reliability with implications for patient outcomes and clinic efficiencies. A quality improvement project was undertaken in the JHC outpatient hand therapy clinic to address these concerns; however the main outcome, a clinic guideline, was implemented with limited success. This evaluation aimed to explore therapist attitudes and perceptions which may have impacted successful implementation.

A formative evaluation phase included four therapists and a process evaluation involved six therapists. Staffing changes resulted in two groups - Group 1 (original staff) and Group 2 (new staff). Qualitative methodology using semi structured interviews and thematic analysis was used to explore therapist perceptions and attitudes towards a standardised clinic guideline for goniometry assessment and documentation.

Similar themes were identified by therapists in both groups as enablers (interrater reliability education, evaluation and expectation setting) and barriers (time and equipment). Group 1 (original staff) therapists also identified therapist engagement and patient clinical implications as enabling factors, as well as a belief in the benefit and importance of the guideline. Group 2 (new staff) therapists identified issues related to the evidence base and habitual tendencies as barriers. Group 2 therapists also identified a likelihood to deviate from a standardised protocol due to patient related factors such as pain, oedema or goniometer positioning issues. Perceptions and attitudes appeared to be influenced by involvement and contribution to the guideline development.

All therapists recognised the importance of a standardised guideline in a multi-therapist clinic for improving inter-rater reliability and the potential impact on patient outcomes. Differences in therapist attitudes appeared related to their involvement in the formative evaluation and intervention design. Therapist engagement is vital in successful implementation of a new process, as are clear expectations regarding adoption and regular feedback.

## **A-0169** MODIFIED VOLAR APPROACH TECHNIQUE FOR PROXIMAL ROW CARPECTOMY

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### Introduction

Proximal row carpectomy is a well-accepted surgical procedure for the management of traumatic and degenerative wrist pathologies. Albeit routinely performed through a dorsal access, the volar approach might be strongly indicated in selected cases (inveterate perilunate dislocations, concomitant carpal tunnel syndrome and/or extensor tendons pathologies). We present a modification of the standard volar access, with detailed description of the skin incision (reproducing the standard palmar access to the scaphoid), capsular section (beginning with a longitudinal cut just radial to flexor carpi radialis tendon and prolonged transversally along the radio-lunate joint) and sequence of carpal bone removal (starting from the scaphoid rather than the lunate).

### Materials and Methods

The 74 patients who underwent surgical treatment with modified volar proximal row carpectomy between 1992 and 2015 were enrolled in a retrospective analysis. At an average of 132 months (11 years) after surgery (range 5-21 years), the patients were recalled to carry out a physiotherapeutic clinical examination, evaluated using the modified Mayo Wrist Score plus active range of motion (AROM), and routine X-rays assessment.

### Results

We report an improvement in both the Mayo Wrist score and total active range of motion, in line with the outcomes of dorsal proximal row carpectomy, without increased complications. Indications for PRC included Kienböck disease (21 cases), SLAC (19 cases), SNAC (16 cases), chronic carpal dislocation (13 cases), and radio-carpal arthritis (5 cases). The average modified Mayo Wrist Score increased from 43 to 75 at final follow-up. The AROM mean flexion/extension increased from 68.9° (35.0° flexion and 33.9° extension) preoperatively to 84.5° (44.5° flexion and 40.0° extension) postoperatively. The AROM of the radio-ulnar deviation increased from 22.6° (7.0° radial deviation and 15.6° ulnar deviation) pre-operatively to 35.0° (8.5°

radial deviation and 26.5° ulnar deviation) postoperatively. No cases of ulnar translocation of the carpus were observed.

#### Conclusions

The main advantages of this approach are: better visualization and access to proximal carpal bones (especially if volarly dislocated), contextual carpal tunnel decompression and no risk of dorsal capsule or extensor tendons adhesions.

### **A-0171** SURGICAL TREATMENT OF CAMPTODACTYLY WITH MALEK CUTANEOUS APPROACH AND STEPWISE RELEASE: A RETROSPECTIVE MULTI-CENTRE STUDY

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#### Background

Clinical manifestations of camptodactyly are varied and no official consensus on the etiopathogenesis or best treatment is available. Conservative treatment is generally preferred and, in refractory patients, surgery might be considered. However, reported results of surgery are often unsatisfactory and it is difficult to compare outcomes as different classification systems are adopted. We reported the outcomes of surgical treatment of camptodactyly with the Malek cutaneous approach and stepwise release, assessed using the Siegert classification.

#### Methods

A retrospective analysis of paediatric patients ( $\geq 1$  and  $\leq 18$  years) with congenital camptodactyly refractory to conservative management (flexion contracture  $>30^\circ$ ), treated with Malek cutaneous approach and stepwise release surgery between June

2009 and June 2019 with at least 1 year of follow-up was performed. Pre- and post-operative clinical and radiographic assessments were evaluated for degrees of flexion contractures and early ( $<30$  days) or late ( $>30$  days) complications were recorded.

#### Results

A total of 59 patients underwent surgery, of whom 38 (64%), including 42 fingers, were enrolled; mean patient age was 8 years (range 1–18). Post-operative mean flexion contracture was significantly improved ( $p > 0.001$ ) and no infections were recorded. Mean follow-up was 6 years (range 1–10) and proximal interphalangeal joint extension deficits were rated according to Siegert classification as excellent (69%), good (12%), or fair (9.5%) and poor (9.5%).

#### Conclusions

The Malek cutaneous approach and stepwise release of the retracting soft tissues allow prompt evaluation of the anatomical structures involved in the deformity and seem to be an effective surgical correction in the long term.

**A-0172** QUANTITATIVE 2D AND 3D-ANALYSIS OF THE AXIS AND ANGLE-CORRECTION IN CLOSING WEDGE OSTEOTOMY (WILSONS-OT) OF THE METACARPAL I FOR THE TREATMENT OF EARLY-STAGE OSTEOARTHRITIS OF THE CMC I-JOINT  
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**Purpose**

The aim of this project is to define the necessary axes (anatomical, mechanical and adjacent joint axis) of the first metacarpal bone in order to calculate a first metacarpal tilt angle and to determine a correction angle to be used in a Wilson osteotomy.

**Material and Methods**

CT-scans of twenty healthy and six symptomatic patients were used to find a method to define the required axes. Once the axes were defined, the first metacarpal tilt angle could be determined. This value was compared between healthy and symptomatic data. The angle of the closing wedge in a Wilson osteotomy was the calculated and explained with the defined axes and the determined angles. The effect of a Wilson osteotomy was described based on these data.

**Results**

We defined and reproduced the anatomical, mechanical and a proximal joint axis. The angle between the anatomical and mechanical axis showed an average of 6.1° (SD 1.2°). An angle of 85.4° (SD 2.8°) between the proximal joint axis and the mechanical axis (metacarpal tilt angle mechanically) and 79.4° (SD 3.1°) for the anatomical axis (metacarpal tilt angle anatomically) was calculated. The proximal joint axis is angulated 9.6° (SD 4.6°) to the middle plane of the metacarpal one. There was no statistically difference between healthy and symptomatic preoperative MC I angles and axes.

A mean angle of 28.7° (SD 5.2°) of correction was found in 6 symptomatic patients. Based on these data an angle of 22.6° (SD 2.5°) 1 cm and 26.7° (SD 2.5°) 1.5 cm above the proximal joint axis has been identified as optimal average correction angle for a Wilsons-osteotomy.

A comparison between the mean values calculated based on 2D and 3D data showed no significant differences.

**Conclusion**

The correction angle of 20°-30° determined by Wilson could be reproduced with the calculations and explained with the axes of the bone. However, the angle of correction is variable depending on the osteotomy height, bone thickness and angle between the axes. This newly developed method for calculating the angle of correction when performing a Wilson osteotomy can be used to improve the surgical technique and outcome.

If the axes are defined with small adjustments on a lateral 2D X-ray, similar values can be calculated and a 3D data set is not necessarily required, which is more suitable for a daily clinical routine.

**A-0173** SHAPE MODIFIED RADIAL FOREARM FLAP. DOES IT STILL HAVE A ROLE IN UPPER EXTREMITY RECONSTRUCTION?

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**Background**

To carry out a radial forearm flap, the radial artery is usually harvested with great donor site morbidity. Advances in

anatomical knowledge discovered constant radial artery perforating vessels, enabling the subdivision of this flap into smaller components suitable for a wide range of differently shaped recipient sites with marked reduction of the downsides.

#### Methods

Ten shape modified radial forearm (pedicled and free) flaps to reconstruct upper extremity defects (2014-2018) are presented and the surgical technique is analysed. Skin texture and scar quality were assessed with the Vancouver Scar Scale while functional activities and symptoms with Disabilities of the Arm, Shoulder and Hand score.

#### Results

At a mean follow up of 39 months no cases of necrosis, impaired hand blood circulation or cold intolerance were reported. Seven flaps were divided in 2 parts and 3 flaps in 3 segments, according to radial artery perforators pattern distribution. The average VSS score was 2.7 and the mean DASH score was 42.5.

#### Conclusion

The shape modified radial forearm flap is not a new technique but it has received little attention among hand surgeons; in contrast we believe it proved to be reliable, with acceptable functional and aesthetic outcomes in selected cases.

### **A-0174** A SINGLE MACHINE LEARNING MODEL CAN ACCURATELY PREDICT POST-TREATMENT PAIN IMPROVEMENT IN 26 HAND AND WRIST CONDITION-TREATMENT COMBINATIONS

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**Introduction:** Predicting individual pain improvement after treatment can facilitate shared decision-making in hand and wrist surgery. However, a prediction model for every condition-treatment combination is 1) time-consuming to develop, 2) underpowered in rare conditions, and 3) impractical to implement in daily care. This study evaluates whether a single machine learning model can accurately predict post-treatment pain improvement in a large number of hand and wrist condition-treatment combinations.

**Methods:** In a training dataset (N=14,707), we developed different potential models to predict the probability of improvement in pain after treatment beyond the minimal clinically important difference on a Numeric Pain Rating Scale. In a separate test dataset (N=4902), we evaluated the optimal models' performance (discrimination and calibration) on the entire dataset and for each of the 37 specific condition-treatment combinations.

**Results:** The best prediction model, a gradient boosting machine model, showed good discrimination (AUC=0.87) and calibration in the test dataset. When evaluated per condition-treatment combination, this model showed sufficient discrimination (AUC≥0.75) and good calibration for 26 of the 37 combinations.

**Conclusion:** We can accurately predict post-treatment pain improvement for 26 condition-treatment combinations using a single model. This model was recently implemented in a real-time clinician dashboard and helps patients and clinicians on a daily basis to decide on the most suitable treatment option.

**A-0176** OBSTETRICAL SHOULDER: REMODELING IN CHILDREN OPERATED AT THE AGE OF MORE THAN 05 YEARS OLD; ABOUT 13 CASES

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The aim of the study was to assess the capacity for glenohumeral remodeling, after anterior release, in children over 5 years of age with obstetric brachial plexus palsy

Materials and methods: 13 children, with an extreme age: 05 to 09 years old, the morphology of the preoperative glenohumeral was evaluated by CT imaging. Patients underwent anterior shoulder release. Control CT and clinical measurements were used to assess the results at a minimum of 02 years of follow-up.

Results: There was a significant improvement in glenoid retroversion and the percentage of the anterior humeral head, up to the middle of the glenoid cavity at two years. Passive and active external rotation increased with a slight loss of internal rotation; All children demonstrated clinical improvement of active motion, recorded with preop and post op videos

Discussion :

In all the cases, the restoration of an anatomy at the level of the shoulder is interesting, because it generates a sufficient bone stock, and one can imagine an additional surgery if it proves to be necessary, a central shoulder is a real guaranteed for the future, because for dysplasia at an advanced age of 30 to 40 years, the patient consults for terrible pain, and at this stage there are very few therapeutic options

Conclusion: Anterior release of the obstetric shoulder generates an objective functional gain. In addition, it prevents or corrects posterior shoulder subluxation. It is indicated if the amplitude of passive external rotation is limited. Muscle transfer to resuscitate active external rotation, or humeral derotation have only very few indications.

**A-0177** PRIMARY ARTHROSCOPY-ASSISTED FOVEAL REPAIR OF TRIANGULAR FIBROCARILAGE COMPLEX ASSOCIATED WITH ACUTE DISTAL RADIUS FRACTURES IN YOUNG ADULTS

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Aims:

This retrospective case series study was conducted to investigate the short-term outcome of primary arthroscopy-assisted foveal repair of triangular fibrocartilage complex (TFCC) associated with acute distal radius fractures in young adults.

Patients and Methods:

Fourteen patients at age under 65 who underwent open reduction and internal fixation for distal radius fracture and arthroscopy-assisted repair for TFCC foveal tear were included. Those subjects were observed to have complete peripheral TFCC tear by preoperative wrist magnetic resonance imaging (MRI) and intraoperative distal radio-ulnar joint (DRUJ) stability test, and confirmed with arthroscopic examination. Trans-osseous technique was used for the repair of TFCC after the firm fixation of distal radius fracture. The patients were immobilized in the long arm splint with neutral position for postoperative 2 weeks, and removable short arm wrist brace was applied for another 2 weeks. Grip strength, DRUJ

stability and patient-reported outcomes including Disabilities of Arm, Shoulder and Hand (DASH) and Patient-Rated Wrist Evaluation (PRWE) scores were evaluated at 3, 6, 12 months postoperatively.

Results:

All patients showed stable DRUJ through entire follow-up periods. The average grip strength ratio compared to the unaffected side after adjusting the ratio according to the hand dominance was 71.2% (range 31.5-107) at 3 months after surgery, 83.1% at 6 months (range 48.6-116.7), and 88.5% (range 71.3-115.9) at 12 months after surgery. The mean DASH was 25.9 (range 0.86-57.5) at 3 months postoperatively, 18.4 (range 0.86-48.27) at 6 months postoperatively, and 7.3 (range 0 – 17.5) at 12 months postoperatively. The mean PRWE was 22.4 (range 0-45) at 3 months postoperatively, 17 (range 0-53) at 6 months, and 7.4 (range 0-19.5) at 12 months.

Conclusion:

Primary arthroscopy-assisted TFCC foveal repair with internal fixation of distal radius showed early recovery of DRUJ stability and good clinical outcome in young patients.

Keywords

distal radius fracture, triangular fibrocartilaginous complex tear, distal radioulnar joint instability, wrist arthroscopy, early mobilization

## **A-0178** NEW EIGHT-STRAND CORE SUTURE TECHNIQUE FOR REPAIR OF FLEXOR TENDON LACERATIONS: A BIOMECHANICAL ANALYSIS

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**HYPOTHESIS:** Multi-strand sutures (typically four- or six-strand repairs) may withstand much greater tension than conventional two-strand sutures during early active mobilization. However, the placement of multi-strand sutures during flexor tendon repair requires complicated surgical skills; such suturing is difficult. We developed a new, simpler eight-strand suture, which we term the Yoshizu cross-lock. The purpose of this study is to introduce our technique and evaluate its tensile properties.

**METHODS:** Fourteen porcine flexor tendons were transected and repaired using the Yoshizu cross-lock system; no peripheral sutures were placed to rule out any influence of variations therein. Our system employs two cross-lock suture grasps placed on either side of the repair site; two knots are embedded in the repair site of the tendon (Figure. 1). We used a 4-0 monofilament nylon double strand with two needles (Bear Medic Corp., Ichikawa, Japan). The core suture purchase length was 10 mm, the lock width was 4 mm, and all lock depths within the tendon were approximately 2 mm. The core sutures were placed under tension to shorten the tendon segment encompassed within the core suture strands by 10%. The repaired tendons were subjected to linear, noncyclic load-to-failure tensile testing using a tensile test machine (AG-1 10kN; Shimadzu Corp., Kyoto, Japan) (Figure. 2). The initial distance between the clamps was 5 cm. A preload of 1 Newton (N) was applied before loading evaluation. The overhead crossbar connected to the upper clamp was advanced at a constant speed of 25 mm/min. The distance between the stumps was monitored by a video camera that had been vertically mounted at the level of the tendon repair site. The pulling force was continuously recorded. The initial gap, the 2-mm gap force, and the ultimate strength were measured.

**RESULTS:** Under linear loading conditions, the mean initial gap force was 12.6 N (range; 3.3–22.5 N), the mean 2-mm gap formation force was 33.9 N (range; 15.6–54.1 N), and the mean ultimate strength was 70.1 N (range; 42.3–93.5 N).

All tendons subjected to Yoshizu cross-lock repair failed due to suture rupture rather than pullout.

**SUMMARY:** This suture technique is a modification of the four-strand exposed cross-lock repair method of Xie et al using double-stranded nylon suture material instead of a single-stranded suture. The four-strand exposed cross-lock repair method requires more needle reversal than our repair technique. Such needle reversal is technically difficult. Yoshizu cross-lock repair afforded sufficient tensile strength to counter the 2-mm gap formation force. The clinical relevance of this study lies in the fact that Yoshizu cross-lock repair (with peripheral sutures) may allow the repaired flexor tendon to withstand the stresses encountered during early active mobilization. This simple eight-strand technique will be particularly useful to surgeons who commonly employ the cross-lock stitch for primary flexor tendon repair following early mobilization.

## **A-0179** DUPUYTREN'S SURGERY UNDER WALANT

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Wide-Awake Local Anesthesia No Tourniquet (WALANT) Approach to Dupuytren's contracture involves fasciectomy under local anesthetic with epinephrine and no tourniquet. The goal of this study is to show WALANT is a safe and effective procedure and can be performed in an outpatient setting. This paper was IRB approved and has respected Helsinki's Declaration. Between April 2019 and September 2022, 17 patients with single or multiple digit involvement were operated for Dupuytren's contracture. All surgeries were performed in an outpatient setting and under WALANT anesthesia. All patients signed an Informed Consent and were operated by the same surgeon, without sedation and in an opioid sparing procedure. With Brunner's incision, selective fasciectomy was performed. Results showed no complications and no patients required further analgesia during the procedure. Complete resection of the cords was achieved in all patients and the immediate finger range of motion could be evaluated, and all patients were capable to see their hand immediately after surgery. There were no post-op infections. None patient required the use of phentolamine. WALANT surgery incorporates the use of local anesthetic with lidocaine and epinephrine for hemostasis without the use of tourniquet, sedation, or general anesthesia. None of the patients undergoing WALANT surgery suffered any common general anesthesia related complications. With the use of this technique the patients suffer no pain after the initial needle poke of the local injection when it is injected slowly, the needle never gets ahead of the wheal of the local anesthesia, generous volumes are used, and the local anesthesia is given time to become intense. Many patients who feel stressed coming into the new surgical environment usually adapt quite rapidly when they realize there is total numbness and that they will not be sedated. One of the patients had a severe COPD and had to be operated in a seated position. In a previous situation he had had his operation cancelled due to respiratory problems, since he was not fit to general anesthesia. The myth of epinephrine-induced digital necrosis was probably generated by procaine. Injection of phentolamine reliably reverses epinephrine vasoconstriction in the finger in 1.5 h, whereas it normally takes epinephrine vasoconstriction 6.5 h to wear off by itself. None of the patients needed the use of phentolamine. Despite Dupuytren's fasciectomy may be one of the more difficult operations to perform with WALANT because of the bleeding generated by cord dissection adjacent to the digital arteries, there were no complications during the procedure, even in multiple digit involvement. Many Dupuytren's patients are older with comorbidities. If they have only had lidocaine and epinephrine for anesthesia, they simply get up and go home. This avoids general anesthesia problems. WALANT for Dupuytren's contracture surgery is a safe, reliable and effective technique and allows complete resection of the pathological tissue, even in multiple digit involvement and in multi-comorbidity patients. It allows the patient to see their hands just after surgery and comprehend what the surgeon needs him to do in the post-operative period, regarding the achieved range of motion observed during the surgery.

## **A-0181** VASCULAR MALFORMATIONS OF THE HAND: DIAGNOSIS AND SURGICAL TREATMENT OF 220 CASES

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### Introduction

Vascular malformations (VM) are congenital anomalies that are subdivided into numerous categories grouped into arterious, venous, capillary lesions or a combination of all of these. There is much confusion surrounding these little known malformations, this is due mainly to the presence of numerous and varied classifications. Incorrect diagnoses are common and are usually due to the limited experience of clinicians or radiologists involved in the diagnosis and management of vascular malformations; recognizing a vascular malformation and appropriately it classifying, is essential for optimal patient care and requires solid knowledge and experience.

### Material and Methods

From 1986 to 2022, 220 patients affected by VM have been treated surgically.

VM were divided into: 144 venous forms, 66 arteriovenous forms and 10 others.

A medical examination is sufficient in most cases to establish diagnosis. Pain, intermittent bleeding, ulcerations thrill and bruit are the hallmarks of VM. Instrumental investigations include ultrasound doppler, AngioMRI, AngioCT and in the arteriovenous forms Angiography. Surgical treatment was performed in locoregional anaesthesia with a tourniquet at the axilla.

### Results

While the lymphatic and venous forms have a good result by surgical treatment, arteriovenous forms have a high rate of recurrence that is augmented in case partial eradication.

### Discussion

The origin of vascular malformations is a genetic defect that, in many associated syndromes, is inherited in an autosomal recessive manner, while the non-inherited forms, it is a random genetic defect.

### Conclusions

Although embolization and sclerotherapy are helpful in other districts should be avoided in the hand because of the high failure rate and sequelae, that's why surgical treatment is the best choice for the hand.

## **A-0183** 10 YEARS FOLLOW-UP COMPARING COLLAGENASE AND OPEN SURGERY AS TREATMENT FOR DUPUYTREN DISEASE

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**INTRODUCTION:** In our unit traditional treatment for Dupuytren disease has always been open surgery with fasciectomy (OSF), believing that percutaneous needle fasciotomy is a too dangerous procedure. At the beginning of the last decade, with the apparition of new techniques, we started to treat some patients with Collagenase (CCH). The aim of this study is to compare retrospectively recurrence rate and complications of these two techniques at 10 years follow-up.

**MATERIALS AND METHODS:** All patients treated for single digit Dupuytren disease in 2012 have been analyzed. We included

in this study all patients with at least a stage 2 of Tubiana, and excluded those with other hand pathologies or that did not return for the 10 years follow-up visit.

**RESULTS:** Among the 150 patients treated for single digit Dupuytren disease in 2012, we included in this study 60 patients treated with OSF (44 MPJ, 16 PIPJ) and 42 patients treated with CCH (34 MPJ, 8 PIPJ). Recurrence rate for OSF was 18.3% with mean time of appearance of 6 years from surgery (range 2-10 years), whereas it was 16.7% with mean time of appearance of 4.2 years from surgery (range 2-7 years). Satisfaction on a 1-10 scale at 10 years follow-up was 7.7 for OSF and 8.3 for CCH. All patients treated with CCH had minor complications (bruises, swelling, skin lesions) that were resolved within four weeks, while only 5 patients had complication (all skin lesions) among those treated with CCH. Finally, mean time to return to work was 16 days (4-20) after CCH, and 24 days (12-40) after OSF.

**CONCLUSION:** Recurrence rate and satisfaction are similar for both techniques, with a difference in time of appearance. CCH is more frequently associated to complications but as a shorter time before return to work when compared to OSF. Both techniques are valid, and each has its advantages and disadvantages that a surgeon should know in order to choose which one to use more appropriately depending on patient needs.

### **A-0184** RESURFACING CAPITATE PYROCARBON IMPLANT AS SALVAGE PROCEDURE IN SEVERAL SERIOUS OUTCOMES OF CARPAL INJURIES. CLINICAL EXPERIENCE AND FOLLOW-UP

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**INTRODUCTION:** Resurfacing Capitate Pyrocarbon Implant has been introduced in the surgical practice as an alternative method to restore wrist motion, strength and functions in patients suffering from wrist osteoarthritis. It has already been well described in the literature as a treatment for advanced stages of degenerative wrist diseases which follow scaphoid's and lunate's injuries such as scapho-lunate advanced collapse, scaphoid non-union advanced collapse, and advanced stages of Kienböck disease. Authors extended the use of RCPI to other selected cases of complicated wrist injuries, spreading out from the classic indications for which this device was designed.

**MATERIALS AND METHODS:** We discuss 8 cases with serious outcomes of carpal injuries treated with Resurfacing Capitate Pyrocarbon Implant as salvage procedure between 2005 and 2013 by the first author of this paper

**RESULTS:** Among the eight particular selected cases, at a mean 4.3 years follow-up (range 2-11) only one was considered a failure and underwent a total wrist arthrodesis, resolving pain after all. The seven other cases reported good results. Range of Motion, Visual Analogue Scale for pain, subjective satisfaction and radiographical outcomes are reported.

**CONCLUSIONS:** As a result of this heterogeneous clinical experience, validated by long-term follow-ups in most cases, we think that the use of a Resurfacing Capitate Pyrocarbon Implant can be suggested as an option in the outcomes of various carpal injuries.

## **A-0185** FEASIBILITY OF A FASCIAL FLAP TO AVOID ANTERIOR TRANSPOSITION OF UNSTABLE ULNAR NERVE: A CADAVER STUDY

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**INTRODUCTION:** Compression of the ulnar nerve at the elbow is the second most frequent site of nerve compression in the upper limb. Upon release, ante-position of the nerve may be necessary to avoid dislocation of the latter when unstable. Numerous techniques are described in the literature (subcutaneous transposition, intramuscular transposition, subfascial transposition, medial epicondylectomy...), none of which is without complications. Based on Han's work, the authors propose a technique of covering the ulnar nerve with epicondylar fascial flap, avoiding transposition, but ensuring good stability of the ulnar nerve.

**MATERIALS AND METHODS:** As part of the SICM (Italian Society of Hand Surgery) cadaver dissection course (ICLO, Verona, Italy) the authors dissected 36 elbows, of which 20 presented subluxation of the ulnar nerve after its decompression. The fascial flap was therefore made on these 20 elbows, coming from 14 different donors (9 men, 5 women) with an average age of 78 years. The diameter of the ulnar nerve was then measured (at the level of the passage in the cubital canal), the diameter of the newly formed canal, the difference between the two previous measurements (residual space in the flexed elbow canal), and it was verified whether the ulnar nerve was unstable once covered by the flap.

**RESULTS:** The mean diameter of the ulnar nerve was 5.1 mm (range 4-6), while the mean diameter of the neo-canal was 10.1 mm (range 8-11) in elbow extension and 8.9 mm (range 7-10) in elbow flexion. The remaining space in the flexed elbow canal was 3.8 mm (range 3-5).

In none of the 20 cases the ulnar nerve was dislocated after having made the fascial flap.

**CONCLUSIONS:** In light of the results obtained, the authors think that the use of the epicondylar fascial flap may be a solution to keep in mind to avoid dislocation of the ulnar nerve when it becomes unstable following its decompression. This work obviously needs clinical confirmation on living patients.

## **A-0186** ISOLATED COMPRESSION OF THE ULNAR MOTOR BRANCH DUE TO CARPAL JOINT GANGLIA: CLINICAL SERIES, SURGICAL TECHNIQUE AND POSTOPERATIVE OUTCOMES

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**INTRODUCTION:** The entrapment of the ulnar nerve in Guyon's canal (GC) is a well-known wrist canalicular syndrome which is usually followed by a gradual combination of both sensitive and motor symptomatology. However, GC nerve compression could also cause a pure hand motor dysfunction. This condition, less frequent than the classic Guyon's syndrome, can be difficult to diagnose.

**MATERIALS AND METHODS:** Authors report a case series of eight patients affected by isolated compression of the ulnar nerve motor branch, due to piso-triquetrum or triquetro-hamate joint ganglia.

**RESULTS:** The mean time lapse between the beginning of the symptomatology and surgery was 8.25 months (min: 2; max: 18; SD: 5.49). The mean follow-up was 54 months (min: 12; max: 96; SD: 34.54). All patients showed improved hand

function and quality of life as demonstrated by the PRWE score (pre-op: 35.25—min: 12; max: 90; SD: 30.62—post-op: 5.06—min: 0; max: 28.5; SD: 8.43; p value < 0.05). Clinical tests were negative in 6 of 8 patients at follow-up. Clinical signs of muscular atrophy (Masse and Wartenberg signs) remained positive in two patients older than 50 years of age, who underwent surgery more than one year after the onset of symptoms, respectively 14 and 18 months.

**CONCLUSION:** The isolated compression of the ulnar nerve motor branch is a very rare clinical condition which is often linked to several causes. The rarity of the pathology is probably due to lack of knowledge and therefore to the difficulty in formulating a correct diagnosis. Surgical treatment appears to be decisive in most cases, although late diagnosis often leads to incomplete functional recovery.

## **A-0187** THE ROME EXPERIENCE WITH COLLAGENASE AND PERCUTANEOUS NEEDLE FASCIOTOMY

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**INTRODUCTION:** Dupuytren's disease is a slowly progressive fibroproliferative disease involving the hand. This is a disease of unknown origin for which there is no medical cure whereas there are numerous surgical options to solve the problem that leads the patient to visit the hand surgeon: the inability to fully extend one or more rays. Among these the most commonly used, without there being a gold standard, are fascectomy, fasciotomy and percutaneous techniques. Among these last ones percutaneous needle fasciotomy (PNF) and collagenase injection (CCH), have the advantage of being less invasive for the patient and significantly shortening surgical times but on the other hand have a bad reputation in terms of relapse. The aim of this study is to evaluate outcomes in terms of recurrence and complication rates of these two minimally-invasive techniques.

**MATERIALS AND METHODS:** We reviewed all patients treated with either PNF or CCH between 2010 and 2017, though with a minimal 5 years follow-up. We included in this study all patients affected by Dupuytren contracture at one single digital ray (fourth or fifth finger), excluding those who underwent previous surgical treatments and those affected by Diabetes. Overall, we included 341 patients in the PNF group, with 421 treated digits and 603 treated joints (391 MP and 212 PIP); and 135 patients in the CCH group, with 135 treated digits and 157 treated joints (94 MP and 63 PIP).

**RESULTS:** Two weeks after surgery, in the PNF group 92% achieved full extension at the MP joint and 87% at the PIP joint; whereas in the CCH group 100% achieved full extension in the MP joint and 90% in the PIP joint. At five years follow-up only 3 major complications occurred: 2 nerve lesions in the PNF group and 1 tendon rupture in the CCH group, whereas skin tear occurred more frequently 17% in the PNF group and 37% in the CCH group. Regarding recurrence rate at 5 years: 31% at the MP joint and 78% at the PIP joint for the PNF technique, and 35% at the MP joint and 73% at the PIP joint for the CCH technique. Moreover, at the PIP joint, when stratified the recurrences rates are higher when PIP lack of extension before surgery was higher than 45°.

**CONCLUSIONS:** Recurrence rates in the 2 groups are similar, with higher recurrence rates at the PIP joint and a significant correlation between disease severity and recurrence risk. We believe surgeons should consider a hybrid approach to PIP joint contracture with CCH and volar plate release to lower recurrences, and should consider open surgery in patients showing recurrence before 2 years after minimally invasive treatment and in patients aged under 50 years old with PIP severe contracture.

## **A-0188** RECONSTRUCTIVE STRATEGY IN UPPER BRACHIAL PLEXUS INJURIES

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**INTRODUCTION:** C5-C6 injuries are characterized by an adducted and internally rotated shoulder due to palsy of the axillary and suprascapular nerves, and by an extended elbow due to weak biceps brachii innervated by the musculocutaneous nerve. When also C7 is involved, the forearm is pronated and there is an impaired wrist extension. The restoration of elbow flexion is the highest priority, followed by external rotation and shoulder abduction. Reconstructive strategies, nerve grafting, nerve transfers and tendon transfers, will depend on the type of lesion, either root avulsion or postganglionic nerve injury. **MATERIALS AND METHODS:** Authors propose their reconstructive algorithm for upper brachial plexus injuries reviewing over 240 cases treated between 2010 and 2020.

**RESULTS:** 64 patients underwent biceps reanimation with Oberlin nerve transfer with minimum 18 months follow-up achieving at least M3 for the biceps in 86% of cases and at least M4 in 69% of cases. When grafts were used instead of transfer, 79% of biceps achieved M3. Regarding shoulder reanimation, 67 patients underwent Axillary nerve reanimation by grafts achieving a result >M3 in only 25 % of cases, whereas 85 were treated with nerve transfer (Radial n. motor branch for Triceps medial head to Axillary n. anterior division combined with Oberlin and Accessory n. transfer to Suprascapular n.) and achieved at least an M3 result in 85% of cases. In cases with C7 involved, 34 patients underwent tendons transfers for extension recovery, achieving full wrist extension in 32 cases and full finger extension in 30 cases.

**CONCLUSION:** Nerve transfers allowed better results than grafts and shorter recovery time. Transfers are very helpful in late surgery, as time of target nerve reanimation is shorter. Nerve transfers showed great efficacy in particular for Axillary nerve reanimation. Nevertheless, nerve grafts still remain an option in presence of good root stumps, and are very useful as backup procedure combined with Oberlin nerve transfer to increase biceps reanimation success rate. To obtain a good shoulder reanimation double reinnervation of both Suprascapular and Axillary nerve is needed.

## **A-0189** IS IT POSSIBLE TO USE FLEXOR CARPI ULNARIS AS DONOR IN TENDON TRANSFER IN C5-C6-C7 BRACHIAL PLEXUS PALSY AFTER OBERLIN NEUROTIZATION?

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**INTRODUCTION:** Oberlin nerve transfer is a popular and effective surgery to restore elbow flexion with low donor site comorbidities in traumatic upper brachial plexus palsies. Flexor Carpi Ulnaris (FCU) partial denervation theoretically excludes the muscle as possible donor in a second stage tendon transfer in case of C5-C6-C7 lesion. The aim of our study is to demonstrate that FCU can greatly recover from the partial denervation and therefore can be used as donor to regain wrist extension.

**MATERIALS AND METHODS:** In this retrospective study we selected patients with C5-C6-C7 traumatic palsy who underwent primarily Oberlin neurotization and, secondarily, FCU pro Extensor Digitorum Communis (EDC) tendon transfer. We

recorded demographic data, time between trauma and neurotization, time for biceps recovery, biceps strength after neurotization, FCU residual strength after neurotization, time between neurotization and FCU tendon transfer and EDC strength after FCU tendon transfer.

**RESULTS:** 11 patients had Oberlin neurotizations followed by a second stage tendon transfer surgery. Most of patients were young adults (32 y), male (82%) and involved in motorcycle accident (82%). Mean follow up was 6 years (2 y-12 y). Mean time from trauma and neurotization was 7 months (4-15 m). Mean time between neurotization and FCU tendon transfer was 14 months (12-19 m). Biceps recovery was observed on average at 7,5 months (3-12 m) from surgery. 8 out of 11 had a M4 for the biceps, whereas the 3 others had a M3. 73% got excellent results (M4) in EDC strength after tendon transfer. The residual strength of the partial denervated muscle (FCU or EDC) was good or excellent in 82% of the total sample.

**CONCLUSIONS:** in our experience the use of FCU as donor transfer after Oberlin neurotization, it has sufficient strength to achieve good results in radial nerve palliative surgery in C5-C6-C7 palsies.

## **A-0190** A BIOMECHANICAL STUDY COMPARING PATIENT-SPECIFIC IMPLANTS WITH STANDARD PLATES FOR THE SURGICAL MANAGEMENT OF DISTAL RADIUS MALUNION

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### Introduction

Malunions of the distal radius are the commonest complication of distal radius fractures, with a reported incidence of 5-17%. These can be debilitating to patients and difficult to manage, with up to 83% of affected patients reporting pain, functional loss, and deformity. Evidence has shown malunited distal radius fractures to be multi-planar deformities, with accurate anatomical restoration directly related to quality of functional outcome. Advances in technology have assisted in the planning and execution of corrective osteotomies, however little work exists comparing the role of patient-specific instrumentation and implants, against standard fixation methods.

The aim of this study was to directly compare the biomechanical properties of a standard distal radius plating system, with a patient-specific design.

### Method

Ten artificial, identical 3D-printed right distal radii were used for testing. Five samples were fixed using a standard distal radial locking plate (Geminus), with the desired osteotomy site measured by hand prior to fixation. The remaining five samples were prepared using a 3D-printed jig, to mark the osteotomy site and screw holes, prior to fixation with a patient-specific distal radius locking plate. The specimens were held in a servo-mechanic testing machine (Test Resources, USA), and cyclically loaded for 2,000 cycles (1-2Hz) at loads of 80N and 250N, reflecting loads anticipated during rehabilitation. Primary outcomes were interfragmentary motion at the central fracture site, measured using a linear variable displacement transducer (LVDT), with secondary outcome measures of stiffness of the construct and failure of fixation.

### Results

At both loading levels a statistically significant difference in cyclic interfragmentary motion was found between specimens fixed using standard locking plates and custom-made implants. At 80N, patient-specific plates reduced mean cyclic movement by 88µm (95%CI 30-180, p<0.001) compared to standard plates (custom: 30µm [SD 20], standard: 118µm [SD 36]). At 250N there was a greater mean reduction of 316µm (95%CI 104-454, p<0.001) when comparing custom-made

and standard plating systems (94µm [SD 43] vs 410 µm [SD 110]). The larger interfragmentary motion with the standard plate was mainly due to motion at the interface between the plate and radius, distal to the osteotomy site. Permanent deformation after 2000 cycles, however, did not show a statistically significant difference between the two groups. The custom-made plate was found to form the stiffer construct, and this difference was statistically significant (80N: 3830N/mm, p0.018]. 250N: 2598N/mm, p0.001]).

#### Discussion

Advances in technology have led to the use of patient-specific instrumentation and implants across a wide range of surgical specialties. Distal radius fractures are the most common fractures in the adult population of the UK, and their malunions have significant repercussions for the patient and healthcare system. Our study has shown that, biomechanically, custom-made implants are associated with a better fixation of the distal radius, and less motion at the plate/bone interface.

#### Conclusion

This biomechanical study suggests that the use of patient-specific implants can be beneficial to our patients suffering from malunions of the distal radius. It has also highlighted the need for high-quality patient-led studies, directly comparing such fixation methods with more traditional techniques.

### **A-0191** SHORT-TERM OUTCOME AFTER ISOLATED HSN OF THE ELBOW FLEXORS ASSESSED VIA 3D MOTION ANALYSIS AND SURFACE EMG

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#### Objective:

A reduction of spasticity can be achieved surgically by so-called hyperselective neurectomies (HSN), in which 2/3 of the nerve fibres innervating a specific muscle are dissected. Until now, the documentation of the surgical improvement was only done by means of subjective scales (modified Ashworth Scale (MAS), modified Tardieu Scale (MTS)).

The aim of this work is to determine, for the first time, the changed muscle activity and spasticity reduction using surface EMG and 3D motion analysis 6 months after HSN of the elbow flexors and to compare it with the MAS and MTS.

#### Methods:

Patients with elbow flexor spasticity due to Cerebral Palsy (CP), post traumatic brain injury (TBI) or apoplex were included. An instrumented spasticity assessment is performed 1 day before HSN of the elbow flexors (Mm. biceps brachii, brachialis and brachioradialis) and 6 months postoperatively. Therefore, 3D motion analysis data (U.L.E.M.A. model (Jaspers et al. 2014)) and surface EMG on the biceps brachii muscle and the antagonistic triceps brachii muscle during slow (LV) and fast (HV) passive elbow extension are captured.

The EMG data were normalized to the maximum voluntary isometric contraction (MVIC) and recorded over a pre-defined period of time (starting 200ms before reaching the maximum stretch velocity, ending when 90% of the maximum extension is reached). The maximum achieved passive elbow extension and the EMG parameters (LV and HV), as well as the difference of the EMG parameters between LV and HV (EMGchange) were compared pre- vs. post-operatively (Bar-On 2013). Normal distribution of the data is confirmed and a two-tailed t-test is used.

#### Results:

Our preliminary results from the first 5 patients show an approximately 50% reduction in EMGchange from 15% (SD 12%) to 8% (4%) (p = 0.310), an approximately 50% reduction on the MTS scale from 1.8 (0.8) to 0.8 (0.8) (p = 0.151)

and a slightly smaller reduction on the MAS scale from 3.6 (3.2) to 2.2 (1.5) ( $p = 0.690$ ). The maximum elbow extension deficit during slow passive extension did not show any change (preop:  $43^\circ$  ( $23^\circ$ ), postop:  $43^\circ$  ( $32^\circ$ ),  $p = 1.000$ ) and was only minimally reduced during fast speed (preop:  $60^\circ$  ( $30^\circ$ ), postop:  $52^\circ$  ( $40^\circ$ ),  $p = 1.000$ ).

Conclusions:

Our results confirm the reduction in muscle tone and spasticity by isolated HSN of the elbow flexors. As expected, an isolated HSN seems not to affect the biomechanical component (contracture) of spasticity. Nevertheless, we see a reduction in EMG change appropriate to the neurophysiological component that should be addressed with the HSN.

The surface EMG combined with 3D motion analysis can be presented as an objective measurement method for recording spasticity and postoperative changes.

## **A-0192** INCIDENCE AND MANAGEMENT OF MALLET FINGER IN PRIMARY CARE

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Background: A mallet finger (MF) is a traumatic extensor tendon injury at the distal finger joint, that is diagnosed clinically and can predominantly be managed in primary care. The incidence and management of MFs in primary care however is unknown.

Aims: 1) To determine the incidence of MFs in Dutch primary care, 2) to obtain estimates for the proportions of osseous and tendon MFs, and 3) to gain insight in the clinical management of patient diagnosed with a MF in primary care.

Design and setting: A retrospective cohort study was conducted using electronic healthcare records of more than 200.000 primary care patients within the Netherlands.

Methods: Patients aged  $\geq 18$  years with a new diagnosis of a MF from 1 January 2015 to 31 December 2019 were extracted using a search algorithm based on International Classification of Primary Health Care coding and search terms in free text. The medical files of random 200 potential cases were manually reviewed to obtain positive predictive value (PPV) for the search algorithm. Incidence numbers per year were multiplied with the PPV to obtain yearly incidence estimates. Data on the management of MFs was manually interpreted, up to 6 months after the first consultation.

Results: 161 of the 200 (PPV 0.81) potential cases were actual MF cases. The mean incidence over the study period was 0.58 per 1000 person-years. The mean age at diagnosis was 53 (range 18 – 91) years and men had a higher incidence rate of 0.60 compared with women 0.56. Peak incidence was between 41-60 years of age for men and 61-80 years for women. Digit III and V were the most common injured fingers. In 58% of the cases, a radiograph was taken at or directly after the first presentation. Of these, 23% of cases had an osseous MF confirmed by radiography, 35% had a tendon MF, and for 42% no distinction between osseous or tendon could be made. 93% of the patients with a MF were initially assessed by the general practitioner. The mean number of consultations with the general practitioner was 2 (IQR 1-2). Conservative treatment in-house was the most applied strategy (48%), followed by referral to a secondary care specialist (36%), and referral to a paramedical professional (9%). Two percent (4/161) of patients with a MF underwent surgery.

Conclusions: To the best of our knowledge, for the first time the incidence of MF in primary care has been determined and was 0.58 per 1000 person-years. There was a discrepancy between the current Dutch general practice guidelines and how general practitioners manage the condition in clinical practice, especially for the use of imaging. The guidelines advise to make a radiograph in all cases of MF, while in clinical practice imaging was only used in little over half of all cases.

Since only a minimal number of patients required surgical treatment, the guideline recommendation for performing radiography in all patients with MF can be questioned.

**A-0193** PROXIMAL MEDIAN NERVE COMPRESSION DUE TO GIANT LIPOMA. SURGICAL TREATMENT UNDER WALANT  
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### 1. INTRODUCTION

Lipomas are benign mesenchymal tumors, which can be found anywhere in the body. In less than 1% of cases, they can be observed in distal extremities. They usually present asymptotically as solitary lumps.

Median nerve compression by lipomas, located at the proximal forearm, is a rare condition with a few reported cases.

### 2. METHODS

We present the case of a 74-year-old Caucasian man with a lipoma in the proximal third of the right forearm. The patient was referred with paresthesia in the distribution of the median nerve with at least one-year of evolution, which got worst after a cubital fracture in the same forearm.

On clinical examination, there was a soft mobile mass, non-tender, with well-defined edges.

An ultrasound and MRI studies of the forearm was performed and showed a large lipoma with compression of the median nerve. EMG test demonstrated a median nerve compression with slight-moderate severity.

We proposed an operative treatment to excise the tumor.

### 3. RESULTS

Treatment with surgical exploration under Wide - awake Local Anesthesia No Tourniquet (WALANT) was performed. This kind of procedure can be made in an ambulatory setting with multiple benefits, including improved patient safety and intraoperative diagnosis and assessment, while also being more accessible to surgical care. A large mass with 10x9x3.5 cm, compressing the median nerve was found and a complete excision of the tumor was achieved.

Clinically, the patient had an improvement in the paresthesia of the right hand in the early post-operative period and the healing of the wound went well.

Histopathological study of the resected mass confirmed it was a tumor composed of adipocyte cells encapsulated by a thin layer of fibrous tissue compatible with a lipoma and excluded any malignant tumoral evidence.

At follow-up, 2 months after surgery, the patient is getting gradually better with improvement of the hand sensitivity and grip strength.

### 4. CONCLUSIONS

Although extrinsic median nerve compression in the forearm by a lipoma is rare, we should be aware of its existence. Clinical evaluation of the extent of lipoma may be difficult so imaging studies with ultrasound and MRI are recommended in pre-operative assessment. EMG also plays an important role to identify possible nerve compression.

WALANT surgical resection allows for a shorter awaiting period and improves patient safety, while also providing excellent results in symptom resolution.

Histopathological study of the removed tissue remains necessary to confirm the diagnosis and exclude malignant tumor hypothesis.

Early post-operative period is of special importance, being a good predictor of the treatment success.

Keywords: median nerve; lipomas; WALANT

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## **A-0194** NOVEL DESCRIPTIONS OF THE RADIAL OSTEOTOMY IN KIENBÖCK'S DISEASE: A SYSTEMATIC REVIEW

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### Introduction

Kienböck's disease consists of intrinsic and extrinsic characteristics which coalesce into a pathology with multifactorial etiology. Mechanical, morphological, and vascular factors have been identified as contributory. Radial osteotomy is one of the most commonly utilized surgical treatment for late stage Kienböck's disease. Despite its frequent utilization and reported value, the specifics of the radial osteotomy have not been described in aggregate. The dimensions and the osseous location of the radial osteotomy are integral characteristics which require consideration. Our objective was to review the recent literature for descriptions of the radial osteotomy used for treatment of Kienböck's disease.

### Methods

Inclusion criteria for the systematic review were: 1) patients over 18 years of age, 2) a publication date no older than 2012 and 3) a complete description of the distal radius osteotomy, including verbiage that specified numeric dimensions of the bony resection or verbiage that detailed a goal in radiographic parameter that would guide the bony resection.

### Results

The studies were grouped according to the stated description of the radial osteotomy. This process yielded the following 3 main groups: (a) studies that utilized radial shortening, lateral closing wedge osteotomy or a combination of these, (b) studies that utilized radial shortening or lateral closing wedge osteotomy with dimensions based on the preoperative determination of ulnar variance, and (c) novel osteotomy descriptions.

### Discussion

Kienböck's disease is a disorder which we still do not fully understand. There are various theories for its etiology, with agreement on the multifactorial nature. Kienböck's disease is the pathologic result of intrinsic and extrinsic factors which lead to lunate necrosis. The morphology and compositional structure of the lunate are contributory intrinsic factors. Extrinsic factors include mechanics of the capitulunate joint, load distribution across the wrist, the mechanobiology of the surrounding structures, and the radioulnar relationship. Mechanical theories are not sufficient to describe the etiopathology of Kienböck's disease. There is a multi-factorial etiology which predisposes the lunate to pathology in the presence of mechanical overload

Extra-articular radial osteotomy is a common surgical treatment in late-stage Kienböck's disease. The intent is decompression of the lunate. Treatment techniques include radial shortening osteotomy, closing wedge osteotomy and

variations of these. There is enduring controversy for the primary mechanism of value in radial osteotomy. A mechanical value and biologic value have been widely discussed. Mechanical alterations have demonstrated a reduction in load onto the lunate. Biological value may occur following radial osteotomy due to the induction of biochemical factors which initiate the healing cascade. Further, stress-induced adaptations in lunate architecture following radial osteotomy may provide value without accompanying shortening.

The predominance of the Kienböck's disease literature describes an osteotomy to shorten the radius 2-3mm. In some studies, the degree of radial shortening corresponded to the value necessary to achieve near neutral ulnar variance. The common goal in utilizing lateral closing wedge osteotomy was to achieve radial inclination of 5-15 degrees. Unique wedge resections, some with multi-planar correction of the distal radius have been recently described, with specific advantages purported for each.

### **A-0195** SHOCK WAVES IN SCAPHOID PSEUDOARTHROSIS: A CASE SERIES

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Scaphoid fracture accounts for 60% of carpal fractures. The mechanism of fracture occurs after a fall with the hand extended, in pronation and radial or ulnar deviation in addition to the importance, they gain for their frequency; clinically, their problem lies in the high possibility of non-consolidation, due to the type of vascularization that it has, fractures located mainly in the waist and in the proximal pole are a high-risk factor. Most of the up-to-date papers available confirm a positive outcome of the use of focused extracorporeal shock wave therapy (ESWT-F) in pseudarthrosis. According to the literature, the success rate is between 50% and 91%. Complications when ESWT-F are performed by qualified personnel and following the standards established by international scientific organizations, are limited to petechiae and local hematomas having as a requirement, to be performed by trained personnel. This manuscript will discuss a series of cases treated in a certified center for the application of Focal Shock Waves between 2018 and 2021 to patients with scaphoid fracture with a diagnosis of Fracture Consolidation Delay and pseudarthrosis of scaphoids, which subjected to treatment with high-intensity focal shock waves under ultrasound guidance. We analyzed six male patients with an average age of 31.3 years who were treated with ESWT-F. About 33.3% were taken to osteosynthesis as initial management without achieving satisfactory bone consolidation; hence, ESWT-F was performed. About 0% complications were reported, bone consolidation occurred in 100% of patients on average of 6 weeks from the last session of ESWT-F. The results were clinically evaluated, where 100% of patients manifested a decrease in pain by an average of 75% at 2 weeks of the last session of ESWT-F and 100% at 12 weeks. In the imaging evaluation, the six patients (100%) showed signs of bone consolidation in the complete radiological assessment at 12 weeks and the Disabilities of the Arm, Shoulder, and Hand scale applied revealed improvement in their functional capacity.

### **A-0196** VOLAR GANGLION WITHIN THE CARPAL TUNNEL, A RARE CAUSE OF CTS, A CASE REPORT

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We report the case of a patient who comes to consultation referring a sensation of numbness in his right hand in the region of innervation of the median nerve, he refers to nocturnal predominance and denies important antecedents.

The sensitivity in the region of sensory innervation of the median nerve is normal, however the Phalen maneuvers and wrist flexion and compression are positive for carpal tunnel syndrome, the opposition force measured with a Jamar dynamometer corresponds to 50% of the contralateral hand (2kg vs. 4kg)

An MRI is performed and shows a volar ganglion within the carpal tunnel and this is determined as a probable cause of the patient symptoms.

Among the rare causes of carpal tunnel syndrome is the presence of masses or tumors within the tunnel itself that generate compression of the median nerve, since the cause is defined, the definitive treatment is the exceresis of the mass that causes the syndrome. Just perform the release of the transverse carpal ligament does not eliminate the cause of compression and it is not a real solution to the problem, to perform the exceresis of this mass is the only way to have a real solution to the problem.

We have two ways to take out the mass, first one is to do an open resection which implies a wide release of tissues in the carpal tunnel in addition to a high risk of damage of the median nerve. As the mas is a ganglion, this can be treated openly or arthroscopically, the first one having a recurrence percentage (26%) higher than if the exceresis is performed arthroscopically, also reporting a much lower risk of complications when not having to manipulate the median nerve or the elements that are inside the tunnel itself.

In our patient, we performed the arthroscopic excision of the palmar ganglion, achieving immediate relief of the neurological symptoms that remain to date. We performed a control MRI one year after the surgery, in which we evidenced the elimination of the ganglion without the presence of recurrence until the moment.

## **A-0198** EVERYTHING YOU CAN DO WITH WALANT

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WALANT, Wide Awake Local Anesthesia No Tourniquet is an anesthetic technique that has taken a significant boost in recent years, probably the Covid 19 pandemic has been one of the impulses for this technique since it has allowed us to perform surgeries without the need to invade our patients airway, however, how far can we go with WALANT?

This is a question that has often been answered with phrases such as “only for soft tissues” or “not for such proximal surgeries, only from the wrist to the fingers”.

These limits have been pushed further and further, we present some clinical cases of patients operated on with this type of anesthesia in which we have managed to break the limits that a local anesthesia technique was initially thought to have. The advantages of active mobility of our patients during surgery has meant that patients with fractures of the phalanges, a bone structure, benefit from being able to check mobility during surgery, likewise it has been said that performing tendon surgeries should no longer be done without being able to verify their mobility during surgery, so we present a patient in whom we performed complete transfers for a radial nerve injury using WALANT, checking the functionality of the transfers performed and the tension given to the tendons during surgery, the functional outcome of the patient in the medium and long term could not be better.

Local anesthesia is the safest anesthesia and that makes it an excellent option in patients with multiple morbidities, so we present the case of a patient with diagnoses of chronic obstructive pulmonary disease that required a proximal row carpectomy to regain mobility and relieve pain in her wrist.

Much has been said about whether or not we can perform surgeries in traumatic cases with WALANT, the advantages

obtained from them such as the safety of local anesthesia or the active verification of mobility are known, however it has been said that it is not an anesthesia good enough to allow surgery with bone manipulation without pain, this is not entirely true and for this reason we present a case of a patient with a distal radius fracture in which we were able to actively check pronosupination during surgery, confirming that the distal radioulnar joint was not affected and that mobility was complete, likewise we present the case of a patient who, after a consolidated fracture of the distal radius in bad position, underwent a distal radius osteotomy under WALANT, allowing the transoperative evaluation of the patient in terms of mobility and tendon integrity after osteotomy and fixation of the radius.

It is important to know how far a surgical or anesthetic technique can go, to know the advantages and difficulties that it presents, in the case of WALANT, we have managed to reach limits that were previously unimaginable with wonderful capabilities for intraoperative evaluation of functionality, safety, reduction of complications and how not to control perioperative pain.

### **A-0199** LOCKED-WIRE TYPE EXTERNAL FIXATOR (ICHI-FIXATOR) FOR HAND FRACTURES

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[Introduction] To treat hand fractures, percutaneous pinning is sometimes less invasive but insufficient, and plate fixation has enough stability but too invasive. We report 11 cases treated percutaneously with novel locked-wire type external fixator (ICHI-FIXATOR®; IF) for hand fracture which seems to be insufficient with percutaneous pinning.

[Materials and Methods] Thirteen fractures in 11 hands in 11 cases (10 males and a female) were treated by wires and IF for hand fractures with a mean age of 42.8 (range of 14-83) years. Right hand was affected in 5 cases and left in 6 cases. Contracted finger, variety of the fracture, characteristics (number, size, etc.) of the wire and IF, postoperative complications and results were investigated in all cases.

[Results] Contracted fingers (thumb/index/middle/ring/little) were 3/1/1/2/6 fingers, and location of fractures (metacarpal/proximal/middle/distal phalanx) were 9/1/1/2 respectively. Intraarticular fracture was included in 3 fractures in 3 cases, and pathological fracture caused by enchondroma in a case. Two wires were used for IF in 11 fractures, 3 and 4 in a remaining fracture respectively. Also, an IF was used in 7 fractures and 2 IFs in 4 fractures and 3 IFs to stabilize 2 fractures together in a case. Additional independent wire was used to stabilize the intraarticular fragment in 4 fractures in 4 cases. Postoperative backout of the unit of 2 wires and IF was occurred in a case with enchondroma, however, no pin-site infection was observed in all cases. Finally, successful reconstruction and bony healing were achieved in all cases without any restriction of the wrist and finger motion.

[Conclusions] IF can lock wires temporally compared that other locked-wire type external fixator can only lock permanently. IF may possibly expand the indication for hand fractures such as intraarticular fracture, multiple fractures, pathological fracture, and other difficult conditions.

## **A-0200** A BIOMECHANICAL COMPARISON OF PLATE POSITION FOR TRAPEZIOMETACARPAL ARTHRODESIS

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Trapeziometacarpal arthrodesis has historically been indicated for the young, high demand laborer or persons who require strong grip for activities with arthritis or instability. However, non-union at fusion site may require prolonged immobilization or additional surgery. Generally, dorsal approach has been preferred and the locking plate has been usually positioned on dorsal side for arthrodesis of this joint. The purpose of this study is to compare the biomechanical properties between two different plate positions: dorsally versus radially placed positioned plate. Eight pairs of fresh-frozen cadaveric hands were harvested (n=16 specimens), and divided into two groups (n=8 per group), dorsally positioned locking plate (A), radially positioned locking plate (B). The biomechanical performance of each group was evaluated primarily for a load to failure through cantilever bending tests. Stiffness was also evaluated as a secondary outcome. Anatomic features showed no difference between two groups. The load to failure of Group A ( $52.24 \pm 12.82\text{N}$ ) was significantly lower than that of Group B ( $77.80 \pm 11.38\text{N}$ ) ( $p = 0.018$ ). Accordingly, the bending moment was significantly lower in Group A ( $2.32 \pm 0.51\text{Nm}$ ) compared to Group B ( $3.52 \pm 0.76\text{Nm}$ ) ( $p = 0.028$ ). However, there were no significant differences in stiffness between the two groups ( $p = 0.237$ ). Therefore, a radially positioned locking plate of the TM joint showed superior biomechanical performance versus a conventional, dorsally positioned plate for arthrodesis of the joint.

## **A-0201** PREDICTIVE FACTORS FOR CLINICAL OUTCOMES AFTER ARTHROSCOPIC TREATMENT OF TRAUMATIC CENTRAL TEARS OF THE TRIANGULAR FIBROCARILAGE COMPLEX

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Injuries of the triangular fibrocartilage complex (TFCC) are frequent causes of ulnar wrist pain and the most common indications for wrist arthroscopy. Although most studies reported that arthroscopic debridement is effective for central tears, sustained ulnar-sided wrist pain has been reported 10.3% to 29.8% and 8.1% to 19.0% of patients undergo additional surgery like ulnar shortening osteotomy (USO). Positive ulnar variance and associated lunotriquetral ligament tears has been reported as predictive factors of poor outcomes of debridement procedure in patients with central TFCC tears. However, these findings were inconsistent between the studies because most previous studies included traumatic and degenerative tears together although pathophysiology of them are different. The purpose of this study was to evaluate the clinical outcome following arthroscopic debridement for patients with traumatic central tears of TFCC and investigated predictive factors of clinical outcomes. We retrospectively analyzed patients who were arthroscopically diagnosed with Palmer 1A lesion from March 2009 to February 2021 with follow-up for at least 12 months. We excluded patients with any degenerative lesions in the ulnocarpal joints based on arthroscopic findings. Each patient was assessed with DASH score, Mayo Wrist Score, and VAS pain score preoperatively and at each postoperative follow-up. Any operation-related complications and reoperation were also investigated. The poor results group was defined as patients with preoperative and last follow-up clinical scores differences were less than the MCID of DASH score (10.83). We reviewed medical records of these patients for demographic factors. Intraoperative arthroscopic findings were evaluated based on the operation

record and arthroscopic videos. For radiographic assessment, preoperative true posteroanterior radiographic views of the wrist and magnetic resonance imaging or arthrography scans were reviewed. Ulnar positive variance was measured with the perpendicular method on posteroanterior grip views, and they were categorized into 3 groups: negative (-1.0 mm or less), neutral (-1.0 to 1.0 mm), and positive (1.0mm or more). In a total of 267 patients who were arthroscopically diagnosed with Palmer 1A lesion, 129 patients were enrolled in this study. The mean follow-up period was 17.1 (14.1-20.3) months. The mean DASH score (36.9 to 18.2), MWS (60.4 to 77.6) and VAS (6.2 to 2.3) improved significantly at last follow-up ( $p=.000$ ). In a total of 129 patients, 19 patients (14.7%) were showed poor clinical outcomes and 11 patients (8.5%) required second operation. Among demographic, arthroscopic, and radiographic factors, only ulnar positive variance was associated with poor clinical outcomes ( $p=.000$ ). Ulnar positive variance was found in 39 patients (30.2%), 43.6% of whom showed poor outcomes. Arthroscopic debridement alone seems to be effective and safe procedure for patients with traumatic central TFCC tears although ulnar positive variance was associated with poor clinical outcome of the procedure. Ulnar shortening osteotomy may be considered as a secondary procedure only in patients with sustained ulnar-sided wrist pain after arthroscopic debridement.

## **A-0202** CARPAL ALIGNMENT MEASUREMENT RELIABILITY: COMPUTER-AIDED ANALYSIS VERSUS HUMAN OBSERVERS

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**Background:** Assessing carpal alignment is crucial in diagnosing carpal instability. Traditionally this is done by tracing carpal bones axes in lateral radiographs and measuring the resulting angles. These measurements are prone to errors, and their reliability can vary. While computed tomography (CT) shows individual bones clearly, drawing the carpal bone axes can be difficult with landmarks not visible on a single image slice. Recently, a computer-aided automated cone-beam CT (CBCT) analysis software was introduced, capable of highly reliable carpal alignment measurements. **Objective:** To determine the inter- and intra-observer reliability of carpal alignment measurements by hand surgeons and to compare the reliability and the measured angles to those of the computer-aided analysis. **Methods:** CBCT images of 30 healthy wrists were acquired. The image data was reconstructed into lateral radiograph mimicking summation images. Two groups of hand surgeons ( $n=7$  and  $n=6$ ) measured the radioscapoid, radiolunate, radiocapitate, radiotriquetral and radio-3rd metacarpal angles, the first group with no instructions and second with detailed instructions. The second group also measured stripped reconstructions of the same image data, with overlapping carpal bones removed. The measurements were repeated after one month for intra-observer reliability assessment. The CBCT image data was analyzed with a dedicated software (Disior Bonelogic, Disior Oy, Helsinki Finland). 20 of the wrists were imaged twice to enable intra-observer reliability assessment for the software. Intra-class correlation coefficients (ICC) were used in reliability analysis. Measured angles were compared with the t-test.

**Results:** The mean intra-observer ICC for software was 0.98. The human observers identified the axes of the radius and the middle metacarpal very consistently ( $ICC \geq 0.9$ ). For the scaphoid, lunate and capitate in the summation images, the inter-observer reliability was slightly improved from the uninstructed group ( $ICC$  mean 0.82) to the instructed group ( $ICC$  mean 0.88) and greatly improved in the stripped images ( $ICC$  mean 0.97). Intra-observer reliability was similar with and without instructions ( $ICC$  mean 0.88 and 0.90 respectively) in the summation images and was improved to a nearly perfect agreement ( $ICC$  mean 0.97) in the stripped images. For the triquetrum the uninstructed groups' inter-observer ICC was 0.07 and mean intra-observer ICC was 0.24. With instructions the inter-observer ICC was 0.33 in the summation

and 0.51 in the stripped images. Mean intra-observer ICC was 0.49 in the summation and 0.72 in the stripped images. Radiocarpal angles acquired by the observers were similar to the angles acquired by the software. There were small statistically significant differences between the observers and the software for the axes of the scaphoid ( $p = 0.002$ ), capitate ( $p = 0.01$ ) and triquetrum ( $p=0.005$ ), the mean differences being  $7^\circ$ ,  $3^\circ$  and  $2^\circ$ , respectively. Conclusions: The reliability of carpal alignment measurements by hand surgeons varies from good to excellent, with the exception of the triquetrum. Reliability can be improved with dedicated instructions and removing landmark overlap. The reliability of the computer-aided analysis is on par with hand surgeons' reliability in optimal conditions, with similar measured angle values. The software can also measure triquetral angles reliably (ICC 0.97), enabling new research avenues.

## **A-0203** REHABILITATION AFTER DISTAL RADIUS FRACTURE SURGERY USING DIGITAL THERAPEUTICS: A PROSPECTIVE ANALYSIS

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### Introduction

Appropriate rehabilitation after surgery for distal radius fracture is essential for early recovery and pain control. Although early rehabilitation is recommended, adequate rehabilitation is often impossible due to limitations in available medical staff, equipment, and cost. Digital therapeutics(DTx) using wearable IoT devices can be an alternative to rehabilitation after surgery. In this study, we prospectively analyzed the results of using digital therapeutics for rehabilitation after distal radius fracture surgery.

### Method

A prospective comparative study is conducted from April 2021 to November 2021. The inclusion criteria were patients with distal radius fractures between 50 and 80 years of age who could use wearable IoT gloves. Fractures at other sites, neurological problems, open fractures, infections, and patients over 80 were excluded. The DTx group performed passive motion rehabilitation from the 2nd week and active motion exercises from the 4th week. The control group underwent rehabilitation for 1 hour twice a week through a professional therapist from the 2nd week after surgery from second weeks. The outcome was measured by pain visual analogue scale (VAS), wrist range of motion (ROM), Disabilities of the Arm, Shoulder, and Hand score (DASH score), and Modified Mayo Wrist Score (MMWS) at 6 and 12 weeks after surgery.

### Result

A total of 20 patients aged 55 to 77 years were included in the study. Six patients dropped out during the follow-up because they could not use gloves. Finally, seven patients were each assigned to the DTx group and the control group, and there was no statistical difference in fracture type, age, or sex. The DTx group had a better Mayo score (65.7 Vs 56.4,  $p$ -value 0.044), wrist ROM (259.3 Vs 179.3,  $p$ -value 0.021), and pain VAS (1.43 Vs 3.29,  $p$ -value 0.011) than the control group at 6 weeks after surgery. At 12 weeks postoperatively, there were no differences between the two groups in all results.

### Conclusion

Rehabilitation using digital therapeutics is beneficial for early recovery after distal radius fracture surgery.

#### **A-0204** FEASIBILITY OF HOMODIGITAL FLEXOR DIGITORUM SUPERFICIALIS TRANSPOSITION, A NEW TECHNIQUE FOR A2-C1 PULLEYS RECONSTRUCTION: A KINEMATIC CADAVER STUDY

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**Introduction:** Homodigital flexor digitorum superficialis transposition (HFT) is proposed as a new technique for A2-C1 pulley reconstruction. Flexor digitorum superficialis is transposed on the proximal phalanx and inserted on the pulley rims, crossing over flexor digitorum profundus and acting as a pulley.

**Materials and methods:** The kinematic feasibility was investigated in a cadaveric bowstring model (after A2 and C1 pulley removal) on 22 fingers (thumb excluded).

**Results:** HFT was effective in restoring the correct flexion of proximal and distal interphalangeal joints, compared to bowstring model. No adverse events were registered.

**Conclusion:** HFT is a feasible technique. Clinical application is encouraged.

#### **A-0205** COMPLICATIONS AND OUTCOMES OF OPERATIVE TREATMENT FOR ACUTE PERILUNATE INJURY: A SYSTEMATIC REVIEW

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This study aimed to systematically review complication rates and outcomes of different surgical methods for acute perilunate injury. The MEDLINE, Scopus, Embase and Cochrane Library databases were accessed to scan scientific literature. 43 articles with 880 patients were included in the analysis. The most common complications were arthritis (30%), carpal instability (15%), avascular necrosis of the lunate (12%), complex regional pain syndrome (11%), and nonunion or avascular necrosis of the scaphoid (9%). In meta-analysis, the mean scapholunate gap was 1.73 mm in the closed surgery group and 2.32 mm in the open surgery group, which was statistically significant. The mean flexion-extension arc of the wrist and modified Mayo wrist (MMW) score were also better in the closed surgery group than in the open surgery group. Arthritis is the most common complication of acute perilunate injury. The closed surgeries, including arthroscopic surgery, showed a smaller scapholunate gap and better results than the open surgeries with respect to the flexion-extension arc of the wrist and MMW score.

## **A-0206** COMPARISON OF DOUBLE ANATOMICAL LOCKING COMPRESSION PLATES VERSUS NONLOCKED PLATES IN DISTAL HUMERUS FRACTURES

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### Abstract

**Background:** The current literature contains no guidelines for choosing the method of fixation for fractures of the distal humerus. This study aims to compare the functional and radiological outcomes between anatomical locking compression plates and nonlocked reconstruction plates in fractures of the distal humerus (AO type A 3).

**Methods:** This was a prospective randomized comparative study that was conducted between 2015 and 2021 on 60 patients with distal humeral fractures (AO type A 3). There were 30 patients (23 males and 7 females) with a mean age of 40 years and two months who were followed up for 62 months in group 1. The patients in group 1 underwent Open reduction and internal fixation with double anatomical LCP. There were 30 patients (21 males and nine females) with a mean age of 41 years and seven months in group 2. The mean follow-up period was 58 months. Fifteen of the patients in group 2 underwent open reduction and internal fixation with nonlocked plates.

**Results:** There was no significant difference in the degree of extension, flexion, arch of motion, and MEPS between the two groups at the six-month follow-up appointment. There was a highly significant difference between the study groups in the mean union time ( $3.27 \pm 0.46$  months vs.  $4.27 \pm 0.70$  months) and time taken to mobilize the elbow joint after surgery (10–14 days [mean  $11.33 \pm 1.40$ ] vs. 21–30 days [mean  $24.87 \pm 4.45$ ] days) in groups A and B, respectively.

**Conclusions:** There was no difference in the functional outcomes of distal humeral fractures (AO type A 3), including range of motion and MEPS, between the precontoured anatomical LCP and 3.5-mm nonlocked reconstruction plates. There was improvement in the union time and short postoperative time of mobilization in group 1.

the Level of Evidence: III

## **A-0207** LONG TERM RESULTS OF MAJOR REPLANTATIONS IN UPPER AND LOWER EXTREMITIES

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Traumas resulting with major amputations of the extremities are devastating injuries which require expertise handling and follow up. We retrospectively assessed the long term functional results of 14 patients (mean age:24 years, range: 3-34 years) whom undergone major upper or lower extremity replantations for complex traumatic amputations between 2014-2019 in two centers. All of the injuries sustained via industrial or motor vehicle accidents. Mechanism of injury was clean-cut type of injury in 3 patients, crush injury in 9 patients and avulsion-degloving injury in 2 patients. Level of replantations were transmetacarpal (n:2), wrist (2), forearm (n:4), arm (n:1), scapulothoracic (1), ankle (1), below knee (3). Mean follow up time was 38 months (range:22-46 months). 5 patients had undergone secondary operations; amputation was performed to 2 patients for failed replantation surgery, one patient had required repeated debridements, bone-length surgery with Ilizarov was performed to one patient with lower extremity replantation at the below-knee level and one patient with lower extremity replantation at the ankle level was operated for removal of external fixators and definitive arthrodesis. 1 patient with scapulothoracic amputation had deceased in intensive-care unit on postoperative

day 1. Functional outcomes were evaluated using the AOFAS scoring system for lower extremity replantations (n:4) and with Turkish version of DASH questionnaire and Chen's criteria for upper extremity replantations (n:7). The mean AOFAS score was 78 in patients with lower extremity replantations. Of the seven patients with upper extremity replantations, very good or good results had been achieved in 6 patients according to Chen's criteria, while one patient had moderate results. The mean DASH score was 6,4. Patients with upper extremity replantations were also evaluated with hand dynamometer and Semmes-Weinstein monofilament test. The mean grip and pinch strenghts on the operated side were 11,7 kg and 3,2 respectively while mean grip strength was 40,2 and mean pinch strength was 8 on the unaffected side. Protective sensation was restored in all patients as had been demonstrated by Semmes-Weinstein monofilament test. Traumas resulting with major extremity amputations are both physically and psychologically debilatating injuries, while it is critical to choose between whether to replante or amputate, it is also important to keep in the mind that several secondary procedures might be necessary to tailor the replanted extremity as helper arm/leg .

## **A-0208** THE USE OF CROSS FINGER FLAP FOR THE TREATMENT OF AMPUTATION OF THE FINGERTIP

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### Introduction

Replantation cannot be performed in all cases of fingertip amputation, and in such cases, a pedicle flap is sometimes used to cover the skin and soft tissue defect. We usually use cross finger flap especially for reconstructing oblique amputations with large volar defects. The aim of this study is to evaluate the outcomes of using cross finger flap for treating fingertip amputation.

### Materials and Methods

**Materials:** We reviewed 13 cases (all men, average age, 52years) of fingertip amputation treated by cross finger flap from July 2009 to March 2018 with at least 6 months observation. The injury sites were as follows: thumb (1), index finger (2), middle finger (7), ring finger (2), and little finger (1). All cases were injured in crush. The average follow-up period was 165 weeks (32-395). Seven cases are accompanied with distal phalanx bone defect, and remained 6 cases are without bone defect. Numbness, pain, sensory defects, and usefulness were examined at the final follow-up. Sensory defects were evaluated by using a 10-point subjective estimation, in which 10 was the highest score.

**Methods:** "U" shaped pedicled flap, raised from the plane between the paratenon of the extensor mechanism and the subcutaneous fat overlying the middle phalanx, was elevated from adjacent finger. And this flap was harvested to injured digit. A full-thickness skin graft from volar side of elbow used to cover the defect on the extensor surface of the donor finger with a tie over.

### Results

All flaps survived with an average score of sensory was 8.2 points (5-10). Slight numbness remained in 6 cases. Pain due to an attack remained in 2 case, which both cases were accompanied with bone defect of distal phalanx. And slight pain remained in 5 cases (3 cases with bone defect, 2 cases without bone defect). Affected finger were useful in all patients nevertheless of slight sensory disturbance.

### Summary

Surprisingly, sensory recovery was good after cross finger flaps without neuro-vascular bundles. And remained numbness and pain were almost no problem, and all patients use affected finger validly. Good outcomes were anticipated after reconstruction of the fingertip pulp defects with a cross finger flap.

## **A-0210** EXTRAPHYSEAL DISTAL RADIUS FRACTURE IN CHILDREN: IS THE CAST ALWAYS NEEDED? A RETROSPECTIVE ANALYSIS COMPARING EPIBLOC SYSTEM AND K-WIRE PINNING

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**Introduction** Closed reduction and internal fixation are a widespread surgical treatment for pediatric displaced extraphyseal distal radius fractures. Post-surgical cast immobilization is usually needed. Epibloc system (ES) is a device used to fix Colles fractures in adults, not requiring post-surgical immobilization. The aim of the study is to investigate the effectiveness of ES in a pediatric population suffering from displaced extraphyseal distal radius fractures.

**Methods** We retrospectively analyzed 52 patients (age 8–12 years) who underwent CRIF. Patients were divided into two groups. Group A (25 patients): ES osteosynthesis. Group B (27 patients): K-wires and short arm cast osteosynthesis. The primary outcome is the maintenance of reduction in radiographs (displacement on frontal and lateral view). The secondary outcome is the reaching of the complete active range of motion recovery (compared with the contralateral side) and the time needed to obtain it. The need of further additional treatment (physiotherapy) and the presence of complication were also assessed.

**Results** Reduction was equally maintained in both groups ( $p > 0.05$ ). Physiotherapy was mandatory for 11 patients in group B; only for 3 patients in group A, the difference was statistically significant ( $p = 0.03$ ) according to Fisher test. Otherwise, the difference was not statistically significant regarding complications. ( $p > 0.05$ ). At the last follow-up, complete functional recovery was reached in all patients.

**Conclusions** Functional recovery is faster, and postoperative physiotherapy is rarely required with ES. This device allows us to go beyond the traditional concept of mandatory postoperative immobilization after pediatric wrist fractures surgery.

## **A-0212** HAND THERAPY CONSULTATION AFTER TREATMENT OF HAND FRACTURES AND DISLOCATIONS: A SNAPSHOT OF CURRENT PRACTICE

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### **Introduction**

Fractures and dislocations of the hand are common upper extremity injuries. Early mobilization is often emphasized because of risk for stiffness and adhesions. Little is known about the current practice of hand therapy in the treatment of fractures and dislocations of the hand. The aim of this study is to provide an overview of the current practice of hand therapy. The secondary aims are to assess patient and fracture characteristics associated with hand therapy and to assess patient reported hand function outcomes after hand therapy referral using the Michigan Hand Questionnaire (MHQ).

### **Methods**

This was a multicenter observational snapshot study conducted in 12 hospitals in the Netherlands over a three month period in 2020. All patients admitted to the emergency department with fractures and dislocations of metacarpal or phalangeal bones of the hand were included. We evaluated hand therapy referral rates, factors associated with hand therapy and patient reported outcomes using the Michigan Hand Questionnaire (MHQ) three months after injury.

## Results

Of 1625 fractures and 181 dislocations among 1642 adult patients included for analysis, 30% were referred to hand therapy. Distal intra-articular phalangeal fractures of digits 2-5 were most frequently referred (56%). Hand therapy referral was independently associated with female gender (OR1.65, CI 1.27-2.14,  $p < 0.001$ ), multiple injuries (OR 1.78, CI 1.31-2.43,  $p < 0.001$ ), surgical treatment (OR6.38, CI4.35-9.45,  $p < 0.001$ ) and radiographic displacement of the fracture (OR1.49, CI1.02-2.15,  $p < 0.037$ ). The median total MHQ score of patients who received hand therapy was significantly lower compared to patients who did not receive hand therapy (72 (IQR 59, 82), 78 (IQR 66, 88)).

## Conclusions

The majority of hand fractures and dislocations were not referred to hand therapy which is contradictory to the recommendations of the guidelines. Referral to hand therapy varied significantly by patient and injury characteristics. Hand therapy referral did not result in better MHQ scores compared to no hand therapy referral in this cohort. Further research should focus on identifying patients who benefit most from post-injury therapy to achieve for better resource utilization following these common injuries.

## **A-0213** CAN WE TREAT COMPLETE UCL RUPTURES, INCLUDING STENER LESIONS, WITH A CONSERVATIVE TREATMENT STRATEGY, INSTEAD OF SURGERY? STUDY PROTOCOL FOR A NON-INFERIORITY RANDOMIZED CONTROLLED TRIAL TO ASSESS FUNCTIONAL OUTCOMES AND COST-EFFECTIVENESS: MUSCAT-STUDY

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## Background:

Guidelines recommend surgery for complete Ulnar Collateral Ligament (UCL) ruptures, including Stener lesions. This recommendation is based on expert opinion, anatomic theories and low quality retrospective case series. High quality studies comparing cast immobilization with operative treatment are lacking. We hypothesize that cast immobilization is non-inferior regarding functional outcome and carries concomitant lower costs compared with operative treatment for complete UCL ruptures, including Stener Lesions.

## Methods:

This is a multicenter randomized controlled non-inferiority trial (RCT) including patients of 18 years and above, requiring treatment for an acute complete UCL rupture, including Stener Lesions. Patients are randomized to cast-immobilization or surgical treatment. Patients in the non-operative treatment group receive immobilization of the thumb for 4 weeks. Two to three weeks after cast immobilization the thumb will be re-examined to determine if secondary surgery is required. In case of unimproved laxity, secondary surgery is required. The primary outcome is hand function expressed as a change in the Michigan Hand outcome Questionnaire (MHQ) in 6 months (from injury to 6 months after).

## Discussion:

If cast-immobilization is non-inferior to surgical treatment, the proposed treatment strategy will reduce patient burden by preventing surgery. It is expected that about 1 in 10 patients who started with cast immobilization will need secondary surgery during re-evaluation (2-3 weeks after the start of cast immobilization). As a result, completion of the treatment will take longer for these patients compared to patients who received immediate surgical treatment.

## **A-0214** RESULTS OF COMPLEX TREATMENT OF MALIGNANT SOFT TISSUE TUMORS IN THE UPPER EXTREMITY

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### Introduction:

Malignant soft tissue tumors are prone to recurrence and metastasis. In this regard, the treatment of soft tissue malignant tumors is usually complex with the use of all treatment methods: surgical treatment, polychemotherapy and radiation therapy.

The aim of the study:

To evaluate the effectiveness of complex treatment of malignant soft tissue tumors in the upper extremity

Materials and methods:

The results of treatment of 17 patients with malignant tumors of the soft tissues of the upper extremity aged from 18 to 62 years were analyzed. There were cases of: liposarcoma - 7 (41.2%), rhabdomyosarcoma - 5 (29.4%), fibrosarcoma - 3 (17.6%), malignant fibrous histiocytoma - 2 (11.8%). Localization: forearm - 8 (47.1%), shoulder - 5 (29.4%), hand - 4 (23.5%). Treatment of patients was complex: Group I (5 patients) - preoperative polychemotherapy and radiation therapy to 20 Gray cumulative dose, then surgical treatment and postoperative polychemotherapy and radiation therapy to 20 Gray cumulative dose; Group II (9 patients) - preoperative polychemotherapy and radiation therapy to 30 Gray cumulative dose, then surgical treatment and postoperative polychemotherapy; III group (3 patients) preoperative polychemotherapy, then surgical treatment and postoperative radiation therapy to 30 Gray cumulative dose. During surgical treatment, if necessary, skin plastic or skin-muscular flap plastic was used. Patient survival was calculated using the Kaplan-Meier method.

Treatment results:

In the I group of patients, tumor recurrences were found in 1 (20%) patient, metastases - 1 (20%). In the II group, tumor relapses were observed in 4 (44.4%) patients, metastases in 3 (33.3%). In group III, tumor recurrences were found in 1 (33.3%) patient, metastases - 1 (33.3%). In connection with tumor recurrence, operations leading to mutilation (amputation, exarticulation) were performed in 2 (11.7%) patients, wide excision of tumor recurrence - 4 (23.5%). The three-year survival rate of patients was  $65.4 \pm 1.6\%$ .

Conclusions:

The use of complex treatment of malignant soft tissue tumors of the upper extremity increases the three-year survival of patients by reducing the number of repeated tumor recurrences and metastasis.

## **A-0215** DOES RADIOGRAPHY PREDICT SUBJECTIVE OUTCOME AFTER DISTAL RADIUS FRACTURE IN SUPERELDERLY?

A REGISTER STUDY

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Purpose

With a rapidly ageing population, the number of wrist fractures in elderly will rise dramatically. We used our prospective register to find radiographic findings predictive of inferior outcome (DASH).

Methods

All adult patients (18+) with a distal radius fracture (DRF) are prospectively registered and a subjective outcome

questionnaire (quick-DASH) sent 12 months post fracture. In this study we analyzed data from patients aged 80 years or older at fracture.

#### Results

Between January 2013-January 2018, 1899 patients (1926 fractures) were registered and 349 patients were older than 80 years at fracture. 26 men and 199 women returned a valid DASH at one year and the median score was 25 (0-100).

55/225 reached a good subjective outcome (DASH 0-10) at one year. 89/225 reported inferior outcome (DASH exceeding 35), indicating substantial problems, still one year after fracture!

After the first visit 155 patients had an acceptable position, and 67 had not. 3 patients were operated primarily. At 7-10 days, 90 patients had an acceptable position. 18 patients were operated. 18 patients had no follow up.

The operated patients had the best outcome (median 14). The patients with acceptable position at 7-10 day, had better outcome (DASH 20 vs 36).

103/225 patients with an ipsilateral radiographic CMC-I and/or STT osteoarthritis had worse outcome (DASH 32) compared to the 109/225 without (DASH 20)

33/ 225 patients had a concomitant ulnar metaphyseal fracture (DASH 35 vs 25 without).

#### Conclusions

- In superelderly DRF patients, 40% end up with a DASH exceeding 35 at one year, indicating pain at rest.
- Concomitant ulnar metaphyseal fracture, CMC-I / STT osteoarthritis or a radiographic position outside the national guidelines predicted worse subjective outcome.
- 21 patients were operated, all healthy, in ages between 80-85, and all with severe fractures, still ending up with good subjective outcome after one year.

### **A-0217** LONG-TERM RESULTS AFTER SEMICONSTRAINED DISTAL RADIOULNAR JOINT ARTHROPLASTY

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Arthroplasty of the distal radioulnar joint (DRUJ) using a semiconstrained implant yields good outcomes according to the literature. The aim of this study was to investigate outcomes in 34 patients operated in our institution between 2010 and 2021 and compare them with our previously published follow-up results in 2019 and 2016. Between 2010 and 2021 36 patients were operated in our institution for a symptomatic condition of the DRUJ with a semiconstrained implant (Aptis). Two patients were lost to follow-up. 34 Patients completed patient-rated wrist/hand evaluation (PRWHE) questionnaires. A clinical assessment with measurement of active range of motion and grip strength was obtained. Details about concomitant procedures and subsequent revision surgery was collected. 34 patients with a mean follow-up of 5.3 years were available for analysis. The average age of examined patients was 51 years. We observed complications in 9 patients. Two patients had heterotopic ossifications requiring revision surgery. In one patient a recurrent ECU-tendonitis was observed. Three patients had scar-tethering of either the dorsal branch of the ulnar nerve or superficial branch of the radial nerve, requiring revision surgery. In two cases the explantation of the prosthesis was necessary. In one of these two cases a new prosthesis was implanted. In this patient an ulnar impaction syndrome caused by too-distal placement of the implant needed revision. One patient had an allergic reaction to the metal alloy of the prosthesis which led to removal. One patient had a periprosthetic fracture requiring surgery. We observed no infection or wound healing problems. Pain reduction was significant and active range of motion was stable over time. Arthroplasty with the semiconstrained DRUJ

implant in general reduces pain and improves function. The complication rate was high in the first nine patients treated at our facility according to our previous publications. We observed a learning curve with lower complication rate in our recent investigation. An extremely precise surgical technique is mandatory to avoid complications.

### **A-0218** MADELUNG'S DEFORMITY AND ITS TREATMENT – ABOUT A CLINICAL CASE

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Madelung's deformity is a wrist deformity characterized by excessive palmar and radial angulation of the distal radius associated with distal radioulnar dysfunction due to growth arrest of the cubital and palmar radius physis.

Despite the deformity, this pathology may have little functional repercussion. In advanced cases, the pain can be limiting, so in these cases, surgical treatment may be indicated.

The authors present a case of bilateral Madelung deformity submitted to radio and ulna osteotomy to correct the wrist deformity.

Female teenager, 14 years old, who was seen in consultation presenting bilateral pain and wrist deformity. The imaging study with radiography and magnetic resonance showed a deformity of the distal radius associated with a dorsal subluxation of the distal radius-ulnar, characteristic of Madelung's deformity.

During follow-up, there was a complete improvement in pain in the right wrist, with pain remaining at the cubital edge of the left wrist.

At 16 years of age, she underwent correction of Madelung's deformity of the left wrist through a dome osteotomy of the distal radius and a shortening osteotomy of the ulna. Postoperative immobilization was maintained, with the removable orthosis being replaced 1 month after surgery.

At 3 months postoperatively, the patient presents an improvement in pain at the wrist with complete mobility and correction of the deformity of the radius and ulna.

The treatment of Madelung's deformity is not necessary in the absence of pain but can be performed to allow a progressive correction of the deformity during growth. In the presence of pain, surgical treatment is indicated. Given that most patients only experience pain in adolescence and do not have sufficient growth potential, there are multiple surgical options involving radial osteotomy with or without ulna procedures to correct the deformity and improve pain.

Radius dome osteotomy is a biplanar osteotomy. Due to the type of osteotomy, it allows a simpler correction of a three-dimensional deformity that is complex to correct through a uniplanar osteotomy.

In this case, due to the permanence of pain in the left wrist and lack of growth potential, a radius dome osteotomy was chosen, associated with a shortening osteotomy of the ulna. This procedure allowed a correction of the deformity and a clinical improvement.

Madelung's deformity is a rare pathology that, in most cases, does not present any functional repercussion. However, in certain cases, pain and progressive esthetic alteration may motivate the performance of a surgical intervention.

Radius dome osteotomy associated with ulna shortening osteotomy is a surgical option with good deformity correction and clinical improvement that can be used in patients who have reached skeletal maturity or are close to reaching it.

## **A-0220** USE OF RELATIVE MOTION ORTHOSES FROM THE PERSPECTIVE OF INDIVIDUALS WITH HAND INJURIES

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**Introduction:** Relative motion (RM) orthosis is an orthosis that allows active movement of the hand by positioning the metacarpophalangeal joint in 15° to 20° flexion or extension, depending on the injury. The use of RM orthosis is divided into three, namely protective orthosis, exercise orthosis and adaptive orthosis. While the use of RM orthosis has been well documented in different pathologies, there is limited research focusing on the effects of the orthosis on other aspects of a person's life, like daily living, social, and emotional aspects. Therefore, by interviewing users of RM orthoses, this study aimed to determine the users' perspectives and explore the problems of using orthoses. Secondly, we aimed to provide insight into the opinion of individuals who use the RM orthosis as an exercise or protective orthosis.

**Methods:** We conducted semi-structured interviews face to face with individuals who had orthopaedic hand injuries, used RM orthosis as an exercise or a protective orthosis for at least 4 weeks, and were Turkish-speaking aged 16-65. We used the protective RM orthosis for immobilization for the healing of injured structures in patients with diagnoses such as tendon injury or boutonniere deformity. The exercise RM orthosis was used to manage stiffness or lag developed in healing structures such as fractures. Individuals used the protective RM orthosis full-time except for hand hygiene. Individuals who used the exercise RM orthosis were advised to wear the RM orthosis during functional tasks throughout the day. All interviews were recorded using voice recorder, converted into text quoted verbatim and coded to derive themes. All interviews were conducted while the individuals were wearing RM orthosis.

**Results:** Thirteen individuals with a mean age of 28 years (min 16, max 54) who used protective RM orthosis and 7 individuals with a mean age of 34 years (min 20, max 51) who used exercise RM orthosis completed interviews. Diagnoses of the individuals were extensor tendon injury, proximal phalanx fracture, closed boutonniere deformity, volar plate injury and ulnar digital nerve injury. The mean duration of orthosis use of the individuals who used exercise RM orthosis was 12.42 hours per day (min 6, max 16). The mean time of total orthosis use of the patients was 4.5 weeks (min 4, max 6) for both groups. Thematic analysis of experiences with RM orthosis resulted in the generation of four major themes: physical characteristics of the orthoses, challenges in daily living activities, emotional influence and influence of social environment.

**Conclusions:** Most individuals for both groups using protective and exercise RM orthosis found the orthosis comfortable and easy to use. However, they have made relevant considerations about some aspects, such as skin irritation as a result of rigidity of the orthosis, restriction on some daily living activities and problems related to social participation. Therefore, the selection of the orthosis design should depend on the clinical presentation, vocation, and leisure activities of the patients. RM orthosis may be an alternative to other orthoses due to its small size and aesthetic appearance to many patients.

## **A-0221** DETERMINATION OF THE ACTIVITY LIMITATION PERIOD AFTER PLATE REMOVAL OF FOREARM DIAPHYSEAL FRACTURES: THE BONE STRENGTH EVALUATION USING PATIENT SPECIFIC CT BASED FINITE ELEMENT ANALYSIS

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### Background

Forearm diaphysis fractures are usually treated by open reduction internal fixation with plates. In the long-term period

after surgery, some patients present with bone atrophy adjacent to the plate. Therefore, in some patient after plate removal, refracture occur. However, it is not known when the bone strength recovers. The purpose of this study was to estimate the bone strength after plate removal over time and to investigate the progression of bone strength recovery.

#### Methods

A consecutive series of 41 forearm fracture was investigated for evaluation of bone strength before and after forearm plate removal. Patients who were included underwent plate fixation for forearm diaphyseal fractures and who were scheduled for plate removal. Computed tomography (CT) scans of the entire length of the bilateral forearms were taken before plate removal and at 1, 3, and 6 months postoperatively. Patient-specific CT-based finite element analysis was used to predict the forearm bone fracture strength against axial load (N), which was defined as the bone strength. Bone strength was estimated by patient-specific CT-based finite element analysis at each time point.

#### Results

The mean age of the patients was 37.3 years. The mean time between plate fixation and removal was 25.4 months. Bone strength before removal was estimated as reduced to 48% of that of the uninjured side. This was constant regardless of age group, involvement of the radius or ulna, AO classification, open fracture, or type of plate. Bone strength at 1, 3, and 6 months after removal was estimated to be 66%, 83%, and 96%, respectively. The bone strength of the distal ulna was weaker than that at the other sites in the forearm and showed delayed recovery.

#### Conclusion

Bone strength after plate removal showed recovery within 3-6 months and was fully recovered by 6 months. The degree of recovery of bone atrophy varies from site to site, and patients should be careful about refracture after removal. Therefore, we use patient specific CT based FEM to determine the bone strength of the individual patient's forearm in real time and use this data as an adjunct to the decision to allow the patient to return to sports or work.

### **A-0223** DARRACHS RESECTION FOR DRUJ ARTHROSIS; NOT AN UNCOMPLICATED PROCEDURE

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**Introduction:** Traditionally, distal radio-ulnar joint (DRUJ) arthrosis has been treated either by resection of the distal ulna (Darrach resection, 1913) or arthrodesis between caput ulna and the sigmoid notch followed by resection of a segment of the distal (Sauve-Kapandjii, 1936). Although widely performed, results after Darrach resection are scarce. A prospective follow-up study of our patients operated with resection of the distal ulna was performed.

**Materials and methods:** 24 (13 women, 12 dominant wrists) patients, 61 (43-76) years of age with radiologically confirmed DRUJ arthrosis were enrolled in a prospective quality study. The diagnosis was sequelae distal radius fracture/carpal injury (15), primary arthrosis (6), Madelung deformity (2) and rheumatoid arthritis (RA) (1). Seventeen had ipsilateral wrist problems (sequelae forearm fracture/distal radius fractures/carpal fractures, arthrosis due to RA, Madelung and primary arthrosis). 11 had DRUJ or wrist arthrosis on the contralateral side and sixteen patients had been operated all together 30 times (fracture treatment, arthrodesis, arthroscopic procedures, carpal tunnel syndrome in the affected forearm/wrist). Preoperatively and at follow-up radiographs were taken, active range of motion (AROM) in the forearm and wrist, grip and key pinch strength were measured and Quick-DASH, PRWHE and VAS pain scores completed by the patients. The surgery comprised resection of the caput ulna through the neck, reconstruction of the capsule/FCU tendon sheath to the radial notch to stabilize the distal ulna and a plaster cast for 4-5 weeks allowing forearm rotation. Complications and

reoperations were recorded at follow-up 3 (1-6) years.

Results: Two patients ruptured extensor tendons (4 and 4 and 5) during the first 2 months, sutured and working well at follow-up. One patient had a further shortening of the distal ulna due to pain and wear between the ulna stump and radius, solving the problem. Five patients were converted to DRUJ arthroplasties (3, Aptis®, Aptis Medical, USA) or hemi (2, UHP®, KLS Martin, Germany) due to pain, instability of the distal ulna, reduced function and range of motion. Their functional result is not included. 7/8 reoperations occurred early (within 12 months). At final follow-up the remaining patients reported significantly reduced pain scores at rest (40 to 6) and activity (66 to 22), increased function (Quick-DASH 48 to 26 and PRWHE 55 to 25), AROM (140 to 164°) and supination (68° to 82°). The changes in pronation (72° to 81°), grip (20 to 26 kg) and key pinch strength (5.5 to 6.2 kgs) were not significant. 14/19 reported residual wrist complaints. The distal ulna is stable in all patients.

Conclusion: A structured follow-up revealed more complications than we expected and reported by others. Darrachs resection yields satisfactory pain relief and good rotation in the majority of patients, but tendon ruptures, pain and instability are problems, resulting in reoperation in one third of patients. Most complications occurred early. Thus, patients should be followed until they reach a stable situation, minimum 1 year after the procedure. Failed Darrachs resection can be treated with an arthroplasty (hemi or total) depending on the stability of the ulna.

## **A-0224** MAY BE THE SPACERS THE BEST SOLUTION IN CMC ARTHROSIS EATON'S STAGE 2-3 IN UNDER-SEVENTY PATIENTS?

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Methods: I used two different spacers in in my personal series of 270 consecutive cases of: Arthroplasty in CMC arthrosis, stages 2°-3° Eaton classification.

One hundred seventy-five cases with Pirodisk (pirocarbon spacer, age thirty-six to sixty-five (seventy-four only two man), follow up from twelve to one year ), ninety-five cases Reg Joint (poliLactid acid biosorbable spacer, age from 45 to eighty-one, follow up nine to one years).

The same technique for the Reg Joint, created an hole with specific tools into the biosorbable spacer.

The terminal end of FRC split is used to reconstruct the CMC dorsal ligament, "reinforced" from ALP detached from the 1° metacarpal base.

One hundred-fifteen and thirty bilateral cases, thirty-eight man (seven bilateral) in Pirodisk series, eighty-five women (ten bilateral) and ten man in Reg-Joint series.

Results and Conclusions: Two hundred thirty were evaluated clinically, at 15, 30, 60 e 90 days, only sixty rx control.

Eight Tc were done in first five months for persistent wrist pain (only reg-joint series).

Two hundred thirty-five patients compiled the quick-D.A.S.H. (Short disability of Harm-Shoulder and Hand) questionnaire (the average value was 18.5 point (from 13 to 29).

Kapandy value 8-10, (average nine)

Pain: V.A.S. 2.1 average (range 1-4 maior score in Pirodisk series), average was 5.5 before surgery.

Pinch 4.6 (was 3.4 before surgery because of pain) similar to the other hand.

Grip: average 18.5 Kg (was 13 before surgery), 22 kg the value of the other hand (high values in pirodisk series).

No statistically difference were find between two groups.

All patients reached their best range of motion and were able to restart the normal work related activities in 1.5 to 6 months (best in reg-joint series) average 2.4 months ( higher in pirodisk serie ).

Fifteen patients were treated for trigger thumb and twelve for Dequervain disease at four-eight month from first surgery. On conclusion 85% of very-good and good results, 14% fair, 1% bad (two cases in pirodisk serie was re-operated after eighteen months, replacing with reg-joint spacer.

### **A-0225** USE OF THE INTRA-OPERATIVE FLUOROSCOPIC GUIDANCE FOR SAFE PLACEMENT OF DISTAL SCREWS INTO SUBCHONDRAL ZONE IN VOLAR LOCKING PLATING FOR DISTAL RADIUS FRACTURES

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**Introduction:** A careful distal locking screw insertion into the subchondral zone is necessary to obtain a proper mechanical strength of the construct in volar locking plating for unstable distal radius fractures. But subchondral zone screw insertion increases the risk of intra-articular screw penetration, which may go un-recognized during surgery because of complex geometry of the distal end of radius. The purposes of this study were to evaluate the role of fluoroscopic guidance with 45° supination oblique view technique for placing the distal screws into subchondral zone during volar locking plating for unstable distal radius fractures and to explore the factors associated with poor screw placement.

**Methods:** We retrospectively analyzed 171 wrists of 169 patients treated with variable-angle volar locking plate for unstable distal radius fractures. A subchondral zone was defined as the metaphyseal area within 4mm from the articular margin of distal radius. The location of distal locking screws and radiographic parameters including teardrop angle were measured using computed tomography scan and X-rays. Clinical and radiographic factors were examined for possible association with screw placement failure.

**Results:** Of 581 distal screws inserted, 559 screws (96.2%) were inserted into subchondral zone and 17 screws into the metaphyseal zone (2.9%). Five screws (0.7%) in three wrists showed intra-articular placement; four screws were placed into lunate fossa and one into scaphoid fossa. These three wrists also showed significantly decreased teardrop angle. The distal screws were significantly closer to the joint line in the lunate fossa than the scaphoid fossa ( $1.9 \pm 0.9\text{mm}$  vs.  $2.8 \pm 1\text{mm}$ ,  $P < 0.000$ ).

**Conclusion:** The use of fluoroscopy-guided screw insertion technique is useful to safely place the distal locking screws into the subchondral zone. However, decreased teardrop angle or extended lunate fossa should be corrected before the distal screw insertion to avoid intra-articular screw placement.

### **A-0226** PATIENT SELF ACQUIRED PHOTOGRAPHS (SELFIE) ; A VALUABLE TOOL IN HAND TRAUMA TRIAGING

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#### **Aims**

In recent years, mobile device and mobile app use among health care providers has mirrored that of the general population. Regular mobile device usage will be the future in medicine, with particular reference to images.

Plastic and Hand surgery is such an emerging visual discipline. The functionalities that mobile devices offer and the

potential to revolutionize the way we practice medicine is becoming a reality, particularly where visual examination is a principal step in assessing patients. The readily available high-resolution devices have simplified photography, without the need to carry a camera.

Our Plastic surgery department introduced Medical Selfie as a valuable tool in the daily management of hand trauma. The main aim of this study was to assist triaging trauma cases especially from peripheral hospitals, offer convenience to patients by minimizing dressing changes, ensure smooth handover between members of the team, facilitate the educational discussions and surgical planning between juniors and seniors. Selfie images uploaded on patients' records will also provide visual documentation for present and future reference.

#### Methods

This prospective study is an update of the data presented virtually in the last FESSH meeting 2020. All trauma patients referred to our department in the last 18 months were initially included in the study and verbally consented. Patients were advised to take more than one Selfie of the injured parts. The A&E staff, GPs and peripheral hospital staff were provided with similar instructions. A secure NHS email address with written instructions was handed to the patients, to which the selfies were emailed while maintaining pseudo anonymity.

The exclusion criteria were patients with learning disability, prisoners, deliberate self-harm, lacking mental capacity, identifiable areas and poor quality images/blurred

#### Results

927 patients were referred to the Plastic surgery department. 788 patients including 139 paediatric trauma patients emailed images using their guardian mobile phones. Interestingly, the majority of patients had already taken Selfie, prior to our request. The overall number of visits to A&E and number of dressings were reduced. The ease of communication amongst members of the team in the handover was greatly facilitated.

#### Conclusion

Our current generation sees mobile technology as a second nature and an expected means of communication in everyday occurrence. Medicine is no different in that. This is balanced against the challenge of maintaining patient's confidentiality and personal data. Selfie addresses some of the confidentiality issues in taking and transferring images, without additional resources.

Selfie technology is a very valuable visual tool for triaging, safe and efficient handover and improving the patient management. Our data and results confirm reduction in the number of dressings and hospital visits which amounts to between £124-400/visit. This is of significant value, particularly in children where additional dressing changes can cause severe anxiety and additional stress for the whole family. Additional benefit was noted during the COVID -19 era where it helped reducing the exposure time and visits to hospital.

### **A-0227** INVESTIGATION OF THE EFFECT OF RADIAL NERVE MOBILIZATION ON PAIN, FUNCTION AND GRIP STRENGTH IN PATIENTS WITH HAND THUMB OSTEOARTHRITIS

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Introduction: It has been shown that the level of pain expressed by patients with thumb base osteoarthritis (OA) may not always correlate with the degree of degeneration in the joint. Pain is mostly the primary complaint in these patients

besides being the origin of a decrease in function and grip strength. The superficial branch of the radial nerve, which is the primary sensory nerve of the joint, was shown to contribute to the pain level. Thus, radial nerve mobilization exercises may improve pain and function. In this study, we planned to assess the effect of radial nerve mobilization on pain, functional level, and grip strength in patients with thumb base OA.

**Methods:** In this prospective, randomized, and controlled study, a total of 23 patients with thumb base OA were included in two groups (mobilization and control groups). Patients were assessed before and after the completion of the 4-week treatment. Pain levels at rest, activity, and night, grip, and pinch strength (bipod and lateral) were measured. Dexterity was assessed by 9-Hole Peg Test (9HPT). Disability level was evaluated with the Michigan Hand Outcome Questionnaire (MHOQ) and Functional Index of Hand Osteoarthritis (FIHAO). All the patients received hand therapy twice a week for 4 weeks including patient education and training about correct gripping and pinching, massage, and ice. The mobilization group received radial nerve gliding exercises additionally. Patients were also instructed to repeat the exercises at home 3 times a day. Results were analyzed both within groups and between groups.

**Results:** A total of 13 patients in the mobilization group (53,76±8,49 years; 13 females) and 10 patients in the control group (61,9±10,96 years; 1 male and 9 females) completed the study. Groups were similar regarding age, gender distribution, and all clinical parameters at baseline ( $p>0.05$ ) except the MHOQ work subscale ( $p=0.015$ ). The frequency of the dominant hand as the symptomatic hand was also similar ( $p=0.305$ ). Within-group analyses showed significant improvements in all parameters except the 'appearance' subscale of MHOQ in the mobilization group ( $p<0.05$ ). No statistically significant improvement was found between the pre- and post-treatment results in the control group ( $p>0.05$ ). Grip strength, bipod pinch strength, and 3 subscales of the MHOQ ('general hand function', 'daily life activity', and 'satisfaction') were superior to the control group in the mobilization group after treatment ( $p=0.047$ ,  $p=0.019$ ,  $p=0.041$ ,  $p=0.01$ ,  $p=0.006$  consecutively).

**Conclusion:** This preliminary study showed that radial nerve mobilization is effective in improving clinical outcomes in patients with thumb base OA when compared to conventional treatment. It is concluded that radial nerve gliding can be added to the hand therapy program in those patients for pain relief and functional improvement.

**Keywords:** Osteoarthritis, thumb, nerve mobilization, radial superficial nerve, first carpometacarpal joint

## **A-0230** ARTHROSCOPIC TREATMENT OF KIENBÖCK'S DISEASE: MID-TERM OUTCOME OF ARTHROSCOPIC LUNATE CORE DECOMPRESSION

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Arthroscopic treatment of Kienböck's disease: mid-term outcome of arthroscopic lunate core decompression

### Abstract

**Purpose:** This study evaluated the mid-term functional and radiological results of doing arthroscopic lunate core decompression for treating Kienböck's disease.

**Methods:** In a prospective cohort study, 40 patients with confirmed diagnosis of Kienböck's disease (stages 1 to 3b of Lichtman classification) underwent arthroscopic core decompression of lunate bone. We did the surgery using a cutting bur through the trans-4 portal with visualization from 3-4 portal after synovectomy and debridement of radiocarpal joint using a shaver from 6R portal. Functional disabilities of arm, shoulder and hand (DASH) and visual analog scale (VAS) scores, wrist's range of motion, grip strength, radiological changes of Lichtman classification, carpal height ratio, and scapholunate angle were evaluated before and two years after the surgery.

Results: The mean of DASH score improved from  $52.5 \pm 13$  to  $29.2 \pm 16.3$  ( $p = 0.000$ ). The VAS score also improved from  $7.6 \pm 1.8$  to  $2.7 \pm 1.9$  ( $p = 0.000$ ). There was also an improvement in hand grip from  $6.6 \pm 2.7$ kg to  $12.3 \pm 3.1$ kg ( $p = 0.000$ ). Wrist's range of motion in flexion, extension, ulnar deviation, and radial deviation improved significantly. Lichtman's classification radiologically remained the same in 36 patients (90%). Carpal height showed no significant change ( $p = 0.131$ ). Intergroup evaluation showed no significant functional difference in response to surgery for different radiological Lichtman stages.

Conclusion: Arthroscopic lunate core decompression seems to be an effective and safe surgery for treating Kienböck's disease based on mid-term follow-up.

## **A-0231** DEVELOPMENT OF A SCREENING METHOD FOR CERVICAL MYELOPATHY BY HAND MOVEMENTS USING MACHINE LEARNING

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### Background:

Cervical myelopathy (CM) primarily causes hand clumsiness, such as difficulty in writing or buttoning, and gait disturbance and has a poor prognosis if left untreated. For a good prognosis, early detection and early treatment are important because CM is often undetected due to its gradual course. Moreover, only few subjective symptoms are noted in the early stages. We aimed to examine writing behavior in patients with CM and developed a novel tablet-based CM screening tool using machine learning.

### Methods:

We included 23 patients with CM and 56 healthy volunteers in this study. The CM group included preoperative patients with CM scheduled for cervical spine surgery at our hospital. We asked them to trace several types of figures displayed on the tablet system (iPad pro 11-inch, Apple) using a stylus pen (Apple Pencil), which were widely available commercially. The figures included spiral, square, and triangular waves. During the exercise, writing behaviors, such as the coordinates, velocity, and pressure of the stylus tip, and drawing time were recorded. Among these data, features related to drawing pressure and time were combined and used as training data for the support vector machine, a machine learning algorithm, for each figure. To evaluate the accuracy of the classification model, a receiver operating characteristic curve was generated, and the area under the curve (AUC) was calculated.

### Results:

Among these classifiers, the best classifier was the triangular wave model and classified patients with CM and healthy volunteers with 78% sensitivity and 93% specificity, yielding an AUC of 0.82. While the accuracy was low with only one feature in each shape model, high accuracy was obtained by combining features.

### Conclusions:

We developed a novel binary classification method for CM using a machine learning algorithm trained with writing behavior. By focusing on hand movements, this method could classify CM with high accuracy. Because this tool consists of commercially available devices, it may be useful for screening in daily life outside hospital settings. This may allow for the early detection of CM, prompting patients to visit spine specialists to receive early treatment.

## **A-0232** SLIDING OSTEOTOMY FOR OLECRANON NONUNION TREATMENT

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Sliding osteotomy for olecranon nonunion Treatment

Nonunion is a rare complication after surgical treatment of olecranon fracture, but indeed it is a devastating one because of high potentials for elbow stiffness, pain, soft tissue and skin problems and device complaining. To our knowledge there is no treatment of choice for olecranon nonunion in the literature. We describe a unique New technique by sliding osteotomy of olecranon and refixation with tension band wiring.

There is no need for grafting or any special devices for fixation. We described two patients operated with this technique. Both of them demonstrated good results. X-rays showed solid fusion in 12 weeks with no complications.

## **A-0233** ARTHROSCOPIC-ASSISTED TRANSOSSEOUS EN MASSE REPAIR FOR TRAUMATIC FOVEAL TRIANGULAR FIBROCARILAGE COMPLEX TEAR

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**Introduction:** The traumatic peripheral triangular fibrocartilage complex(TFCC) tears present various configurations involving the deep and superficial limb. Surgical ulnar foveal reattachment is indicated when the deep limb is involved and unresponsive to conservative treatments. The arthroscopic-assisted foveal repair is a feasible surgical option with the merits of minimal invasiveness. Here, we introduced arthroscopic en Masse repair of the TFCC for the treatment of foveal TFCC tears and reported clinical outcomes and operation-related complications.

**Materials & Methods:** From Oct 2015 to May 2021, patients who had an arthroscopic-assisted transosseous two-stranded en Masse repair for TFCC peripheral tear were included in this retrospective study. We included (1) traumatic peripheral TFCC tear involving deep limb (Atzei class 2 or 3) and (2) followed up at least 12 months after the operation. The following criteria were excluded; (1) traumatic TFCC superficial limb tear without deep limb tear (Atzei class 1), (2) any associated degenerative lesions either in ulnocarpal joint or distal radioulnar joint (DRUJ), and (3) revisional TFCC repair, and (4) followed up less than 12 months after the operation. The preoperative and postoperative DRUJ stability was examined to assess the re-rupture of TFCC. For clinical outcomes, Visual Analogue Scale pain score, grip strength, Mayo Wrist Score(MWS), Disabilities of Arm, Shoulder, and Hand(DASH) score, and range of motion (ROM) of the wrist were evaluated. We also reviewed postoperative complications. Additionally, with the DASH score, we analyzed the negative preoperative factors of postoperative clinical outcome with age, sex, symptom duration, ulnar positive variance, associated ulnar styloid fracture, and associated traumatic central tear of TFCC.

**Results:** A total of 48 patients were included in this study, and 14 patients were Atzei class 2 (29.2%). The DRUJ stability assessed by the Ballottement test was secured after the operation ( $p<.001$ ). The mean VAS pain(7.1 to 1.9), grip strength(66.1% to 81.3%), MWS(64.3 to 81.9), and DASH score(37.1 to 12.7) were improved postoperatively. The postoperative range of wrist motion was similar to preoperative (flexion-extension arc; 141.5 to 145.4, supination-pronation arc; 166.3 to 165.9, radial-ulnar deviation arc; 50.6 to 53.0). There were no surgery-related complications except for one patient who had a secondary ulnar shortening osteotomy for persistent ulnar wrist pain after the operation. In multiple regression analysis with DASH score, there was no specific factor affecting poor clinical outcomes in this study.

Conclusion: Arthroscopic-assisted transosseous en Masse Repair for patients with peripheral TFCC tear involving the deep limb restored DRUJ stability and improved clinical outcomes at postoperative one year or more.

### **A-0234** THE VALIDITY AND RELIABILITY A SMARTPHONE APPLICATION FOR MEASURING WRIST AND METACARPOPHALANGEAL JOINT RANGE OF MOTION

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Objectives: Accurate measurement of range of motion (ROM) is crucial for guiding, comparing and evaluating treatment and rehabilitation of the upper extremity. Inaccurate measurements may mislead clinicians/researchers and harm patient compliance with treatment. The aim of this study was to evaluate the validity and reliability of the Angulus smartphone app (app) to measure wrist and metacarpophalangeal (MCP) joint ROM in healthy adult volunteers.

Patients and Methods: Sixty-four healthy adult volunteers, (18-45 years), were included in this study. An experienced physiotherapist (Rater 1) measured wrist flexion/extension, wrist radial/ulnar deviation, and MCP joint flexion/extension ROM using the Angulus app (twice in different sessions) and a standard two-arm goniometer. Validity of the Angulus app was assessed by the correlation with the goniometer measurements (Pearson correlation coefficient). For reliability analysis in addition to Rater 1, an inexperienced biomedical engineer (Rater 2) performed same measurements by Angulus app twice in different sessions. Intra-rater and inter-rater reliability was tested using the intraclass correlation coefficient (ICC). Results: Mean (SD) age was 29.5 (8.2) years, most participants were women (62%). Adequate to excellent correlation between Angulus app and goniometer measurements (r values ranging from 0.44 to 0.81) indicated validity of the Angulus app measurements. The intra-rater reliability of Angulus app was excellent for Rater 1 (r values ranging from 0.76 to 0.90), while adequate to excellent for the Rater 2 (r values ranging from 0.71 to 0.88). The inter-rater reliability of Angulus app between Rater 1 and Rater 2 was excellent (r values ranging from 0.91 to 0.96).

Conclusion: Angulus is a valid and reliable method to measure wrist and MCP joint ROMs without the need of clinical experience.

### **A-0235** HOW THE TECHNICAL ASPECTS OF MRI DETERMINE THE DIAGNOSTIC ACCURACY REGARDING THE MOST COMMON LIGAMENTOUS LESIONS OF THE WRIST - A SYSTEMATIC REVIEW AND META-ANALYSIS

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Background: MRI plays an increasingly important role in the preoperative diagnosis of ligamentous wrist injuries, such as scapho-lunate, TFC and luno-triquetral lesions. Technical aspects of wrist MRI have evolved at a rapid rate. Our aim was to analyze the underlying factors that currently influence the diagnostic accuracy of MRI.

Materials and methods: The systematic search for our meta-analysis was executed on the 22nd of October, 2021 using

MEDLINE, Embase, and CENTRAL. Studies comparing the diagnostic accuracy of wrist MRI to that of wrist arthroscopy in adult patients (>18 years) with suspected wrist ligamentous injuries were eligible for inclusion.

Results: The result of the systematic search was 4,258 articles. Thirty-eight studies were eligible for inclusion following duplication removal, title and abstract selection, and full text screening. The studies displayed heterogeneity in terms of technical conditions and research methods. Overall sensitivity of wrist MRI was 0.76 (0.69 – 0.82) and specificity was 0.87 (0.79 – 0.92). For low field MRI (< 1.5T) the sensitivity was found to be 0.69 (0.60 – 0.76) and the specificity was 0.66 (0.26 – 0.94). For 1.5 T MRI the sensitivity was 1.79 (0.68 – 1.87) and the specificity was 0.82 (0.72 – 0.89). Using 3T MRI, overall sensitivity reached 0.76 (0.69 - 0.81 and specificity reached 0.96 (0.66 - 1.00). The effect of wrist coils, 3D sequences and fat saturation was also assessed. The application of 3D sequences has a positive effect on sensitivity, while fat saturation increases specificity.

Conclusion: When appropriate technical requirements (>1.5T MRI, use of wrist coils, 3D sequences and fat saturation) are met, the diagnostic specificity of MRI is clinically reliable regarding the most common ligamentous injuries of the wrist.

### **A-0237** VALIDITY AND RELIABILITY OF K-FORCE SENS TO EVALUATE OF JOINT POSITION SENSE IN CARPAL TUNNEL SYNDROME: A PILOT STUDY

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Aim: The aim of our study is to investigate the validity and reliability of the K-Force Sens device to evaluate the wrist joint position sense in subjects with carpal tunnel syndrome.

Material-Method: Participants who applied to the Pamukkale University Hospitals, had mild or moderate severity CTS and met the inclusion criteria were included in the study. Joint position sense evaluated with K-Force Sens and Baseline electrogoniometer for 30° and 60° wrist flexion-extension and 10° ulnar 15° radial deviation movements. Evaluations with K-Force Sens were repeated after 7 days. In the scale validity and reliability analysis; for the reliability of the scale, in-class correlation coefficient (ICC) was used in test-retest examinations. In parallel form studies, the correlation coefficient of Spearman was used.

Results: Twenty one patients (17 women, 4 men) with a mean age  $47.74 \pm 10.46$  years were included. 32 affected hand were evaluated as 17 right and 15 left. 22 hands were mild and 10 hands were moderate severity. The test-retest joint position sense reliability on K-Force Sens was “very good” for wrist 30° flexion (ICC=0.91), wrist 30° extension (ICC=0.91), 60° extension (ICC=0.82), 15° ulnar deviation (ICC=0.70) and 10° radial deviation (ICC=0.71). For 60° wrist flexion (ICC=0.68) was “good”. There was a very high correlation between K-Force Sens and Baseline electrogoniometer at 30° extension ( $r=0.88$ ) and radial deviation movements ( $r = 0.82$ ), and a high correlation at 30° flexion ( $r=0.75$ ), 60° extension ( $r=0.61$ ), ulnar deviation ( $r=0.66$ ) with electrogoniometer. There was a moderate correlation at 60° flexion movement ( $r=0.48$ ) ( $p<0.05$ ).

Conclusion: According to our results K-Force Sens is a valid and reliable device that can be used to measure joint position sense in patients with carpal tunnel syndrome.

## **A-0238** INVESTIGATION OF WRIST POSITION SENSE IN PATIENTS WITH MEDIAN NERVE NEUROPATHY

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**Aim:** The aim of this study was to investigate the wrist position sense in patients with median nerve neuropathy and to compare it with healthy individuals.

**Method:** Eighteen patients (25 hands) with median nerve neuropathy between the ages of 18-65 years and 23 healthy individuals of similar age and gender, were included in the study. Wrist position sense was evaluated with the K-FORCE Sens<sup>®</sup> electrogoniometer. The target measurement values were determined as 30 degrees for wrist flexion, 30 degrees for extension, 10 degrees for radial deviation and 15 degrees for ulnar deviation, and the reposition error of the cases was evaluated.

**Results:** Flexion reposition and radial reposition error values were found to be higher in individuals with right median nerve neuropathy than in the right hands of healthy individuals. ( $p < 0.05$ ). Flexion reposition and radial reposition error values were found to be higher in individuals with left median nerve neuropathy than in the left hands of healthy individuals. ( $p < 0.05$ ). Regardless of whether they were right or left hand, there was no significant difference in extension reposition and ulnar reposition error values between individuals with median nerve neuropathy and healthy individuals ( $p > 0.05$ ).

**Conclusion:** The results of this study shows that the flexion and radial position senses of individuals with median nerve neuropathy are affected compared to healthy individuals. In individuals with median nerve neuropathy, even if the motor functions of the hand are normal in terms of hand functions, sensorial losses in the hand should not be overlooked.

## **A-0240** SHORT ARM CAST IS AS EFFECTIVE AS LONG ARM CAST IN MAINTAINING DISTAL RADIUS FRACTURE REDUCTION: RESULTS OF THE SLA-VER NONINFERIORITY TRIAL

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### BACKGROUND

Distal radius fractures (DRFs) are a common challenge in orthopaedic trauma care, yet for those fractures that are treated nonoperatively, strong evidence to guide cast treatment is still lacking.

### AIM

To compare the efficacy of below elbow cast (BEC) and above elbow cast (AEC) in maintaining reduction of manipulated DRFs.

### METHODS

We conducted a prospective, monocentric, randomized, parallel-group, open label, blinded, noninferiority trial comparing the efficacy of BEC and AEC in the nonoperative treatment of DRFs. Two hundred and eighty patients > 18 years of age diagnosed with DRFs were successfully randomized and included for analysis over a 3-year period. Noninferiority thresholds were defined as a 2 mm difference for radial length (RL), a 3° difference for radial inclination (RI), and volar tilt (VT). The trial is registered at Clinicaltrials.gov (NCT03468023).

### RESULTS

One hundred and forty-three patients were treated with BEC, and 137 were treated with AEC. The mean time of immobilization was 33 d. The mean loss of RL, RI, and VT was 1.59 mm, 2.83°, and 4.11° for BEC and 1.63 mm, 2.54°, and

3.52° for AEC, respectively. The end treatment differences between BEC and AEC in RL, RI, and VT loss were respectively 0.04 mm (95%CI: -0.36-0.44), -0.29° (95%CI: -1.03-0.45), and 0.59° (95%CI: -1.39-2.57), and they were all below the prefixed noninferiority thresholds. The rate of loss of reduction was similar.

#### CONCLUSION

BEC performs as well as AEC in maintaining the reduction of a manipulated DRF. Being more comfortable to patients, BEC may be preferable for nonoperative treatment of DRFs.

### **A-0242** CAN WE DIAGNOSE CARPAL TUNNEL SYNDROME OVER THE TELEPHONE

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The restrictions placed on face-to-face assessments throughout the COVID-19 pandemic have invited hand surgeons to turn to remote diagnostic tools. This retrospective cohort study aimed to assess whether we could reliably diagnose Carpal Tunnel Syndrome (CTS) using a questionnaire delivered over the telephone.

The Kamath and Stothard Carpal Tunnel Questionnaire (CTQ) score is quoted in the literature as an effective tool for the diagnosis of Carpal Tunnel Syndrome. In our nurse-led telephone clinic the CTQ score is delivered over the telephone and is used as an initial screening tool. Depending on the patient's score they are then referred for nerve conduction studies (NCS) or a hand surgery consultant clinic where they will receive a "final diagnosis". We assessed the performance of the CTQ score in predicting both NCS diagnosis and final diagnosis within our pathway.

In total, 702 patients were reviewed in the assessment pathway between July 2020 to September 2022, making this the largest study of remote CTS diagnosis to date. We found that a CTQ score  $\geq 3$  predicted NCS diagnosis of CTS in 64% of patients, however, CTQ score  $\geq 3$  was able to predict final diagnosis of CTS in 83% of patients. A score of  $< 3$  ruled out CTS in 90% of patients. Higher scores received on the CTQ predicted an increased likelihood of CTS diagnosis. Our findings suggest the CTQ score was effective at predicting final CTS diagnosis but not as effective in predicting NCS diagnosis. This difference suggests the CTQ score can be accurate when delivered remotely, and that NCS is a flawed as a diagnostic standard for CTS. This will help us to safely and reliably diagnose CTS without requiring face-to-face assessment.

### **A-0243** REPLACEMENT OF THE DISTAL RADIOULNAR JOINT WITH A CONSTRAINT SCHEKER PROSTHESIS

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#### Objectives

The Scheker-Aptis prosthesis is intended to replace the DRUJ in patients with degenerative or posttraumatic arthritis of the sigmoid notch and/or ulnar head, or gross instability of the DRUJ. Our objective is to describe long-term outcomes of patients treated with the Scheker-aptis prosthesis.

#### Methods

We performed a retrospective study of all consecutive patients who underwent a DRUJ replacement surgery with a Scheker-Aptis prosthesis between 2016 and 2021. Primary outcome measure was the PRWE questionnaire and secondary outcome measure was complications.

## Results

In total 43 Schecker-Aptis prostheses in 42 patients were included. The median age was 56 years (IQR: 50-66) and 26 (62%) were female. Median follow up was 33 months (IQR: 26-50). The median PRWE-score at final follow up was 22 points (IQR: 9-52). Four patients developed complications. Three of which were ECU tendinitis, requiring surgery in one case and one patient developed a neuroma of the DBUN, also requiring surgical removal.

## Conclusion

The Schecker-Aptis prosthesis leads to excellent clinical outcomes and a low complication rate. No prosthesis had to be removed.

## **A-0244** PREOPERATIVE SCAPHOID BONE DENSITY IN CT-SCANS AS A PROGNOSTIC FACTOR FOR THE HEALING CAPACITY OF NON-UNIONS

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We investigated whether the bone density of the scaphoid fragments, measured in preoperative CT scans, and an increased densification in conventional radiographs are suitable for predicting the healing capacity of a scaphoid reconstruction with a non-vascularized bone graft (NVBG).

In this retrospective study, clinical and radiological characteristics of 67 scaphoid non-unions were investigated. Preoperative X-rays were assessed regarding densification of the proximal scaphoid fragment. Further, the relative bone density of both scaphoid fragments, compared to the trapezium, were measured in the preoperative CT-scans. Patients were followed 24 weeks to evaluate bone healing by CT-scans.

The scaphoid healed in 47 cases, while the non-union persisted in 20 cases. Only patients' age had a significant effect on the healing rate in our study population. Densification of the proximal scaphoid fragment in conventional radiographs was found not precise enough for predicting the healing capacity. Preoperative CT-scans showed a significantly greater relative bone density of the proximal (384.6%) and distal (256.3%) scaphoid fragments in those with persisting non-unions, compared to scaphoids healed (proximal 242.1%, distal 151.2%). According to the ROC analysis, the optimal cutoff values to correctly predict healing prognosis were 209.0% for the distal and 286.2% for the proximal scaphoid fragment. With both fragments below these thresholds, a strong healing capacity can be assumed. If one of the fragments exceed the threshold, the prognosis is intermediate. If both fragments exceed the thresholds, the healing capacity is poor with a positive predictive value for a persistent non-union of 94%.

The relative bone density of the fragments in scaphoid non-unions, assessed preoperatively in CT-scans, is a valid prognostic factor. It may be used to determine individually the appropriate reconstruction method, e.g. using a vascularized graft in non-unions with poor healing prognosis.

## **A-0245** TELEREHABILITATION VERSUS IN-PERSON HAND THERAPY AFTER FLEXOR TENDON REPAIRS: A PRELIMINARY COMPARISON STUDY

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**Introduction:** Telerehabilitation has appeared as an alternative method in hand therapy in case of physical distance. We had started remote hand therapy after flexor tendon repairs under pandemic restrictions. After getting good results with this method, we decided to offer it to the patients in our clinical practice. In this preliminary study, we are reporting the results of comparative analysis between remote and in-person hand therapy in patients with flexor tendon repairs. **Methods:** A total of 26 patients with flexor tendon repairs were included in the study. All patients were operated under wide-awake anesthesia and were treated according to the early active motion protocol in a dorsal block splint. Telerehabilitation was performed by smart phone using a video conference application. Both groups had treatment sessions once a week. Range of active exercises progressed weekly and active full composite fist was reached at the end of the 4th week. The splint was removed totally in the 6th week. All the patients visited the clinic for assessments at 6th, 8th and 12th weeks post-operatively. Total active motion (TAM) was measured, and disability level was assessed with Disabilities of Arm, Shoulder and Hand (DASH) Questionnaire at each visit. Groups were compared regarding the TAM and DASH scores and p value was <0.05 for significance.

**Results:** Five patients were lost to follow-up. One patient in each group had rupture (one due to non-compliance with the instructions and one due to trauma). Ten patients in telerehabilitation group and 9 patients in in-person therapy group were analyzed. Groups were similar regarding age (p=0.13) and gender distribution (p=0.51). In telerehabilitation group, 5 patients were injured on second finger, 2 patients on ring and 2 patients on small finger. In in-person therapy group, 4 patients were injured on second finger, 1 patient on ring and 5 patients on small finger. In-group analysis showed significant recovery in TAM and DASH scores at consecutive weeks in both groups (p<0.01). Groups were similar regarding TAM and DASH scores at each assessment (p>0.05) except the DASH score at 8th week (p=0.045). Despite extension deficit was observed in some patients in both groups, all patients had excellent or good level of TAM at the final assessment.

**Conclusion:** Preliminary clinical outcomes in this study revealed that remote and in-person hand therapy showed similar results after flexor tendon repairs. Telerehabilitation, which had come to the stage during the pandemic, now appears to be an alternative way of hand therapy and may be offered to those patients in clinical practice for its good results.

## **A-0246** THE SCAPHIX STUDY: COHORT ANALYSIS OF A CUSTOMIZED PERCUTANEOUS 3D-PRINTED GUIDE FOR SCAPHOID FIXATION

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**Purpose:** The aim of this study is to compare the accuracy and reliability of percutaneous fixation of minimally-displaced scaphoid fractures using a customized three-dimensional (3D)-printed guide to the conventional freehand method.

**Methods:** A prospective cohort of 10 patients underwent scaphoid fixation with the aid of a customized 3D-printed guide. This

group was compared to a retrospective cohort of 10 patients who underwent conventional freehand technique. We evaluated the final screw position by measuring the angular deviation of the screw axis from the ideal axis ( $\alpha$  for the posteroanterior view and  $\beta$  for the lateral view). We also measured the distance between the middle of the scaphoid axis and the screw axis in the PA (d1) and lateral (d2) views. Total surgery time (minutes) and fluoroscopy time (seconds) was also compared. Results: There were no differences in final screw position between both methods. Median  $\alpha$  and  $\beta$  angles were 2.12° (IQR 3.35) and 4.73° (IQR 4.53) for the 3D guide group and 2.80° (IQR 2.51) and 5.63° (IQR 7.33) for the freehand group respectively. Median d1 and d2 diameters were 2.07mm (IQR 1.78) and 2.21mm (IQR 0.99) for the 3D guide group and 1.75mm (IQR 0.99) and 1.67mm (IQR 1.37) for the freehand group respectively. The patients in which the 3D guide was used had a surgery time reduction of 43% and a fluoroscopy time reduction of 52% compared to the control freehand group. Conclusions: The use of a customized 3D-printed guide is a reliable method that can be used for scaphoid fixation. It is as accurate as the standard freehand technique and it reduces surgical time and intraoperative x-ray exposure.

### **A-0247** COMPARISON OF EFFECTS OF DIABETES TYPES ON UPPER EXTREMITY FUNCTION, PAIN, AND QUALITY OF LIFE Zeynep Irem Bulut<sup>1</sup>, Yavuz Yakut<sup>1</sup>, Murat Ali Cinar<sup>1</sup>, Cigdem Ayhan Kuru<sup>2</sup>

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The diabetic involvement of the upper extremity causes limitation of mobility, fixed contractures, impairment of grip strength and accompanied by changes on skin. In the literature, there is lack of researches about how type of diabetes effects upper extremity in terms of function and pain. Less attention is directed to upper extremity problems although patients with type 2 diabetes have reported to be more disabled in activities of daily living than non-diabetic patients. In this preliminary study, it was aimed to investigate the comparison of effects of diabetes types on upper extremity function, pain, and quality of life in individuals with diabetes from Turkiye. This study was a web-based cross-sectional study. Between the dates 8th November 2020 to 29th January 2021, datas collected via a online questionnaire form that reached participants with diabetes mellitus (DM) by social platforms. Online questionnaire form included Disabilities of Arm, Shoulder and Hand (DASH), Michigan Hand Outcomes Questionnaire (MHQ), Numeric Rating Scale (NRS) for pain intensity upper extremity parts, Neuropathic Pain Questionnaire-Short Form (NPQ-SF), Word Health Organization Quality of Life Questionnaire-BREF (WHOQoL-BREF), and also questions of demographic datas and diabetes specific queries. The study was included 130 individuals (72 women, 58 men) from Turkey who has diabetes (54 type 1, 76 type 2). The participant's age was between 18-65 years. Mean age of individuals was 42.1±15.4 years for type 1 DM, and 52.2±8.4 years for type 2 DM. Body mass index was 27.0±6.2 kg/m<sup>2</sup> for individuals with type 1 DM, and 29.7±6.7 kg/m<sup>2</sup> for individuals with type 2 DM. Mean duration of diabetes was 9.1±8.3 years for type 1 DM, and 8.5±6.5 years for type 2 DM. Mean duration of insuline use was 7.7±8.2 years for type 1 DM, and 4.3±6.7 years for type 2 DM. When comparements were made between type 1 and type 2 DM; individuals with type 2 diabetes had shown significantly lower score in the satisfaction subparameter of MHQ for left hand ( $p<0.001$ ). Significant difference were not found in other subparameters of MHQ, NRS, NPQ-SF and WHOQoL-BREF between types of diabetes ( $p>0.05$ ). Individuals with type 2 diabetes had shown lower scores in terms of total score of DASH ( $p<0.001$ ). DM has negative effects on upper extremity function and quality of life. Between types of diabetes; upper extremity function were found worse in type 2 DM according to patient reported outcomes. On the contrary, it is considered hand spesific evaluation is not reflecting clinical status of this patient group sufficiently. Upper extremities of diabetic individuals requires more attention, and especially detailed hand evaluations is needed to determine normative data to be able to determine spesific rehabilitation protocol for diabetic patients.

## **A-0250** THREE-DIMENSIONAL MOTION ANALYSIS OF THE UPPER EXTREMITY ON PIANO PERFORMANCE - AN EXPLORATORY STUDY

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### Introduction

Though Performing Arts Medicine (PAM) deals with injuries and illnesses of musicians, there is little evidence regarding treatment. For example, when returning to play after rest or surgery, patients should begin with low-impact practice regimen, but little is known about the range of motion (ROM) of the joints necessary for performance. Similarly, the effect of joint fusion on performance is rarely known. The purpose of this study is to measure the ROM of each upper extremity joint during piano playing and to obtain an objective index for planning rehabilitation and surgery.

### Material and Method

The subjects were 11 hands of 8 people: 2 professional pianists, 2 experienced players, and 4 inexperienced pianists. The average age was  $37 \pm 10$  years, and the average playing experience was  $18 \pm 18$  years. Hands with a history of trauma or disease were excluded. Five essential techniques of playing; scales, arpeggios, trills, octaves, and hand crossing were measured, and free playing was added only for professional pianists and experienced players. Eleven-camera motion capture system (Vicon, Oxford, UK) were used for motion analysis. A total of 34 markers were placed at 3 points on the shoulder, 3 points on the upper arm, 2 points on the elbow, 4 points on the wrist, 1 point each on the 1st, 2nd, and 5th CM joints, 1 point each on the 1st-5th MP joint, 1 point each on the thumb IP joint, 1 point each on the 2nd-5th PIP joint, 1 point each on the 2nd-5th DIP joint, and 1 point each on the 1st-5th nail. Wilcoxon rank sum test was used for statistical analysis.

### Results

The elbow joint was played at an average angle of  $86 \pm 8^\circ$  flexion. Maximum ROM of the wrist joint was required for free playing (maximal palmar flexion  $34^\circ$ , maximal dorsal flexion  $-35^\circ$ ), followed by hand crossing (maximal palmar flexion  $24^\circ$ , maximal dorsal flexion  $-28^\circ$ ). The most ulnar flexion of the wrist joint was required for free playing ( $27^\circ$ ) and hand crossing ( $26^\circ$ ). While the average position of the DIP joints throughout all performances was  $12^\circ$  flexion of the index finger,  $14^\circ$  flexion of the middle finger,  $5^\circ$  flexion of the ring finger, and  $5^\circ$  extension of the little finger, while the arpeggio and hand cross technique required the DIP joints of the index and little fingers to be flexed to  $59^\circ$  flexion. In trill playing, inexperienced piano players tended to flex and extend fingers not used in playing, suggesting that they had little independence of finger movement.

### Conclusion

Hand crossing and free playing require greater ROM of the wrist joint and were considered preferable to be practised at a later stage than other techniques in recovery from injury. The average position of the DIP joints of the index to little fingers was  $5$  to  $14^\circ$  of flexion, but arpeggio and hand crossing required a maximum of  $59^\circ$  of flexion, which may interfere with playing when the joints are fixed. The angle values need to be verified by comparison with measurements using a goniometer.

## **A-0251** HOW DIFFICULT IS IT TO PIN A FRACTURE? FACTORS INFLUENCING RADIATION EXPOSURE DURING CLOSED REDUCTION PERCUTANEOUS PINNING OF HAND FRACTURES

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**Aims:** To investigate the relation between fracture type and surgeon experience to the amount of radiation used during closed reduction and percutaneous pinning of common metacarpal and phalangeal hand fractures.

**Methods:** A retrospective analysis of consecutive patients with hand fractures undergoing fracture fixation using Kirschner wires.

**Results:** Fixing distal phalanx fractures required the lowest number of images and shortest fluoroscopy time, followed by bony mallet and Bennet fractures. The largest amount of radiation was needed to complete the procedure in the shaft fracture group treated with crossed pins. Total number of images required to complete the fixation was lower in surgeries done with a hand specialist compared to surgeries without his attendance

**Conclusions:** Distal phalanx fracture fixation is easiest to perform, and crossed pinning of shaft fracture is the most challenging. This relation can help define difficulty levels of various procedures and assist in planning a gradual training program for residents learning to perform these tasks.

**Take home message:**

- Closed reduction and percutaneous pinning of hand fractures is technically demanding.
- Defining difficulty levels of various procedures can assist in planning training programs for residents learning to perform these tasks.

## **A-0253** ARTHROSCOPIC TREATMENT OF SCAPHOID NONUNION, FIVE YEARS' EXPERIENCE

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**Objective:**

Scaphoid nonunion is still a challenging problem in hand surgery. The rate of nonunion could be reduced by optimizing acute surgical treatment, but still remains between 5% and 10%.

Till now most of the patients have been treated with open revision, cancellous or cortical bone graft and stabilizing. Open procedure needs to mobilize the capsule and divide attachments of these structures from the scaphoid, including also parts with nutrient vessels, worsening the vascularization especially of the proximal pole.

Arthroscopy (ASK), in the last decade, plays an increasingly role in hand surgery also in treatment of radiocarpal and carpal disorders.

**Methods:**

Since 2017, we use arthroscopically treatment of scaphoid nonunion in our hospital. Till 2022 we operated 48 scaphoids of 47 patient.

Debridement was done arthroscopically as well as insertion of the radius cancellous bone graft. Fixation has been accomplished with K-wires or head compression screws using x-ray and checked arthroscopically, offering the possibility to correct the position and reduction. There have been three women and 44 men with a median age of 24,4 years (13-

37). Nine patients have been treated before but did not heal. In the middle third of the scaphoid we found 34 nonunion and 14 in the proximal. In eight patients we could find a Humpback deformity preoperatively, necessitating a Linscheid Maneuver to correct the scaphoid alignment. Fixation was done using K-wires, headless compression screws, or both.

Results:

Without one, all Humpback deformities could be reduced closed. In this patient we had to change to minimal open procedure. Forty two of the 48 nonunion could be treated primarily successful using ASK, the median time to healing was 9.1 weeks. In two patients we applied additional extra corporal shock wave therapy (ESWT), 8 weeks after ASK because of insufficient trabecular structure in the first computer tomography. After further 8 weeks these two scaphoids have been stable too. Four of our patients didn't heal and got further treatment using free vascularized bone grafts and healed uneventful. Median operation time could be reduced from 145 to a median of 102 minutes.

After a median follow-up of 32 months we found an excellent range of motion, a high satisfaction rate and most of the patients have been free of pain, 40 patients came back to earlier occupation.

Conclusions:

Because of these satisfying results, ASK has a fix place in the algorithm for scaphoid nonunion in our institution. The minimal invasive approach obtains the blood supply of the scaphoid and minimal scaring allows good range of motion. ASK also allows an exact diagnostic round through the wrist for detecting additional pathologies and assessment of the joint cartilage.

Growing experience and good results allowed us to escalate the indications to the proximal pole, requiring an undestroyed pole fragment, and using ASK also in patients who have been treated with open reduction unsuccessfully before. This yielded to a reduction of microvascular procedures.

In a nonunion of the proximal third of the scaphoid we now additionally use ESWT after ASK routinely.

## **A-0254** PRELIMINARY RESULTS OF LIDAR TECHNOLOGY IN HAND SURGERY

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Introduction: LiDAR is a method for measuring the distance by illuminating the target with laser light and measuring the reflection with a sensor. Differences in laser return times and wavelengths can then be used to make digital 3-D representations of the target. The authors used LIDAR technology to scan patient's hands before surgery to determine baseline values for the range of motion of small hand joints.

Materials and Methods: The study involved 10 patients (8 men and 2 women) between the ages of 51-81 years with a median age of 63 years. None of the patients had a thumb or index finger contracture. The most often contracted was IV. finger - in 7 cases, V. finger in 6 cases and III. finger in 1 case. The evaluation was performed with the assistance of experienced physiotherapists, who measured the extent of contracture of individual fingers using a goniometer (accuracy calibrated at 5°) before surgery.

Results: Evaluation was finished on 8 fingers (7 patients) out of a total of 14 fingers (10 patients). The differences between the results using the goniometer and the LiDAR technology are as follows. Difference in MCP: 2°-24° with median of 9°,

difference in PIP: 4°-23° with median of 6.5°. Different values in the results might be due to inexperience in taking LiDAR scans or incorrect evaluation of the angles on the individual joints of the fingers.

Conclusion: A pilot study confirmed the applicability of LiDAR technology for measuring trigonometric functions of small hand joints. In our opinion the biggest disadvantage of LiDAR technology is time delay in obtaining results compared to goniometer measurements. The biggest advantage is the accuracy of measurement to individual degrees. If the evaluation software can be implemented in a scanning application, this will lead to significant increase in speed of results acquisitions.

## **A-0255** A NEW SUTURE METHOD FOR THE FINGER PROXIMAL INTERPHALANGEAL JOINT COLLATERAL LIGAMENT: A CADAVER STUDY

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### Background:

Collateral ligament injuries of the proximal interphalangeal (PIP) joints of the fingers are encountered during clinical practice. Repairing collateral ligaments is difficult due to high fraying in detached ligaments. Thus, anchor-based reconstruction is widely used for the treatment of collateral ligament injuries, and Tokunaga designed the novel suture anchor technique (hereafter referred to as the N method) using multiple locking sutures to prevent pulling of the anchor sutures. However, the mechanical effects of different suturing methods using anchor sutures are still unclear. Therefore, this study aimed to determine the optimal repair method by measuring the rupture strength of the PIP joint collateral ligament repair using anchors.

### Methods:

First, the rupture strength of the PIP joint collateral ligament was determined. Sixteen fingers obtained from the fresh-frozen upper limbs were severed at the MP joint, and the joint capsule, collateral ligament, and palmar plate of the PIP joint were removed, leaving behind the bilateral collateral ligaments. The proximal portion of the proximal phalanx was embedded in a methyl methacrylate cylinder designed using a plastic 20-ml syringe that had been divided transversely and cemented in place. A tensile test was performed using a mechanical testing machine at a rate of 1 mm/s to determine the breaking strength of the collateral ligament. Subsequently, the rupture strength of the PIP joint collateral ligament repaired using a suture anchor was quantified. Collateral ligaments were also detached from their proximal attachments using 24 fingers obtained from upper limbs of fresh-frozen cadavers and repaired using anchors. In the simple suture group (hereafter referred to as "S group"), ligaments were repaired using bone anchors and simple sutures. In the N method group, ligaments were repaired using bone anchors and multiple locking sutures. Thus, the only difference between the two groups was the suturing method of the ligaments. The disruption strength of the S and N method groups was evaluated using a mechanical testing machine.

### Results:

The rupture strength of the PIP collateral ligament was  $68.3 \pm 8.9$  N,  $83.3 \pm 8.1$  N,  $68.9 \pm 13.8$  N, and  $50.1 \pm 7.0$  N for the index, middle, ring, and little fingers, respectively.

Of the 16 fingers studied, 12 were injured at the proximal portion. In the tear model repair experiment, the breaking strength of the S and N method groups was 25.4 N and 44.1 N, respectively.

## Conclusion:

The N method can improve the rupture strength of the collateral ligament and it can be used to improve initial fixation; moreover, it can also enable early initiation of exercise therapy, and encourage rapid recovery.

## **A-0256** DOES SCREW TRAJECTORY AFFECTS SURGICAL OUTCOME IN PERCUTANEOUS FIXATION OF SUBACUTE SCAPHOID FRACTURE?

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### Introduction

Fractures of the scaphoid are most common in carpal bone fractures and they can be easily overlooked in the acute stage. Scaphoid fractures detected in the subacute stage require a more meticulous and prompt approach. Recent publications suggest that certain delayed fractures may be amenable to percutaneous fixation without formal bone grafting. Although certain characteristics appear to be appropriate indications for such management, we believe there will be an optimal screw insertional trajectory. We would like to compare the results by analyzing surgical outcome of subacute scaphoid fractures with concentrate on screw trajectory.

### Materials and methods

Between 2000 and 2020, 98 patients with subacute scaphoid fracture, who underwent percutaneous fixation between 2 weeks and 3 months after initial trauma were enrolled. Retrospective review of medical record and pre- and post-operative computerized tomography (CT) was done to determine fracture patterns and screw trajectory. They were divided into perpendicular and non-perpendicular group by measuring fracture lines and screw angles. Tran-Trapezial entry was confirmed through CT. Clinical assessment included range of motion of the wrist joint, Disability of the Arm, Shoulder and Hand (DASH) score, union time of fracture, conversion to revision surgery, and presence of postoperative complications.

### Results

From 98 patients, male was 87, female was 11. Mean age of subacute patients was 33.0. Injury to operation period was 26.3 days. Perpendicular and Non-perpendicular fixed group was 70 to 28. In non-perpendicular group, mean screw length was 23.13( $\pm$ 2.95)mm, mean screw angle was 57.65( $\pm$ 2.40) $^{\circ}$ . 3 patients got trans-trapezial entry. In perpendicular group, mean screw length was 22.32( $\pm$ 2.00)mm, mean screw angle was 83.54( $\pm$ 6.00) $^{\circ}$ . 47 patients got trans-trapezial entry. Last follow up, mean ROM of non-perpendicular group was Dorsal Flexion(DF)/Volar Flexion(VF)/Radial Deviation(RD)/Ulna Deviation(UD); 63.1/70.1/16.3/26.3, mean DASH was 7.52( $\pm$ 10.19), mean union time was 7.75weeks, union rate was 100%, revision rate was 0%. Mean ROM of perpendicular group was DF/VF/RD/UD; 67.4/76.3/17.5/25.8, mean DASH was 6.34( $\pm$ 9.38), mean union time was 7.02weeks, union rate was 100%, revision rate was 0%. No Significant difference was shown on DASH( $p=0.761$ ), Union time( $p=0.461$ ), DF( $p=0.224$ ), VF( $p=0.101$ ), RD ( $p=0.465$ ), and UD( $p=0.814$ ) by statistical analysis between non-perpendicular versus perpendicular fixation. Additionally, from trans-trapezial fixation group, mean DASH(6.58,  $p=0.882$ ), union time(6.96,  $p=0.633$ ), DF/VF/RD/UD ; 68.4/76.7/18.1/26.2 shown quite better outcome, but not statistically significant different from the other.

### Conclusion

The percutaneous trans-trapezial approach facilitates and allows more accurate screw placement. More satisfactory results could be obtained by perpendicular trajectory with percutaneous screw fixation in subacute scaphoid fractures.

## **A-0257** CARPAL INTRAOSSEOUS GANGLIONS - RARE CAUSES OF CHRONIC WRIST PAIN

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**Introduction:** Intraosseous ganglion cysts (IGC) of carpal bones are usually incidental X-ray or CT findings and can lead to chronic wrist pain. They are usually diagnosed after ruling out other more common causes of wrist pain.

**Material and method:** Between January 2016 and January 2021 we treated five patients with symptomatic IGC (lunate 3 pts., scaphoid 1 pt. and trapezium 1 pt.). Here we present two interesting case studies.

**Case 1:** A 40-year-old female without history of trauma was examined for gradually arising pain on the radiopalmar side of the right wrist. The wrist was free of swelling, with no apparent instability, full ROM and painful end positions of flexion and extension. The initial DASH score was 70.83. X-ray showed a round-shaped 7mm defect of trapezium and MRI revealed a bone cyst with communication into the area of the course of the FCR tendon. We performed curettage using radiopalmar approach and the cavity was packed using cancellous bone grafts harvested from Lister's tubercle. Histological examination showed a mucoid cyst with minimal chronic inflammation. After a one year follow-up patient was free of pain, satisfied with DASH score 0.

**Case 2:** A 45-year-old female was treated conservatively for pain near the CMC I joint for suspected rhizartritis. For persistent difficulties she was referred to a hand surgeon. Initial DASH score was 55. Application of local anaesthetics to CMC I joint was without pain relief. Subsequent MRI showed large cyst of scaphoid waist with soft tissue content. Using palmar approach the curettage was performed and defect was filled with spongy bone chips harvested from Lister's tubercle. Histological examination confirmed mucoid cyst. After 10 months follow up the patient was symptom free with DASH score 2.5.

**Conclusion:** The possibility of the presence of an intraosseous ganglion in chronic wrist pain when excluding other causes should be considered. MRI can provide important information. Treatment by curettage and application of spongy bone grafts leads to good results.

## **A-0261** COMPARATIVE EFFECTIVENESS OF PNA WITH AND WITHOUT TRIAMCINOLONE ACETONIDE FOR DUPUYTREN'S CONTRACTURE; AN OBSERVATIONAL MULTICENTER STUDY

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There are studies suggesting that corticosteroids reduce the progression of Dupuytren's disease when injected into nodules. However, there is paucity in literature regarding the additional benefit of steroid usage when applied during Percutaneous Needle Aponeurotomy (PNA). We conducted a comparative study using routinely collected data of patients with primary Dupuytren's contracture who underwent tangential PNA with or without triamcinolone acetonide (TCA)

10 mg/ml between 2012 and 2020.

Adult patients with and without additional TCA injections who completed the Michigan Hand Outcomes Questionnaire (MHQ) at baseline, three months, and twelve months postoperatively were matched on baseline characteristics. The complication rate was assessed with the International Consortium for Health Outcome Measurement (ICHOM) Complications in Hand and Wrist conditions (ICHAW) classification. Data on reoperation (defined as having a second procedure for a new or worsening contracture in the same digit in our clinic) and goniometry (measured at baseline and 3 months after PNA) were also collected.

A total of 120 patients (41 with and 79 without TCA) were included. We found no significant difference in the MHQ scores ( $\beta = -1$ ;  $p = 0.71$ ) and goniometry (whole digit ( $\beta = 3$ ;  $p = 0.51$ ), MCP joint ( $\beta = 4$ ;  $p = 0.17$ ), and PIP joint ( $\beta = -2$ ;  $p = 0.65$ )) between patients with and without TCA. The reoperation rate within five years after PNA was similar between patients with and without TCA (29% and 23%, respectively). However, the complication rate was significantly higher in the TCA group (45%) compared to the no TCA group (21%).

In conclusion, we found similar functional outcomes but more complications using TCA during a PNA. This suggests that the potential benefits of using TCA during PNA do not outweigh the high complication rate.

## **A-0263** THE INTERNAL ROTATION IS IMPORTANT AS THE EXTERNAL ROTATION IN THE FUNCTION IN CHILDREN WITH BRACHIAL PLEXUS BIRTH PALSY

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**Aim:** The aim of this study was to evaluate the effect of internal rotation scores on arm function in conservatively followed children with Brachial Plexus Birth Palsy (BPBP). We also aimed to compare the internal and external rotation scores in children with BPBP.

**Method:** Thirty-two conservatively treated children, mean age  $4,92 \pm 1.91$  years old were included to the study. One child had Type 1, 18 children had Type 2a, 8 children had Type 2b and 5 children had Type 4 involvement according to Modified Narakas Classification. Modified Mallet Scale (MMS) and Active Movement Scale (AMS) were used to evaluate shoulder's active movement range. Functional levels were assessed with using Pediatric Outcomes Data Collection Instrument (PODCI). Correlation analyses were performed between rotation scores and PODCI scores.

**Results:** MMS scores of all children were given as median and minimum-maximum: abduction 4, 3-5; global external rotation 4, 3-4; hand to neck 4, 2-4; hand to spine 3.5, 2-4; hand to mouth 4, 2-4 and internal rotation 4, 2-4. AMS scores of all children were as follows: shoulder flexion 6, 5-7; abduction 6, 5-7; adduction 5, 2-6; external rotation 6, 3-6; internal rotation 5.5, 2-6.

Correlations between MMS-PODCI scores were as follows: abduction ( $p=0.01$ ,  $r=0.567$ ), global external rotation ( $p=0.04$ ,  $r=0.503$ ), hand to neck ( $p<0.01$ ,  $r=0.604$ ), hand to spine ( $p=0.07$ ,  $r=0.474$ ), hand to mouth ( $p=0.01$ ,  $r=0.583$ ), and internal rotation ( $p=0.011$ ,  $r=0.451$ ). Correlations between AMS-PODCI scores were as follows: shoulder flexion ( $p<0.01$ ,  $r=0.617$ ), abduction ( $p<0.01$ ,  $r=0.721$ ), adduction ( $p=0.07$ ,  $r=0.477$ ), external rotation ( $p>0.05$ ), internal rotation ( $p=0.04$ ,  $r=0.505$ ). According to the MMS, Hand to Spine had the lower score; according to the AMS, lower scores were achieved in shoulder adduction and internal rotation movement. Besides, internal and external rotation parameters of MSS were correlated with PODCI. AMS internal rotation was correlated with the functional score whereas external rotation was not.

Conclusion: The results show that the most affected movements were internal rotation and adduction, and they were also important for the function. Generally, treatment approaches are designed to increase abduction and external rotation in BPBP. However, internal rotation is needed for many functional daily living tasks (i.e., perineal hygiene, dress, button up). We suggest that all components of the rotator cuff should be evaluated and improved instead of one-way view.

Keywords: Brachial Plexus Birth Palsy, Rotator Cuff, Upper Extremity Function

## **A-0265** SAFETY AND RELIABILITY OF ANTEROLATERAL THIGH FLAP FOR UPPER EXTREMITY RECONSTRUCTION

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### Background:

When treating soft tissue defects of the hand, well-vascularized flap coverages are necessary. The anterolateral thigh flap (ALT flap), one of the perforator flaps, has been promoted for use in certain surgeries due to favorable features, such as its large and thin skin paddle, long pedicle length and minimal donor site morbidity, despite its disadvantageous anatomical vascular variation. We examined our case series of soft tissue reconstruction of the upper extremities using the ALT flap.

### Materials and Methods:

Seventeen patients who underwent ALT flap with thinning for soft tissue defects in the upper extremities from 2010 to 2020 were included. The patients' mean age was 63.5 (range, 26 to 83) years. Ten of 17 patients were smokers. Defect locations were the dorsum of the hand in seven patients, palm in two patients, dorsum and palm in two patients, and forearm in six patients. Etiologies of the defect were traumatic in 14 patients and malignant tumor in three patients. The defect size was 8 to 25 × 5 to 11-cm. When dissecting the perforators, we preserved the surrounding small muscular and fatty tissue with the perforators and to harvest them together to prevent intima damage. Flap thinning was performed for 16 flaps to adjust the flap thickness to match defect site requirements. We used an end-to-side or interposition arterial anastomosis to regulates the blood flow.

### Results:

All flaps survived. The flap size was 9 to 28 × 5 to 13-cm. One patient had venous congestion and vein re-anastomosis was needed. One patient had a methicillin-resistant *Staphylococcus aureus* infection and debridement and irrigation was needed. No additional defatting surgery was required. The mean follow-up period was 20 (range, 13 to 37) months. Fifteen patients returned their previous activities. The mean DASH score was 30.6 (range, 3 to 70).

### Conclusions:

Flap thickness can be adjusted to match defect site requirements by using the thinning technique. Regardless of patient age and smoking status, the anterolateral thigh flap is one of the safe and reliable surgical options for reconstruction of soft tissue defects of the upper extremities.

## **A-0266** THE ROLE OF MEASURING TWO-POINT DISCRIMINATION IN THE DIAGNOSIS OF CARPAL TUNNEL SYNDROME – IS IT A RELIABLE DIAGNOSTIC TOOL?

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**Background:** Making the clinical decision of operative versus conservative treatment for Carpal Tunnel Syndrome (CTS) still poses grey areas in everyday practice. Most studies come to the conclusion that data from all available diagnostic moduli (physical examination, subjective and objective symptoms, ENG, peripheral nerve ultrasound) must be considered when treating patients with CTS. These moduli differ regarding precision, sensitivity, availability, stress and strain on the patient, and pain.

**Aim:** The goal of our study was to determine the role of measuring the reliability of two-point discrimination (2PD) compared to ENG. We aimed to determine the role that 2PD values may play in establishing a treatment regime for the CTS patient.

**Materials and methods:** Prospective analysis was performed between April 2015 and April 2019 at the Department of Orthopedics Semmelweis University. Inclusion criteria were patients who underwent surgical treatment for carpal tunnel syndrome during this period and underwent ENG examination as a part of the diagnostic procedure. 81 patients met the inclusion criteria. Sensory and motor function of the hand was examined preoperatively. 2 PD values, grip strength, pinch strength, and the results of clinical tests (Tinel-sign, Phalen-sign, hypesthesia) were registered. Symptoms were assessed by the Boston CTS Questionnaire and the Disabilities of the Arm Shoulder and Hand (DASH) score. The two-point discrimination values were correlated with the results of the electroneurographic parameters by numeric value and by category (normal, elongated, severe).

**Results:** A significant correlation was found between distal sensory latency and two-point discrimination values ( $r: 0.25$ ,  $CI: 0.02 - 0.46$ ). The two-point discrimination values also showed a significant correlation with the severity of the disease based on ENG ( $r: 0.29$ ,  $CI: 0.07 - 0.48$ ). We found a negative correlation between the nerve conduction velocity and two-point discrimination values.

**Conclusion:** Based on our limited data there is definitely a correlation between two-point discrimination values and ENG values, however to determine the precise strength of this correlation a larger cohort is needed. However, we may state that measuring 2PD during physical examination is a useful diagnostic tool and it may also orient the hand surgeon regarding severity of the CTS – thereby aiding treatment planning during the visit, before further formal testing is performed.

## **A-0268** STANDARD VS VASCULARIZED BONE GRAFT VS APSI FOR TREATMENT OF PROXIMAL POLE SCAPHOID NON-UNION

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**INTRODUCTION:** The proximal pole non-union remains the main challenge, due to the high instability of the pole and its reduced vascularity. Different techniques are available to treat scaphoid proximal pole non-union: the standard bone graft with screw osteosynthesis is one of the most widespread techniques. Vascularized bone graft from the distal radius,

based on alternative vascular pedicles described by some authors, seems to give good results. More recently, adaptive proximal scaphoid implants (APSI) introduced an alternative solution to address the complexity of surgical treatment and the relatively high risk of non-union relapse. Unfortunately, few studies report comparative outcomes for standard bone graft, vascularized bone graft and APSI. This study compares the primary outcomes, consolidation pain and function, of these three alternative techniques to treat proximal pole scaphoid non-union.

**MATERIALS AND METHODS:** We carried out a multicentric, comparative, retrospective cohort analysis of all patients affected by scaphoid proximal pole non-union. All patients sustained scaphoid surgery between 2011 and 2019, with the minimum follow-up set at 24 months. The authors assessed the radiographic values of scapho-lunate, radio-lunate and intra-scaphoid angles for evaluation of carpal pattern, arthritic evolution and development of possible early stages of carpal collapse, and the carpal height (mm) preoperatively. All patients underwent a Mayo Wrist score and QuickDASH questionnaire. Through multiparametric analysis, the improvements in all radiographic parameters and evaluation scores were evaluated.

**CONCLUSIONS:** From the results of our study, which confirm the current literature, the vascular graft is a valid alternative to the classic cortico-spongious graft, offering superior results in terms of patient quality of life and recovery of the radiocarpal ROM.

Based on our study, the prosthetic alternative (APSI) in this type of patients has proven to be a valid solution, with superior results compared to the techniques previously described in terms of restoring radiographic parameters, with an excellent recovery of the patient wrist and hand functionality, leaving the possibility to perform the rescue techniques now well consolidated in the technical background of Hand Surgery.

## **A-0269** A SYSTEMATIC REVIEW OF NERVE GAP REPAIR: COMPARATIVE EFFECTIVENESS OF ALLOGRAFTS, AUTOGRAFTS, AND CONDUITS

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**Introduction:** An ideal nerve repair is a tensionless direct repair. However, this is often unachievable due to the need to resect back to healthy tissue, resulting in the need to bridge the gap with either autograft, allograft, or conduits. Despite an increasing body of literature direct comparisons for these techniques remain sparse. Therefore, the primary aim of this study was to perform a systematic literature review to compare meaningful recovery rates (defined as  $\geq S3/M3$ ) after allograft, autograft and conduit repairs in nerve gaps  $>5$ mm.

**Methods:** A systematic literature review was performed using PRISMA guidelines. The search was conducted in MEDLINE from January 1980 to March 2020. Criteria were established a priori and included nerve type, repair type, gap length, and functional outcome measures for meaningful recovery rates. Two independent reviewers evaluated each study with respect to inclusion/exclusion criteria and validated the data extraction. Descriptive statistics with weighted averages were calculated for each cohort and a bootstrap method using Monte Carlo methodology to generate the distribution. A p-value of  $<0.05$  was set as statistically significant for all tests.

**Results:** Thirty-five studies with 1,559 results met criteria. The mean follow-up was  $\geq 12$  months ( $n=33$ ). Overall meaningful recovery for sensory and motor function was not significantly different between autograft( $n=670$ ) and allograft( $n=711$ ); sensory 71.8% vs. 81.9%; motor 56.0% vs. 58.3%. When evaluated by gap length and nerve type, the autograft and

allograft groups were also comparable ( $p>0.05$ ). However, meaningful recovery rates for autograft and allograft were significantly better than conduits ( $n=178$ ;  $p=0.031$  and  $0.033$  respectively).

Conclusion: Literature showed that autograft and allograft have comparable rates of meaningful recovery regardless of gap length or nerve type. In addition, both nerve graft types had meaningful recovery rates that were significantly better than conduits.

### **A-0270** MANNERFELT SYNDROME: REVIEW AND CASE REPORT

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Flexor tendon ruptures in rheumatoid arthritis are caused by either attrition on bone spurs or by direct invasion of the tendon by hypertrophic tenosynovium. In 1969 Mannerfelt published his series of flexor tendon ruptures in rheumatoid arthritis from attrition caused by a bony spur in the carpal tunnel. The flexor pollicis longus was the most affected tendon. We present the case of a 67-year-old woman, retired, with rheumatoid arthritis since 2017 and with tenosynovitis already diagnosed by ultrasound. She referred noticing a “click” while using the lighter and afterwards she couldn’t flex her IPJ of her right dominant thumb. The exploration showed hyperextension of her thumb interphalangeal joint with impossibility of flexion. On the ultrasound severe tenosynovitis, carpal bone irregularities and complete flexor pollicis longus tendon rupture in zone V was confirmed. The severity of the patient’s rheumatoid arthritis has a great effect on the outcome of the reconstructive surgery. Treatment options include debridement and direct suture, bridge grafts, flexor digitorum superficialis tendon transfer, or arthrodesis of PIP joint and synovectomy. There is no ideal treatment, and the recovery usually is partial (30–40° of IF flexion). Prevention of tendon ruptures by early tenosynovectomy and the removal of bone spurs should be the goal of the surgeon.

### **A-0273** TREATMENT OF CALCIFIC TENDINITIS AROUND THE ELBOW

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Purpose: To evaluate surgical outcomes in calcific tendinitis around the elbow due to persistent pain despite conservative treatment.

Methods: The study retrospectively reviewed seven consecutive patients who visited Jeju National University Hospital due to pain around the elbow and underwent operative treatment due to persisting calcific lesion evidenced by radiographs and ultrasonography. The patients’ mean age was 40 years, and the average follow-up was 5 years and 10 months. Surgical procedures were performed under brachial plexus block anesthesia to remove calcific deposits at the common extensor tendon with incision around the lesion along with repair of partially ruptured tendons during the removal using nonabsorbable sutures. The patients were immobilized with a long-arm splint in a neutral position for 2 weeks after operation, followed by rehabilitation involving continuous passive motion and physical therapy for elbow joint range of motion and muscle strengthening, respectively. Intraoperative biopsy revealed inflammatory cells and microcalcification

indicative of calcific tendinitis in all patients. Surgical outcome was evaluated based on patient's subjective satisfaction under five-point grading scale, Mayo Elbow Performance Index (MEPI) score, and the Disabilities of the Arm, Shoulder and Hand (DASH) score.

Results: The patient's subjective satisfaction scale revealed "very satisfactory" in three cases and "satisfactory" in four cases. The median MEPI and DASH score were preoperatively 45 and 88.8, which improved to 85 and 36.2 at final follow-up, respectively.

Conclusion: In patients with persistent pain despite aggressive conservative treatment in calcific tendinitis, direct surgical removal of calcific deposit is an effective way to resolve symptom and prevent recurrence.

## **A-0274** INTERPOSITION ARTHROPLASTY WITH EXTENSOR TENDON GRAFT IN POST-TRAUMATIC OSTEOCHONDRAL DEFECTS OF PROXIMAL INTER-PHALANGEAL JOINT: A CASE SERIES

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Osteochondral defect of the proximal inter-phalangeal joint often need arthrodesis or arthroplasty with metal or silicone implants, joint resurfacing with synthetic or autologous implants.

However, all these approaches may have disadvantages.

Arthrodesis, by fusion of the joint, causes complete loss of motion, on the other side total joint arthroplasties showed high rates of complications, including loosening of the prosthesis, infection, bone absorption, instability and for these reasons it's non indicated in blue collar workers and active young patients.

Autologous osteochondral grafts require harvest from an intact joint with risk of donor site morbidity.

Another surgical option for osteochondral defect can be volar plate interposition arthroplasty described by Malerich.

In these paper we report our case series of five patients affected by severe post-traumatic osteochondral defect with chronic pain and functional impairment, who underwent interposition arthroplasty with a personal modified technique using an extensor tendon graft.

All patients were male, blue collar workers, average age 46 years old.

Pre operative range of motion, grip and pinch strength and DASH SCORE were recorded and compared with post operative results with an average follow up of 26 months.

All patients presented a severe joint contracture: average active and passive pre-operative flexion was 7°(2-11°).

Patients were operated under Walant. A dorsal surgical approach was performed, a dorsal arthrolysis was required, a tendon graft from central slip was harvested to fill joint space.

Two patients also needed flexor tendon tenolysis to recover active motion.

Early rehabilitation program was started 2 days after surgery.

The average post operative flexion increased from 7° to 68°. Grip strength increased from 38.2 KG to 43.5 KG, DASH score improved and all patients were able to return to their work and to their hobbies, without pain and instability. No complications on extensor mechanism were reported.

As our results showed interposition arthroplasty represents a good alternative both to arthrodesis and to arthroplasty with prosthesis also in blue collar workers, and avoids many of the complications inherent to these procedures.

key words: interposition arthroplasty, osteochondral defect, proximal inter-phalangeal joint, post-traumatic osteoarthritis.

## **A-0275** COMPARISON OF THE POOLE TRACTION SPLINT AGAINST SURGERY OR CONSERVATIVE MANAGEMENT OF PHALANGEAL FRACTURES OF THE HAND

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**Background:** Hand phalangeal fractures can be difficult to treat. Surgical intervention could create more soft tissue damage, leading to a higher incidence of adhesions; however, if the fracture is unstable the soft tissue complex will be stressed, also leading to adhesions. The aim of this audit was to compare outcomes and cost to the NHS of 3 groups of patients who had a fracture to the proximal phalanx: surgical fixation (OP group), conservative management in a static metacarpophalangeal joint (MCPJ) flexion blocking splint (CM group), and the Poole traction splint (PTS group). **Method:** This was a retrospective analysis of 3 groups of gender and age-match patients from a major trauma centre who had similar fracture presentations but underwent different interventions due to changes in hospital protocols related to the COVID-19 lockdowns. OP group underwent surgery under the pre-lockdown protocols. PTS group underwent splinting during the lockdown. CM group received conservative management including MCPJ flexion splint with IPs free to move after lockdown when hospital protocol for conservative management had been broadened. All groups received hand therapy in the same specialist hand unit. **Outcomes:** Number of hand therapy sessions [median (IQR)] was 6.5 (4.8) in OP group, 4.8 (3.0) in CM group, and 7.9 (5.3) in PTS group. Return to work (days) after the initial hand therapy session was 71.4 (35.3) for OP group, 15.9 (24.5) for CM group, and 113.14 (119) for PTS group (after removal of patients with splints on multiple fingers, 45.2 (32)). Range of motion (Strickland outcomes) after 6 hand therapy sessions, or discharge if first, was Excellent in 7 patients (7 fingers) and Good in 1 patient (2 fingers) in OP group, Excellent in 9 patients (9 fingers) and Fair in 1 patient (1 finger) in CM group, and Excellent in 7 patients (8 fingers) and Poor in 1 patient (3 fingers) in PTS group. Estimated cost for initial treatment (£/procedure) was £66.66 for the PTS group (based on 2018 NHS costs for materials, trust overheads and clinician), £3069 for the OP group, and £160 for the CM group. The follow up sessions in hand therapy were £29.33 irrespective of the intervention received. **Discussion:** ROM outcomes appear similar among all groups while return to work and number of hand therapy sessions appear to be better in the CM group; however due to the small number of patients in each group, statistical comparisons could not be made. The change of practice and protocols after the lockdowns opened up conservative management, specifically the MCPJ flexion splint, to patients with potentially unstable fractures but no functional limitations which could have similar or better outcomes than surgery or Poole traction splints in this clinical group. The MCPJ flexion splint would also present less economic burden on the hospital. Future studies should compare conservative management and surgical intervention prospectively in larger sample sizes. **Keywords:** Hand fractures, phalangeal, orthosis, conservative management, poole traction splint

## **A-0276** CLINICAL AND NEUROPHYSIOLOGICAL RESULTS TWO YEARS AFTER AIN TO DBUN TRANSFER FOR COMPLETE PROXIMAL ULNAR NERVE LESIONS

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Nerve transfers have been suggested as a possible way of improving results after proximal ulnar nerve repair in adults,

but there are still many unanswered questions around their use. The purpose of this prospective cohort study was to give a detailed assessment of results, both clinically and neurophysiologically, after the use of a distal nerve transfer to augment traditional proximal ulnar nerve repair.

Adult patients with isolated, total ulnar nerve injuries at the elbow or proximal were offered the nerve transfer which was performed concomitantly with proximal repair, or at the latest 1.5 yrs after nerve injury. The proximal injury was repaired with either direct epineurial suture or graft reconstruction. Distally the anterior interosseous nerve was sutured to the side of the ulnar nerve motor branch via a perineurial window (reverse, or supercharged end to side). Patients were assessed preoperatively and after 9,12 and 24 months clinically (strength measurements, clawing, Froment's sign, the Rosen Score and quick DASH) and neurophysiologically (assessing both the motor and sensory recovery)

Results are presented as median with range. Nine patients were included (6 men), median age 40 (27-55). There were 7 sharp injuries and 2 iatrogenic nerve injuries. Seven nerves could be sutured directly, whilst 2 required graft reconstruction (ipsilateral sural nerve). The proximal repair was performed at median 3 (1-90) days after injury, whilst the nerve transfer was performed median 1 (0-17) month later. At the last follow up there were significant improvements in the quick DASH from 35.3 (11.4-63.6) to 16 (2.3-52.3), grip- and key pinch strength from 43 (25-90) to 77 (43-87) and 33 (20-48) to 53(43-73) % of the healthy side respectively. The Rosen motor subscore improved significantly from 0.27 (0.13-0.56) to 66 (0.32-0.87) as did the sensory subscore from 0.26 (0.18-0.33) to 0.42 (0.29-0.51). At final follow up (2 yrs, n=8) half the patients had a persisting positive Froment's sign and 2 showed persisting clawing of the 4th and 5th digits. Six patients had a weak adduction of the 5th digit (Wartenberg's sign). EMG showed signs of reinnervation from one year, but we could only show definite signs of a functional nerve transfer in one patient (who unfortunately had a poor clinical result). Thermal thresholds (C-fibres) improved in all patients and was almost normalised (particularly the cold threshold) at 2 years.

We saw an improvement in function throughout the study period, but this seems in a large part to be due to reinnervation across the proximal nerve repair. The contribution from the nerve transfer was difficult to show. The recovery of the intrinsic musculature was only moderate at two years, whilst there was a significant sensory recovery (signifying proximal reinnervation). Thus, we conclude that in this cohort the contribution of the nerve transfer seems to be small.

## **A-0277** EXTERNAL FIXATION SYSTEM IS A VALID TREATMENT CHOICE IN DISTAL RADIUS FRACTURES: CLINICAL AND RADIOLOGICAL FOLLOW-UP OF 22 CASES

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**Background:** Distal radius fractures are common condition, with an estimated incidence of 643,000 cases each year in the USA. These fractures are a major burden on the healthcare system (535 million per year). The optimal method of fixation remains a topic of debate. The most common treatment is open reduction with internal fixation (ORIF) with volar plate. But this method is not without its complications. The use of an external fixator allows good reduction of the fracture, with ample maneuverability due to the use of various pins, allowing early mobilization, less surgical disability, and ambulatory removal of the pins, instead of surgery.

**Materials and methods:** Twenty-two patients with distal radius fractures who had been treated with an external fixator in the last 2 years were evaluated. In the observational study, articulation, limitations in daily activities and strength were evaluated.

**Results:** In the study fractures 23A2 (9 patients), 23A3 (1), 23B1 (1), 23B3 (4), 23C1 (2), 23C2 (4), 23C3(1) were evaluated.

an average flexion of 50.21°, an average extension of 64.5°, an average pronation and supination of 86.7° were seen. an average DASH value of 11% and an average PRWHE value of 12% were seen. The reduction, at radiological level, has been sufficiently achieved.

Conclusions: Treatment with an external fixator remains an excellent alternative to plate. Costs and disability are lower for the NHS. The major advantage is early mobilization and low local invasiveness.

## **A-0279** LONG-TERM FOLLOW-UP OF SCAPHO-LUNATE RECONSTRUCTION WITH THE DRAW TECHNIQUE

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Background: Aim of this study was to evaluate the long-term effectiveness of the DRAW technique, which is a personal arthroscopic-assisted minimally invasive technique to reconstruct the scapholunate (SL) ligament using the trapezoid-to-second metacarpal joint bone–ligament–bone graft.

Materials and Methods: Between January 2009 and June 2014, thirty-one patients underwent the arthroscopic-assisted minimally invasive technique to reconstruct the SL ligament. All patients presented with chronic (>6 weeks) SL dissociation (19 Geissler type III, 12 Geissler type IV lesions) and no signs of arthrosic degeneration. Briefly, the surgical technique consisted in: SL rotatory subluxation reduction and stabilization with percutaneous K-wires, trapezoid-to-second metacarpal graft harvesting that was eventually advanced and secured within a tunnel created through the SL bones. A volar cast in neutral position of the wrist was applied and maintained in place for about 2 months when K-wires were removed and active range of motion exercises began. Follow-up visits were performed at 3, 6, 12 months, and every year afterwards. Radiographic, functional, and subjective outcome measurements were collected during the outpatient visits. Statistical analysis was performed with a significance threshold of  $P < 0.05$ .

Results: Mean follow-up was 71.55 months (range 50 to 115). All the grafts were in place with no SL synostosis or any carpal bone necrosis reported. No progression toward SLAC was observed in any patient. Only four patients had SL gap > 3 mm at the final follow-up however they returned to a pain-free wrist that allowed returning to their daily life activities. Patients were returned to work by the end of the 4th month and to contact sports and heavy jobs by the end of the 6th month. All the radiographic, functional and subjective outcomes analyzed not only significantly improved between the preoperative period and the 24-month follow-up but they also were maintained at the last follow-up or further improved (wrist mobility, grip strength). Conclusions: The DRAW technique ensures anatomical SL ligament reconstruction through a minimally invasive arthroscopic-assisted technique that does not require extensive capsulotomy, hence dramatically lowering the risk for reduced postoperative wrist mobility. The restored normal kinematics was also demonstrated by the long-term follow-up, where functional outcomes were even improved, while wrist degenerative changes were prevented.

## **A-0281** PSEUDOMONAS AERUGINOSA OSTEOMYELITIS AFTER TREATMENT OF THE DISTAL RADIUS FRACTURE

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A 69-year-old female patient was admitted to the hospital due to repeated inflammation after surgery for a fracture of the right ankle at another hospital. At that time, there was a fracture of the right wrist as a comorbid injury, but it was in

a nonunion state. Five months after the first surgery, I & D was performed for osteomyelitis of the right ankle at our clinic, and *Pseudomonas aeruginosa* was identified, and he received long-term antibiotic treatment. During the treatment of osteomyelitis of the ankle, nonunion of the right distal radius was observed. However, half a year after ankle surgery, he visited the hospital again due to painful swelling of the right wrist and was diagnosed with osteomyelitis of the distal radius. First, massive debridement and implant removal were performed. After debridement of a large amount of pus and necrotic tissue, Curettage nonunion site of distal radius. And we put vancomycin mix cement bead on the nonunion site. The surgery was terminated after massive irrigation was performed. *Pseudomonas aeruginosa* was identified as a result of bacterial identification, and antibiotic treatment was performed for 3 months.

After 3 months, infection control was confirmed by blood test and MRI, and reoperation was performed. All of the previously inserted vancomycin mixed cement beads were removed and the nonunion site was cured. All of the previously inserted vancomycin mixed cement beads were removed. Afterwards, an allogeneous bone graft was performed. A locking plate was used for bone fixation. As of 1 year and 8 months after the operation, the infection was completely controlled and a bone union was successfully obtained.

## **A-0285** DORSAL SCAPHOLUNATE INTEROSSEOUS LIGAMENT: ULTRASOUND EVALUATION BETWEEN DOMINANT AND NON DOMINANT WRIST IN YOUNG SPORTS PATIENTS

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we evaluate 60 wrists of 30 young athletic volunteers with ultrasound, recording the SLIL radial-ulnar (length) and dorsal-volar (thickness) dimensions and dimension of the scapholunate interval, comparing it with their non-dominant hand, in order to evaluate the thickness variations of the dorsal component of SLIL between two hands, to confirm our hypothesis that the dorsal component SLIL has proprioceptive activity and therefore the thickness of the ligament increases following wrist activity.

### Materials and Methods

With a high-frequency ultrasound probe > 17 MHz (Sonoscape X3 Pro) we analyze 60 wrists of 30 young manual sports volunteers (16 males, 14 females; 19 right-handed, with average age 28.2years and 10 tennis players, 8 padel players, 7 swimmers, 5gym goers, Table 1) without discomfort in the hand or wrist to participate in the study. For evaluation of the SL ligament, is necessary to positionated the wrist in ulnar deviation, Lister's tubercle is an identifiable landmark on the dorsal wrist to start the exam.

When the ultrasound probe is positioned on its short axis on Lister's tubercle, it appear as a hyperechoic spike on the dorsum of the distal radiu. To identify the SL range, the probe is slid distally through the radiocarpal joint until hyperechoic bodies of the scaphoid and lunate are observed, with the ligament surrounding the space between them. All measurements were obtained in the distal 5 mm of the scapholunate joint to be sure of having measured the dorsal, non-proximal, component of the ligament, according to Berger

Results: We measured an average scapholunate dorsal ligament length 7.2 mm and average thickness of 1.9 mm in the non-dominant hand (Table 3) and average 7.7 mm in length and average 2.3 mm thickness in the dominant hand. The mean dorsal scapholunate interval was average 4.7 mm and the mean central interval was average 1.9 mm in the non dominant hand and 4.9 mm and 2.1 mm in the dominant hand,

The aim of the study is to evaluate, by ultrasound, the possible presence of changes in the thickness of the dorsal component of the scapho-lunate ligament between the dominant and non-dominant hand of subjects who play sports.

In our study we ultrasonographically measured an average scapholunate dorsal ligament length 7.2 mm and average thickness of 1.9 mm in the non-dominant hand and average 7.7 mm in length and average 2.3 mm thickness in the dominant hand and average scapholunate dorsal ligament length 7.2 mm and average thickness of 1.9 mm in the non-dominant hand and average 7.7 mm in length and average 2.3 mm thickness in the dominant hand.

This implies the hypothesis that there is a direct stimulus on the fibrous component of the dorsal SLIL in the dominant hand following repeated use and stress such as to cause an increase in thickness of the ligament just to want to highlight the possibility of a proprioceptivity of the ligament if subjected to continuous stress / training.

### **A-0288** PROXIMAL ROW CARPECTOMY VERSUS FOUR-CORNER FUSION IN THE TREATMENT OF SLAC AND SNAC WRIST: META-ANALYSIS AND LITERATURE REVIEW

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**Objective:** A systematic meta-analysis was performed comparing the results of proximal row carpectomy (PRC) and four-corner arthrodesis (FCA) used in patients with posttraumatic wrist osteoarthritis.

**Methods:** A systematic literature review was performed on 84 articles from 2000 to 2020 that described at least one of both techniques. A qualitative assessment was performed on 14 articles using the Newcastle-Ottawa Scale (NOS) and the National Heart, Lung and Blood Institute (NIH) assessment. Clinical follow-up parameters such as pain, range of motion (ROM) grip strength and complications were analyzed using weighted average means. Meta-analysis with a random effects model was performed for the flexion-extension arc and grip strength.

**Results:** A total of 1066 PRC and 2771 FCA were analyzed with a mean follow-up of 9 and 7 years respectively. Mean flexion after PRC and FCA was 36,2° and 31,1°, mean extension 41,4° and 32,4°, mean grip strength 26,4 kg and 27,5 kg respectively. PRC had a higher flexion-extension arc than FCA with a standard mean difference (SMD) of 0,41 (0,02-0,81). No significant difference was found for grip strength. Osteoarthritis occurred in 42,2% of PRC cases independent of the capitate's shape. Conversion to wrist arthrodesis was performed in 10,1% of failed PRC. Revision was chosen in 4,7% of FCA and conversion to wrist arthrodesis was the treatment of choice in 4,6%.

**Conclusion:** We conclude that functional results of both techniques are equal, but PRC can be preferred above FCA because of the higher complication rate.

### **A-0289** PLATE REMOVAL AFTER SCAPHOID NONUNION FIXATION WITH A VOLAR PLATE: PURSUING MAXIMAL FUNCTIONAL AND PATIENT REPORTED OUTCOMES

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**Introduction:**

Fixation with a volar locking plate and cancellous bone grafting has become a popular technique for treatment of long lasting nonunion of the scaphoid. Although favorable outcomes have been described in literature, removal of the plate is

often considered as a complication of this procedure and might be a reason to renounce this technique. We hypothesized that plate removal contributes to an additional improvement in functional and patient reported outcomes after treatment of scaphoid nonunion using a volar locking plate and should therefore be considered as an essential part of the technique and not as a potential complication.

#### Methods:

All patients that underwent plate removal after previous treatment of a clearly established scaphoid nonunion between November 2013 and march 2022 in our center were included. A total of 87 patients that underwent internal fixation of the scaphoid nonunion using a precontoured 1.5 mm miniplate and autologous bone grafting were considered for inclusion. After radiological confirmation of union, using CT scans at a three-monthly interval, 42 patients underwent plate removal and were analyzed for functional (range of motion (ROM), grip strength) and patient reported outcomes (patient rated wrist-hand evaluation (PRWHE) questionnaire) at a 3 monthly interval.

#### Results:

Out of 87 consecutive patients that were treated for scaphoid nonunion using the above-described technique, the plate was removed in 42 patients (48%) with a mean age of 27 years (16 to 60) and a mean duration of nonunion of 47 months (4 to 216). Mean time to removal of the plate after primary surgery was 12.6 months (3 to 37). Most common reasons for removal of the plate were discomfort or functional limitation (34%), radiographic signs of impingement of the plate on the volar rim of the radius (30%) or both (25%). Mean ROM showed significant additional improvement after plate removal (132 vs. 104 deg,  $p < 0.001$ ). Furthermore, mean grip strength also showed significant additional improvement after plate removal. (88% vs 75%,  $p = 0.023$ ) Regarding patient reported outcomes, PRWHE showed statistically significant improvement after plate removal compared to pre-operative outcomes. Moreover, the improvement should be considered as clinically relevant, since the improvement in PRWHE after plate removal was beyond the minimal clinical important difference. (58 preoperative, 18 after plate removal)

#### Discussion:

Volar plate fixation combined with cancellous bone grafting is an effective technique for treatment of complex and long-lasting scaphoid nonunions. Discomfort, functional limitation and radiographic signs of impingement are frequent reasons to remove the plate and as a consequence, plate removal is often considered as a complication of this technique. We have shown that plate removal may further significantly improve functional and patient reported outcomes and contribute to the acclaimed success of this technique. Moreover, improvement in patient reported outcomes after plate removal is far beyond the minimal clinical important difference, compared to the preoperative situation. As a consequence, plate removal leads to clinically relevant improvement in outcome and should be considered as an essential part of a staged treatment of a complex problem and not as a complication per se.

## **A-0290** PREVALENCE OF POST-TRAUMATIC NEUROPATHIC PAIN AFTER DIGITAL NERVE REPAIR AND FINGER AMPUTATION

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### Introduction

Post-traumatic neuropathic pain is a major factor affecting the quality of life after finger trauma and is reported with considerable variance in the literature. This can partially be attributed to the different methods of determining neuropathic pain. The Douleur Neuropathique 4 (DN4) has been validated to be a reliable and non-invasive tool to assess the presence of neuropathic pain. This study investigated the prevalence of neuropathic pain after finger amputation or digital nerve repair using the DN4 questionnaire.

### Methods

Patients with finger amputation or digital nerve repair were identified between 2011 and 2018 at our institution. After a minimal follow-up of 12 months, the short form DN4 (S-DN4) was used to assess neuropathic pain.

### Results

A total of 120 patients were included: 50 patients with 91 digital amputations and 70 patients with 87 fingers with digital nerve repair. In the amputation group, 32% of the patients had pain, and 18% had neuropathic pain. In the digital nerve repair group, 38% of the patients had pain, and 14% had neuropathic pain.

Secondly, of patient-, trauma-, and treatment-specific factors, only the time between trauma and surgery had a significant negative influence on the prevalence of neuropathic pain in patients with digital nerve repair.

### Conclusion

This study shows that persistent pain and neuropathic pain are common after finger trauma with nerve damage. One of the significant prognostic factors in developing neuropathic pain is treatment delay between trauma and time of digital nerve repair, which is of major clinical relevance for surgical planning of these injuries.

## **A-0291** RESULTS OF A STUDY COMPARING THE MECHANICAL PROPERTIES OF HAND FLEXORS OF PRESERVED AND FRESH CADAVER

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**Introduction:** The flexor apparatus of the hand and forearm is the most mechanically strong and durable fibrous part of the hand. It can be used as a basic reference tissue to determine the strength of other fibrous structures of the hand. The aim of the study was to determine the mechanical resistance of flexors to each other and to compare the mechanical

properties of tendons from preserved cadavers with the mechanical properties of tendons taken from fresh cadavers. Preserved cadavers are more accessible and the measured values validate the robustness of future studies that will be used to determine the mechanical properties of other fibrous structures of the hand.

**Material and Methods:** During the anatomical dissection at the Institute of Anatomy of the Medical Faculty of Masaryk University, the finger flexors were taken: 1. from fresh cadavers; 2. of preserved cadavers. A total of 45 fresh flexor tendons and 40 preserved tendons were included in the study. Tendon diameters were measured at both ends and at half length. In the research laboratory of the Institute of Solid Mechanics, Mechatronics and Biomechanics, FME BUT in Brno, a strength test was performed on a tearing machine.

**Results:** The study managed to evaluate 40 flexors from preserved cadavers, with an average strength of 44.27 MPa. The maximum strength was 94.6 MPa and the lowest 18.7 MPa. Furthermore, 45 flexors from fresh cadavers, whose average strength value was 50.59 MPa with a maximum of 113.3 MPa and a minimum of 24.7 MPa. In terms of comparing the strength of individual flexors relative to each other, the strongest tendon is the superficial flexor of the 5th finger, which has a cross section of 0.98 to 4 mm<sup>2</sup> and whose average strength is 69.2 MPa. The weakest tendon is the superficial flexor of the 3rd finger, which has a cross section of 7.0 to 15.3 mm<sup>2</sup> and whose average strength is 32.4 MPa. Furthermore, the strength curve of flexor tendons was determined depending on their diameter.

**Conclusion:** The measured values show that the range of strength of flexors from preserved cadavers and fresh cadavers is relatively wide, while the average values are so close that from a practical point of view, more easily available preserved preparations can be used for testing in the future. The measured results have a practical impact, on the one hand in determining the minimum tendon diameter necessary for its function in a given muscle, which can safely withstand the force of its tension.

## **A-0292** PREVENTION IS BETTER THAN CURE: SURGICAL METHODS FOR NEUROPATHIC PAIN PREVENTION FOLLOWING AMPUTATION

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### Background

Pain after amputation can be known as residual limb pain (RLP) or phantom limb pain (PLP); however, both can be disabling in daily life with reported incidences of 8% for finger amputations and up to 85% for major limb amputations. The current treatment is focused on reducing the pain after neuropathic pain occurs. However, surgical techniques to prevent neuropathic pain after amputation are available and effective, but they are underutilized. The purpose of the review is to investigate the effects of techniques during amputation to prevent neuropathic pain.

### Methods

A systematic review was performed in multiple databases (Embase, Medline, Web of Science, Scopus, Cochrane, and Google Scholar) and following the PRISMA guidelines. Studies that reported surgical techniques to prevent neuropathic pain during limb amputation were included.

### Results

Of the 6188 selected studies, 13 eligible articles were selected. Five articles reported techniques for finger amputation: neurovascular island flap, centro-central union (CCU), and epineural ligatures, and flaps. For finger amputations, the

use of prevention techniques resulted in a decrease of incidences from 8% to 0–3% with CCU being the most beneficial. For major limb amputations, the incidences for RLP were decreased to 0 to 55% with TMR and RPNI and compared to 64–91% for the control group. Eight articles reported techniques for amputations on major limbs: targeted muscle reinnervation (TMR), targeted nerve implantation, concomitant nerve coaptation, and regenerative peripheral nerve interface (RPNI).

#### Conclusions

Based on the current literature, we state that during finger and major limb amputation, the techniques to prevent neuropathic pain and PLP should be performed.

### **A-0294** TRIBUTE TO A BOOK OR CASE REPORT ON FINGER INJURIES WITH LACK OF SOFT TISSUE ON THE DORSUM OF THE FINGER

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I would like to express my appreciation for a book (*Pedicated Flaps for Coverage of the Limbs – C.Oberlin, D. Bastian, P. Grant, C. Touam, A.Bhaita*) that I received from one of the authors in the beginning of my career as a hand surgeon at my first international Handsurgery Meeting. I still remember a few pieces of advice I got that time and what still work. I am a member of a generation who grew up with books but uses the Internet now. I admit that this presentation looks a little bit nostalgic but I want to show how a book with some simple drawings and short words can give solid help even today. How it can give ideas, support to plan an operation without getting confused during surfing on the Internet when you are bombed with a massive variety of choices. The distally based, retrovascularised digital island flap has worked well in these cases too. Presentation of this flap in this book is described in a simple and easily comprehensible way. I would like to give a «take home message» to our young colleagues with my casereport – the same way I got the book long ago - to remember easily when they meet with similar cases in their own practice.

### **A-0298** HIGH BIOMECHANICAL REQUIREMENT TENDON REPAIR: A NOVEL TECHNIQUE

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**Background:** Tendon lacerations are commonly presented in hand injuries. Tendon repair in flexor Zone 5 has not been a spotlight topic in the literature. The aim of this work is to highlight the importance of high biomechanical requirement tendon repair introducing a Tendon Graft Wrap novel technique (TGW).

**Methods:** In the period between April 2021 and September 2022, we treated 125 flexor Zone 5 injuries at our unit. Gender, age, etiology and surgical complications matches with limited world literature. We analyze biomechanical properties of tendons involved in Zone 5. We propose a functional and anatomical classification for high biomechanical requirement tendons (Type I: <2 cm from Osteotendinous Junction, Type II: Tendon Body and Type III < 2 cm from Musculotendinous Junction). We also introduce our surgical novel technique to manage different types of tendon lacerations according to the proposed classification. We indicate our own rehabilitation protocol: “The 3’s Recovery System” (3 periods; 3 days, 3 weeks and 3 fortnights. 3 routine repetitions with 3 hours rest between each repetition).

Outcomes: Our tendon injury classification permits a more successful repair. It is based on a “like to like” complementary tendon supply to achieve a strong biomechanical reinforcement in our reconstruction. Our rehabilitation protocol is also simple to follow and functional.

Conclusion: Tendon reconstruction still have a field of research and improvements. Our work stands out some specific tendon requirements and propose a simple management with a novel technique.

### **A-0301** THE PERFORATOR PROPELLER HOMODIGITAL FAP: CASE REPORT

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Background: Fingertip injuries are the most common hand injuries in our unit. Numerous homodigital flaps varieties have been described over the years. In 2006, Koshima. described the digital artery perforator flap where the skin paddle design was uncertain. In 2019, Haoliang. described a dorsal artery perforator chain-based propeller perforator flap with no pad specifications. In 2022, Roulet proposed a propeller skin paddle designed in an homodigital flap in an anatomical study but result to exceeds rotational degree permitted on propeller flaps and this may jeopardize the blood flow. In this case report we unify different concepts and techniques resulting on a Perforator Propeller Homodigital (PPH) flap.

Methods: The patient was a 15-year-old female that suffered a bicycle accident. We notice an oblique fingertip injury in the ulnar surface of the distal phalanx in the index finger, with skin and adipose tissue loss and minimal bone exposure. We performed a propeller skin paddle design nourished by a perforator pedicle from the main distal perforator digital artery with a permitted 180-degree rotation. We made a rotation against clockwise, covering the original defect with the larger blade of the propeller and covering 1/3 of the resulting defect from the donor site with the smaller blade of the propeller.

Outcomes: We achieved a full skin coverage of the defect and a minimal scar contracture at the donor site. After 1 week the patient was able to return to her usual school activities. 1 months later, the flap showed optimal blood supply and sensibility test present a complete recovery. The nail growing and cosmetic aspect was equal to the non-injured fingers.

Conclusions: Homodigital perforator propeller flaps are an uncommon but elegant reconstruction alternative. This case report results on a refinement of this versatile and reliable flap.

### **A-0302** RING AVULSION INJURIES

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Introduction: Ring avulsion injuries presents 2 - 4% of loss injuries on the upper limb. Urbaniak classifies injuries according to the typical extent of injury. The force of 375N is required to tear off the scalp. Method: Between 2007 and 2021, 21 patients with ring avulsion injuries (11 men and 10 women) were treated at Department of Plastic and Aesthetic Surgery in Brno. The IV finger of the left hand was most often affected (12 cases). According to Urbaniak, type II A and type II B in 1 case, type II C in 2 cases and the most common type III in 17 cases were observed. Results: Within the group of, amputation of finger was primarily performed in 5 patients, due to lack of scalp in 2 patients and due to technical impossibility of replantation in 3 patients. Replantation was performed in 16 patients, followed by finger amputation in 1 patient for

perioperative non-perfusion of the scalp. The other fingers healed without complications. The revision was performed for arterial thrombosis in 3 cases and for venous thrombosis in 2 cases. A venous graft was used for the reconstruction of the arterial flow in 11 cases (69%), for the reconstruction of the veins in 2 cases (13%). Mean total active motion was 195° (ranging from 175° to 220°). Mean 2-point discrimination was 8.6 mm static (ranging from 4 to 11 mm) and 6.2 mm moving (ranging from 3 to 9 mm).

Conclusion: Finger replantation in patients with ring avulsion injury using a venous graft to reconstruct digital artery has a high probability of success (88%) and is the method of choice.

## **A-0304** USEFULNESS OF ENHANCED MAGNETIC RESONANCE IMAGING IN LATERAL EPICONDYLITIS; A NOVEL CLASSIFICATION CORRELATED WITH PAIN

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### Introduction

Magnetic resonance imaging (MRI) has been known to not reflect the severity of the lateral epicondylitis. Although some authors have reported a meaningful finding in conventional MRI, it is not yet widely accepted that MRI is useful for evaluating the lateral epicondylitis. The purpose of this study is to evaluate the relationship between patient's perceptive pain and a novel classification of lateral epicondylitis using the contrast-enhanced MRI.

### Method

A retrospective study was conducted on 50 patients who were clinically diagnosed with lateral epicondylitis and took contrast-enhanced 3.0-T MRI. The patient's pain level was addressed with visual analogue scale (VAS), and the involvement of the common extension tendon (CET) origin, radial collateral ligament (RCL), lateral ulnar collateral ligament (LUCL), and plica were evaluated using T2-weighted images, and the enhancement of CET and subcutaneous tissue was evaluated and scored using a novel classification in the enhanced T1-weighted images. The evaluation was conducted by one orthopedic surgeon and one musculoskeletal radiology specialist, and the intraclass correlation coefficient (ICC) 2-way random model on absolute agreement was used to analyze the inter- and intraobserver reliability. Pearson correlation analysis was performed to evaluate the relationship between patient's VAS and MRI finding.

### Result

The average age of 50 patients was 49.8 (31-66) years, the average morbidity period was 15 months (1-72), and the average VAS was 7 (3-9). In T2-weighted image evaluation, correlation of VAS and grade of CET, RCL, LUCL, and plica were -0.03 ( $p=0.87$ ), -0.03 ( $p=0.87$ ), -0.14 ( $p=0.39$ ), and 0.36 ( $p=0.02$ ) respectively. Contrast enhancement in T1-weighted images compared with the nonspecific T2-weighted images was observed in 46 of 50 cases (92%). There was significant correlation between patient's VAS and a novel classification (correlation coefficient  $r=0.67$ ,  $p<0.01$ ). Inter- and intraobserver agreements of the evaluation of MRI finding were excellent.

### Conclusion

Contrast-enhanced MRI showed excellent inter- and intra-observer reliabilities for the evaluation of lateral epicondylitis. A novel classification showed significant and positive correlation with severity of pain.

## **A-0306** LONG TERM CHANGES OF BONE DENSITY REDUCTION OCCURS STRONGLY IN DISTAL RADIUS COMPARED WITH SCAPHOID

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[Introduction] It is well known that scaphoid fractures are common in young patients and distal radius fractures are common in elderly patients. It is reported that the fact derives from the deference of bone density in scaphoid and distal radius. But there are no objective reports which proves this fact.

We presumed that bone density in distal radius is more influenced by age, compared to scaphoid. And that this explains the reason of why scaphoid fractures are more common in young patients and distal radius fractures are more common in elderly patients.

[Purpose]The aim of this study is to evaluate long term changes in bone density of distal radius and scaphoid by using quantitative CT.

[Method] Between April 2012 and April 2022, a total of 1343 patients who underwent CT scan of hand, wrist and forearm were extracted from the database of Chiba University Hospital. Patients with distal radial fracture, scaphoid fracture, rheumatoid arthritis, infection, osteoarthritis, lack of calibration phantom were excluded. 102 patients remained and we analyzed the CT data by using MECHANICAL FINDER. Cortical bone and bone marrow were separately analyzed in both Distal radial and scaphoid. In addition, distal radius was divided in subchondral bone and distal radius and distal metaphysis. Multiple regression analysis was used.

[Resoult] Distal radius bone density/scaphoid bone density showed negative correlation (correlation coefficient  $r=0.6863$ ).

[Discussion]This study indicates that bone density in distal radius is more influenced by age, compared to scaphoid. In young patients whose bone density of distal radius is maintained, external force to the wrist causes scaphoid fracture. On the other hand in elderly patients whose bone density of distal radius is declined, distal radius fracture occurs.

[Conclusion]Bone density in distal radius is more influenced by age, compared to scaphoid. This can be one reason of why scaphoid fractures are more common in young patients and distal radius fractures are more common in elderly patients.

## **A-0307** EVALUATION METHOD AND REFERENCE VALUE OF THUMB PRONATION ANGLE IN THUMB OPPOSITION: ANALYSIS OF THE NAIL TIP ANGLE OF THUMB-RING FINGER OPPOSITION

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### Introduction

Disorders of thumb opposition occur in patients with severe carpal tunnel syndrome. Kapandji score is a well-known method for clinical assessment of thumb opposition. However, a high Kapandji score can be obtained by flexion of the thumb alone, making it inappropriate for the assessment of thumb opposition. Correct evaluation of thumb opposition is difficult because it involves three motions: palmar abduction, flexion, and pronation. Although pronation is important in thumb opposition, but a simple method for its evaluation is unavailable, unlike palmar abduction and flexion. In this

study, we hypothesized that the nail tip angle of thumb–ring finger opposition (T-R angle) can be suitable for evaluation of the thumb pronation angle. The purpose of this study was to verify this hypothesis and calculate the reference values for different age groups.

#### Materials and methods

Between October 2021 and March 2022, 600 hands of 300 healthy volunteers were studied. There were 50 volunteers in each of the six age groups (Group 1, 20–39 years old; Group 2, 40–49 years old; Group 3, 50–59 years old; Group 4, 60–69 years old; Group 5, 70–79 years old; and Group 6, ≥80 years old). Each group had equal number of male and female volunteers. Exclusion criteria included pain, deformity, paralysis, sensory disturbance, contracture, a history of trauma in the hand and fingers, and inability to follow the indicated movements. The subjects wore a FASTRAK sensor on the fingernail of the thumb and performed 30 random thumb oppositions. The thumb rotation angle was calculated using FASTRAK data. At the time, T-R angle was photographed and analyzed using image J. The correlation between the two angles was examined. T-R angle of 600 hands of 300 volunteers were measured and the mean [standard deviation (SD)] was calculated for each age group. In addition, the trend between T-R angle and age were examined by the linear trend test.

#### Result

There was a correlation between the thumb pronation and T-R angles ( $\rho = 0.65$ ,  $p < 0.01$ ). The mean (SD) values of T-R angles in different groups were as follows: Group 1, 142.5° (12.36); Group 2, 139.9° (10.13); Group 3, 142.3° (9.69); Group 4, 140.2° (12.56); Group 5, 138.3° (11.90); and Group 6: 135.4° (13.03) presented a negative linear trend with age (test for linear trend,  $p < 0.0001$ ).

#### Discussion

The T-R angle was found to be correlated with the thumb pronation angle, proving its usefulness as an evaluation method for thumb pronation angle in thumb opposition. This test can facilitate early diagnosis of thumb opposition disorder. It can also help in evaluating the disorder's severity and treatment efficacy in clinical settings. The reference value for T-R angle decreases with age and should be considered for subjects based on their age group.

## **A-0308** FEASIBILITY, ACCEPTABILITY AND SAFETY OF 3D PRINTED SPLINTS COMPARED TO PLASTER CASTS FOR THE TREATMENT OF NON-SURGICAL DISTAL RADIUS- AND SCAPHOID FRACTURES

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#### Background:

Splint comfort and optimal return of hand function are important issues in the rehabilitation of conservatively treated distal radius and scaphoid fractures. To date, applying a plaster cast for approximately 6–8 weeks of immobilization is the gold standard. However, these splints are often cumbersome, restricting hand use for light activities while wearing the splint. New 3D technologies such as the design of Patient Specific Anatomical Braces (PSAB) might, therefore, be a good alternative to immobilize such fractures. To design such PSAB, the fractured limb must be scanned, printed in a 3D printer and finally fitted to the patient's forearm.

The primary objective of this study is to assess if the patients' personal experiences and perceptions of safety and satisfaction are superior in the PSAB compared to a custom-made plaster cast while using the hand for light daily activities.

#### Method:

The study is organized in two phases:

Phase I (terminated): A pre-clinical study was conducted with 10 healthy volunteers testing the 3D-splint for 72h. The volunteers completed the self-designed “adult rated splint evaluation questionnaire”. A splint satisfaction score of  $\geq 70\%$  was a prerequisite to start with phase II.

Phase II (ongoing): For the feasibility study, a criteria sample of 20 adult patients is recruited and randomly assigned to either the 3D splint or plaster cast group. The patients complete the self-designed “patient-rated splint evaluation” (PRSE) questionnaire after 2, 4, and 6 weeks. The hand therapists evaluate the “assessment of patient satisfaction” on a weekly basis, while the hand surgeons perform the “assessment of clinical effectiveness” after splint removal. The study duration is planned from 01/07/2021 to 31/12/2022.

Preliminary results:

To date, 23 patients were screened for eligibility. Eight patients were excluded before (no time or interest) and three patients after (other diagnosis, e.g. scapholunate ligament lesion) study inclusion. Fifteen patients have completed the study by September 2022, out of which seven were in the 3D-group. Mean age was 32 years, the ratio men / women was 4:1. Eleven patients had a scaphoid fracture and four a distal radius fracture.

The PRSE questionnaire showed that patients in the 3D group experienced less pain, higher comfort and safety than those in the cast group. Satisfaction with the splint was higher in the 3D (91%) than the cast group (60%). Hand therapists' rating of patient satisfaction was higher in the 3D group regarding splint comfort, odor and skin itchiness. Patient compliance was equally rated between groups. Hand surgeons judged the stability of immobilization of the fracture site, wear pressure related pain, blood circulation and pressure scores after splint removal slightly better in the 3D group.

Conclusion:

The preliminary results of this feasibility study show a trend in favor of the 3D splint from the patients', hand therapists' and surgeons' point of view. The 3D splint seems to be more comfortable than the cast while conveying a high feeling of protection, therefore allowing better hand function during the splint wearing time. Further data collection of five patients will confirm or challenge these preliminary findings.

## **A-0309** SURGICAL TREATMENT FOR TRIGGER FINGER IN DIABETES MELLITUS - A RETROSPECTIVE STUDY USING PROMS AND SWEDISH NATIONAL QUALITY REGISTRIES

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Introduction: Trigger finger (TF) usually has a successful outcome after surgery and diabetes Mellitus (DM) is a known risk factor its development. However, it is still unknown if DM affects outcome after surgery for TF in patients with DM. Our aim was to use data from Swedish national quality registers to explore outcome after open trigger finger release (OTFR) in patients with type 1 (T1D) and type 2 DM (T2D).

Methods: Data included patient reported outcome measurements (PROM) from all OTFR registered in the Swedish national hand surgical register (HAKIR) in individuals aged  $\geq 18$  years between 2010–2020. The data was crosslinked with the Swedish national diabetes register (NDR). Individuals with a concomitant surgical procedure ( $n = 670$ ), OTFR before the date of their DM diagnosis ( $n = 188$ ) and all with an undefined type of DM ( $n = 29$ ) were excluded from further analysis. PROMs included QuickDASH and 8-point questionnaire designed for HAKIR; HQ-8, addressing pain at rest, pain on motion without load, pain on load, stiffness, and overall patient satisfaction preoperatively and at a three and twelve months

after surgery. HQ-8 is scored with a Likert scale from 0 (no problems) to 100 (worst imaginable problems). Outcome after OTFR was calculated using linear mixed models to model how PROMs evolved over time and was presented as estimated means from the models. All models were adjusted for age, stratified by sex, and calculated separately for T1D and T2D and using individuals without DM as the control group.

Results: There were in total 6242 OTFR during the study period whereof 496 with T1D (332, 67% female) and 869 with T2D (451, 52% female). Both the control group and all individuals with T1D and T2D improved their overall QuickDASH scores as well as all studied HQ8-questions three months after surgery ( $p < 0.01$ ). Women with T1D had more symptoms of stiffness ( $p < 0.001$ ) and women with T2D had more pain at rest ( $p < 0.05$ ) as well as motion without load ( $p < 0.01$ ) and pain on load ( $p < 0.05$ ) at three months compared to the control group. However, at 12 months, there were no longer any difference in any of the outcomes studied. Men with T1D and T2D experienced more pain preoperatively ( $p < 0.01$ ); however, there were no difference in outcome at 3 nor 12 months compared to the control group. There was no difference in QuickDASH scores between T1D nor T2D and the control group at three or twelve months among men nor women.

Conclusion: Patients with T1D and T2D can expect the same results after OTFR as individuals without DM although the improvement might take longer time, especially among women with T2D. From a clinical standpoint, these results are important to communicate to the patients with DM when discussion surgical intervention for TF and patient expectations after OTFR.

### **A-0310** SONOGRAPHIC EVALUATION OF TENDINOUS MALLET FINGER TO EXPECT THE EXTENT OF EXTENSION LAG

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Purpose: We attempted to suggest sonographic classification of tendinous mallet finger (TMF) and show how much of flexion deformity and active extension loss of distal interphalangeal joint (DIPJ) would occur, according to our sonographic classification. Materials and method: The inclusion criterion was an acute tendinous mallet finger which occurred within 2 weeks. The tendinous mallet finger with concomitant fractures in the same phalanx, previous injury at DIPJ and late presentation over 2 weeks from the injury was excluded. Ultrasonographic examination was performed and range of motion including extension lag was checked at initial visit, 6 weeks and 3 months from the injury. Finger splint was applied with the affected DIPJ fully extended for 6 weeks. A removable splint was applied additionally for 2-4weeks. Statistical analysis was performed to show the relationship between the sonographic types and amount of extension lag.

Results: 38 patients (23 male and 15 female) with mean age of 48.9 (15-79) years were involved. Mean observation period was 17.1 (12.3-23.5) weeks. Mean extension lag was 42.6(25-80) degrees at initial visit and 24.8 (20-50) degrees at the final follow-up. Sonographic findings at initial visit were classified as three types (1. hypo-echoic, 2. thinned, 3. wavy) according to the echogenicity and the shape of injured segment of terminal extensor tendon. The length of injured extensor segment was 2.6 (2.2-3.4) mm. "Thinned" type was the most common. The mean extension lag was 42.2 degrees in hypo-echogenic type, 42.5 in thinned type and 46.2 in wavy type. According to Jonckheere-Terpstra test, there is statistical significance between the extension lag at the final follow-up and sonographic findings at initial visit.

Conclusion: We thought that sonographic evaluation of TMF would be helpful to expect how much extension lag of the tendinous mallet finger would occur. According to our observation, wavy type TMF was likely to cause more extension lag than hypo-echoic or thinned type TMF.

### **A-0311** EARLY HEALING STRENGTH AND HISTOLOGY OF THE FLEXOR TENDONS REPAIRED WITH KESSLER OR MODIFIED KESSLER METHODS IN A CHICKEN MODEL

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**Objective** The purpose of this study was to assess the strengths and the histological changes of flexor tendon repairs using Kessler (core suture knots placed over the tendon surface) and modified Kessler (core suture knots placed between two tendon ends) in vivo chicken models.

**Material and Methods** Thirty-one long toes of adult chickens were used as experimental models for two groups: Kessler (in 16 toes) and modified Kessler (in 15 toes). The flexor digitorum profundus (FDP) tendons of toes were transected completely. We repaired the FDP tendons with a Kessler or a modified Kessler core suture. The operated toes were immobilized in semi-flexed position with a boxing glove fixation for 3 weeks and free toe motion for another week after surgery. Four weeks after surgery, the healing tendons were measured in a tensile testing machine, the adhesion formation and histological changes were observed.

**Results** The strength of the Kessler repairs was significantly greater than those of the modified Kessler repairs with 35% mean difference. No significant difference was found between adhesion scores and the elastic modulus of the tendons repaired with both techniques. In histological sections, the arrangement of collagen fibers in the modified Kessler repair group was more disordered.

**Conclusions** The tendons repaired with Kessler method are stronger than those with the modified Kessler technique. The knots between tendons ends are detrimental to the early healing strength of digital flexor tendons.

### **A-0312** DIFFERENT DIAGNOSIS OF OBSTETRICAL BRACHIAL PLEXUS PALSY

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To determine the background, symptoms, and other factors that are useful for differential diagnosis of obstetrical brachial plexus palsy (OBPP).

414 cases with suspected OBPP in neonatal period or infancy between 1994 and 2021 were included in this study. We divided them into two groups according to the final diagnosis; OBPP (Group A) and non-OBPP (Group B). Based on patient records, we compared the birth histories of the two groups and investigated physical findings and clinical course characterized as factors in group B.

There were 387 cases (93%) in group A and 27cases (7%) in group B. Final diagnosis in group B were congenital abnormalities including arthrogyposis in 6, hemiplegia in 5, monoplegia including acute flaccid paralysis in 4, trauma in 4, intrauterine molding syndrome in 4, spinal cord infarction in 1, and intramuscular abscess in 1 case. In the remaining 2 cases, OBPP was denied but definite diagnosis was not determined. Regarding birth history, there were statistically significant differences in gestational week (38.4 vs. 39.0 weeks), birth weight (3896 vs. 2910 grams), date of first visit (81 vs. 115 days). Shoulder dystocia was present in 54% of group A, but none in group B. 3% of the cases in group A and 33% in group B was delivered with caesarean section. In all cases, the letter from the referring physician clearly stated that OBPP was suspected. Reasons for rejecting the diagnosis of OBPP were the presence of joint contracture immediately after birth (9/27), abnormal distribution of paralysis (8/27), no paralysis immediately after birth (7/27), and abnormal

findings in cervical spinal cord on MRI (1/27). In the remaining 2 cases, we explored the brachial plexus and found normal appearance of the brachial plexus with normal MRI.

Although the birth histories of the two groups differed significantly, but there were no clear-cut findings to distinguish OBPP. Two patients required brachial plexus exploration, but the differential diagnosis of OBPP was possible in 25 of 27 patients, considering the physical examination and clinical course.

## **A-0316** ULTRASONOGRAPHY AND THE SONOGRAPHIC INDEX – – RELIABLE ALLIES IN THE DIAGNOSIS OF CARPAL TUNNEL SYNDROME

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### Objectives

The purpose of the study was to demonstrate the efficiency and utility of ultrasonography and sonographic index (SIMNCT) in the diagnosis of carpal tunnel syndrome (CTS).

### Methods

We study a group of 120 patients with CTS symptoms, which were examined with ultrasonography. The size of the cross-sectional area of the median nerve was measured at the carpal tunnel inlet and outlet, and the nerve morphology at the passage through the carpal tunnel, while also analyzing the neighbouring structures with the purpose of possibly determining the disease etiology. In all patients, we examined in the affected hand the vertical thickness of the median nerve (MN) as entering into the carpal tunnel (CT) - G1, the lowest vertical thickness in the CT or leaving the CT - G2 and the thickness of the MN in the transverse plane, as entering in the CT - L. Normal values were considered the similar measurements from the healthy hand.

The sonographic index was calculated after the formula:  $SIMNCT = 100\% (1-G2 / G1)$ . We have established the normal value in the healthy hand as  $SIMNCT = 16\%$ .

### Results

We demonstrated a statistically significant sensitivity of median nerve sonographic index at carpal tunnel level ( $p < 0.0001$ ) compared with cross-sectional area (CSA) and flattening ratio in the diagnosis of CTS. By analyzing the SIMNCT developed by us, with a higher value than 16%, we demonstrated a sensitivity of 94.81% and a specificity of 99.66% in establishing the diagnosis of CTS. Thus, we proposed a classification of the CTS severity according to the SIMNCT: normal = 16%, mild = 16-19%, moderate = 19-28%, severe = 28-50%, very severe over 50%.

### Conclusions

Ultrasonography is an effective method of studying the morphology of the carpal tunnel and compressed nerve at various CTS stages and of determining the cause of compression in patients with this disease, being easily used while non-invasive and cheap. The sonographic index at the level of the carpal tunnel is a valuable and practical indicator which can be used in the diagnosis of CTS and it may be also helpful in determining the severity of the lesion. It has a more valuable significance than the flattening ratio (sensitivity 4,49%, specificity 97,95%) and the cross-sectional area (sensitivity 88,76%, specificity 32,08%).

Key words: ultrasonography, sonographic index, diagnosis, carpal tunnel syndrome

## **A-0317** ATYPICAL TUMORS OF THE HAND - CLINICAL AND IMAGISTIC FEATURES

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### Objective

This study highlights the broad spectrum of atypical tumours that can occur in the hand and their features. A thorough understanding of the differential diagnosis of these lesions and comprehensive imagistic examination, such as IRM, is essential for effective care, as the clinical diagnosis is often challenging. Naturally, the biopsy will establish the final diagnosis.

### Methods

This study included 50 patients diagnosed and treated over a period of 9 years at our institute. The patients were subjected to the analysis of tumour localization, clinical imagistic and pathological diagnosis, and maximal tumour size. All lesions were classified as benign soft tissue tumours. Among them, one patient was diagnosed with nailbed neurofibroma, 8 patients with glomus tumour (fingers), 12 patients with schwannoma (fingers), 6 patients with tenosynovitis with rice bodies of idiopathic etiology (mid palm) and 23 patients with lipoma (palm and fingers).

### Results

In all cases, the tumours had a long-term evolution due to delayed and uncertain diagnosis. We described the following clinical and imagistic features. Lipomas were preponderantly localized in the thenar eminence (12 cases), followed by fingers (10 cases) and mid-palm (1 case). The mid-palm lipoma had dimensions of 9.5/5/3.5 cm and weighed 137 grams. The IRM exam offered detailed descriptions of 7 cases: 1 liposarcoma and 6 cases of rice-bodies tenosynovitis. In the liposarcoma case, the image on MRI was of a heterogenous, poorly encapsulated tumour, with thick fibrous septa and nodules on T1-weighted sequences and hyperdense septae on fat-suppressed T2-weighted. For the rice-bodies tenosynovitis, MRI exam showed millimetric and nodular images in the flexor group tendon sheath in T2-weighted sequences, thickening of the synovial membrane with increased vascularization, fluid within the tendon sheath, reactive inflammation around the tendon and swelling of the tendon. MRI aspect of a schwannoma localized a tumoral mass with a moderate hyperintense feature in T1-weighted images and a hyperintense feature on fluid-sensitive sequences. In all cases, the ablation of tumours was successfully performed without relapse, and histopathological examination established the diagnosis. Quality of life was improved, socio-professional reintegration was swift and complete, and functional and aesthetic results were highly satisfactory. The patients rated the results "good" and "very good".

### Conclusions

Hand tumour clinical examination can sometimes be uncertain, as symptoms are similar for different types of tumours. Imagistic investigations, like MRI, can prove useful in such situations. Knowledge of typical and atypical imaging features of hand tumours is essential and can lead to a proper diagnosis. However, ultimately the patient will need a biopsy for a definitive diagnosis to rule out the malignant lesions.

Keywords: lipoma, rice-bodies tenosynovitis, schwannoma, neurofibroma

## **A-0318** COMPLEX TRAUMA WITH SOFT TISSUE AND BONE LOSS IN HAND SURGERY – A REAL RECONSTRUCTIVE CHALLENGE

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### Aim

Bone defects in the hand are frequently encountered as a result of trauma but also as a result of tumour excisions. There are many reconstruction techniques, but they must be adapted to the characteristics and size of the affected bone, the characteristics of the defect and its association with other bone and/or soft tissue lesions, associated defects and patient's bad habits (smoking), and the patient's occupation, social status and preference.

### Material and Method

This study comprises a group of 25 patients with complex trauma of the hand, aged between 27 and 70, with bone defects in the metacarpals and phalanges and also with soft tissue defects. Different techniques were used for bone loss reconstruction: harvesting of autologous bone from a "bank finger" or from a distance (radius) and fixation with osteosynthesis materials, injectable or solid synthetic bone substitutes, techniques used in some cases in association. In some cases, large soft tissue defects required reconstruction and also covering the reconstructed bone with flaps. In most cases the flaps used were loco-regional or remote, because local resources were insufficient due to the large size of the soft tissue defects. Autologous bone fixation was done in all cases with Kirschner wires placed in X. Follow-up of patients was done for 1.5 years, assessing both bone regeneration and possible bone resorption in case of use of autologous bone graft covered with loco-regional or remote flap, with radiological examinations at 1, 2, 6, 12 months after surgery. Functional outcomes were assessed using Disabilities of the Arm, Shoulder and Hand (DASH) score and Range of Motion (ROM) score, pain was assessed with Visual Analogue scale (VAS) scale. Patient satisfaction was also recorded.

### Results

In 16 cases the bone graft required for reconstruction of a metacarpal or phalanx was harvested from another traumatized finger (without indication for reconstruction) - "bank finger", in 6 other cases the graft harvested from the distal end of the radius was used, and in 3 cases solid bone substitute could be used. In 7 cases there were consistent soft tissue defects, so that the use of fascio-cutaneous flaps was necessary: posterior interosseous flap (3 cases), radial flap (2 cases), McGregor flap (2 cases). In all cases the immediate and late postoperative evolution was favorable, with no intraoperative accidents or incidents or disturbances of vascular supply to the flaps or venous congestion. In all cases the patient satisfaction was maximal.

### Conclusions

The use of autologous bone graft in bone defects reconstruction remains the gold standard. It is recommended for use whenever it is possible, although this technique has several disadvantages such as: a new operating field, a donor site with possible long term morbidity and pain. The intervention has a prolonged estimated time and longer anesthesia. The use of bone substitutes is a developing trend, with a facile use; they are available in different forms: solid or liquid. The intervention time is reduced, and a donor site is no longer needed.

Key words: complex trauma, bone loss, soft tissue defect, flap, autologous bone

### **A-0319** WALANT TECHNIQUE: WHEN, WHY, WHERE, HOW?

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#### Objectives:

Prof. Lalonde revolutionized hand surgery by introducing local anesthesia without sedation and tourniquet. Good results, technique safety and patient satisfaction made us ask ourselves, "what are the limits of this technique?". We performed a prospective analysis of patients who underwent hand surgical interventions under WALANT with reduced anesthetic dose.

#### Material and method:

Our personal experience is based on 198 patients, aged between 20 and 77 years, 88 women and 110 men, with various hand and finger pathologies. The study included patients with Dupuytren disease in different stages of evolution, carpal tunnel syndrome, trigger finger, and acute pathologies like zone 2 flexor tendons and digital neurovascular bundles injuries, fractures of the metacarpal and phalanx bones. In all the cases, we used local anesthesia with lidocaine 1% and epinephrine (1:100.000 concentration). We reviewed literature dosing recommendations and decreased them by 5% to 40%. The most significant decrease was noticed in 20 cases of carpal tunnel syndrome. We always respected the injection points recommended in the literature.

#### Results

There were no operative incidents or accidents, skin necrosis or other complications related to the effects of adrenaline. Patient satisfaction was high in all the cases, and the costs were significantly reduced due to short-term (several hours) hospitalization. Surgeries were performed during the pandemic in safe conditions, for both patients and surgeons, with fewer medical employees and lower costs. Hand surgical interventions under WALANT are found to be safe and present comparable operative and functional outcomes to more traditional anesthetic techniques, with additional advantages.

#### Conclusions

WALANT technique is safe, easy, and less expensive. It assures the necessary comfort for both the patient and the surgeon, allowing a dissection in similar visibility conditions as an exsanguinated surgical field obtained using a tourniquet. WALANT was a real ally in the fight against the pandemic. The possibility of decreasing the anesthetic dose will bring an additional advantage to this surgical technique.

Key words: local anesthesia, walant, hand, surgery

### **A-0320** IMMUNOREGULATORY ROLE OF ORGAN SPECIFIC NK CELLS IN P3 DIGIT TIP REGENERATION

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Finger regeneration in mammals has been shown to be less comprehensive compared to amphibian models. Part of the reason for this difference in regenerative capacity is due to the immune system. The effects of immune cells, such as macrophages, on regeneration have been well examined, however the role of Nature Killer (NK) cells remains largely unknown. Here, we demonstrate the importance of NK cells in regeneration and that the effects of these cells depend

on tissue origin.

Amputation of the distal one-third of the terminal phalanges was performed on aged matched 8-10 week old immunodeficient NSG mice. Two digits per hind paw (digits 2 and 4) were amputated. Digit number 3 functioned as an uninjured control. Adoptive cell transfer (ACT) of flow cytometry purified splenic NK (SpNK) or thymic NK (ThNK) cells from C57BL/6 mice were injected via the tail vein. Changes in hard and soft tissue volume were assessed using microCT and histology. To determine immune cell presence and receptor expression in the regenerating digit tip we used immunofluorescent staining and flow cytometry.

We confirmed NK cell recruitment to the regenerating digit tip. NK cell cytotoxicity was observed against osteoclast and osteoblast progenitors. ACT of ThNK cells induced apoptosis with a reduction of osteoclasts, osteoblasts, and proliferative cells, resulting in inhibition of regeneration. By contrast, ACT of splenic NK cells showed reduced cytotoxicity towards progenitor cells and improved regeneration. Adoptive transfer of NK cells deficient in NK cell activation genes identified that promotion of regeneration by SpNK cells requires *Ncr1*, whereas inhibition by ThNK cells is mediated via *Klrk1* and perforin. These findings yield insight into mammalian digit tip regeneration and demonstrate the importance of NK cells on regenerative ability. Successful future therapies aimed at enhancing regeneration will require a deeper understanding of progenitor cell protection from NK cell cytotoxicity.

### **A-0321** THE EFFECTS OF VASOPRESSOR USE IN FREE FLAP TRANSPLANTS IN PATIENTS WITH VASCULAR COMORBIDITIES: A RETROSPECTIVE STUDY

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The perioperative use of vasopressors in free flap surgeries is controversially debated. The predominant concern is pedicle blood supply will be negatively affected, thus leading to increased post-operative complications. However, little is known about the relationship between vasopressor use and its impact on intrinsic blood supply of free flaps. Comorbidities that diminish blood circulation may cause a higher risk of necrosis from vasopressor use due to the decreased intrinsic free flap blood supply. The aim of this study is to establish the role of peri-operative vasopressors in free flap necrosis based on flap localization and patients' comorbidities. We retrospectively analyzed 106 patients that received free flap treatment between 2006 and 2020 stratifying based on age, sex, body mass index (BMI), and smokers vs non-smokers. We assessed the role of mean arterial pressure (MAP) and the perioperative use of catecholamine during free flap surgeries using univariate and multivariate analyses. The use of fasciocutaneous flaps, especially on breast and extremities in patients with vascular disease, had the highest risk for marginal flap necrosis (OR: 1.64,  $p=0.01$ ). Musculocutaneous free flap transplanted on central body defects were less affected by catecholamine use (OR: 1.01  $p=0.05$ ). In summary fasciocutaneous flaps used on extremities in patients with cardiovascular disease showed the greatest vulnerability to high vasopressor use. Additionally, we identified that low MAP ( $<65\text{mmHg}$ ) in patients with peripheral artery disease (PAD) led to increased flap marginal necrosis (OR: 1.32  $p=0.02$ ). To minimize the risk of flap marginal necrosis in patients with cardiovascular disease, we recommend limited use of catecholamine or minimizing the flap size, particularly when using fasciocutaneous flaps to cover defects on extremities. Maintaining a mean arterial pressure above 65mmHg in patients with PAD was beneficial.

## **A-0322** AN ALTERNATIVE TREATMENT FOR DEGENERATIVE TRIANGULAR FIBROCARILAGE COMPLEX INJURIES WITH DISTAL RADIOULNAR JOINT INSTABILITY: FIRST EXPERIENCE WITH 48 PATIENTS

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Ulna impaction syndrome (UIS) combined with distal radioulnar joint (DRUJ) instability due to irreparable degenerative triangular fibrocartilage complex (TFCC) injuries often results in ulnar-sided wrist pain and can lead to disability in daily activities. Treatment of this condition can be complex. We describe the outcomes of a novel technique for restoring DRUJ stability due to UIS using a distally based longitudinal extensor carpi ulnaris tendon split (ECU) combined with Ulna Shortening Osteotomy (USO).

We report on 48 patients with irreparable degenerative TFCC injuries with DRUJ instability who received ulna shortening osteotomy (USO), combined with a distally based longitudinal ECU split, between 2012 and 2020. Wrist function and pain were evaluated with the Patient Rated Wrist/Hand Evaluation (PRWHE) at intake, 3 and 12 months postoperative. Active range of motion (AROM) and grip strength were measured at intake, 3 and 12 months postoperative. Complications were scored using the International Consortium for Health Measurement Complications in Hand and Wrist Conditions (ICHAW) tool.

The PRWHE total score improved from 66 (SD =15) at intake to 40 (25) at 3 months, and 28 (23) at 12 months postoperatively ( $P<0.001$ ). The AROM showed a significant improvement in dorsal flexion and palmar flexion from 53° (11) at intake to 65° (8) 12 months ( $P<0.001$ ) and from 45° (10) to 56° (12) ( $P=0.01$ ), respectively. Mean grip strength improved significantly from 22 kg (12) at intake to 29 kg (11) at 12 months ( $P<0.001$ ). The most common complication seen in this study was hardware removal (75%).

In conclusion, adding a distally based longitudinal ECU split to USO for restoring DRUJ stability, seems to be an effective treatment in patients with irreparable degenerative TFCC injuries due to UIS. Hardware removal was often performed, probably due to its dorsal position, as shown in a previous study in isolated ulna shortening osteotomy.

## **A-0323** PREDICTORS FOR IMPAIRED FOREARM ROTATION AFTER BOTH-BONE FOREARM FRACTURES IN CHILDREN

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### Background

Patient-, fracture- and treatment-related factors can determine the clinical outcome after a both-bone forearm fracture in a child. Previously, 410 consecutive children with both-bone forearm fractures were prospectively followed and 37% had a limitation of pro-supination of  $\geq 20^\circ$  at six months after trauma. Diaphyseally-located fracture and re-fracture were identified as risk factors for functional impairment at short-term follow-up. We aimed to assess the functional outcome at minimum 5-year follow-up, as it might change insights into how to treat pediatric both-bone forearm fractures. We asked: "Which factors are associated with limitation of pro-supination after pediatric both-bone forearm fractures at minimum 5-year follow-up?"

### Patients and methods

We analyzed the minimum 5-year follow-up study of a prospective multi-centre study. 410 consecutive children aged

<16 years who presented with a both-bone forearm fracture were included. Treatment strategy varied as patients were included in various randomized controlled trials: Undisplaced distal fractures were randomized between below-elbow and above-elbow cast (BEC/AEC); Displaced distal fractures were randomized between closed reduction with or without K-wires fixation; Stable diaphyseal fractures were randomized between AEC and early conversion to BEC; Unstable diaphyseal fractures were treated with 1 or 2 intramedullary nails. The criteria for reduction and re-manipulation were set a priori: closed reduction was performed in cases with >15° of angulation in children aged <10 years; or >10° of angulation in children aged 10-16 years. All participants were invited for clinical re-evaluation at minimum 5-year follow-up. Our primary outcome measure was limitation of pro-supination. Multivariate logistic regression analysis was used to assess the relationship between clinical factors and persisting limitation of pro-supination ( $\geq 20^\circ$ ).

### Results

At minimum 5-year follow-up, 315 out of 410 participants (77%) with 145 diaphyseal and 170 distal fractures were included with a mean follow-up of 7.2 years. Re-displacements occurred in 48% of non-operatively treated displaced distal fractures and 34% of non-operatively treated displaced diaphyseal fractures. Re-displacement was accepted in 63% of re-displacements in the expectation of spontaneous correction by growth. There was a re-fracture rate of 17% in distal fractures and 11% in diaphyseal fractures. 14 diaphyseal re-fractures required re-operation, while only 2 distal re-fractures required re-operation. At minimum 5-year follow-up there was a limitation in pro-supination of  $\geq 20^\circ$  in 8.6% of patients. Multivariate logistic regression analysis revealed that factors associated with inferior functional outcomes were: Re-fracture requiring a re-operation with an odds ratio (OR) of 4.8 ( $p=0.015$ ); Accepted distal re-displacement managed without K-wire fixation with an OR of 4.3 ( $p=0.047$ ).

### Conclusions

Factors associated with inferior functional outcomes at long-term follow-up were re-fracture requiring re-operation, which particularly occurred in diaphyseal forearm fractures, and accepted re-displacement of distal forearm fractures managed without K-wire fixation. Therefore, in reduced distal forearm fractures weekly radiographic monitoring to detect re-displacement is recommended if no additional K-wires are used. Especially in diaphyseal forearm fractures, at cast removal, parents should be counseled that the fracture is still healing and high-risk activities should be restricted to prevent re-fractures.

## **A-0327** OVERUSE OF PSYCHOACTIVE ANALGESICS (OPIOIDS AND GABAPENTINOID DRUGS) IN THE SWEDISH POPULATION AND SURGERY FOR CARPAL TUNNEL SYNDROME AND ULNAR NERVE ENTRAPMENT

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The increased risk for overuse of opioids and other psychoactive analgesics after surgical procedures is relevant in public health. Knowledge about overuse before and after surgery for carpal tunnel syndrome (CTS) and ulnar nerve entrapment (UNE), or combination of both, compared to the general population, is limited. Our aim was to investigate if patients treated with primary surgery for CTS and UNE, or both, have a higher risk of later overuse of psychoactive analgesics (i.e., opioids and gabapentinoid drugs) than observed in the general population after accounting for demographical,

socioeconomical and behavioural (i.e., previous overuse of psychoactive analgesics) factors.

Using a large record linkage database [Total Swedish Population and Longitudinal Integration Database for Health Insurance and Labour Market Studies (Statistics Sweden), National Patient Register, Cause of Death Register and Swedish Prescribed Drug Register, (National Board of Health and Welfare)], we applied logistic regression to estimate relative risk (RR; 95% confidence interval; CI) and area under curve (AUC) to estimate discriminatory accuracy of the models. We analysed 5,966,444 individuals aged 25–80 years residing in Sweden by December 31st, 2010. We followed them until 2014, of which 31,452 underwent surgery for the present conditions 2011–2013.

Previous use of psychoactive analgesics (during 1 year prior to surgery) was distinguished from posterior use of psychoactive analgesics (during 1 year from the second month from surgery episode). In individuals without surgery, we used 31st December 2010 as index date. In those periods we calculated time covered by drugs for one year using cumulative number of defined daily doses of dispensations divided by 365. We arbitrarily defined outcome variable posterior overuse of psychoactive analgesics as a binary variable defined as “1” if proportion of covered time within studied year was >60% and as “0” otherwise. Concerning previous use of psychoactive analgesics, we constructed five categories of use (no use, <20%, 20–40%, 40–60% and >60%) as we assumed risk of posterior overuse could depend of intensity of previous use. Overall, overuse (proportion of covered time within studied year >60%) of psychoactive analgesics was low in the general population without undergoing surgery (i.e., 0.85%), but compared to those individuals, unadjusted RR of overuse was 2.77 (2.57–3.00), 6.52 (5.46–7.79) and 6.21 (4.27–9.02) in patients with surgery for CTS, UNE and combined, respectively. These risks disappeared [i.e., 0.80 (0.71–0.91), 1.22 (0.91–1.64) and 1.10 (0.60–2.01)] after adjustment for demographical and socioeconomical factors as well as previous overuse of the psychoactive analgesics. The discriminatory accuracy of the fully adjusted model was outstanding (AUC= 0.969).

Socioeconomic factors, and especially previous overuse of drugs, are strongly associated to overuse of drugs after surgery. However, undergoing surgery has a relative minor impact on risk of posterior overuse of psychoactive analgesics. Absence of such overuse before surgery indicates that patients will not develop later overuse. In contrast, patients with antecedents of overuse will most probably continue with this behaviour the year after surgery. Findings need be considered by when planning postoperative analgetic treatment.

## **A-0329** FOUR-CORNER FUSION: COMPARISON BETWEEN OPEN AND ARTHROSCOPIC TECHNIQUES

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**Objective:** The aim of this study was to evaluate outcomes and complications in patients, who underwent our technique of arthroscopic scaphoid excision and four-corner arthrodesis and compares the clinical and radiological outcomes with those achieved with the open method.

**Methods:** We performed retrospective follow-up study of all patients operated between 2015 and 2020 in patients affected by level II and III SLAC/SNAC wrist. We treated 44 patients (20 in arthroscopy group and 24 in open group). Indication due to SLAC was 36 and SNAC 8. Residual pain, preoperative ROM, postoperative ROM increases, grip strength, radiographic changes, long-term complications, and reasons for revision or failures were evaluated.

**Results:** The follow-up period was 12 - 60 months. Three patients had perioperative complications – one injury of a. radialis and one injury of sensitive branch of n. radialis. Bone union was achieved in 18 of 20 patients in the arthroscopy group and in 23 of 24 patients in the open group. One was asymptomatic and the two was reoperated with refixation of

midcarpal joint by Herbert screws. In one case, pain lingered after 3 months, and this condition required plate removal due to a dorsal impingement. At follow-up, the Mayo score was 61.56 (preoperative 40.12), and the DASH was 20.46 points (preoperative 42.50). The average ROM in flexion–extension movements was 68%. The average grip strength was 29 kg (60% of the other limb strength). In the open group, severe stiffness (flexion–extension arc was 10°) occurred in two patients after surgery. The mean postoperative flexion–extension arc was 67° and 55° in the arthroscopy group and open group, respectively. The pain, clinical scores, and radiological indices were improved in both arthroscopy and open groups. Arthroscopic and open scaphoid excision and four-corner arthrodesis did not show significant differences in clinical outcomes and bone union rates.

Conclusion: 4CF gives satisfactory pain control and functional motion. The pain, clinical scores, and radiological indices were improved in both arthroscopy and open groups. Arthroscopic and open scaphoid excision and four-corner arthrodesis did not show significant differences in clinical outcomes and bone union rates. The arthroscopic method provided a superior range of motion. Disadvantage of the arthroscopic approach is technically demanding procedure with long learning curve.

### **A-0330** MASQUELET PROCEDURE FOR THE TREATMENT OF INTRA-ARTICULAR DEFECTS OF THE WRIST: A CASE REPORT SERIES OF FIVE PATIENTS

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Background: The purpose of this case series is to show our experiences with the Masquelet procedure in a variety of infected defects of the wrist.

Case Description: All consecutive patients that were treated between 2015 and 2021 were included in this case series. Five patients were included with an infected defect of the wrist, involving the radiocarpal and/or the distal radio-ulnar joints (DRUJ). All patients underwent thorough debridement of the defect and the created void was filled with a gentamicin/vancomycin cement spacer. Cultures were taken and appropriate antibiotic therapy was initiated. Two patients had a renewal of the cement spacer before definitive surgery. Finally, two patients received a DRUJ prosthesis, two patients had autologous bone grafting and wrist arthrodesis and one patient kept the cement spacer as distal ulna prosthesis due to minor complaints. Literature Review: current literature provides examples of the Masquelet procedure in traumatic defects or non-unions of the long bones. These cases are almost always about metaphyseal or diaphyseal defects but rarely include intra-articular joint defects therefore no comparisons could be made between the cases we reported with any existing literature.

Clinical Relevance: The Masquelet procedure showed to be effective in eradicating infected defects of the wrist involving the radiocarpal joint and/or DRUJ. All patients had an aseptic environment before performing definitive surgery. This technique showed to be safe and no reinfections occurred.

### **A-0331** STABILIZATION OF THE DISTAL RADIOULNAR JOINT USING A DISTAL OBLIQUE BUNDLE AUGMENTATION

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Background: Triangular fibrocartilage complex (TFCC) injury often results in Distal radioulnar joint (DRUJ) instability. However, not all patients with a ruptured TFCC have an unstable DRUJ as in these patients a distal oblique bundle (DOB) may be present. We assumed that augmentation of the DOB leads to a more stable situation following reinsertion of the

TFCC. We present the clinical results of a new surgical technique using the TightRope® system as a DOB augmentation. Description of Technique: All cases were treated under local anesthesia with the TightRope® implant for which a tunnel was drilled from the distal ulna through the radius along the path of the DOB. The TightRope® was passed through the tunnel and secured with buttons on either side. X-rays were made during surgery to confirm correct positioning. Methods: a retrospective study was performed analyzing 21 cases treated with a Tightrope® augmentation of the DOB. The primary outcome was measured using the patient rated wrist evaluation (PRWE) score at least 12 months after surgery. Results: Postoperatively, the DRUJ was stable in all patients. The median PRWE score was 16 for the injured side compared to zero for the uninjured side (p-value: <0,001). The median pronation and supination were not statistically significant when we compared the injured side versus the uninjured side. The median grip strength was 31 kilograms (kg) for the injured side compared to 38 kg (p-value: 0,015). There were two minor postoperative complications (10%). Conclusion: this technique is capable of restoring DRUJ stability with a short immobilization period resulting in good patients related outcomes and a low complication rate. Keys words: distal radioulnar joint, triangular fibrocartilage complex, wrist stabilization, TightRope®

### **A-0332** NORMATIVE VALUES OF THE MICHIGAN HAND OUTCOMES QUESTIONNAIRE IN THE DUTCH POPULATION

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Purpose: The aim of this study was to determine the normative data for the Michigan Hand Outcome Questionnaire (MHQ) in the general Dutch population. In addition, we aimed to determine the influence of patient characteristics, such as age, sex, history of hand conditions and comorbidities, on these normative data.

Methods: Participants were recruited in the central hall of different hospitals, dental offices and physical therapy offices as well as on different train stations in the Netherlands. Participants were asked to complete the MHQ, the Self-Administered Comorbidity Questionnaire (SCQ), and their age, sex, ethnicity, education level, daily activities and income level. Respondents with wrist or hand trauma within the past 12 months or who were scheduled for hand surgery were excluded.

Results: A total of 430 participants were included. The median MHQ score of the total population was 96.1 (Interquartile range [IQR]: 89.8-100.0). Men had significantly higher scores than women, 97.6 (IQR: 93.8-100.0) versus 95.2 (IQR: 85.4-99.4) respectively. A negative correlation between age, comorbidity index and MHQ scores was found. Positive correlations between income, educational level and MHQ were found.

Conclusion: High MHQ scores are found in the general Dutch population. These MHQ-scores are age, sex, education and income dependent and are lower in individuals with a high comorbidity index.

### **A-0333** VASCULAR MALFORMATIONS AND TUMORS OF THE HAND: A THERAPEUTIC APPROACH

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Background: Vascular anomalies (VA) of the hand are rare entities (7%), but are relevant regarding differential diagnosis of soft tissue lesions of the hand. Their inconspicuous nature, large variety, clinical, and even radiological similarity often

makes VA a diagnostic challenge.

Accurate and targeted approach has shown to improve outcomes, and may even spare the patient unnecessary invasive procedures, and future morbidity. The majority of cases tend to be malformations, once denominated as deep soft tissue hemangiomas. Establishing a precise and exact diagnosis is essential when formulating an appropriate treatment plan, which impacts prognosis, clinical and radiological follow-up, as well as the outcome.

Goal: To assess how to differentiate and diagnose vascular anomalies of the hand in the clinical practice more effectively in order to improve patient management, treatment planning, aftercare and follow-up.

Methods: Retrospective data collection and analysis between 2008 and 2019, from the Orthopedic Department of Semmelweis University Tumor Registry. Results were compared to data from the current literature (PubMed, Ovid). Level of evidence III. Inclusion criteria were patients who had undergone surgery at Semmelweis University Department of Orthopedics between 2008 and 2018 for vascular anomalies of the hand and wrist. Exclusion criteria, conservative management only, no clear management on database. Standardly distributed data with confidence level of 95%.

Results: N = 16, average age of 34,2. Male to female ratio was 3:5. Hemangiomas accounted for 67%. The accuracy of clinical vs. histological diagnosis was 77%. Recurrences observed in 25%.

Conclusion: Clinical examination, radiological evaluation, patient history and fine needle biopsy proved to be accurate guides in most cases. Conservative and watchful waiting approaches are valid, but in our study, histological analysis of the surgical biopsy was the most effective method in establishing a definite diagnosis.

#### **A-0334** OUTCOME OF FUNCTIONAL TREATMENT WITH A LUCERNE-CAST IN PATIENTS WITH HAND FRACTURES: A RETROSPECTIVE CASE SERIES

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Purpose: The purpose of this study was to determine the clinical outcome of patients treated with a functional Lucerne Cast (LuCa) for different types of hand fractures. Static casting has traditionally been the preferred treatment for hand fractures. However, functional casting may lead to good functional outcomes, less stiffness and earlier return to work.

Methods: A retrospective case series of all consecutive patients with a metacarpal or phalangeal fracture treated with a LuCa between 2018 and 2019 was conducted. A total of 92 patients were included. Clinical data was collected directly from the patient's medical records. Functional outcome was assessed with the Michigan Hand Outcomes Questionnaire (MHQ). Results: The median Michigan Hand Outcomes Questionnaire score was 96 (IQR: 86-100) with a median follow up of 23 months. Complications occurred in 8 of 92 patients (9%). Functional impairment occurred in 2 (2%) patients. Functional impairment was defined as stiffness, persisting rotational deformity, a boutonnière or swanneck deformity. Persisting pain or CRPS occurred in 6 (7%) patients.

Conclusions: The LuCa shows to be effective in the functional treatment of both metacarpal and proximal phalangeal fractures with excellent patient reported outcomes.

## **A-0335** PATIENT SATISFACTION AND OUTCOME OF CARPAL TUNNEL RELEASE USING WIDE-AWAKE LOCAL ANESTHESIA NO TOURNIQUET (WALANT) TECHNIQUE IN KHARTOUM STATE- SUDAN

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**Background:** Carpal tunnel syndrome have a considerable economic burden to the health care system. the purpose of this study was to evaluate outcome of CTR and to investigate patient's satisfaction upon using WALANT "Wide-Awake Local Anesthesia No Tournique". Hence, it will support decision making and emphasising hand surgery practice.

**Methodology:** It's a descriptive cross-sectional study, November 2019– December 2020 in three hospitals in Khartoum state, Sudan. Investigating outcome and patient satisfaction of all open CTR using WALANT technique. Data collected pre and postoperative using two prevailed questionnaires; Boston Carpal Tunnel questionnaire (BCTQ) , and Patients' perception and satisfaction questionnaire.

**Result and Discussion:** Total number of 52 hands, with mean follow up period 8.7 month. Our entire patients got significant improvement regarding their hand symptoms, and near all (96.1%) gets improved in function; symptoms improved to 1.26 from 3.03 preoperatively, function to 1.21 from 2.89 preoperatively. The mean wound healing time is 2.5 (SD  $\pm$ 1.6) week, only 3.8% complicated by wound infection. Regarding patients satisfaction; 92.3 % reported that they will choose WALANT again if they had to do the producer again, 90.4% stated that they would definitely recommend WALANT to others. Post-surgery anxiety level significantly reduced (1.65 out of 5), and 86.5% found that their experience was better than expected.

**Conclusion:** Open CTR using WALANT technique is safe, efficient and effective technique, and associated with significant improvement of hand symptoms and function with high patient satisfaction.

## **A-0336** PAEDIATRIC HERPETIC WHITLOW: COMMON SURGICAL PITFALLS IN DIAGNOSIS AND MANAGEMENT

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**Background and Aim:**

Herpetic whitlow is a self-limiting, cutaneous hand infection caused by herpes simplex virus (HSV) types 1 or 2. It affects approximately 2.4 per 100,000 individuals per year and is transmitted via direct contact. It is highly contagious and occurs across all age groups, with children and healthcare providers at increased risk. It is encountered by hand surgeons worldwide.

Herpetic whitlow is often misdiagnosed, with differential diagnoses of bacterial paronychia or hand, foot and mouth disease, leading to delays in the appropriate treatment. Mismanagement can lead to unnecessary and potentially detrimental interventions such as incision or debridement. This increases the risk of bacterial superinfection, systemic involvement and herpes encephalitis in what is otherwise a self-limiting condition if correctly diagnosed.

We aim to highlight and discuss common surgical pitfalls in the management of herpetic whitlow.

**Case Report:**

A previously fit and well 15-month-old, female patient was referred to our tertiary hand surgery service in 2021. She presented with a two-day history of progressively worsening vesicular proliferation on her left hand, with isolated skip lesions extending to the volar forearm and elbow. She had associated cellulitis in the affected digits. Clinical examination was otherwise unremarkable and the patient was systemically well on admission. There was no preceding history of trauma and had no recent unwell contacts. The patient was assessed by the paediatric, dermatology and hand surgery

teams, and pre-emptively commenced on antibiotic and antiviral treatment following sampling of vesicular fluid (for bacteriology and virology). Her clinical course improved and microbiological sampling revealed concurrent HSV-1 infection (confirming diagnosis of herpetic whitlow) and bacterial superadded infection (*Staphylococcus aureus*).

Discussion/Conclusion:

Challenges in investigation arose around obtaining vesicular fluid samples without exacerbating the condition while ascertaining if bacterial infection was main driver for surrounding cellulitis and weighing up whether surgical intervention was indicated. We have proposed a figurative treatment algorithm for managing such cases.

Herpetic whitlow can be challenging to differentiate from conditions with similar initial presentations and will often be referred to hand surgeons for definitive management due to diagnostic uncertainty. A thorough history, careful examination and appropriate microbiological sampling are essential to elucidating the correct diagnosis and avoiding unnecessary, and potentially harmful, interventions.

### **A-0337** CENTRAL PALMAR NECROSIS FOLLOWING STEROID INJECTIONS FOR THE TREATMENT OF CARPAL TUNNEL SYNDROME - A CASE REPORT

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Steroid injections are commonly used as a diagnostic tool or an alternative to surgical management of carpal tunnel syndrome (CTS) and are generally safe. Ischaemia is a rare complication with very few cases reported in the literature.

We report a case of a 50-year-old female that presented with a necrotic wound to her left palm one month after a steroid injection into the carpal tunnel. She had a 2-year history of CTS in her left hand that was treated with six previous steroid injections in primary care during this period. The wound evolved from a blister to a necrotic ulcer which led to a painful, hollow defect in the centre of her palm. She did not report any history of trauma nor did she have any co-morbidities.

Clinical photographs were taken.

On examination she had a 0.5cmx1cm defect in the palm of her left hand down to aponeurosis. There was purulent discharge in the wound with surrounding erythema but no spreading cellulitis. She had full function of her fingers but was very tender on movements and at rest.

She was admitted for intravenous antibiotics and underwent a debridement, washout and carpal tunnel release the next day. The defect was packed to heal by secondary intention and has now fully healed one-month following her operation. This is an extremely rare complication of steroid injections to the carpal tunnel and may have been avoided by earlier referral for surgery rather than treatment using multiple steroid injections.

### **A-0338** VOLAR LOCKING PLATING WITH OPPOSITE SIDE PLATE FOR VOLARLY DISPLACED INTRA-ARTICULAR FRACTURES OF DISTAL RADIUS WITH VOLAR LUNATE FACET FRAGMENTS

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Object: Volarly displaced intra-articular fracture of the distal radius with volar lunate facet fragments (VLFF) are very difficult for internal fixation. For stabilization of the fragments we have used volar polyaxial locking plate of opposite

side purposely. The object of this study is to evaluate the results following the locking plate fixation of the fractures.

**Material and Methods:** A retrospective study was conducted to identify patients who had been treated with opposite side polyaxial locking plates (Aptus2.5 correction plate, Medartis, Basel) for volarly displaced intra-articular fractures of distal radius with volar lunate facet fragments. 12 patients were identified with an average age of 53.4 years old (and with an average follow-up period 12.3 months). Fracture types were classified type B3 6 cases, C2 2 cases, C3 4 cases in AO classification. We evaluated various parameters with X-rays included carpal translation, size of volar lunate facet fragments and coverage rate of locking plate with CT, range of motion, and Mayo modified wrist score.

**Results:** All fractures were united. Final ulnar variance averaged 0.6mm, radial inclination was 21.7°, and volar tilt was 13.4° and carpal translation was corrected. The average range of motion were : flexion-extension 124° (94.8% of the opposite extremity); pronation-supination 172° (95.1%) ; grip strength was 12.4 kg (72.1%). There were no complications. Mayo wrist score were averaged 87.1 points.

**Conclusion:** This study for unstable volarly displaced intra-articular fracture of the distal radius, resulted in union, good to excellent alignment and wrist motion. Fixation using opposite side locking plate enabled to support VLFF completely by placing plate distally on ulnar side of distal radius by changing the side. This feature led to stabilize VLFF by buttress effect. The fixation technique were very unique and useful for the fractures.

### **A-0340** SHORT-TERM OUTCOMES OF DORSAL WRIST GANGLION EXCISION – IS WHAT WE ARE DOING WORKING?

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#### Purpose

To describe patient-reported pain and function 3 months following dorsal wrist ganglion excision. Secondary outcomes included the hand/wrist appearance, return to work, patient satisfaction with treatment results, recurrence of the ganglion cysts and complications.

#### Methods

659 patients were included in this prospective observational cohort study which was a part of the Swiss Upper Extremity Outcome Registry (SUPEXOR) Studyathon 2022. Included patients filled out the Patient Rated Wrist/Hand Evaluation questionnaire, Satisfaction with Treatment Results Questionnaire, and a questionnaire on return to work both preoperatively and 3 months postoperatively. Additionally, data on complications and disease recurrence were extracted from 1000 patients records and were scored following the International Consortium for Healthcare Outcomes Complications in Hand and Wrist conditions tool.

#### Results

The median Patient Rated Wrist/Hand Evaluation pain score improved from 31 preoperatively to 11 at 3 months postoperatively. A clinically relevant improvement in pain was noticed in 63% of the patients. Median hand/wrist appearance improved from 3.5 preoperatively to 2.0 after the surgery. Satisfaction with treatment results was excellent in 24%, good in 43%, fair in 20%, moderate in 10%, and poor in 3% of the patients. Over 80% of the patients reported that they would undergo the same treatment again. The median time to return to work was 3 weeks, with noticeable

differences depending on the type of work. Data on complications and ganglion recurrence was available for all the 1000 patients. 11% experienced a complication with most of them graded as minor. 104 patients had a ganglion recurrence; 61 of them underwent an open ganglion excision again.

#### Conclusion

Open excision of dorsal wrist ganglia leads to a clinically relevant pain reduction as well as good satisfaction in most patients 3 months after the surgery. Despite, on average, satisfactory results, we noticed a relatively high variability of the outcomes in our population. Complication and recurrence rates are comparable to other studies and are fairly high. It is important to consider and elaborate this to the patients preoperatively, in order to address their expectations and meet an informed consensual decision regarding the treatment.

#### Keywords

Ganglion cysts, wrist, dorsal, open ganglion excision, patient-reported outcome measures, short-term outcomes

### **A-0341** A PATIENT'S HOLIDAY... KEEPS THE HAND THERAPIST AWAY - A CASE REPORT

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Keywords: trauma, fracture, compartment syndrome, rehabilitation, mindset

#### Introduction

This case report describes a special process of rehabilitation after a common injury, distal radius fracture, complicated with compartment syndrome. A rare complication after this injury (Denolf et al. 1994, Simpson et al. 1995), associated with bad prognosis (Jones et al. 2019, Kistler et al. 2018). Intensive rehabilitation started. Then a long holiday was scheduled. After the patient returned, he showed an unexpected high progress. Being an experienced rehab team, we couldn't believe this. What is our role as hand therapists and what about mindset, time and taking a break.

#### Main concerns & primary diagnosis

Male, 44 years, right dominant. Trauma and X-ray 28/4/22: comminuted intra-articular distal radius fracture left wrist. Surgery 9-5-2022: ORIF followed by circular cast. Within two days return to the hospital with extreme pain and swelling. A half circular cast was provided. Nevertheless, pain was still increasing. Complication: acute compartment syndrome. Surgery 15/5/22: fasciotomy. Wounds closed 17/5/22. Patient was sent to our rehab center and started the 20th of May 2022.

#### Clinical findings

Inspection: edema, suture staples from wrist to elbow, fingers in flexion, position of injury.

Assessments (van de Ven – Stevens et al. 2015): pain (VAS): max 7/ min 5. Active range of motion (AROM) wrist, thumb and fingers (goniometry) extremely limited. Tightness of extrinsic flexors and adhesive scarring formation. Limited in all activities of daily living, at this point he is one-handed.

#### Interventions

Intensive hand therapy: edema control, splinting, scar management, exercises to improve AROM and coordination and when allowed, improving strength and PROM. Also, advices were given about using the hand/arm in daily live. After 8 weeks the patient mentioned a scheduled holiday leave for 6 weeks. Based on assessments a 40% of recovery was achieved. He insisted to leave and agreed to one videocall in the middle of the holiday.

#### Outcomes

When he returned, we could see big improvement. We made a video and performed assessment: high progression in

ROM, grip strength, improvement of the use of his hand and decrease of pain. The scar was souple and less adhesive. He admitted that he didn't exercise much, he swam every day.

#### Conclusion

During an important phase, 8 weeks post-surgery, the patient went on holiday. From rehab view, 8 weeks post-trauma is soon. From patient's view 8 weeks of being in this situation is long. A short holiday could be discussed, however in contrary the patient left for 6 weeks. The perspective of the patient is different, as well as the expectations of the team. As take-home lesson we could address the perspectives and expectations better. And second, we should wonder how important we actually are. As we know from research a good mental health gives better outcomes in fracture healing (Goudie et al. 2022, Jayakumar et al. 2020). Swimming and being in another environment could have contributed to improve these factors. Maybe we should be more mindful and confident that time will tell. Should the therapist sometimes be seen more as a coach?

### **A-0342** THE OUTCOME OF ARTHROSCOPIC RESECTION OF DORSAL WRIST GANGLIA

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**Objectives:** Arthroscopic ganglionectomy has become an increasingly popular surgical option for dorsal wrist ganglia. The aim of our study was to describe our technique for arthroscopic treatment of the dorsal wrist ganglia and evaluate the clinical results, as well as the recurrence rate in our patients.

**Methods:** In a prospective study 60 patients who underwent arthroscopic treatment of dorsal ganglion of the wrist were included. Patients were evaluated preoperatively and 3 and 24 months post arthroscopy. The presence of the recurrence at 24 months was recorded. Subjective outcome was evaluated with The Patient-Rated Wrist Evaluation (PRWE) and the Visual analog scale (VAS). Objective outcomes included grip strength and range of movement measurements. The Wilcoxon matched pairs test was used to determine statistical difference of the results of the examined patients pre- and postoperatively.

**Results:** The mean age was 36 years; the majority were women (45/60).

The position of the ganglion was predominantly midcarpal in 47 (78,3%) and radiocarpal in 13 (21,7%) patients. Arthroscopic resection was completed through the midcarpal joint in 37 (61,6%), through the radiocarpal joint in 10 (16,7%), and through both joints in 13 (21,7%) patients. The mean operative time was 42 minutes (range 22-78 minutes).

Mean grip strength and the average flexion and extension in the wrist showed improvement after 3 months. Mean preoperative grip strength was 71% of the strength of the unaffected side, while 3 months after arthroscopic resection it improved up to 98% of the contralateral value ( $p=0.016$ ).

Range of movement showed improvement in the average flexion (from 86% to 99%) and extension (from 82% to 96%), but it was statistically not significant ( $p=0.389$ ). The total PRWE score improved from 26.7 preoperatively to 10.2 at three months and 2.4 two years after surgery. The PRWE results showed a significant difference preoperatively and the third month postoperatively (total PRWE score,  $p=0.002$ ), as well as preoperatively and 24 months postoperatively (total PRWE score,  $p=0.001$ ).

After 24 months follow-up there were three patients with recurrence (5%). **Conclusions:** The arthroscopic resection of the dorsal wrist ganglia is a safe procedure with low recurrence rates and low scaring and stiffness; it should be considered standard for operative treatment of the dorsal wrist ganglia.

## **A-0343** DOES SHAPE SYMMETRY EXIST IN THE LUNATE BONE? TOWARDS DEVELOPMENT OF A PATIENT-SPECIFIC LUNATE IMPLANT

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**Introduction:** Kienböck's disease is generally defined as the collapse of the lunate bone, and this may lead to osteoarthritis of the wrist in young patients. Replacing the collapsed lunate with an implant has regained renewed interest with the advancing technology of additive manufacturing (3D printing). This enables design of patient-specific implants, which are expected to restore wrist kinematics more accurately than off-shelf implants. The aims of this research project are (1) to determine whether a 'mirror' design (i.e., the contralateral lunate shape is used as a shape template) is an accurate method for developing patient-specific implants, and (2) to study the effects of a 'mirror'-designed patient-specific lunate implant on wrist kinematics using 4D-computed tomography (CT) scanning.

**Methods:**

(1) A 3D statistical shape model (SSM) of the lunate was built based on bilateral CT scans of 54 individuals with no known carpal bone pathologies. Using the model, the 3D shape variations of the lunate were studied. The intra- and inter-subject shape variations for the first few significant shape modes were compared with each other by performing an intraclass correlation (ICC) analysis.

(2) A radiolucent motor-operated wrist-holder was designed to guide flexion/extension and radial/ulnar deviation of ex vivo wrist specimens under 4D-CT scanning. In a pilot study with 3 different wrist specimens, a total of 18 4D-CT scans were acquired, by varying the speed (slow versus fast) of the holder in performing the movements (i.e., flexion/extension and radial/ulnar deviation). Using each CT, the scapholunate angle (SLA) and capitulunate angle (CLA) were measured by two assessors. The inter- and intra-observer reliability of the measurements will be analysed assessed by performing an ICC analysis.

**Results:**

(1) The shape of the lunate was not symmetrical, defined as the intra-subject variation similar to that of the inter-subject, in (1) the angle scaphoid surface - radius-ulna surface, (2) the dorsal end and the length of the bone side adjacent to the triquetrum, (3) the orientation of the volar surface, (4) the width of the bone side adjacent to the scaphoid, (5) the skewness in the coronal plane, and (6) the curvature of bone articulating with the hamate and capitate.

(2) Preliminary data shows that extension to flexion movement from 10° to 40° resulted in an average SLA of 60° (extension) to 84° (flexion) and a CLA of -7°(extension) to -29°(flexion). Radial to ulnar deviation from 10° to 10° resulted in an average SLA of 70° (radial) to 65° (ulnar) and CLA of -9° (radial) to -13° (ulnar). The effect of movement speed and the inter- and intra-observer reliability of these measurements is currently analysed.

**Discussion:** The design of patient-specific lunate implants may prove to be challenging using a 'mirror'-design as it will lead to a degree of shape asymmetry. The relevance of this variation in lunate shape will be investigated further with 4D-CT scans. To determine the most reliable scan protocol, the pilot study is completed and currently analysed. In the next phase, we plan to acquire 4D-CT scans with and without 'patient-specific' lunate implants.

**A-0344** CAN A GENERIC FRACTURE FIXATION ASSESSMENT TOOL (FFAT) BE USED TO ASSESS QUALITY OF DISTAL RADIUS FRACTURE FIXATION, AND DOES THE SCORE CORRELATE WITH FIXATION FAILURE?

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**Aims**

The Fracture Fixation Assessment Tool score (FFATs) is an established evaluation tool for appraising generic fracture fixations according to AO principles. The aim was to assess the reliability of FFATs for the analysis of distal radius fixation, and whether this varied by seniority. We also investigated if a lower FFATs is associated with fixation failure.

**Methods**

The tool comprises four domains; reduction, stability, implant choice and overall impression, each scored 0-4. 64 distal radius fracture fixations with preoperative and final intraoperative images were randomly sorted into sets of 10 fractures. 41 fixations were successful and 23 went on to fail.

27 Orthopaedic doctors from F2 to consultant hand surgeon assessed 10 fractures each. Interobserver reliability was determined by degree of consensus, and agreement in FFATs according to level of experience was compared. Scores for failed and non-failed fixations were compared. Means were analysed with the unpaired T test.

**Results**

Each domain of the FFATs demonstrated good Inter-rater Reliability (IRR): reduction IRR 0.607; stability IRR 0.665; implant IRR 0.605; and overall impression IRR 0.625.

Overall, comparing failed and non-failed fixations, scores were significantly better for not-failed (mean 8.43, SD 2.54) compared to failed fixations (mean 7.47 SD 2.98),  $p=0.0052$ . All domains showed higher score in not-failed compared to failed cases, with statistical significance demonstrated in reduction (mean 2.18 vs 1.76,  $p=0.0001$ ) and overall impression (mean 1.96 vs 1.72,  $p=0.0114$ ).

When analysing by seniority, both trainees and consultants gave higher scores for not-failed compared to failed fixations (Consultants: 8.28 vs 6.85,  $p=0.0142$ ; trainees: mean 8.51 vs 7.96,  $p=0.184$ ).

**Conclusion**

FFATs can be used by both trainees and consultants to assess quality of fixation for distal radius fractures. This provides a useful structure for formative feedback, either intraoperatively (when changes can be made) or postoperatively as a learning tool.

**A-0346** ACCURACY OF WRIST WEIGHT-BEARING TEST FOR DIAGNOSIS OF TFCC TEARS

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Functional use of the hand for activities of daily living and sports is dependent on the absence of pain and the presence of wrist stability. The ulnar side of the wrist consists of a multitude of anatomical structures, making it increasingly difficult to accurately diagnose specific conditions. Up to 85% of ulnar sided wrist pain cases present with TFCC tears, but clinical tests often used to diagnose TFCC tears have low levels of sensitivity, specificity, positive and negative likelihood ratios and predictive values. Recently, normative values for adult wrist weight-bearing tolerance using a quantified version of the "press-test" have been established. The purpose of this study was to investigate the sensitivity, specificity, positive and negative likelihood ratios of the

wrist weight-bearing test to diagnose TFCC tears compared to wrist MRI with the donning of a TFCC brace (WristWidget®). Wrists (n=74) that were both symptomatic and asymptomatic for ulnar-sided wrist pain, and were examined utilizing the wrist weight-bearing test with or without the WristWidget® brace.

This test was able to identify 29 of the 33 symptomatic wrists identified to be positive for a TFCC tear by MRI indicating a sensitivity of 88%. Additionally, this test was able to predict 39 of the 41 wrists that were identified as not having a TFCC tear via MRI suggesting a specificity of 95%. Positive and negative likelihood ratios and predictive values derived from the test results were calculated to be 18.0, 0.1, 94% and 91% respectively. Furthermore, wrist weight bearing capacity was found to be statically significantly different from the unaffected wrists in patients with diagnosed TFCC tears and the effect size of this change was found to be 1.5

The results of this study indicate that the wrist weight-bearing test performed before and after the donning of a commercially available wrist brace resulted in a higher diagnostic accuracy than all other reported clinical tests for the diagnosis of TFCC tears.

### **A-0347** ONE-STAGE RECONSTRUCTION OF OLD FLEXOR TENDON LESIONS BY HETERODIGITAL TRANSFER OF HALF OF THE FDP IN CHILDREN. ABOUT 6 CASES

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The secondary flexor tendon repair remains one of the most difficult challenges in hand surgery.

The aim of this study is to evaluate the results of Durand/Oberlin technique in children after a neglected lesion or failure of a primary repair.

Materials and methods:

6 children have been operated according to this technique, with extreme ages: 14 months to 05 years old. In all 6 children the preoperative clinical evaluation demonstrated a finger with flexible joints, sensitive, well vascularized with perfect skin coverage and a solid skeleton. The main outcomes measured were the total active flexion (TAF) and the total active motion (TAM). TAF is the sum of flexion of the MCP, PIP and DIP joints combined. TAM is calculated as TAF minus total loss of active extension of MCP, PIP and DIP joints

Results :

According to Strickland criteria, all children demonstrated clinical improvement of active motion, recorded with pre op and post op videos.

Discussion :

The classical two stages reconstruction did not result, in our hands, in satisfactory results, especially in children. The better results of our technique can be explained: no need for a proximal tendon suture; the distal fixation, the pull-out technique, allows some immediate mobilization, of course under the protection of a splint the wrist being completely flexed, during 6 weeks. The hemi-tendon FDP is sufficiently narrow to allow easy passage of the tendon through the original pulleys which are preserved in case of neglected injury.

Conclusion :

This procedure has, in our hands, replaced the 2 stages procedure for unidigital lesions in adults.

Our study demonstrates that the technique can be used in children and early childhood as well.

**A-0348** INTRAMEDULLARY HEADLESS SCREW FIXATION FOR PROXIMAL PHALANX FRACTURES: A 3 YEAR FOLLOW-UP  
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### Introduction

Trans-articular intramedullary fixation using cannulated headless screws is an established method for fixation of displaced and unstable finger fractures. It is stable and allows early postoperative mobilization, reduces the risk of adhesions, and shows a low implant removal rate. Malrotation is, as in all phalangeal fractures, a risk and proper reposition should be checked after definitive fixation. Clinical short-term results are very satisfactory, there is however little evidence in literature regarding long-term outcomes.

### Patients and Methods

From March 2014 to Mai 2016 we treated 28 patients with proximal phalanx fractures with intramedullary screw fixation. 8 patients with 9 fractures could be recruited for a follow-up visit, the remaining were lost to follow-up.

All the fractures were initially treated with an open or closed reduction and intramedullary headless compression screw fixation, 6 in an antero- and 3 in a retrograde fashion. Patients were revisited 3 years postoperatively. Subjective and objective patient related outcome measures were assessed by means of the Michigan Hand Questionnaire (MHQ), active range of motion (aROM) and grip strength. Additionally a conventional x-ray and tomography was performed to assess consolidation and signs of osteoarthritis.

### Results

Two of the fractures needed revision, one after 6 weeks due to malrotation and the second one after two years due to malrotation and MCP joint contracture. Other than that there were no complications noted and no screws removed.

The average 3-year follow-up MHQ was 83% with a satisfaction score of 86 %. Mean total aROM was 216° (range 95°-285°) compared to 185° at 1-3 months postoperatively. The average extension lag for the MCP-joint was 27.2°, 5.5° for the PIP- and 1.1° for the DIP-joint. Mean Jamar grip strength in the dominant injured hand was 35.5kg (range 30kg-48kg) and 25.4kg (range 19kg-30kg) in the non-dominant injured hand.

Digital tomosynthesis showed a full fracture consolidation in 7 fingers. In one finger the fracture gap was slightly visible and in one case the images were unusable. Incipient athrosis was only found in one case, which was an intra-articular thumb fracture.

### Conclusion

Given our results, the use of intramedullary headless screw fixation has shown good clinical long-term outcomes, with satisfactory range of motion and grip strength, as well high rates of patient satisfaction. Furthermore there were no signs of arthrosis due to the trans-articular screw insertion.

### **A-0349** THE GREAT IMPOSTORS- ATYPICAL MYCOBACTERIA INFECTIONS IN HAND SURGERY

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Atypical mycobacteria infections are a rare diagnosis in the hand surgery population. Due to various clinical presentations they are often misdiagnosed and patient present with a long standing clinical course.

## Patients and methods

We report on 3 patients who were referred to our hand surgery service in the last 2 years. All of them were men, mean age 42 years, age range 29-56 years. The first patient presented with long standing left wrist pain and slight swelling for one year, x-rays and MRI imaging showed joint effusions and bony alterations interpreted as arthritis. The patient remembered no trauma to his wrist but a small cut in his left thumb while hunting. He first underwent arthroscopy and biopsy with no specific findings, rheumatological work up was negative. In the meantime it turned out the patient was a mechanic installing and repairing swimming pools. Because of persistent pain he underwent arthrotomy and large biopsies were taken as well as joint fluid and sent for mycobacterium cultures and PCR. Both revealed mycobacterium kansasii infection. The second patient presented with long standing flexor tendon synovitis of his right long finger for 2 years, two outpatient surgeries in another clinic showed no specific results. He did not remember any lacerations but mentioned an aquarium at home. He underwent tenosynovectomy and cultures as well as PCR were positive for mycobacterium marinum. The third patient presented with an ulcer on his right index finger for 2 years, dermatological therapy was not successful. In his medical history he mentioned a cut to his right index while working in his garden at the pond, he also had an aquarium at home. Large size biopsies were taken, PCR was negative, but cultures revealed mycobacterium marinum infection. In all three patients histopathological exams were non specific.

All three patients were referred to the pneumatology department for further work up. They were started on antibacterial therapy according to the guidelines with regular internist check ups. All patients recovered successfully.

## Discussion

Mycobacterium marinum and kansasii are ubiquitous slow growing atypical mycobacteria living in aquatic environments, salt and fresh water as well, which can affect humans causing superficial as well as deep lesions to various organ systems. The mycobacterium marinum strain was first described in 1926. Infections have been known as swimming pool or fish tank granuloma. Usually infections occur with swimming or with keeping or working with fish. Mycobacterium kansasii was first identified 1953, tap water appears to be the major reservoir, infection via aerosol route is postulated.

## Conclusion

Key point in diagnosis is a high index of suspicion. In patients presenting with long standing lesions unsuccessful to treatment so far should undergo a thorough medical history with emphasis to exposure to fish, aquarium or frequent professional exposure to water. Large sample size biopsies should be taken and sent for PCR tests and appropriate cultures well. The microbiologist should be informed since these organisms do not grow under routine culture conditions.

## **A-0352** THE EFFICACY OF BOTULINUM TOXIN FOR MANAGING UPPER LIMB NEUROPATHIC PAIN

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## Intro

Botulinum toxin has a combined effect on the vascular and nervous systems. It blocks pain neurotransmitters directly and blocks sympathetic stimulation (which is upregulated in chronic pain). It has been shown to reduce pain and improve perfusion in the hand in patients with Raynaud's and it is successfully used in lower limb complex regional pain syndrome (CRPS). This is the first study to assess its efficacy in the upper limb for neuropathic pain.

## Methods

Between 2017 - 2022, 22 patients underwent botulinum toxin nerve blocks as part of their management of upper limb

neuropathic pain. All patients had failed conservative management with the pain team and hand therapy departments and many had previously had unsuccessful neurolysis and nerve wraps. Causes of neuropathic pain included trauma in 15 patients, and seven patients with postoperative CRPS following routine elective hand surgery. We assessed function and pain levels using the Quick-DASH score and the Brief Pain Index score pre- and postoperatively. Five patients had 50iu of the toxin injected percutaneously around the nerve and 17 patients had the same dose applied directly to the nerve at the time of surgery which included decompression, neurolysis and nerve wraps.

#### Results

Reduction in neuropathic pain was reported immediately after surgery demonstrating the fast acting block of pain neurotransmitters. Quick-DASH scores improved at two and six weeks post injection. Most patients had at least one pain level reduction on their quick dash scores. 18/22 had only a single dose and this led to a permanent improvement in pain at long term follow up. 4/22 had a repeat dose with further improvement of pain. Patients reduced or came off their pain medication. The feedback from patients was overall positive with no significant adverse outcomes observed due to the Botulinum toxin injection.

#### Conclusion

We have shown that botulinum toxin is a safe and effective adjunct to managing neuropathic pain in the upper limb and it has a long lasting effect. It is more cost effective and has fewer side effects compared to long term treatment with oral medication such as gabapentin and amitriptyline. We observed that it has better outcomes compared to neurolysis and nerve wrap alone. As a result of these positive findings, it has now been added to the Joint Medicines Formulary as an approved off-label treatment for neuropathic pain in the upper limb.

### **A-0353** CONGENITAL BRACHIAL ARTERY OCCLUSION: A PATIENT SERIES

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#### Introduction:

Congenital brachial artery occlusion is a rare event. Management of the condition requires prompt decision making and multidisciplinary input. We report four patients treated at a single tertiary centre who presented at birth with signs of an occluded brachial artery. This is followed by a discussion of relevant literature and conclusions regarding appropriate management.

#### Methods:

We report four patients who were thought to have an occluded brachial artery at birth. Relevant information was extracted from electronic patient records, including the perinatal circumstances, prenatal history, family history, appearance of the ischaemic limb at birth, investigations, operations performed, and the outcome of the affected limb. Informed consent for presentation was obtained from the guardians of all patients.

#### Results:

All four patients were born in peripheral hospitals before transfer to the same tertiary unit between 2014 and 2021. They presented at birth with an ischaemic forearm and hand. Brachial artery thrombosis was confirmed by duplex ultrasound in three patients. No child had a prenatal history predictive of vascular occlusion. However, three had a difficult delivery and all had a complicated postnatal period. Fasciotomy was performed in three of the four cases. The outcome ranged in severity from total limb salvage to above elbow amputation and depended upon the site and extent of occlusion. The causes of each occlusion were not determined.

## Conclusions:

Review of the relevant literature shows a relative scarcity of evidence regarding causes of arterial occlusion and the appropriate management. The focus is primarily on medical anticoagulant therapy. Surgical options include 1) operating at the site of thrombosis and 2) mitigating consequences of arterial occlusion, such as acute compartment syndrome. From our experience and review of the literature, we propose recommendations for the management of the condition including anti-coagulation, duplex ultrasound assessment, immediate referral to a specialist centre, and early fasciotomy surgery.

### **A-0355** ARTHROSCOPIC ASSISTED FIXATION OF THUMB DISLOCATION: A CASE REPORT

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Fractures of the base of the thumb metacarpal (M1) are common findings which usually requires an early surgical treatment. Recently, arthroscopy assisted techniques have been developed to improve articular reduction and to preserve vascularization, both of them necessary to achieve ligamentous integrity along with joint stability. The experience with this technique offers the advantages of a minimally invasive method that provides articular reduction under direct vision, with limited soft-tissue damage, and which allows an early rehabilitation.

We present the case of a 20-year-old male patient who attended the emergency department with a history of two days of inability to move his thumb accompanied by severe pain in his right hand following direct trauma. Physical examination showed clear instability in his trapeziometacarpal joint. Neurovascular examination was preserved. X-rays of the hand were requested, showing a dislocation of the base of the first metacarpal. A CT scan was also performed to rule out associated fractures. At first, at the Emergency Area, a closed reduction and then immobilization with a cast was carried out. Unfortunately, due to the high instability of the injury, the patient precised a surgical treatment to ensure an anatomical reduction and an allow early mobilization.

He was planned to complete closed reduction and percutaneous fixation with two k-wires, assited by arthroscopy and by fluoroscopy control. Arthroscopical reduction let us ensure anatomical reduction and check the stability of the trapeziometacarpal joint. K-wires were removed after 4 weeks and the patient was kept immobilized in a splint for a 5 more days. From then on, active and assisted thumb mobilization exercises were started, with readaptation of the thumb to gradually resume work and leisure activities. Weight bearing and forced abduction were delayed until three months after surgery.

Carpometacarpal fractures involving joint instability require surgical treatment. The recent introduction of arthroscopy for the treatment of these injuries achieves a better anatomical reduction, allows greater stability to be achieved and reduces the postoperative period, so that early rehabilitation can begin.

### **A-0357** TRANS-FRACTURE RETRO-ANTEGRADE TECHNIQUE IN THE MANAGEMENT OF SEVERELY ANGULATED METACARPAL NECK FRACTURES: A CASE SERIES

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Introduction: Many techniques have been described within the literature for the management of metacarpal fractures requiring operative treatment. The Jahss Manoeuvre can be used in the reduction of displaced metacarpal fractures,

but its' effectiveness is limited in the reduction of severely angulated fractures of the metacarpal neck with significant hand oedema. This study introduces a method for reduction of closed metacarpal neck fractures using traction instead of the Jahss Manoeuvre, as well as intramedullary fixation using a trans-fracture retrograde technique with antegrade conversion; namely, a retro-antegrade technique.

**Methods:** 28 cases of severely angulated closed metacarpal neck fractures underwent reduction using traction and fixation via trans-fracture retro-antegrade intramedullary K-wire insertion from January 2016 to December 2018. We performed a retrospective review of the clinical data for these patients examining their clinical and radiological outcomes following treatment.

**Results:** Six months post-operatively, all fractures demonstrated bony union and correction of angulation at final follow-up. All patients exhibited excellent range of motion (ROM) with no significant impairment of hand function. Superficial K-wire pin site infections were observed in three cases and managed conservatively. Six patients experienced pain at the level of the wrist secondary to K-wire placement which resolved completely following their removal upon radiographic confirmation of bone healing.

**Conclusions:** Reduction of severely angulated closed metacarpal neck fractures using traction and achieving fixation via trans-fracture retro-antegrade intramedullary k-wire insertion is a simple, minimally invasive and reliable technique that has not previously been described in the literature. This method avoids trauma to the metacarpophalangeal joint, can be used in all metacarpals, and achieves excellent clinical and radiological outcomes. It is suitable for use in the management of closed metacarpal neck fractures with dorsal angulation  $>60^\circ$ .

### **A-0358** KINEMATICS AS THE CORE OF A NEW CONSERVATIVE TREATMENT FOR STABLE VOLAR PLATE INJURIES

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**Purpose:** Volar plate injuries as result of PIPJ hyperextension are one of the most frequent lesions particularly during sports. Although a variety of treatment options have been reported in the literature, there are controversies around optimal treatments. Biomechanics studies showed any interference in the normal kinematics could cause pathogenesis as: immobility, poor positioning following the initial trauma, adherence of the soft tissues, scar, and oedema. Recent researches mentioned the highest among of mechanoreceptors endings in the insertions of the VP which is an interesting point about the proprioception paper of the kinematics and to consider it in rehabilitation protocols to avoid reinjured VP PIPJ. The purpose of this paper is to evaluate and provide evidence as to whether an early conservative intervention using proprioceptive exercises is effective in clinical practice, and how its use can positively impact on results in the treatment of stable PIPJ VP. Furthermore, a new protocol based in proprioception kinematics is presented based in new Kinematics evidence.

**Method:** Before undertaking a literature search, a plan was designed using PICOT guidelines. Inclusion and exclusion criteria were used to select papers and refine the search. A comprehensive literature search was conducted by main scholarly database as well as grey literature. Prisma chart is provided. Each included study was assessed for quality using Critical Appraisal Skills Programme (CASP) checklist criteria (OCEBM). According to other studies, immediate protected mobilisation of the PIP joint has been advocated to prevent finger stiffness and enhances cartilage and soft tissues healing minimising adhesions and PIP joint contracture.

Results: The heterogeneity of the studies founded with various study designs, scale systems, follow-ups, splint designs, and dosages limits the ability to draw conclusions. The literature does not differentiate among the various types of injuries sustained and similar treatment is applied irrespectively to the injuries. However, the results of the protocol proposed based in kinematics open a new conservative treatment option to diminish the risk of reinjuries during sport activities. Furthermore, this protocol promotes EAM in which the immobilization consequences are diminished by the proprioception exercises since the early stages of the injuries.

Conclusions: Conservative treatment of VP injuries is supported by latest research. Indeed, new protocol based in Kinematics is developed to improve early recovery of the collagen fibres as well as diminish the immobilization sequels and avoiding the reinjury during sport activities.

### **A-0359** VOLAR PLATE TYPE II: PROPOSAL FOR A NEW TREATMENT PROTOCOL

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Purpose: VP Type II is a combination of VP avulsion and tears in collateral ligaments. Due to the possible loss of hand function, it is crucial to achieve early active mobilization (EAM) as prevention patients from irreversible consequences as flexion deformity, stiffness, posttraumatic arthritis, swan-neck deformity. There is insufficient research evidence regarding on the key conservative management decisions. The purpose of this paper is providing an early conservative intervention based in current biomechanics studies and new evidence research. Method: Before undertaking a literature search, a plan was designed using PICOT guidelines to convert the clinical information needed into an answerable question. Inclusion/exclusion criteria were specified to avoid confirmation bias. A comprehensive literature search was conducted using medical databases, google scholar. Each included study was assessed for quality using Critical Appraisal Skills Program checklist (OCEBM). Inclusion/Exclusion criteria and Mesh terms used in research. Results: Evaluating the identified papers (six included, sixteen rejected) demonstrated a range of treatment modalities and their clinical effectiveness. Most of the articles about VP stable injuries include Type I, II and stable III fracture dislocation which implies that different VP types of variety included could affect the study results. This heterogeneity makes it difficult for clinicians to establish the correspondence classification with different scales (Eaton, Keifhaber, Hastings) for PIPJ VP injuries initial treatment management. On account of limitations, metanalysis was not provided due to the heterogeneity outcome measures. According to Stanley et al., entails a conservative approach preventing hyperextension and positioning the PIPJ in neutral to allow VP and ligament healing. According to Paxman and Helawell study exhibited better improvements for 0 degrees splint group although the high attrition rate and being a multicentre RCT. A most recent retrospective intervention by Lee analysed the risk factors in conservative PIPJ VP and recommended conservative treatment first because some unstable fractures become stable after conservative management. There are different distributions between VP Types in the studies participants. Joyce researched four different splinting techniques from 2006 to 2012, complete immobilisation, controlled EAM, with figure of eight splint, Dorsal Block splint, Buddy Tape. Finally, studies excluded as the Cochrane review, stated that no agreement was found between the conservative interventions. Overall, studies support orthosis intervention as preventive procedure, but no conservative treatment include proprioception as a mean to diminish reinjury risk. Some authors stated that PIPJ immobilisation in  $>30^\circ$  flexion should be avoided to prevent flexion contracture and recommend  $0^\circ$  DBS to allow new collagen fibres healing. Conclusion: Conservative intervention seems to be effective

as preventive PIPJ flexion deformity after VP Type II injuries . A new protocol proposal is developed based in recent biomechanics and research studies. Proprioception exercises are included as new conservative treatment modality to avoid VP being reinjured. Indeed, to allow safer EAM. Although there is no agreement about superiority of one orthosis design and dosage. According to research, DBS in extension is recommended as flexion deformity prevention in VP PIPJ. Specific Protocol for PIPJ VP type II based in new studies is developed.

### **A-0361** DISTAL RADIOULNAR JOINT INSTABILITY AFTER DISTAL RADIAL FRACTURE: COMPUTED TOMOGRAPHY EVALUATIONS AT 1 VERSUS 6 MONTHS POSTOPERATIVELY

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**Objective:** Instability of the distal radioulnar joint (DRUJ) after a distal radius fracture is relatively common. However, some cases may remain undiagnosed long term, and the time course of DRUJ instability, particularly volar instability, remains unknown. This study aimed to compare the DRUJ instability ratio at 1 versus 6 months postoperatively using computed tomography (CT).

**Methods:** We enrolled 60 patients (16 men, 44 women; mean age, 66.7 years; range, 21–87 years) with distal radius fractures who underwent open reduction and internal fixation with volar locking plates. The DRUJ was stable in all patients during intraoperative manual stress testing. CT was performed at 1 and 6 months postoperatively with the forearm in the pronation position. DRUJ instability was quantified using the modified radioulnar line method. Two lines were drawn on the dorsal and volar borders of the radius, and the maximum width of the ulnar head outside them was measured. The ratio of this width to that of the sigmoid notch was calculated as the DRUJ instability ratio. DRUJ subluxation was diagnosed at a DRUJ instability ratio greater than 25.0%. Additionally, the subluxation ratio at 1 versus 6 months were compared using the Mann–Whitney U test, while the correlation between the ratio changes and fracture patterns were analyzed using the Spearman rank correlation coefficient. All results are shown as mean and standard deviation. Values of  $p < 0.05$  were considered significant.

**Result:** Based on CT evaluation, at 1 month postoperatively, dorsal DRUJ instability was diagnosed in two patients, whereas there were no cases of volar instability. Interestingly, 6 months postoperatively, dorsal instability was diagnosed in one patient, whereas volar instability was diagnosed in three patients. The change in the DRUJ instability ratio between 1 and 6 months postoperatively was  $-3.6 \pm 0.9\%$  ( $1.3 \pm 10.7\%$  and  $-2.2 \pm 14.0\%$ , respectively;  $p = 0.36$ ). However, in the three patients with volar dislocation, the instability ratio changed from  $-6.8 \pm 0.9\%$  at 1 month to  $-41.3 \pm 24.9\%$  at 6 months. Anatomical reduction was achieved in almost all patients, including those with volar dislocation (volar tilt,  $9.5^\circ \pm 5.0^\circ$ ; radial inclination,  $22.7^\circ \pm 5.0^\circ$ ; ulnar variance,  $0.7 \pm 1.7$  mm), and no patient experienced loss of reduction after 6 months. There was no correlation between instability ratio changes and preoperative fracture patterns.

**Conclusion:** Our study demonstrated that the DRUJ instability ratio was not significantly different at 1 versus 6 months postoperatively in most patients; however, volar dislocation was diagnosed in three patients at the 6-month follow-up visit but not the 1-month follow-up visit. It is very difficult to predict whether a distal fracture of the radius is complicated by volar dislocation of the DRUJ. However, despite forearm pronation, the ulnar head in these cases tended to translate more toward the volar border than in other cases at 1 month postoperatively.

## **A-0362** EVALUATION OF THE THENAR MUSCLE USING ULTRASONOGRAPHY

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**Background:** The correlation between the evaluation of the thenar muscle by ultrasonography and grip/pinch strength was investigated.

**Methods:** Fifty-eight healthy female volunteers with a mean age of 46.3 years (range; 22-79 years) were included in this study. The abductor pollicis brevis (APB) and opponens pollicis (OPP) muscles were evaluated by ultrasonography. The transducer was applied onto the palmar surface of the hand perpendicularly to the longitudinal axis of the first metacarpal bone. Then, both muscles were measured their thickness: the "APB depth (mm)" (from the inserted prominence of the OPP muscle above the first metacarpal bone to the palmar surface) and the "OPP depth (mm)" (from the ulnar prominence of the first metacarpal bone to the palmar surface of the OPP). Also, both muscles area was measured. Grip strength with a Smedleys Dynamometer and pinch strength with pinch meter were measured twice and averaged. The correlation of each muscle depth/area and grip/pinch strength was analyzed by the Pearson correlation coefficient.

**Results:** The positive correlation between APB depth and grip strength( $r=0.49$ ), OPP depth and grip strength( $r=0.58$ ) were found. While, APB and OPP depth, and pinch strength were uncorrelated.

**Conclusion:** The APB and OPP thickness measured by ultrasonography could be an useful tool for evaluation of hand function as well as grip strength.

## **A-0363** MID- TO LONG-TERM CLINICAL AND RADIOLOGICAL OUTCOME AFTER PERILUNATE INJURIES

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### Introduction

Perilunate dislocations (PLD) and perilunate fracture dislocations (PLFD) are rare but severe injuries to the wrist, usually resulting from a high-energy trauma occurring in sports injuries, motor vehicle accidents, falls or machine related accidents. Treatment of choice is early reduction with carpal transfixation, fracture fixation and refixation of the injured ligaments. As reports on mid- to long-term outcome are scarce, we aimed to investigate clinical and radiological outcome of open treatment after a minimal follow-up of 2 years.

### Methods

Patients treated for PLD and PLFD in our institution were identified in the electronic OR planning system which was available back to 2008. Inclusion criteria were PLD and PLFD of any kind who underwent open surgery, had a minimal follow-up of 2 years and were available for a clinical and radiological follow-up at our hospital. Clinical examination included ROM and grip strength. PRWE, quick DASH, SF-12 and the single assessment numeric evaluation (SANE) score were used as PROMs. Pain was assessed on a 10cm VAS. Dorsal-palmar and lateral X-rays of both wrists were done and assessed for carpal height, inter- and radio-carpal angles and degenerative changes.

## Results

Of a total of 55 identified patients, 49 had a minimum follow-up of 2 years. Of those, 10 had been treated as tourists or guest workers from abroad and thus, were not available for follow-up. Of the 39 remaining patients, 7 could no longer be located and contacted leaving 32 available for the study. By the date of abstract submission 15 patients after PLFD and 9 after PLD had been followed-up in our clinic. Mean follow-up was 93 months (24-170). Mean F/E was 42/0/50 for the affected and 69/0/67 for the healthy wrist, P/S 78/0/73 and 79/0/79, R/U 24/0/33 and 27/0/44. Mean grip strength was 41kp and 47kp. Mean score for PRWE was 13.2, qDASH 14.2%, SF-12 physical score 50.9, mental score 55.1 and SANE 86%. 12 patients showed a DISI>10° and 13 slight to moderate degenerative changes. Carpal height according to the Nattrass Index differed significantly ( $p<0.008$ ) between affected (1.45) and healthy (1.52) sides.

## Discussion

Generally, patients did well 2-14 years after surgery for PLD and PLFD. Although the affected wrists showed reduced ROM, strength and SANE scores, patients were mostly satisfied with the outcome and only exhibited little pain. Open reduction and fixation of PLD and PLFD reliably lead to satisfactory results even in the long-term.

## **A-0364** PATIENT-SPECIFIC LUNATE REPLACEMENT WITH PERILUNATE LIGAMENT RECONSTRUCTION – A 4D-CT KINEMATIC ANALYSIS IN CADAVERS

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## Introduction

Due to various problems as implant dislocation, silicon synovitis, and continuous carpal collapse, prosthetic lunate replacement has not become a standard procedure so far. We hypothesize that using a patient-specific implant in combination with a reconstruction of the scapho-lunate (SL), luno-triquetral (LT) and long radio-lunate (LRL) ligaments will allow a close to normal restoration of carpal kinematics in the cadaver wrist.

## Methods

Five thawed cadaver wrists were used. 3D-reconstructions of the wrists were obtained based on standard CT-scans. The prosthesis was planned as a replica of the original lunate and manufactured in titanium. Two types of ligament reconstructions using a distally based FCR-stripe in combination with FiberTape® were tested. 1) Anatomical front and back (ANAFAB) technique for SL- and LRL-ligaments combined with an LT- and dorsal intercarpal ligament (DICI) reconstruction through a y-shaped channel in the lunate (2 wrists). 2) SL-/LT-reconstruction through an oblique channel and isolated LRL-reconstruction with an isolated anchoring on the palmar aspect of the prosthesis (3 wrists).

4D-CT scans were obtained for extension/flexion (E/F) and radial-/ulnar-abduction (R/U) with the original lunate and after implantation of the prosthesis. Translation and rotation of the carpals were qualitatively and quantitatively analyzed in a 3D-coordinate system.

This study was supported by Medartis AG and Arthrex (anchors & FiberTape®).

## Results

The prostheses fitted perfectly after removal of the original lunate. In type 1 ligament reconstruction, the whole carpus almost acted as one block with restricted intercarpal and midcarpal motion. While the lunate qualitatively showed a close to normal rotation pattern, the amount of rotation and translational motion was increased in all dimensions. The scaphoid showed close to normal rotation but increased translation too. This improved substantially in type 2 reconstructions.

## Discussion

The production of an anatomically shaped and sufficiently polished prosthesis using conventional milling and polishing techniques nowadays is feasible. We believe that carpal kinematics after lunate replacement is mainly influenced by the type and tensioning of the ligament reconstructions. Including DCL reconstruction led to midcarpal stiffness and should not be done. Future investigations should focus on further refinements of ligament reconstruction with special emphasis on intraoperative control of ligament tension.

## **A-0366** BIOLOGICAL NERVE GRAFTS FOR EXTENDED PERIPHERAL NERVE INJURIES BASED ON SPIDER SILK GUIDED REGENERATION

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In the reconstruction of long distance nerve defects, the availability of appropriate conduits remains an obstacle to immediate and successful nerve repair. After previous successful bridging of long nerve defects in sheep by conduits based on native spider silk fibres, we now reconstructed devastating long nerve defects of 20 to 25 cm length in humans with vein grafts containing luminal spider silk fibers. To our knowledge, this is the first application of this kind in humans. Patients and methods: In 4 patients with extended nerve defects (> 20 cm) the following nerve defects were reconstructed by conduits consisting of an autologous saphenous graft with luminal fibres (app. 300 fibres per graft) of the drag line silk of *Nephila* spiders: Two traumatic nerve defects in the forearm (20cm), one of the median nerve, one of the ulnar nerve, one combined traumatic median and ulnar nerve defect in the forearm (25 cm) and one defect of the sciatic nerve after radical resection of a synovial sarcoma in the posterior thigh (23 cm). Additional procedures in the forearm for the patient with combined median and ulnar nerve reconstruction and one patient with a median nerve defect were functional free gracilis muscle transplantations to reconstruct finger and hand flexor function. Additional tendon transfers and Zancolli procedure for balancing function were added. All patients were evaluated from two to ten years post reconstruction clinically and by neurography. Consent by the ethical commission was given.

Results: In all patients primary wound healing and no adverse reaction to the implanted material was observed. Despite the devastating injuries, patients regained relevant functions: Protective sensibility of the fingers in all forearm injuries in the respective nerve areas (3). Full flexor function with near to normal grasp function after microvascular gracilis muscle transfer (2), key grip function and finger flexion after additional tendoplasties (1). After sciatic nerve reconstruction protective sensibility of the lower leg and foot and gait enabled normal walking and jogging. In none of the patients a neuroma or neuropathic pain occurred.

Conclusion: Autologous vein conduits with luminal *Nephila* spider silk fibers provide a new option for the reconstruction of extended nerve defects due to the lack of adverse reactions and the ease of application. Despite good sensory improvements a lack of reinnervation in the dependent muscles warrants the optimization of the luminal environment in order to improve functional outcome in long distance reconstructions.

## **A-0367** DENERVATION AS A TREATMENT STRATEGY FOR PAIN IN HAND OSTEOARTHRITIS: A SYSTEMATIC LITERATURE REVIEW

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### Purpose

Surgical denervation has been proposed as a treatment for pain in hand osteoarthritis (OA). We performed a systematic literature review to summarize the available evidence and propose a research agenda.

### Methods

A systematic literature search was performed up to September 2021 in the Pubmed, Embase and Cochrane databases. Two independent investigators identified studies that reported on denervation for OA of the proximal interphalangeal joint (PIPJ), distal interphalangeal joint (DIPJ), metacarpophalangeal joint (MCPJ) or first carpometacarpal joint (CMCJ). Reviews, comments, letters or editorials, studies in languages other than English and studies investigating other interventions, joints or conditions were excluded. Quality of studies was assessed with the Joanna Briggs Institute checklist for case series and the ROBINS-I, where applicable. Study characteristics, patient characteristics, details of the surgical technique and outcomes of the surgery were extracted. Due to the heterogeneous nature of the data, no meta-analysis was performed. Data from the studies were pooled and minimal and maximal scores were estimated.

### Results

The search yielded 195 articles. From these, 14 articles reporting on 353 denervation surgeries in 320 patients were selected (range 3-60 participants per study). Eight studies described CMCJ denervation, three described PIPJ denervation, and the others described DIPJ (1), MCPJ (1) or a mixture of MPCJ, PIPJ and DIPJ denervation (1). The surgical techniques varied greatly, both in incisions used and in the nerves severed to achieve denervation, even between studies investigating denervation of the same joint. The vast majority of the studies were case series (n=13), and one was a non-randomized clinical trial. We found all studies to have significant risk of bias. The studies encompassed a patient group representative for the hand OA population, with average age ranging from 55 to 65 and 60-75% female participants.

The thirteen case series reported positive outcomes with respect to pain, function and patient satisfaction. After a follow-up ranging from 4-152 months, average pain decrease ranged from 3 to 8.1 on a 10 point numeric rating scale (NRS), with a 70-92% patient satisfaction rate and a complication rate of 0-75%. The non-randomized clinical trial reported no differences in outcome when comparing denervation to trapeziectomy. Complication rates varied, but were high (0-75%), with sensory abnormalities occurring the most, followed by the need for revision surgery.

### Conclusion

Surgical denervation for pain in hand OA shows promise, but the available evidence does not allow conclusions, as for example regression to the mean can strongly influence the observations in case series. More and higher quality evidence is needed before it can be recommended as part of standard care. On the research agenda are: standardization with regard to the nerves to sever, standardization of the technique, and high quality randomized controlled trials comparing efficacy to no intervention, usual care, or other pharmacological, non-pharmacological or surgical techniques, using validated patient-reported outcome on hand function and health-related quality of life.

## **A-0368** SURGICAL MANAGEMENT OF LATERAL EPICONDYLITIS WITH VARUS INSTABILITY : LATERAL COLLATERAL LIGAMENT (LCL) RECONSTRUCTION VERSUS DIRECT REPAIR

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**Background:** The treatment for lateral epicondylitis (LE) with varus instability is still controversial. Repetitive steroid injections is one of the many causes that induce elbow varus instability. Debridement and restoration of the lateral collateral ligament(LCL) complex associated elbow varus instability will lead to better results in terms of pain relief and functional activity. Therefore, we aimed to determine the clinical outcomes of open extensor carpi radialis brevis (ECRB) release with LCL reconstruction using tendon grafts and open ECRB release with LCL direct repair in patients with LE and LCL insufficiency.

**Methods:** We performed a case series study by retrospectively reviewing the medical records and radiologic findings of all patients who were treated for LE at our hospital between March 2017 and June 2019. There were 36 patients with a history of multiple steroid injections history and had undergone surgery for LE with varus instability. Twenty patients (56%) were treated with open ECRB release and LCL reconstruction with a palmaris longus (PL) graft (group A) and the remaining 16 (44%) patients were treated with open ECRB and LCL direct repair with an anchor suture (group B). Clinical outcomes were evaluated based on the pain visual analog scale (VAS) score; disabilities of the arm, shoulder, and hand (DASH) score; and grip power strength.

**Results:** The postoperative pain VAS score, DASH score, and grip power strength were significantly improved in all patients. All patients had no varus instability on the stress test at 1 year follow-up. There was a statistically significant improvement in pain VAS score in all group A patients at the final visit. However, there was no significant difference in DASH score and postoperative grip strength between the two groups.

**Conclusion:** In patients with LE and associated varus instability, ECRB release and LCL reconstruction provide better clinical outcomes at 1 year follow-up compared to ECRB release and LCL repair in patients with LE with varus instability caused by multiple steroid injections.

## **A-0369** REPLANTATION OF AMPUTATED THUMBS WITH ROTARY AVULSION INJURY THROUGH BRIDGING THE ARTERIAL DEFECTS WITH VEIN GRAFTS AND PRIMARY TENDON TRANSFER IN 10 PATIENTS

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[Abstract] **Objective:** To evaluate the feasibility of repairing rotary avulsion replantation of thumb by bridging superficial carpal vein with deep metacarpal arch. **Methods:** From January 2018 to January 2022, 10 patients (10 thumbs) with complete amputation at the metacarpophalangeal joint with rotary avulsion injury were treated in our department. There were 6 men and 4 women with a mean age of  $42\pm 6.90$  years. The superficial vein harvested from palmar wrist region was used to bridge the defect of the deep palmar arterial arch to restore blood supply to the bilateral digital arteries of the thumb. The same incision was used to repair the function of the flexor pollicis longus (FPL) tendon through transposition of the flexor digitorum superficialis tendon of the ring finger to the distal FPL stump. The survival of the amputated finger was observed after operation, and therapy exercise and follow-up were performed after complete survival. **Results:** 8 patients (8 thumbs) were followed up for 6-10 months (mean, 8 months). 9 cases survived successfully,

1 case had partial necrosis of the proximal skin margin of the severed finger body, and the necrotic part healed after dressing change. Conclusion: Venous transplantation from deep metacarpal arch was used to connect the thumb digital arteries to form a new vascular pathway and restore the physiological blood supply of the thumb. It is feasible to repair the rotary avulsion of the thumb and preserve the length of the finger. Vein transplantation and tendon transposition can be done in the same surgical incision..

Key words: Rotary avulsion detachment; Vein transplantation; No shortening

### **A-0370** THE CHANGE OF WRIST EXTENSION POWER AFTER ECRB RELEASE IN LATERAL EPICONDYLITIS

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Purpose: A degenerative change and microscopic rupture in extensor carpi radialis brevis(ECRB) origin remains the most commonly accepted cause of lateral epicondylitis(LE). One of the most common surgical procedure is arthroscopic or open ECRB release. The function of ECRB is to extend and radially deviate the wrist joint. The purpose of this study was to investigate the change of wrist extension strength after (ECRB) release in LE.

Methods: Thirty-six patients who surgically underwent open ECRB release were included in this study. We measured wrist extension strength with a hand-held dynamometer device (MicroFET2<sup>®</sup>) on the first and final visit. We also evaluated the clinical outcomes with Disabilities of the arm, shoulder and Hand (DASH) score, visual analog scale (VAS), grip strength and wrist extension strength and analyzed the correlation between each factors.

Results: All clinical outcomes including grip strength and wrist extension strength were significantly improved after ECRB release. However on the final visit, wrist extension power was slightly decreased compare to unaffected arm, the reduction of wrist extension power did not affect the clinical outcomes (DASH, VAS) and grip strength.

Conclusion: After ECRB release, promising clinical outcome can be expected. However, a reduction in wrist extension power may occur, but the influence may minimal. Isometric wrist extension strengthening exercise might be helpful to prevent the reduction of wrist extension strength.

### **A-0371** AN UPDATE ON SURGICAL PROCEDURES FOR CARPAL TUNNEL SYNDROME: WHAT IS THE CURRENT EVIDENCE?

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Carpal tunnel syndrome (CTS) is a multifactorial compression neuropathy. It is reported to be very common and rising globally. The main clinical manifestations are median nerve-related sensory and motor dysfunction. CTS's treatment varies from conservative measures to surgical treatments. Surgery has shown to be an effective method for more severe cases. However few unclear aspects and room for further research and improvements still remains.

We performed a narrative literature review on the most up to date progress and innovation in terms of surgical treatments for CTS. It seems that not just the adherence to the current updated indications and guidelines could allow the best surgical outcomes, but specific patient-related aspects need to be taken into account and integrated in the management planning. We have also added few interesting and evidence based medicine inputs that should be taken into account by surgeons dealing with CTS patients.

After reviewing the most up to date literature, it could be said that evidence of superiority of one technique over the others is lacking from a high level of evidence point of view. Specific advantages and disadvantages of surgical methods can however be taken into account when choosing among treatments. The simple algorithm of leaving the choice of the surgical method to surgeons' preference and experience (together with consideration of patients' related factors) seem to be the best available option, which is supported by the most recent metanalysis and systematic reviews.

We suggest that surgeons (unless in presence of precise indications towards endoscopic release) should tend to perform a minimally invasive open approach release, favoring the advantage of a better neurovascular structures visualization (and a consequent higher chance to perform a complete release with long term relief of symptoms) instead of favoring an early reduction (in the first postoperative days) of immobilization and pain. Moreover, in view of higher chances to obtain long term symptoms relief, the risk of hypertrophic or hypersensitive scar formation should be considered secondary, despite temporary discomfort for the patients.

Research towards a universally accepted standardization should be aimed for by the authors, who have failed to date to sufficiently limit bias and limitations.

### **A-0372** A MULTIDISCIPLINARY GLOBAL SURVEY AND REVIEW OF CURRENT EVIDENCE ON THE TREATMENT AND REHABILITATION OF DUPUYTREN'S DISEASE AFFECTING THE LITTLE FINGER

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Dupuytren disease (DD) is associated with high rate of complications. Among these, the recurrences are quite common and lead to worse outcomes and permanent disability. Worse prognosis is associated with the involvement and treatment of the little finger (LF), whose aspects still lack of consensus and scientific evidence.

The aim of our study was to provide objective and subjective information and professionals' experience on the topic for an input to future research.

A questionnaire survey including open and closed questions was sent and distributed among the main professional characters (Hand surgeon, Physiotherapist and Occupational therapist) involved in the treatment of DD among the 5 continents. The involvement and role of the V finger in DD was extensively highlighted and emphasized. Only congruous answers were included. A total of 587 answers were collected. A statistical analysis was performed with Microsoft Excel and Python, statistical significativity was set  $p < 0,05$ .

Current knowledge and evidence was also searched, analyzed and integrated with our results.

The answers were so distributed: 49,7% from hand surgeons, 24,4% from physiotherapists and 26% from occupational therapists. The 76,5 % of questioned figures agreed with the statement: "The 5th finger does not necessarily benefit from good results. Rehabilitation, just like surgery, can be delicate and difficult. Do you agree on this point of view?". The different agreement about the statement was found between surgeons and occupational therapists ( $p: 0.007$ ) and among the surgeons depending on their surgical experience ( $p: 0,008$ ). No significant differences were seen between surgeons and physiotherapists. LF in Dupuytren's disease needs special attention both in surgery and rehabilitation.

Surgeons should be aware of the anatomical and functional singularities of LF to better define the expected outcomes, taking into consideration patient satisfaction and functional improvement more than the particular degree of joint motion. In addition, although it is a quite common surgery, they should be aware that the surgical techniques in DD require a certain amount of experience and it should not be underestimated.

Regarding physical and occupational therapists, they have a key role in maintaining surgical outcomes as well in the early detection and treatment of postoperative complications. They should keep investigating the effectiveness of splinting and propose functional and easily reproducible orthosis for the LF to be able to standardize treatment. In addition, they should insist on the cortical reintegration of the fifth finger using all their creativity in proposing playful and functional activities. Furthermore professions should invest in patient education to ensure early consulting and better compliance to treatment and rehabilitation.

### **A-0373** USE OF WALANT TECHNIQUE FOR PULLEY RECONSTRUCTION IN SITFF FINGERS. REPORT OF 2 CASES

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#### INTRODUCTION

The flexor pulley system is an efficient system that converts tendon excursion to angular motion at the joints of the fingers. Injuries to the pulleys cause volar displacement of the flexor tendons by disrupting the balance of the system. Closed pulley injuries may occur from an extension forced applied over a short period of time to a flexed digit. In some cases, subacute pulley ruptures present an interphalangeal joint contracture.

Acute single pulley ruptures are treated conservatively.

Surgical treatment is indicated for patients with multiple pulley ruptures and impairment of function or those with persistent symptoms after nonoperative treatment.

The most classic reconstructive techniques are based on weaving an autogenous tendon graft through the remaining pulley rim (Weilby/Kleinert and Bennet technique), making a new pulley loop around the bone (Bunell/ Okutsu technique) or passing the flexor tendon under the palmar plate (Karev technique).

WALANT anesthesia technique (Wide Awake Local Anesthesia No Tourniquet) offers to the surgeon the benefit of verifying intraoperatively the movement and biomechanics of the tendon after the pulley reconstruction.

#### MATERIALS AND METHODS

We present 2 patients, with a delayed presentation of pulley rupture and fixed PIP flexion contracture (greater than 45°), surgically treated by Arthrolysis and Weilby technique under WALANT anesthetic.

Postoperatively, both patients were immobilized with an interphalangeal joint in extension and metacarpophalangeal joint at 90° of flexion splint, allowing passive exercises to prevent reappearance of stiffness. Active exercises were not started until six weeks after surgery, using a pulley ring orthosis, in order to protect the plasty.

#### RESULTS

At 6-month follow-up, both patients were completely asymptomatic with satisfactory range of motion of the PIP joint (-15°–105°). They recovered almost complete strength, no recurrence of stiffness was shown and currently, they are both back to their jobs.

#### CONCLUSION

Pulley injury is a condition that hand surgeons may frequently face. Sometimes it can produce a flexion contracture of the PIP joint, which is really dysfunctional for the patient.

Through these two cases, we defend the use of the WALANT technique when performing an arthrolysis and reconstruction of the pulley system with the aim of intraoperatively verify the correct functioning of the plasty and active mobilization of the finger before closing, in order to perform any readjustments if necessary and obtain better results.

## **A-0375** DUPUYTREN'S DISEASE IS A WORK-RELATED DISORDER: RESULTS OF A POPULATION-BASED COHORT STUDY

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### Objectives

Dupuytren's disease (DD) is a fibroproliferative disorder of the hands, characterized by the development of fibrous nodules and cords that may cause disabling contractures of the fingers. The role of manual work exposure in the aetiology DD is controversial. We investigated whether current occupational exposure to manual work is associated with DD, and if there is a dose-response relationship.

### Methods

In this population-based cohort analysis, we used data from the UK Biobank cohort. Our primary outcome was the presence of DD. The exposure of interest was manual work, measured for each participant in two different ways to allow two independent analyses to be undertaken: 1) the current manual work status of the occupation at the time of recruitment, and 2) a cumulative manual work exposure score, calculated based on the occupational history. We performed propensity score matching and applied a logistic regression model.

### Results

We included 196,265 participants for the current manual work analysis and 96,563 participants for the dose-response analysis. Participants whose current occupation usually/always involves manual work are more often affected with DD than participants whose occupation sometimes/never involves manual work (OR 1.29,95% CI 1.12–1.49,  $p < 0.001$ ). There was a positive dose-response relationship between cumulative manual work exposure score and DD. Each increment in cumulative work exposure score increases the odds by 17% (OR 1.17,95% CI 1.08–1.27,  $p < 0.001$ ).

### Conclusions

Manual work exposure is a risk factor for DD, with a clear dose-response relationship. Physicians treating patients should recognise DD as a work-related disorder and inform patients accordingly.

## **A-0377** ETIOLOGY OF DUPUYTREN'S FLARE AFTER TRIGGER FINGER RELEASE SURGERY - A CASE SERIES

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**Background:** Dupuytren's disease is a fibroproliferative disorder of the palmar fascia of the hand characterized with formation of nodules and cords. It is an autosomal dominant disorder with variable penetrance primarily affecting Caucasians of Northern European descent. The ring and small fingers are the most commonly affected digits. Flexion contracture of the metacarpophalangeal (MCP) and proximal interphalangeal (PIP) joints lead to debilitating contractures affecting the patient's activities of daily living. Unfortunately, there is no cure for the disease, however current treatment options for the contracture release include percutaneous needle fasciotomy, enzymatic fasciotomy with collagenase clostridium histolyticum, and open fasciectomy. Secondary to variable penetrance of the disease, surgical intervention may aggravate an initially undiagnosed Dupuytren's disease. Although limited, current literature has suggested an association between trigger finger release surgery and Dupuytren's disease flare. This study is a case series of 10 patients who have undergone trigger finger release surgery and subsequently experienced a Dupuytren's flare.

**Methods:** A retrospective review of patient's charts that have undergone a trigger finger release and experienced a Dupuytren's flare was done between the years of 2012 and 2022. Data included patient's age, sex, hand dominance, prior medical history and surgical interventions, date of trigger finger release and amount of time until diagnosis of Dupuytren's flare, digit most commonly affected, as well as any interventions that followed.

**Results:** We identified 10 patients with a Dupuytren's flare following trigger finger release surgery, with 8 females and 2 males. Average age was 67.9 and all patients were right hand dominant (RHD). None of the patients reported a prior history of Dupuytren's disease; one patient had a recorded history of diabetes mellitus, and two had hypertension well controlled with medication. Average amount of time from surgery to Dupuytren's flare was 70 days. Right ring finger (RRF), followed by left ring finger (LRF) were the most common digits involved, followed by an equal involvement of the middle fingers. All flares presented with initial symptoms of early inflammation, wound healing problems, and tenderness at the surgical site.

**Conclusion:** Dupuytren's disease is an autosomal dominant disorder with variable penetrance. Thus, it is difficult to ascertain if the patient had Dupuytren's disease prior to trigger finger release that lead to a flare. Out of the 10 patients that were identified, most were women in the late 60s. All of the patients were RHD and none had prior Dupuytren's disease diagnosis recorded. RRF and LRF were the most common digits involved. Average time to flare was 70 days and all patients underwent either further surgical intervention or aggressive splinting. The purpose of the study was to show that Dupuytren's flare is a real concern and should be on the radar of any surgeon who performs trigger finger release surgery. Early signs of inflammation, poor wound healing, excessive tenderness might signal that Dupuytren's flare is occurring. It is our hope that our results may aid in risk-benefit discussion with patients and provide increased alertness to the early signs of Dupuytren's flare development.

## **A-0378** ANALYSIS OF UPPER EXTREMITY MOTION DURING VENIPUNCTURE USING OPTICAL 3D MOTION ANALYSIS SYSTEM

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### Introduction

One of the most basic clinical procedures that physicians should become proficient in at an early stage is collecting blood. However, few studies have objectively evaluated its movement characteristics. In this study, we analyzed the movement of the physician's upper extremity, assuming that physicians with more years of experience have shorter blood collection times and perform fewer unnecessary movements.

### Materials and Methods

Nineteen orthopedic surgeons, 19 hands (mean age  $31.4 \pm 3.6$  years), 3 to 15 years post-graduation were included in the study. Exclusion criteria were needle grasping with fingers other than the thumb-index finger. Each subject underwent three venipunctures with a winged needle on the simulator, for a total of 57 punctures. Thirty-four markers were placed on the upper extremity and 11 motion capture camera systems (VICON, Oxford, UK) were used. A color sensor was used to detect backflow of blood.

The elapsed time T (seconds; s) from the point when the needle tip contacted the skin to the point when the color sensor reacted was calculated. The angles (°) of the elbow joint, wrist joint, and MP, DIP, and PIP joints of the thumb and index

finger were calculated. The change in joint angles (°) was calculated by subtracting the minimum value from the maximum value of the joint angles during the trial. The Wilcoxon test was used for statistical analysis.

## RESULTS

Group I was defined as having less than 5 years of post-graduation and Group II as having more than 5 years of post-graduation. The elapsed time T was divided into less than 3 seconds (group A) and more than 3 seconds (group B).

First, T (s) averaged  $3.3 \pm 4.5$  (s) (I 4.2: II 2.6), with a median of 2.0 (s), significantly longer in group I ( $p = 0.0233$ ) compared to group II.

Secondly, the mean change in joint angle (°) was  $6 \pm 5.6$  (I7: II5: A 4: B9) for elbow,  $9 \pm 7.6$  (I13: II6: A 6: B14) for wrist,  $6 \pm 4.1$  (I9: II4: A 4: B9) for thumb MP,  $12 \pm 6.7$  (I12: II11: A 10: B16) for thumb IP,  $6 \pm 6.8$  (I9: II4: A 4: B11) for index finger MP,  $13 \pm 11.6$  (I21: II8: A 9: B20) for index finger PIP, and  $12 \pm 13.4$  (I19: II8: A 10: B17) for index finger DIP. Statistically, there were significant differences between groups I and II in the wrist joint, thumb MP joint, and index finger PIP joint. Significant differences were also observed between groups A and B in the elbow joint, wrist joint, thumb MP and IP joint.

## Conclusion

Physicians with more years of experience tended to have shorter times between puncture and the back flow of blood and fewer wasted movements. In addition, the shorter the time between the puncture and the back flow of blood, the less wasted movement tended to be observed. Angle measurement needs to be verified by comparison with goniometers in the future.

## **A-0379** LONG TERM FUNCTIONAL OUTCOME OF CARPOMETACARPAL FRACTURE DISLOCATIONS: A RETROSPECTIVE CASE SERIES

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**Background:** Carpometacarpal (CMC) fracture dislocations are uncommon injuries. Surgical intervention seems to be favored and can be categorized in open versus percutaneous reduction and fixation.

**Objectives:** The aim of this study is to determine the long term functional outcomes of patients that have been treated surgically for a CMC fracture dislocation. Additionally, we assessed if there was any difference between the used surgical techniques.

**Methods:** A retrospective study of all consecutive patients treated between 2010–2020 with a CMC fracture dislocation of the 2nd to 5th CMC-joint was conducted. Patients were invited to fill out the Michigan Hand Outcome Questionnaire (MHQ). Moreover, it was analyzed if there was a difference between the open and percutaneous technique.

**Results:** A total of 69 patients were included and 26 patients could be analyzed for long term follow up. Most patients had a CMC 4 or CMC 5 fracture dislocation. The median MHQ-score was 88 (interquartile range [IQR]: 83–95) after a median follow-up of 46 months (IQR: 31–65 months). The participants were divided into three groups based on operative techniques: (1) closed reduction and internal fixation with K-wire, (2) open reduction and internal fixation (ORIF) with K-wire and (3) ORIF with bridging plate. The total MHQ-score between the different operative techniques was not statistically significant. Persisting pain occurred in four out of 26 patients (15%).

**Conclusion:** Operative treatment of CMC fracture dislocations of the 2nd to 5th CMC-joint leads to good functional outcome regardless of surgical technique.

## **A-0381** FACTORS AFFECTING RUPTURE OF FLEXOR TENDON REPAIR WITH THE SIX-STRAND TECHNIQUE FOLLOWED BY EARLY ACTIVE MOBILIZATION

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### Hypothesis

Although flexor tendon repair using a strong core suture with early active mobilization (EAM) has favorable outcomes, there remains a small risk of rupture. This study examines the factors affecting the outcomes of repaired tendon rupture.

### Methods

This was a retrospective case series of 60 consecutive patients with 65 flexor digitorum profundus lacerations between 2012 and 2021 who were treated using the Yoshizu #1 technique followed by EAM. We investigated whether the surgeon's level of expertise, the involved digits, cause of injury, and the timing of repair were associated with rupture. We used Fisher's exact test, and a p value of <0.05 was considered statistically significant. Odds ratios of rupture were calculated for the factors.

### Results

Rupture of flexor tendon repair occurred in five patients (five digits). The patients consisted of five males with a mean age of 34 years (range 16–55 years) at the time of injury. The injuries involved one thumb, two middle fingers, one ring, and one little finger. There was one zone T2, one zone 1, and three zone 2 injuries. The injuries in two of the digits were sharp cut, whereas the other three digits had blunt or crush injuries. Tendon repair was performed in two digits at the primary stage and three digits at the delayed primary stage. All ruptures occurred in digits treated by inexperienced surgeons (level 2 expertise according to Tang's levels of surgical expertise). The mean timing of rupture was 3.7 weeks (range 0.3–8 weeks) after repair, and the most common cause of rupture was inadequate tendon repair in two cases, suture rupture in two cases, and unknown in one case. Level of surgical expertise was not significantly associated with increased rate of rupture; however, there were no cases of rupture in digits treated by highly experienced specialists. The odds ratio of rupture was higher in the middle finger (OR 3.67; 95% CI: 0.27–37.1) and thumb (OR 2.69; 95% CI: 0.05–35.8) and in the blunt or crush injuries (OR 6.68; 95% CI: 0.65–85.7). There were no significant differences in terms of the timing of repair.

### Summary Points

- Surgeon experience is a factor associated with rupture.
- Middle finger and thumb injuries as well as blunt or crush injuries were related to rupture.

## **A-0382** AN EXAMINATION OF THE OPERATIVE AND POST-OPERATIVE MANAGEMENT OF TRAPEZIOMETACARPAL OSTEOARTHRITIS IN IRELAND

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### Objective:

The trapeziometacarpal joint is the second most common joint affected in osteoarthritis of the hand. When conservative treatment fails surgical intervention may be required.

There is variation in the literature regarding surgical procedures used, influences on surgical choice and post-operative interventions. This study sought to investigate the operative and post-operative management in Southern Ireland by

surveying hand surgeons and hand therapists on their current practice.

#### Methods:

A cross-sectional survey methodology was chosen. Two purposively designed on-line questionnaires were shared through the on-line survey platform Qualtrics. Recruitment was conducted via the Irish Hand Surgery Society (IHSS), the Irish Association of Hand Therapists (IAHT) and the Irish Society of Chartered Physiotherapists (ISCP).

#### Results:

Twenty surgeon's responses were received and analysed. Trapeziectomy with Ligament Reconstruction and Tendon Interposition (LRTI) was the most common procedure for all stages of arthritis for sedentary and manual patients with 65% (n=13) stating they perform 1-5 over six months. The next most popular procedure was arthrodesis (45%, n=9) and trapeziectomy (40%, n=8). Reasons for choosing Trapeziectomy with LRTI include providing reliable results (n=7), surgeon familiarity (n=4), preserving length and stability (n=2), is supported by best evidence (n=1) and is safe (n=1). Referral rate to therapy following surgery was high. Seventy nine percent (n=15) refer all patients, 16% (n=3) refer over 50% and 5% (n=1) refer less than 50%, one surgeon did not answer.

There were 28 therapist responses. Almost all respondents (n=27) indicated that patients are initially casted post-surgery with 88% (n=24) indicating they remain casted for 1-2 weeks. A variety of splints are used including a long rigid thumb spica, a short thumb spica and a soft orthosis. The most popular combination was a cast for 1-2 weeks followed by a long rigid splint at week 2 and a neoprene splint at week 6 (n=6). The commencement of MCP, CMC and wrist motion differed between respondents and surgical procedures. All respondents (n=20) prescribe strengthening exercises. Most commence strengthening at week 6 (30%, n=6) or 7 (35%, n=8). Protocols were developed by a therapist in conjunction with a surgeon by 72% (n=13) of respondents (n=18). The main factor that influences the protocol used was the therapists own clinical experience (50%, n=9). All participants who answered regarding pain (n=19) stated that pain can be an issue in the rehabilitation of these patients with 63% (n=12) advising patients it can last up to 6 months.

#### Ethics:

Ethical approval was obtained from the School of Medicine Research Ethics committee, Trinity College, Dublin

#### Conclusion/Implications for practice

The findings of this study provide a profile of current surgical and therapeutic practice in Southern Ireland for patients with trapeziometacarpal joint osteoarthritis. Approaches and interventions are variable reflecting published international literature. The study identified that pain post-operatively is common and this area would benefit from further research.

### **A-0383** PREDICTING FAILURE OF DISTAL RADIUS FIXATION WITH VOLAR LOCKING PLATE: IS SURGEON GRADE OR SPECIALTY KEY?

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#### Aims

This study examines the effects of surgeon grade and specialty with rate of failure. This may help to avoid complications by establishing need for specialist supervision.

#### Methods

Complete imaging of 798 consecutive wrist fixations from January 2012-June 2019 were reviewed. Fixation had failed if fracture collapse occurred postoperatively leading to loss of reduction or screw penetration.

Each failed fixation was matched 1:3 to patients with successful fixation by age, gender, displacement direction, and fracture classification (factors associated with risk of failure in our previous work).

Operation notes were reviewed for each of the cases and case control, establishing operating surgeon and their level of experience, as well as the supervising consultant and their specialty.

P values were calculated using a 2 tailed Fisher's exact test.

#### Results

From the database 517 patients treated with the Acu-Loc® 2 Volar Distal Radius Plating System (Acumed, USA) had sufficient imaging for assessment. 23 fixations failed, and each were matched with 69 non-failed fixations meaning 92 fractures were analysed.

Overall, there were 44 consultant led, and 48 junior led procedures, with failures rates of 12 and 10, respectively. Comparison of failure rates in consultant led (27.27%) vs junior led procedures (20.83%) ( $p=0.63$ ).

In the consultant led group, 27 of these cases were performed by hand surgeons with a failure rate of n8 (29.62%), and 17 performed by non-hand surgeons with a failure rate of n4 (23.53%) ( $p=1.00$ ).

Of the junior led procedures, 18 were supervised by hand surgeons with a failure rate of n3 (16.67%), and 30 were supervised by non-hand surgeons with a failure rate of n7 (23.33%) ( $p=0.72$ ).

Comparison of failures rates between hand surgeon (24.44%) vs non-hand surgeon involved procedures (23.40%) ( $p=1.00$ ).

#### Conclusion

This study suggests that complication rates for juniors performing this procedure are reduced when they are supervised by a hand specialist, however, this did not reach significance.

No meaningful or statistical difference was found between any of our major comparison groups of consultant vs junior, hand surgeon vs non hand surgeon (lead, assistant, or supervisor).

Subgroup analysis of the consultants leading surgery showed higher failure rates within the hand surgeon group vs non-hand surgeons. However, subgroup analysis of the juniors leading surgery showed that failure rates were lower in those supervised by a hand specialist, than those supervised by a non-hand specialist. Neither of these subgroups reached statistical significance.

Work is underway to establish the causes of difference between the complication rates for the hand and non-hand specialists. Though case-matched by AO classification, it should be noted that subtleties of fracture complexity are not accounted for, and that other complicating factors such as time from injury to surgery were not included in the matching process.

There is also the possibility that this study is somewhat underpowered, leading to lack of statistical significance.

### **A-0384** A COUNTY BREAKDOWN OF BRACHIAL PLEXUS INJURIES IN ENGLAND AND WALES

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Traumatic brachial plexus injuries (BPI) are life-changing. They may produce paralysis, changes in sensory function, neuropathic pain, secondary joint contractures, and psychological morbidity. To date, there is no nationwide epidemiological data on BPIs in England and Wales. The aim of this study was to investigate variations in epidemiological data of BPIs using data from the Trauma Audit and Research Network (TARN).

The TARN database was reviewed to identify eligible patients admitted between 1990 and 2022. Patient demographics, prevalence, causative factors, injury types and mechanisms of injury were analysed by government-defined ceremonial county lines and the frequency of BPI was standardised by the population.

A total of 1,297 patients with BPI were identified across 48 counties in England and Wales. The mean age of patients with BPI was 39 and 77% were male. Residents of West Glamorgan (Wales) had the highest incidence of traumatic brachial plexus injuries with 6.84 per 100,000 population, followed by Cambridgeshire (England) (6.22), South Glamorgan (Wales) (5.62), Warwickshire (England) (4.73) and Oxfordshire (England) (4.51). The most common mechanism of injury in all counties, except Dorset (England), was vehicle collision. In Dorset, the most common mechanism of injury was a fall of less than 2m. The mean age of the affected residents in Dorset was 13 years older compared to other counties (CI 95%) and the proportion of female residents was higher ( $p=0.056$ ). Residents of Gwent (Wales), Bedfordshire (England), West Glamorgan (Wales) and West Yorkshire (England) had greater than 20% of residents undergoing plexus repair during their primary admission. Overall, significant differences were observed between counties in resident age and time to first hospital attendance. There were no meaningful differences in the length of hospital stay between counties.

This study represents the first description of BPI on a per-county basis in England and Wales. It provides the basis for further work to be undertaken to investigate differences and help inform prevention measures and resource allocation.

### **A-0385** MRI IN TRAUMATIC BRACHIAL PLEXUS INJURIES: A RETROSPECTIVE, NATIONWIDE OVERVIEW

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Traumatic brachial plexus injuries (TBPI) affect 1% of patients involved in major trauma and are becoming more common. Determining the location of nerve injury is essential because the reconstruction and prognosis of pre-ganglionic injuries are different to other types of BPI. The use of magnetic resonance imaging (MRI) to assess BPI has increased given its multi-planar capabilities, unparalleled soft-tissue contrast, biological safety, and ability to assess structure and function. Using data from the Trauma Audit and Research Network (TARN), we show how the use of MRI has changed over time in adults with BPI.

The TARN database was reviewed to identify eligible patients admitted between 1990 and 2022 who had brachial plexus MRI following major trauma. Demographics, year of injury and mechanism of injury were analysed to identify trends in the use of MRI.

A total of 1,280 eligible patients with BPI were identified of which 500 had MRI. No imaging was performed prior to 2006 with most scans performed in 2014 ( $n=59$ ). Only 3 patients of the eligible cohort had a CT myelogram of their brachial plexus. A significant increase in the use of brachial plexus MRI was observed following the introduction of major trauma centres (MTCs) in 2012 (12% vs 51%,  $p<0.001$ ). The median time from arrival to imaging was 96 hours (IQR: 36-213 hours). No significant differences in the time from arrival to a plexus MRI were observed following MTC introduction. The data indicated that males under the age of 65, were more likely to be involved in vehicle collisions (OR 6.29 [95% CI]), whilst females over 65 were more likely to sustain a BPI following a fall from standing height (OR 38.05 [95% CI]). For this reason, males with BPI underwent MRI more frequently than females. Patients who underwent MRI were also 4 years (95% CI) younger than those who were managed without imaging.

This study demonstrates an increase in the use of MRI for BPI since 2006. Variation in imaging appeared to be dependent

on the mechanism of injury, which is in turn a function of sex and age. This study provides the basis for further work to be undertaken to help standardise the use of imaging of the brachial plexus in major trauma scenarios.

### **A-0386** GPS – A RESCUE TECHNIQUE IN NON-HEALING BONES AND IN REPLACEMENT OF LARGE BONE DEFECTS IN HAND SURGERY: A RETROSPECTIVE COHORT STUDY

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**Introduction:** Whole blood contains several components that can be concentrated during centrifugation to form a buffy coat layer or leukocyte-rich platelet-rich plasma (L-PRP). By utilizing the GPS Platelet Concentration System, the patient's own platelets can be separated into a highly concentrated formula. The PRP can be mixed with autograft or allograft bone prior to application at a hand surgery surgical site. In a retrospective study we evaluated the outcome of this system in three subpopulations, namely (1) non-healing fractures (2) non healing arthrodises, and (3) large bone defects after infections or trauma injuries.

**Methods:** Using the Biomet GPS Platelet Concentration System, the patient's own platelets had been separated into a highly enriched layer of platelets out of his own peripheral blood sample (50 ml) during surgery. The platelet rich plasma (PRP) was then separated and mixed with autograft bone from the iliac crest or the radius or allograft bone chips. Finally 2 ml of 10 % calcium gluconat was added to the sample prior to application at the recipient region.

The GPS System was used between 2013 and 2021 in 79 patients with defined indication, mostly in non-healing bone fractures and non-healing arthrodises or large bone defects after infections or trauma injuries.

We assessed bone healing rate, previous surgical (failed) procedures, radiological outcomes, time to bone healing, return to work and other patient reported outcomes. Descriptive statistics for the entire sample and stratified by the three subpopulations were calculated.

**Conclusion:** There is a need for more efficient surgical procedures for failed bone healing and replacement of large bone segments in hand surgery. New technologies such as GPS have to be added to the therapeutic options of hand surgeons. There are many different methods available to induce bone growth. The GPS system seems to be a reliable system to achieve bone healing in special indications such as delayed fracture healing or pseudarthrosis after previous unsuccessful operations. Another strength could lie in the high potency of enabling bone healing over long bone defects in combination with your own bone spongiosa or allograft bone chips.

### **A-0387** THE VOLAR CENTRAL APPROACH IN DISTAL RADIUS FRACTURE SURGERY – A NEUROPHYSIOLOGICAL STUDY OF 38 CASES

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#### **Introduction**

The fracture of the distal radius is the most common fracture in the adult population. The modified Henry approach is safe

and well described, but a volar central approach (VCA) allows for an excellent visualization of the intermediate column and the “critical corner”. This approach exposes the median nerve and has in previous studies been linked to an increased risk of median nerve irritation, but no study has been performed evaluating the median nerve with neurophysiological methods. The aim of this study was to evaluate the risk of median nerve irritation after surgery of distal radius fracture using a volar central approach.

#### Method

This prospective cohort study included patients with distal radius fractures between 18 and 70 years old that underwent surgery with a VCA. Nerve conduction study (NCS) and sensibility evaluation using Semmes-Weinstein monofilaments test (SWMT) were performed preoperatively, 6 weeks and 3 months postoperatively. PROMs were collected 2 weeks, 6 weeks and 3 months postoperatively.

#### Results

Of 38 patients, 35 patients had a valid preoperative NCS. Six (17.1%) patients had significantly lower amplitudes on NCS. Of these patients, one had lower SWMT score than on the contralateral hand and nine of the other patients. At 6 weeks postoperatively, 38 patients had a valid NCS. Eight patients had significantly lower amplitudes on motor conduction study (MCS) and 26 patients had had significantly lower amplitudes on sensory conduction study (SCS), of these 26 patients, one had lower SWMT score than on the uninjured hand and 3 of the other patients. At 3 months postoperatively, 38 patients had a valid NCS. Two patients had significantly lower amplitudes on MCS and 18 patients had significantly lower amplitudes on SCS, of these 18 patients, two had lower SWMT score than on the uninjured hand and two of the other patients.

#### Conclusion

Median nerve irritation is common at short-term follow-up after surgical treatment of DRF with VCA. The neurophysiological changes do not seem to correlate with SWMT score. Median nerve irritation is transient in many patients. Long-term median nerve irritation after DRF treated with VCA needs to be assessed.

## **A-0388** EXTRA-ARTICULAR CHONDROMATOSIS OF FLEXOR AND EXTENSOR COMPARTMENTS OF THE WRIST: CASE REPORT

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#### Introduction / Purpose:

Synovial chondromatosis is a rare benign chronic disease associated with the formation of cartilage in synovial membranes of joints, tendon sheaths, or bursae. There are only a few reports on the wrist in the medical literature. The Diagnosis can often be delayed due to the rarity of the disease and its nonspecific symptoms.

#### Material and Methods:

We report a case of a 59-year-old female patient with a right wrist extra-articular chondromatosis involving the flexor and the extensor compartments treated with surgical excision.

#### Results:

After a follow-up of one year no recurrence. The case was discussed with the aim of analyzing the clinical, imaging characteristics and therapeutic modalities of synovial chondromatosis of the hand according to the literature review.

#### Conclusion:

Synovial chondromatosis of the wrist joint is rare. Close coordination between the clinician, radiologist and pathologist are essential for accurate diagnosis and management.

Keywords: Synovial, chondromatosis, Extra-articular, extensor compartment, hand

### **A-0389** INFLUENCE OF FUNCTIONAL COMPRESSIVE BANDAGING ON THE FUNCTIONALITY OF THE UPPER LIMB AFFECTED BY LYMPHEDEMA SECONDARY TO BREAST CANCER

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**Background:** Functional compressive bandaging is an element of therapeutic approaches for the control of lymphedema secondary to breast cancer treatment. Tissue pressure associated with upper limb movement is essential in managing the chronic and gradual aspect of morbidity and maintaining segment functionality. Outcome tools that assess aspects of function, activity, and participation, such as performance tests and patient-report outcome measurements with validated standardized outcome assessments are necessary, based on the International Classification of Functioning, Disability, and Health. Many instruments were designed and have adequate psychometric properties for functional outcome evaluation, such as muscle strength with grip and pinch dynamometers, range of motion using standards goniometers, functional and threshold sensibility, pain intensity and location, simulated activities of daily living tests and patient-reported outcome measurements.

**Objective:** Our study aimed to analyze the influence of functional compressive bandages on the functionality of the upper limb affected by lymphedema secondary to breast cancer using the Jebsen-Taylor Hand Function Test.

**Methods:** A clinical study, approved by the research ethics committee of the proposing institution (CAAE: 90238218.7.0000.5440), was designed with 23 breast cancer survivors with a mean age of 64.54 (SD = 11.89) years e mean lymphedema volume of 634.9 (SD = 405.3) cm<sup>3</sup>. Upper limb functionality was evaluated by the Jebsen-Taylor Hand Function Test, in the condition of absence and presence of functional compressive bandaging with spica technique. The Jebsen-Taylor Hand Function Test consists of seven tasks that mimic manual tasks, namely writing, handling letters, lifting small objects, simulating feeding, stacking blocks, lifting large and light objects, and lifting large and heavy objects. In the statistical analysis, the Shapiro-Wilk test and Two-Way ANOVA were used followed by Bonferroni's Post-Hoc or Kruskal-Wallis Test with Dunn's Post-Hoc, considered a significance level of 5%.

**Results:** Comparison of the condition of absence and presence of compressive functional bandaging with spica technique showed reduced functionality with significant difference regarding manual tasks of handling letters (10.37±4.57 vs 15.26±13.30; p = 0.001), lifting small objects (10.77±3.14 vs 12.97±5.34; p = 0.003), simulating feeding (9.57±2.87 vs 12.41±4.79; p = 0.001), lifting large and light objects (3.98±1.03 vs 4.49±1.36; p = 0.008), and lifting large and heavy objects (4.04±0.79 vs 4.37±0.98; p = 0.044). There was no significant difference in manual tasks of writing (39.76±31.51 vs 38.81±28.04; p = 0.853), and stacking blocks (6.07±2.39 vs 6.53±2.07; p = 0.221).

**Conclusion:** Although functional compressive bandage is indicated to control lymphedema, therapeutic intervention reduces the functionality of the segment, reflecting the importance of associating physical exercises with maintaining the functionality of the upper limb of breast cancer survivors.

**A-0390** THERAPY-LED HAND CLINIC (TLHC) OFFERS EFFECTIVE AND RAPID ACCESS TO CARE FOR EMERGENCY DEPT PATIENTS WITH MINOR HAND INJURIES

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**Objective:**

The Therapy Led Hand Clinic was established in St. Vincent's University Hospital (SVUH), Dublin, Ireland in 2015. The objective was to alter the pathway so minor hand injuries are directly referred from the Emergency Department to the Therapy Led Hand Clinic without needing to attend a Consultant Led Clinic.

The reason for changing existing practice included increased referral rates to the Hand Clinic, increased demand placed on Physiotherapy and Occupational Therapy services and lengthy waiting times for patients. This clinic saw the commencement of Hand Therapy in SVUH where each patient is seen by a single Hand therapist (one therapist providing both the PT & OT skills and practices).

**Methods:**

The Therapy Led Hand Clinic runs for 3.5 hours once per week, run by a Clinical Specialist Physiotherapist and Clinical Specialist Occupational Therapist. Referrals are accepted from the Emergency department in SVUH as well as two other local hospitals. The patient group to attend is identified by Emergency Department doctors as not requiring review by a hand surgeon. An agreed cohort of conditions are accepted which include mallet injuries, tuft fractures, PIP joint dislocations, hyperextension injuries (volar plate, collateral ligament), thumb UCL/RCL sprains and radial nerve palsy. A total of 12-14 patients are assessed and treated at each clinic (6 new patients, 6-8 review patients).

**Results:**

Over the last 7 years 1,100 patients were assessed, treated, and discharged from the Therapy Led Hand Clinic without requiring further intervention. Referral rate has increased by 150% since the clinic started in 2015. The main conditions treated at this clinic include mallet injuries (22%), distal phalanx fractures (13%), PIP joint hyperextension injuries (12%), Thumb UCL sprains (12%) and PIP joint dislocations (10%). The main cause of injury and referral source was also audited.

**Conclusion:**

Experienced hand therapists either Occupational Therapists or Physiotherapists are appropriately qualified to effectively assess, treat and discharge minor hand injuries without the need to attend a Consultant Led a hand clinic. This model of care has been shown to be effective nationally and internationally advocating for its continued use and expansion. Increase referral numbers each year justifies the investment in further skilled therapists.

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### **A-0391** FUNCTIONAL OUTCOMES AFTER SURGICAL MANAGEMENT OF TERRIBLE TRIAD. SERIES OF CASES

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Terrible triad constitutes a severe injury of the elbow. The treatment is always operative and demands specific skills and experienced surgeon. The purpose of this study is to present the functional results after operative treatment of such injuries. In a 14-year period 24 cases of elbow terrible triad were treated in our department. Fourteen patients were males and 10 females with an average age of 50 years (26-74). ORIF of radial head was used in 14 patients and 10 were treated with radial head replacement. The coronoid process was anatomically reduced by trans-osseous sutures in 20 patients, by an anatomical plate in 2 cases and a lag screw was used in 2. In 15 patients lateral and in 3 medial collateral ligaments of the elbow were repaired by suture-anchors. Concomitant olecranon fracture was treated with ORIF in 5 cases. External fixator was applied in 1 patient due to excessive elbow instability even after the repair of ligaments. The mean follow up was 8 years (1-11.5). Mean elbow flexion-extension and pronation-supination range were 19-135° and 70-62° respectively. Mean MEP score was 89.8. In 1 patient there was functional impairment due to over-stuffing of the radial head and 2 developed arthritis within 2 years. Treatment of terrible triad is always operative. Reconstruction of the injured structures requires expertise and by following a certain treatment algorithm, functional outcome can be satisfying regarding daily living activities.

### **A-0392** CASTING MOTION TO MOBILISE STIFFNESS: A GAME CHANGER IN THE TREATMENT OF STIFF HANDS

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#### Objectives:

To demonstrate that Casting Motion to Mobilise Stiffness (CMMS) is an effective and efficient technique in the treatment of stiff hands.

#### Method:

One of the greatest rehabilitation challenges is to restore digital motion and functional use in a stiff hand. Many patients fall into an unremitting cycle of transient improvements in stiffness, intermittent pain, swelling and lengthy treatment episodes when traditional techniques of splinting and exercise are applied. 2 Certified Hand Therapists (1 Physiotherapist, 1 Occupational Therapist) undertook an innovative online training course in the application of CMMS, receiving mentoring from a therapist in South Africa over a 6-month period. The CMMS technique was then trialed on a range of different patients over a year long period in St. Vincent's University Hospital, Dublin, Ireland. Patient injuries varied from tendon repairs, Dupuytren's fasciectomy to digital as well as distal radius fractures. All patients presented with an abnormal movement pattern, reduced range of motion (ROM) and dysfunction in their day to day lives. ROM, DASH, movement pattern, length of time in cast as well as number of treatment sessions were recorded to assess outcomes. Patients with open wounds and claustrophobia were deemed inappropriate for casting.

#### Results:

25 Patients were treated with the CMMS technique between 2021-22. All patients regained a normal movement pattern. 90% of patients had improved function (DASH) and ROM. Average length of time spent in cast was 4-6 weeks and patients

required face to face therapy appointments on average once every 2 weeks.

Conclusions:

Chronic hand stiffness can be a debilitating and life altering condition. Many patients require multiple procedures to improve range of motion but despite this a portion never regain full functional movement. This case series demonstrates that the CMMS technique is an effective and efficient conservative treatment option in the management of stiff hands.

References

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Ethical Approval: Not required

### **A-0393** SURGICAL MANAGEMENT OF RADIAL HEAD FRACTURES. TREATMENT OPTIONS AND RESULTS

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Radial head fractures can be isolated injuries or part of complex elbow trauma. These of Mason type II-IV are treated operatively by fixation, radial head replacement or (rarely) radial head excision. The purpose of this study is to present the functional outcomes after surgical treatment of radial head fractures in our department. In a period of 13 years, 142 patients with radial head fractures were operatively treated. Seventy patients were males and 72 females with an average age of 40 years. Eighty-two fractures were of type II, 36 of type III and 24 of type IV. In 65 cases fixation was carried out with lag screws and in 38 with plates. Radial head was replaced with a metal prosthesis in 37 cases and in 2 was excised due to patients' age and medical comorbidities. In 24 cases radial head fracture was treated as a part of a "terrible triad" injury of elbow and in 8 cases there was a concomitant olecranon fracture that was treated with internal fixation. The mean follow up was 7.5 years (1-11). Patients treated with ORIF had a mean range of elbow extension-flexion of 13-133 ° and pronation-supination of 76-75 °. Elbow range of motion in patients treated with radial head replacement were 15-130 ° and 73-70 ° respectively. Average MEP score was 92. Over-stuffing of radial head was observed in 3 patients with a moderate functional impairment. In conclusion, ORIF and replacement of the radial head according to indications are treatments of choice for radial head fractures, ensuring satisfactory functional outcomes.

### **A-0394** EARLY OUTCOMES AFTER REGISTRATION OF FINGER IMPLANTS IN THE DUTCH ARTHROPLASTY REGISTER (LROI)

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Background

The main goal of finger arthroplasty is pain relief and preservation of range of motion. Differences in patient selection, techniques of implant placement, and implant characteristics may influence results. These impacting factors are yet to

be assessed in literature. This is the first study focusing on early outcomes and experiences of finger implants based on a national registry.

#### Objectives

The main aim was to investigate and analyze descriptive data regarding primary finger joint arthroplasty from 2017 to 2021 to gain insights in implementation, possible risk factors for revision surgery, and registration of finger implants. Next to that we want to compare completeness of the registry to the total number of reimbursed arthroplasty procedures nationwide.

#### Methods

The Dutch arthroplasty register (LROI) was utilized to gather all data on finger arthroplasties from 2017 to 2021. Variables included gender, age, BMI, smoking, side, surgical specialty, joint, fixation, approach, survival days of implant, and revisions. Two databases (LROI and Opendis data) were used for comparison, and to gain insights in registration completeness.

#### Results

In LROI a total of 951 primary finger arthroplasties were registered, including eighteen revisions. 688 (72.3%) implants were used in females. Mean age was 65.0 years ( $\pm$  17.0), and mean BMI was 27.0 ( $\pm$  4.9). Implant placement was divided as follows: MCP (n=255), PIP (n=619), and DIP (n=22). A dorsal approach was reported in 860 (90.4%) cases. Osteoarthritis (71.4%) was the main reason for arthroplasty followed by rheumatoid arthritis (16.6%).

A total of 84 revisions were registered in the investigated period. No major differences were found in patient or clinical characteristics compared to the primary arthroplasties with exception of the registered joint. The MCP joint re-do arthroplasty was registered in 42 (50.0%) of the cases, this is higher than expected since MCP arthroplasty is only 26.8% of the total primary finger joint arthroplasties.

In Opendis data 1603 arthroplasties were reimbursed from 2017 to 2021, resulting in an overall registration rate of 59.3% (951/1603). Orthopedic surgeons had a registration completeness of 91.5% (281/307), plastic surgeons 50.0% (644/1289), and trauma surgeons 28.6% (2/7). For orthopedic surgeons it is mandatory to register implants in LROI.

#### Conclusion

Our results provide an overall view of the use of finger implants in the Netherlands, and show possible risk factors like gender and joint location for both primary and revision arthroplasties. However, national participation rate for registration is not optimal yet; this needs to be improved to gain a more concise picture of the current state. National registries, such as LROI, can help to understand the current and future application of finger implants, thereby improving finger implant surgery and patient safety.

## **A-0395** FINGERTIP INJURIES TREATED WITH INTRAVENOUS DRESSING SUPPORT

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#### ABSTRACT

**Objective:** the aim of this study is to demonstrate that the semi-occlusive dressing with años intravenous dressing support achieves a reconstruction of the distal phalanx without residual pain, without additional shortening and with a good aesthetic appearance.

**Materials and Method:** 25 fingers with distal lesions were evaluated and divided into three groups: a) lesions with compromised skin and subcutaneous cellular tissue, b) with additional lesion of the nail, and c) aggregated exposed bone lesion. A semi-occlusive dressing was placed on all of them from the day of the injury with a weekly change until

the wound healed, approximately in four weeks.

Results: of the 25 treated fingers, 19 had excellent functional and aesthetic results, fully recovering and distal sensitivity; 6 patients (24%) required additional surgery, all of them with labor conflicts. The mean for complete healing was 68.2 days, with the three changes to complete the treatment.

Conclusion: fingertips injuries, even with bone exposed, can be treated satisfactorily with a semi-occlusive dressing, achieving the result of a reconstruction without residual pain, without shortening, with good strength and sensitivity, as well as an excellent aesthetic aspect of the phalanx, being an economical and easily reproducible method.

Type of study: Level IV, Case series, retrospective.

### **A-0396** EVALUATION OF FUNCTIONAL RECOVERY IN THE INTRINSIC AND FLEXOR MUSCLES AFTER NERVE TRANSFER FOR ULNAR NERVE LESIONS. NEW METHOD FOR MEASUREMENT (CHA METHOD)

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Even though “supercharge” end-to-side (SETS) nerve transfer for lesions of the proximal ulnar nerve has been recognized as a novel option, improvements in motor function after surgery have not been properly evaluated. Thus, we suggested a modified method for quantitative evaluation of improvements in hand intrinsic power. To measure intrinsic muscle power, we screened 216 patients with lesions of the high ulnar nerve who visited the outpatient department from 2012 to 2020. Of these patients, 101 who met our inclusion/exclusion criteria were evaluated just before surgery. We used a newly designed method for the measurement of finger abduction (“2nd-abd”), adduction (“5th-add”), and ring and little finger flexion strength (“4,5 grip”) and analyzed the correlations of these measurements with already well-known pinch strength data. Among one hundred one patients, the male to female ratio was 86:15, and the ratio of “lesion on dominant arm” to “lesion on nondominant arm” was 68:33. All strength measurements were analyzed as a % (ratio of strength; affected side to contralateral normal side). In a Pearson correlation analysis, the strength ratios of “4,5 grip”, “2nd-abd”, and “5th-add”, but not “5 fingers grip (total grip)”, were significantly positively correlated with key and oppositional pinch strength, respectively (all,  $p < 0.001$ ). Additionally, linear regression analysis showed identical results for each strength correlation with key/oppositional pinch, except for “5 fingers grip (total grip)” (all,  $p < 0.001$ ). SETS can be used as the reasonable option rather than other surgical solutions for lesions of the proximal ulnar nerve. The measurement method we propose would be feasible for a specific assessment of intrinsic muscle strength, which would be improved after the procedure.

### **A-0397** ULNAR SHORTENING OSTEOTOMY FOR POSTTRAUMATIC ULNAR IMPACTION SYNDROME IN ADOLESCENT (YOUNGER THAN 18 YEARS)

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Purpose: We performed ordinary ulnar shortening osteotomy (USO) in patients younger than 18 years old with secondary ulnar impaction syndrome (UIS) after traumatic events. Here, we report the clinical and radiologic outcomes with a review

of the previous literature through a retrospective case series.

**Methods:** Twenty-two adolescents treated by USOs from 2006 to 2018 were investigated. The amount of shortening was classified into three categories. The first category was for a still open physis on the medial half of the radius in those younger than 15. In this category, we osteotomized the ulna for the physis level to be left neutral or negative by 1-2 mm. The second category had no growth potency in the radius. If the patient was younger than 15, we considered only residual growth of the ulna, thus performing USO for the ordinary UV to be negative by 2-3 mm. For patients aged 15-18 years old, if growth potency was nearly absent in the ulna, we performed traditional USO with a neutral ulnar variance (UV). **Results:** Categories 1, 2, and 3 for the amount of USO were determined for 4, 4, and 14 patients, respectively. All USOs properly healed without substantial complications. The mean preoperative UV was 2.91 mm, and the final value decreased to 0.23 with statistical significance ( $p < 0.001$ ). The range of wrist motion was improved after USO from 133.86 and 132.73 degrees to 154.77 and 160.68 degrees (all,  $p < 0.001$  in flexion-extension and pronation-supination arcs, respectively). The preoperative VAS and MMWS scores also improved from 2.77 and 75.00 to 0.18 and 88.86, respectively, at the final follow-up (all,  $p < 0.001$ ).

**Conclusions:** UIS in adolescent populations after trauma in their children/younger adolescents could be properly treated by USO. Even with an open physis at the ulna, neutral UVs could be achieved, and the clinical outcomes were satisfactory. However, long-term follow-up is still needed regarding TFCC and DRUJ status.

### **A-0399** USING OUTCOME INFORMATION YIELDS BETTER PATIENT EXPERIENCES, BETTER DECISION-MAKING, AND MORE POSITIVE EXPECTATIONS IN PATIENTS WITH HAND AND WRIST CONDITIONS: A COHORT STUDY

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**Background:** In recent years, personalized and value-based healthcare have gained attention and recognition in hand and wrist surgery and therapy. Part of these frameworks is the use of patient and outcome information in daily clinical care. However, despite global adoption, it is unknown whether this improves patient experiences, shared decision-making, and expectation management. Therefore, this study evaluated the effect of using patient and outcome information in daily clinical care on the patient's experience with 1) shared decision-making, 2) the advantages and disadvantages of the treatment being discussed, 3) the clinician's information provision, and 4) the clinicians' expertise. Furthermore, we assessed the effect on the treatment credibility and outcome expectations.

**Methods:** Data collection took place at 25 clinics for hand surgery and hand therapy. We created two groups based on whether patients indicated that the outcome information was (outcome information group) or was not (control group) used during the clinician consultation. This outcome information was presented in several specific applications that can be accessed by clinicians through the electronic patient records, including display of 1) patient and outcome information, 2) personal request for help and treatment goals, 3) screening tools on mental health, pain, and function, 4) individual predictions on recovery and treatment effects, and 5) 'extreme values'. The patients' experience with healthcare was assessed after the first consultation by a set of questions based on a patient-reported experience measure (PREM) and the Credibility and Expectancy Questionnaire (CEQ). We controlled for confounders using propensity score matching on a 1:3 basis.

Results: After propensity score matching, we included 603 patients in the outcome information group and 201 in the control group. The outcome information group scored significantly higher on all PREM items. Of these patients, 79% scored an 8 or higher on the item on shared decision-making, compared to only 58% in the control group. Also, the score on the advantages and disadvantages of the treatment being discussed was higher in the outcome information group: 79% scored an 8 or higher compared to 44% in the control group. Similarly, this was 92% vs 76% for the item on the clinicians' explanation and 95% vs 82% for the item on the clinicians' expertise. Patients in the outcome information group had more positive expectations of the treatment outcome (Cohen d effect size: 0.46,  $p < 0.001$ ) and found their treatment more credible (Cohen d effect size: 0.31,  $p = 0.001$ ) compared to patients in the control group.

Conclusion: The use of patient- and outcome information leads to better experiences with healthcare, better treatment decisions, and more positive outcome expectations and treatment credibility. The use of patient and outcome information in daily clinical care is therefore highly recommended to fulfill the promise of personalized and value-based healthcare.

#### **A-0400** SYMPTOMATIC NONUNION OF THE DISTAL ULNA ACCOMPANIED BY FAILED SURGICAL TREATMENT FOR A FRACTURE OF THE DISTAL RADIUS

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Background: We hypothesized a guideline for solutions for ulna/radius nonunion after failed surgical fracture treatment and propose to verify it in a prospective study. Herein, we report our preliminary findings and review the current trend. Methods: Six patients who met criteria were retrospectively investigated, then we further categorized "nonunion of both the radius/ulna" into four subcategories. For hypertrophic nonunion of the radius, but with stability maintained by a plate, we only reinforced the mechanical stability of the ulna (osteosynthesis, treatment option-1). In oligo- or atrophic nonunion of the radius with stability maintained by a plate, we added cancellous or tricortical bone grafts to the radius after osteosynthesis of the ulna (option-2). In the presence of definitive pseudomotion of the radius (no stability), we performed revision osteosynthesis for the radius only, without (option-3) or with bone graft (option-4).

Results: Two, one, one, and two patients had corresponding treatment options of 1, 2, 3, and 4, respectively. At a mean postoperative time of 4.3 months, all radii and ulnas showed union. At the final follow-up, clinical outcomes in terms of the VAS/DASH scores were satisfactory. We are currently conducting a prospective trial to verify the hypothesized guideline. For both radius/ulna nonunion, first, if the stability of the radius is good, we compare the final outcomes with or without revision osteosynthesis for the radius, in addition to osteosynthesis for the ulna. Second, if stability is absent in the radius, we compare the final outcomes without or without osteosynthesis of the ulna, in addition to revision osteosynthesis of the radius.

Conclusions: Treatment guidelines for rare nonunion of both the distal radius/ulna were suggested according to the concept of stability based on the principles of fractures. This hypothesis could be used to guide prospective studies of revision surgery for nonunion of both the radius/ulna.

## **A-0401** OUTCOMES OF FLEXOR TENDON REPAIR IN PATIENTS WITH CONCURRENT NEUROVASCULAR INJURIES OF MULTIPLE DIGITS IN ZONE 1

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**Purpose:** We treated several patients with multiple flexor (flexor digitorum profundus; FDP) injuries accompanied by injuries to the digital nerve or vessels around the distal interphalangeal crease (zone 1). Here, we retrospectively report the outcomes and review the literature.

**Materials and Methods:** Between January 2010 and December 2018, 16 patients who met the study inclusion criteria were investigated. Tendons were repaired using the cross-locked cruciate (Adelaide) technique (six-strand) or modified Becker method (four-strand). The neurovascular (NV) structures were repaired under a microscope.

**Results:** Sixteen patients (47 digits) were treated. According to the criteria of Moiemmen and Elliot, the lacerated areas were in zones IA and IB in 7 and 40 digits, respectively. The mean range of motion (ROM) was  $149.27 \pm 7.78^\circ$  and  $66.43 \pm 2.04^\circ$  according to the Strickland and modified Strickland assessments, respectively. The mean two-point discrimination (2PD) was  $5.00 \pm 0.63$  mm. Four patients (group 1) presented with injuries to two digits, and nine (group 2) and three (group 3) patients had three and four injured digits, respectively. The outcomes were satisfactory in terms of the ROM, 2PD, cold tolerance, visual analog scale pain score, Disabilities of the Arm, Shoulder, and Hand score and grip strength, and there were no differences among the groups.

**Conclusions:** Open multiple finger injuries involving FDP rupture with concurrent NV injuries on one or both sides occasionally occur in industrial environments. Fortunately, each digit exhibits a consistent injury type in a particular anatomical location; appropriate repair yields satisfactory outcomes despite the presence of multiple injuries.

## **A-0402** FINGER INJURIES BY EYEBROW RAZOR BLADES IN INFANTS

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Because some infants are injured by an eyebrow razor blade while playing with their mother's razor, we have treated several infants with flexor tendon injuries, which in some cases were accompanied by damage to respective digital nerves and/or vessels. Here, we report the outcomes in these patients as a retrospective case series and review of literature. Between January 2013 and October 2019, eight patients who met our inclusion criteria were initially investigated. The inclusion criteria were: (1) injured by an eyebrow razor during "self-fiddling or grasping", and (2) the availability of complete medical records and radiological data with a follow-up period of at least 2 years. The core sutures were performed using a modified Becker (4-strand) method for flexor digitorum profundus (FDP). Nerves and/or vessels were repaired under a microscope. A long arm mitten cast was then applied, with the fingers slightly flexed in a resting position for 3 weeks. Then, they were allowed to return to unrestricted activity. Formal outpatient hand therapy was not performed. The mean age was 6.3 months postnatal. The FDP was injured at zone-1 and -2 in three and five infants, respectively. Most of the infants were injured near a dressing table, in the bedroom used by their mother. The colors of these razors were all bright, except of one achromatic color (white). The mean total razor length was 11 cm, and the mean width of the area where

the razor blade is attached was 1.1 cm. All of the razors were left uncovered by a cap or were spread out in the case of hinged-type razors. At the follow-up period of 35.8 months, the range of motion was evaluated by the Strickland method and a modified Strickland method, and all results were “excellent”. We encountered no significant complications in any digit, such as neuroma, tendon rerupture, stiffness, or necrosis. The presence of uncapped or unfolded colorful eyebrow razors is highly risky for tendon section with concurrent neurovascular injuries in infants. Even though satisfactory outcomes can be expected, it seems important to prevent injuries through fastidious parental care and modification of the product design or color.

### **A-0403** EXPERIENCE OF BODY OWNERSHIP OF A PROSTHETIC HAND WITH A NON-INVASIVE SENSORY FEEDBACK SYSTEM USED IN EVERYDAY LIFE

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**Introduction:** Sensory feedback in hand prostheses is still limited but wished for. Many amputees experience a phantom hand map on their residual forearm. When the phantom hand map is touched, it is experienced as touch on the amputated hand. Through the PHM it is possible to transfer somatotopical sensory information and use it as a target for a non-invasive sensory feedback system, applicable to existing myoelectric hand prostheses. The aim of this study was to evaluate how forearm amputees experienced a non-invasive sensory feedback system used in daily life over a 4-week period.

**Methods:** A longitudinal cohort study included seven forearm amputees. A non-invasive sensory feedback system was used over 4 weeks in daily life. For analysis, a mixed method was used, including quantitative tests and interviews.

**Results:** The results from interviews showed that sensory feedback was experienced as a feeling of touch which contributed to an experience of completeness. However, the results from the questionnaire showed that the sense of agency and performance remained unchanged or deteriorated. The ability to feel and manipulate small objects was difficult and a stronger feedback was wished for. Phantom pain was alleviated in four out of five patients.

**Conclusion:** This non-invasive sensory feedback system for hand prostheses was implemented in the home environment, and the users wore the prosthesis in their everyday life. The qualitative and quantitative results diverged. The sensory feedback was experienced as a feeling of touch which contributed to a feeling of completeness, linked to body ownership. The qualitative result was not verified in the quantitative measurements.

Wijk U, Carlsson I K, Antfolk C, Björkman A and Rosén B. Sensory Feedback in Hand Prostheses: A Prospective Study of Everyday Use. *Front Neurosci.* 2020 Vol. 14 Pages 663

### **A-0404** ROBOTIC MICROSURGERY, THE FUTURE FOR HANDSURGEONS?

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Decades of evolving technology in microscopes and instruments has brought microsurgery in our daily practice and even evolved into the field of supermicrosurgery.

Completing microsurgical anastomosis requires great technical skill, precision and years of training. However, the precision

and dexterity of our hands are limited. Robot-assistance could help to overcome these human limitations by tremor filtration and motion scaling.

Microsurgeons of the Maastricht University Medical Center and technical engineers from Eindhoven University of Technology have developed world's first dedicated robotic platform for (super)microsurgery, Microsure's MUSA-robot.

We will present our clinical studies in handsurgery with robot assistance using this new microsurgical robot and elaborate on the future of (robotic)microsurgery in handsurgery.

## **A-0405** INCIDENCE AND NATURAL HISTORY OF ASSOCIATED DRUJ INSTABILITY AND/OR SLD IN PATIENTS TREATED WITH ORIF FOR A DISTAL RADIUS FRACTURE, CLINICAL RESULTS AFTER ONE YEAR FOLLOW-UP

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### Objectives

Injuries to the distal radioulnar joint (DRUJ) and scapholunate dissociation may cause pain, functional impairment and subsequent wrist arthrosis. Currently there is no consensus whether these injuries should be treated acutely in patients who undergo surgery for distal radius fracture (DRF). Our aim is to determine if persistent DRUJ instability or SLD following ORIF of a DRF negatively influences patient related outcome after one year of follow up in adult patients.

### Methods

We conducted a multicenter prospective cohort study including all patients who underwent surgery for a DRF. Following ORIF of the DRFs DRUJ stability was manually tested with the ballottement test and wrist cineradiography was performed to assess SLD. The PRWHE questionnaire was obtained at 6 and 12 months after surgery.

### Results

Out of 62 included patients that completed follow-up, 58% (n=36) and 27% (n=21) had intraoperative DRUJ instability and SLD respectively. No statistically significant difference was found in PRWHE scores at 6 months (p=0.34) and 12 months (p=0.20) between patients with or without DRUJ instability, nor between patients with and without SLD (p=0.72 at 6 months and p=0.52 at 12 months). Of the patients with an unstable DRUJ during surgery, 63% were tested stable after half a year. Patients with DRUJ instability did have significant reduction in radial height compared to patients with no instability and patients with SLD had significantly more preoperative carpal malalignment (13mm vs 9mm p=0.04) compared to patients without SLD.

### Conclusion

Our study suggests that patients with intraoperative DRUJ instability or SLD following ORIF of a DRF do not have significantly worse patient related outcomes after one year. Further research is needed to decide if treatment of concomitant DRUJ instability or SLD may be omitted following ORIF of DRFs.

## **A-0406** TREATMENT OPTION OF THE THUMB'S DELTA PHALANX DEFORMITY

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**Introduction:** Delta phalanx is a rare deformity, occurring on the proximal phalanx and metacarpus, metatarsus of the hands and toes. The thumb is most often affected. Deformity of the thumb and lack of tip grip can draw attention to the lesion. Diagnosis is made with the help of an X-ray, on which an abnormal epiphysis in the form of a trapezoid is visible.

**Aim:** The authors present the surgical reconstruction and results of two children's thumb delta phalanx.

**Case reports:** Correction of the delta phalanx was carried out at another institution on a two-year-old girl, where the transversal resection of the radial epiphysis was performed. During follow-up at our department, the deformity of the thumb intensified, which necessitated her to undergo repeated corrective surgeries at the age of four. Wedge-shaped excision of the abnormal epiphysis was performed. The phalanxes of the thumb were stabilised with K-wires for 3 weeks. Another girl underwent genetic testing for an isolated cleft palate, pollex deformity and minor anomalies with a negative result. At the age of eighteen months, the palate was closed, while the correction of the thumb's delta phalanx was carried out at the age of 2 years. A wedge-shaped excision of the deformed abnormal epiphysis was performed. Her finger was stabilised in a Bennett plaster for 3 weeks.

In the cases of both children, follow-up is currently underway, 5 and 7 years after reconstructive surgery, respectively. Control examinations revealed, that their thumb growth is adequate, their degree of deformity is minimal, and their functional result is good.

**Conclusion:** Several procedures are known for the operative management of the delta phalanx. Wedge-shaped excision of the pathological growth zone seems beneficial based on the short-term results.

## **A-0407** THE EFFECTIVENESS OF MINIMALLY INVASIVE AUTOLOGOUS SPONGIOSAPLASTY IN THE TREATMENT OF ENCHONDROMAS ON THE HANDS DURING CHILDHOOD

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**Introduction:** An enchondroma is a benign tumour that starts from cartilage cells located in the bone marrow cavity. Most often, the bones of the hand are affected, and usually, enchondromas do not require treatment. In the case of lesion growth, the cortical is thinning, thereby the tumour weakens the bone structure which can lead to pathological fractures.

**Aim:** Describing the management of enchondroma and its effectiveness, diagnosed as the background of pathological finger and metacarpus fractures in three children.

**Patients and methods:** Benign bone lesions of all three children were diagnosed in connection with pathological fractures after banal injuries. Surgery was performed on one child for a lesion affecting more than one finger and several metacarpuses, while in two children it involved a single finger. Surgical reconstruction under general anaesthesia and antibiotic protection was carried out 3-6 months after the pathological fractures' conservative treatment. All three children had enchondroma extirpation and spongiosaplasty taken from the wing of the ilium in a minimally invasive manner with

a biopsy needle. During follow-up, the range of motion measurement on the operated fingers and the development and frequency of complications, such as infection and recurrence were examined.

Results: Follow-up of the children is still ongoing. Based on the short-term results, complications (refracture, recurrence, infection) did not develop. At the 8-week control examination, children used their affected joints for almost the entire range of motion, without complaints. On the 3-month control X-ray, the incorporation of spongiosa was observed.

Conclusion: The care of persistent and destructive enchondroma affecting the hand bones with the extirpation of the cyst contents and filling of the cavity with spongiosa is the primary recommended treatment method to date. Due to the small size of the cysts, obtaining spongiosa with a biopsy needle provides sufficient material and promises cosmetically better results than open sampling. With the above treatment, a good functional and aesthetic result can be achieved based on short-term results.

### **A-0408** LONG-TERM FOLLOW-UP OF SURGICAL TREATMENT FOR SYNDACTYLY

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Introduction: Syndactyly is the second most common genetic malformation of the hand, its incidence is approximately 1/2000-3000, and causes the fusion of fingers and/or toes.

Objective: The authors studied the demographic data and the most common types of this developmental disorder. They report their experience with surgical interventions in syndactyly and the results of long-term patient follow-up.

Patients and Method: Between 2018 and 2020, 17 children (12 boys and 5 girls) had finger separation due to syndactyly at the Department of Paediatrics in Pécs, Hungary. A total of 23 finger soft tissue growths required corrective surgery, of which 20 involved the middle and ring fingers, while in one case the index and middle fingers, and in another, the ring and little fingers were affected. Interdigital folds were created by forming a dorsal lobe, the separation of the fingers was carried out by multiple zigzag incisions while the stretching areas were covered with full-thickness skin grafts. Ranges of motion of the separated fingers were measured using a goniometer, on average 34 (8-61) months after surgery. The evaluation of the aesthetic result was carried out with the help of a questionnaire, which the parents filled out during the control examinations.

Results: At the time of operation, the average age of patients was 45.5 (16-84) months. Five children had surgery for bilateral syndactyly, while one child had surgery on one hand for multi-finger syndactyly and clinodactyly. In one child, significant function limitation was measured in the DIP joint of the separated ring finger, while in two children there was a moderate (<15°) PIP joint flexion deficiency. Proximal widening of the interdigital fold (> 5mm) developed in five children, the surgical correction of which is planned in the near future. Nail deformity was detected on the face-to-face parts of the operated fingers of two children. Growth disturbance occurred in two children with growth retardation of more than 5 mm on the affected fingers. For each surgery, a full-thickness skin transplant was required, which in almost all cases was performed from the cubital region. In the case of fourteen children, the parents were completely satisfied, in two instances they were satisfied, while on one occasion they were dissatisfied with the surgical result.

## **A-0409** MANAGEMENT OF TRAUMATIC BRACHIAL PLEXUS INJURIES PRE- AND POST-MAJOR TRAUMA CENTRE INTRODUCTION IN ENGLAND AND WALES

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Major trauma centres (MTCs) were introduced in the United Kingdom in April 2012 following re-organisation of trauma services to improve outcomes in trauma patients. Traumatic brachial plexus injuries (TBPI) are serious and life-altering injuries which are occurring with increasing frequency in major trauma patients. This study aims to determine if the management of TBPI has altered following the introduction of MTCs.

The Trauma Audit and Research Network database was reviewed to identify eligible patients admitted between 1990 and 2022. These patients were subcategorised into those admitted prior to and those following MTC introduction. Specific measures of utilisation of plexus magnetic resonance imaging and frequency of operative repair of plexus were analysed for differences pre- and post-April 2012. In addition, time to hospital arrival and length of stay data were assessed.

A total of 1276 eligible patients were identified with 388 identified prior and 888 following the nationwide introduction of MTCs. The advent of MTCs was associated with a longer time from incident to arrival in hospital, adding a median of 33 minutes to transfer time ( $p < 0.001$ ). The number of patients undergoing brachial plexus MRI more than doubled after the introduction of MTCs (51 vs 12%,  $p < 0.001$ ). This improved the access to early surgical repair (during the initial admission) from 5% to 8% ( $p < 0.05$ ). Length of stay was reduced by a median of two days (95% CI: 0-3) following MTC establishment ( $p = 0.012$ ). This corresponded with a significant increase in the proportion of patients discharged to their own or a relative's home (40% to 78%,  $p < 0.001$ ) and decreased likelihood of discharge to a further acute hospital or institution ( $p < 0.001$ ). Management within an MTC was not associated with difference in time from arrival to plexus imaging or survival rates. This study suggests that the introduction of MTCs has improved the utilisation of diagnostic imaging and early surgical repair for patients with TBPI. This is suggestive of an improvement in the specialist care of TBPI during initial admission as a result. An increase in time from incident to hospital arrival post-MTC introduction was identified, which may be explained by increased transit times and redirection to more specialist centres. This study provides the basis for further work to be undertaken to investigate whether improved imaging and early reconstruction is associated with better patient outcomes.

## **A-0410** THE EPIDEMIOLOGY OF TRAUMATIC BRACHIAL PLEXUS INJURIES IN ENGLAND AND WALES – A RETROSPECTIVE 22-YEAR REVIEW

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Adult traumatic brachial plexus injuries are often devastating and life-changing and are becoming more prevalent. Management of such injuries may be operative or nonoperative, depending on severity, age, co-morbidities, and is best managed in a multidisciplinary environment. Several studies have investigated the incidence and epidemiology of traumatic brachial plexus injuries in other countries (e.g. United States, Brazil) however, a similar analysis is yet to be undertaken in the UK. This study aims to determine the incidence and epidemiology of traumatic brachial plexus injuries in the UK. The Trauma Audit and Research Network database was reviewed to identify 1297 eligible patients admitted with traumatic brachial plexus injuries (TBPI) between 1990 and 2022. Patient demographics, injury mechanism, associated injuries,

complications and 30-day mortality were analysed.

The mean age of patients with TBPI was 39 years and 77% of patients were male. There was a significant difference in age between males and females, with males 18 years (95% CI: 14.40-21.30) younger at time of injury ( $p < 0.0001$ ). The predominant injury mechanism was vehicle incident/collision (65%), with 62% riding motorcycle or quadbikes, and the majority of other injuries resulted from falls less than two metres (19%). TBPI was commonly associated with other injuries (94%), predominately bony injuries such as dislocations and fractures. The mean length of hospital stay was 16 days with a 30-day mortality of 2.5%.

This study represents the first formal analysis of the epidemiology and incidence of TBPI within England and Wales. Vehicle collisions, particularly involving motorcyclists, are the commonest cause of TBPI however, falls of less than two metres provide a noteworthy contribution to aetiology. TBPI is commonly associated with multiple injuries which we have been able to characterise within this study. This provides the basis for further investigation of the management and outcomes of these injuries within the UK as greater proportions of patients survive major trauma.

## **A-0412** PEDIATRIC MEDIAL EPICONDYLE HUMERAL FRACTURE TREATED BY BIOABSORBABLE IMPLANTS-NOVEL TECHNIQUE

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**Background:** Medial humeral epicondyle fractures account for 10 to 20 per cent of elbow injuries in children. We hypothesised, that in the fixation of medial humeral epicondyle fractures, bioabsorbable poly-L-lactide-glycolic acid (PLGA) implant's safety and efficiency are comparable to traditional metallic and other novel approaches.

**Materials and Methods:** A retrospective cohort study was performed between 2016 and 2022, analyzing 45 children who had medial humeral epicondyle fractures. Every fracture was stabilized with biodegradable PLGA implants and tension band polydioxanone sutures. Indications for surgery included closed fractures with more than 1 cm dislocation and incarcerated fractures. The degree of anatomic reduction and the presence or absence of non-union or fragmentation were confirmed with X-rays, postoperatively. In this clinical study, we evaluated the operation time, age and gender distribution.

**Results:** Mean age at the time of injury was 12.3 (8-16 years). On the fourth week, every children's X-ray showed callus formation, and the range of motion of the elbow after six months of the operation was almost complete in all children. Transient ulnar nerve palsy was developed in one patient which was spontaneously resolved at the fourth postoperative month. No other complications were observed during the average follow-up period of 38 months (16-70 months).

**Conclusions:** Bioabsorbable pins with absorbable sutures are a good alternative treatment of medial epicondyle humeral fracture. No permanent complications were noted while using this technique. We suggest this method because it does not require a secondary (metal removal) operation.

## **A-0415** DIFFERENCE OF CHRONOLOGICAL IMPROVEMENT OF PULP PINCH STRENGTH BY AGE GROUP AFTER SURGERY FOR CUBITAL TUNNEL SYNDROME

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**Objective:** Although the symptoms of cubital tunnel syndrome (CuTS), such as pain and numbness, have been widely reported, few studies concerning to the motor function have been described. With the recent increase of the elderly population, opportunity to perform surgery of CuTS for the elderly is increasing. However, there have been scattered reports of poor postoperative outcomes in elderly patients with CuTS. In this study, we compared the changes in pulp pinch strength over time after surgery for CuTS between elderly and younger patients.

**Patients and Methods:** Of a total of 81 elbows in 77 patients who underwent subcutaneous ulnar nerve transposition at our hospital between January 2017 and August 2021, 32 elbows in 32 patients who were available for follow-up more than 12 months postoperatively were included in this study. These 32 patients were divided into two groups for comparison: the elderly group consisting of 13 elbows in 13 patients aged  $\geq 65$  years (mean  $73.6 \pm 6.9$  years); and the younger group consisting of 19 elbows in 19 patients aged  $< 65$  years (mean  $48.3 \pm 13.6$  years). We excluded patients who also underwent tendon transfer or King's procedure and those with carpal tunnel syndrome, radial nerve palsy, or trigger finger on the affected side. Outcome measures were thumb-index finger (TI), thumb-middle finger (TM), thumb-ring finger (TR), and thumb-little finger (TL) pulp pinch strengths, measured before and 3, 6, and 12 months after surgery. Statistical analysis was performed using the Friedman test. Variables showing a significant change were subjected to a post-hoc multiple comparison analysis with Bonferroni correction.

**Results:** The younger group showed significant improvements in postoperative TR and TL values compared with the preoperative values ( $p = 0.002$  and  $0.020$ , respectively), but no significant changes in TI or TM. The younger group also showed significant improvements in TR at 6 and 12 months postoperatively and in TL at 6 months postoperatively (Bonferroni corrected  $p = 0.010$ ,  $0.008$ , and  $0.028$ , respectively). No significant change was observed at any postoperative time point in the elderly group.

**Discussion:** TR and TL were significantly improved in the younger group after surgery, while the elderly group showed no improvement in any of the pulp pinch strength measures. The intrinsic muscles (e.g., the interosseous and lumbrical muscles) and the flexor digitorum superficialis muscle are thought to strongly influence pulp pinch strength. The significant improvements in TR and TL observed in the younger group might reflect the recovery of strength in the third and fourth lumbrical muscles. Our data also suggest that it may take more than 12 months for the postoperative recovery of TI and TM in both age groups, which may have been due to delayed recovery of adductor pollicis muscle strength. Our results suggest that recovery of pulp pinch strength after surgery may take longer time in elderly patients compared with younger patients.

## **A-0416** ELECTRO-CLINICAL PREDICTORS AFTER SURGERY FOR CUBITAL TUNNEL SYNDROME: THE COMPRESSION STAGE IS THE MAIN DETERMINANT

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The aim of this study was to determine the predictive value of the McGowan and Goldberg (McGG) classification, the electrodiagnostic studies (EDS), and other clinical and demographic variables for outcome after cubital tunnel release

surgery. We performed a retrospective study of all patients operated upon between 2006 and 2018. A total of 209 operations in 199 patients were reviewed, with a mean follow-up of 10.3 months. According to our definition, poor outcomes were found in 52% of the cases. The variables McGG stages, EDS and duration of preoperative symptoms showed significant association with surgical outcome. Multivariate analysis combining duration of preoperative symptoms and age of the patients with McGG stages resulted in a good prediction model. Our findings suggest that poor outcomes are mainly related to the severity of the neuropathy according to the clinical stage. Patients with McGG stage 3 had worse outcomes. They should be informed before surgery about potentially poor results.

## **A-0417** CUTANEOUS NERVE DISTRIBUTION AROUND 1ST EXTENSOR COMPARTMENT OF THE WRIST: CLINICAL IMPLICATION REGARDING ULTRASOUND-GUIDED INJECTION

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**Introduction:** de Quervain's disease is frequently treated with local steroid injection. The cutaneous nerve exists abundantly around the 1st extensor compartment, such as the superficial branch of the radial nerve (superficial radial nerve; SRN) and lateral cutaneous nerve of forearm (lateral antebrachial cutaneous nerve; LACN), which could be potentially injured by needle. We evaluated the course of cutaneous nerve regarding 1st extensor compartment for investigating whether the dorsal or volar approach is safer for the cutaneous nerve in local injection guided by ultrasound.

**Methods:** We dissected radial side wrists of 28 cadavers (total 52 wrists). An imaginary line between the middle of the antecubital fossa and the tip of the radial styloid process was used for the reference line. Four points along this imaginary line were set: styloid process (SP), 1cm (#1), 2cm (#2), and 3cm (#3) proximal from radial styloid. The number of SRN and LACN were counted and distances from the imaginary line at each setpoint and diameter were recorded. Digital photography was taken, and processed images were superimposed to observe the overall distribution of the cutaneous nerve.

**Results:** Average 3.3 and 0.9 of SRN and LACN were observed in each wrist. On the dorsal side, the number of cutaneous nerves including SRN and LACN was average 2.3 and it was 1.9 on the volar side ( $P = 0.106$ ). The distance from reference line was statistically different only in point #1 ( $P = 0.047$ ), farther in volar side compared to dorsal side. The average diameter of cutaneous nerve was thicker in dorsal cutaneous nerve (1.7 mm in dorsal side versus 1.4 mm in volar side,  $P < 0.001$ ). The superimposed picture showed that both the dorsal and volar sides were occupied by abundant cutaneous nerve and the path of them was largely varied from patient to patient. However, we could observe larger sized nerve with meaningful diameter is more abundant in dorsal side compared to volar side.

**Conclusion:** The number and distribution of SRN and LACN were highly varied across individuals. There were similar numbers of cutaneous nerves on both the dorsal and volar sides, however, we could see more abundant cutaneous nerve with thicker size in dorsal side and it is closer to reference line compared to volar side. Thus, risk to the cutaneous nerves would be lower when we inject needle from volar side according to our anatomical study.

## **A-0418** BIOABSORBABLE INTRAMEDULLARY NAILING OF SEVERELY DISPLACED DISTAL FOREARM FRACTURES IN CHILDREN

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**Introduction and Objective:** Severely displaced and shortened distal pediatric forearm fractures usually require closed reduction. Most authors recommend osteosynthesis if the fracture remains unstable. The gold standard operative method is percutaneous pinning with Kirschner-wires. K-wire related complications like migration of the pins, superficial infections, skin irritation are relatively frequent. We present the results of a retrospective and a prospective multicenter study between the K-wire technique and a new bioresorbable intramedullary nailing procedure.

**Materials and Methods:** K-wire osteosynthesis and bioresorbable nailing (ActivaPin and Activa IM-Nail) has been made in four pediatric trauma center. We compared the incidence of minor and major complications (superficial skin infection, tendon injury, nerve injury, secondary displacement, deep infection, skin irritation). The study periods were between July 2018 and January 2020, and between January 2021 and October 2021. The follow-up lasted from 1 to 2 years. Inclusion criteria was the clinical diagnosis of distal radial/forearm metaphyseal fractures with complete displacement, the presence of open growth plates and the child's age under 14 years. A total of 74 children were studied in the retrospective group (33 treated with ActivaPin 41 treated with K-rnwires) and 130 children in the prospective group (70 treated with Activa IM-Nail and 60 treated with K-wires).

**Results:** No significant differences in age or right or left hand involvement were observed in either group. ( $p > 0.05$ ) Minor complications were significantly less in the bioabsorbable groups, major complications occurred more but not significantly in the K-wire groups. No second intervention (implant removal) was required in the bioresorbable groups. **Conclusions:** intramedullary bioresorbable nailing may be a good alternative technique in the treatment of displaced distal metaphyseal forearm fractures in children. It is a stable, physis sparing procedure without the need of implant removal,

## **A-0419** PREVALENCE OF SURGICAL TREATMENT OF CARPAL TUNNEL SYNDROME AND ULNAR NERVE ENTRAPMENT IN DIABETES

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**Background:** Both diabetes type 1 and diabetes type 2 negatively affect peripheral nerves and increase the risk for nerve compression disorders, such as carpal tunnel syndrome (CTS) and ulnar nerve entrapment (UNE). We aimed to investigate if people with diabetes with CTS or UNE were surgically treated to the same extent as people without diabetes with CTS or UNE.

**Methods:** Data from a regional administrative register, Skåne Health Care Register (SHR), was combined with data from the Swedish National Diabetes Register (NDR). Patients,  $\geq 18$  years conservatively or surgically treated for CTS or UNE between 2004–2019, were identified through appropriate ICD-10 codes. A Cox regression model was used to calculate prevalence ratios (PR).

**Results:** A total of 32,685 patients with CTS and 3,968 patients with UNE were identified. Of the patients with CTS,

16,265/32,685 (50%) were treated surgically and 2,445/32,685 (7.5%) had diabetes. Of the patients with diabetes and CTS, 1,444/2,445 (59%) were surgically treated compared to 14,821/30,240 (49%) of patients without diabetes with CTS. For UNE, 1,331/3,968 (34%) were surgically treated and 263/3,968 (7%) had diabetes. Of the patients with diabetes and UNE, 82/263 (31%) were surgically treated compared to 1,249/3,705 (34%) of patients without diabetes with UNE. In the Cox regression model for CTS, women (PR 1.04 95% CI 1.01-1.08) and patients with diabetes (PR 1.07 95% CI 1.01-1.13) were more likely to be surgically treated. In UNE, women (PR 0.86 95% CI 0.78-0.98) were less likely to be surgically treated and there was a tendency for patients with diabetes (PR 0.89 95% CI 0.71-1.11) to be less likely to be surgically treated. Conclusion: Health care providers in both primary and secondary care should be aware of the susceptibility of nerves to compression and the risk of CTS and UNE in diabetes. Patients with diabetes are more likely to be surgically treated for CTS and may be less likely to be surgically treated for UNE when compared to patients without diabetes.

### **A-0421** EFFECT OF WRIST JOINT ANGLE ON THE RADIOCARPAL JOINT SURFACE: A FINITE ELEMENT ANALYSIS

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#### [Purpose]

The wrist joint functions in a complex manner. Flexion-dorsiflexion and radial-ulnar deviation of the wrist joint changes the alignment of the carpal bones, which in turn changes the load applied to the radial articular surface. However, it remains unclear how such joint motion changes the pressure distribution on the articular surface. This study aimed to evaluate the stress distribution on the radiocarpal joint surface of the wrist at different joint positions using finite element analysis.

#### [Methods]

Six wrist joints from six fresh–frozen cadavers were analyzed in this study. Computed tomography (CT) scans were performed on every 15° from 45° flexion to 45° dorsiflexion to create a model simulating flexion-dorsiflexion motion. CT images were also performed on every 5° from 25° radial flexion to 25° ulnar flexion at the mid-position of the wrist in the flexion-dorsiflexion to create a model simulating the motion of the radial-ulnar deviation. The models were created using Mechanical Finder. With the proximal forearm fully restrained, axial pressures ranging from 6 to 12.5 N were applied to the first to fifth metacarpal heads (6N to first, 10N to second and fifth, and 12.5N to third and fourth metacarpal heads) to evaluate equivalent stress, maximum principal stress and minimum principal stress on the radial articular surface and navicular, lunate, and deltoid bones.

#### [Results]

Stress distribution on the radial articular surface in flexion of the wrist joint showed compression at the dorsal edge and tensile stress at the center. Alternately, in dorsiflexion, tensile stress was generated from the center to the palmar side. During the radial-ulnar deviation of the wrist joint, the lunate protruded ulnarly and the compressive stress was concentrated in the ulnar head. During ulnar deviation, the lunate moved radially and the stress on the ulnar head decreased.

#### [Discussion]

Compressive force was applied to the dorsal side in flexion and to the palmar side in dorsiflexion. These results suggest that dorsiflexion reduce the load on the dorsal side of the radius, supporting the usefulness of dorsiflexion casting for distal radius fractures. Additionally, the ulnar head and lunate showed increased stress due to radial deviation, suggesting that ulnar impaction syndrome occurs in radial deviation rather than ulnar deviation.

## **A-0422** THE INFLUENCE OF PRESSURE APPLIED AND THE TESTING PROTOCOL ON THE TWO-POINT DISCRIMINATION TEST

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**Objective:** The two-point discrimination (2PD) test is the most frequently used test for the assessment of the sensory outcome after nerve repair. However, using the 2PD testing technique as the sole test for tactile gnosis recovery should be seriously questioned. Many factors explain the enormous and implausible variability in reported 2PD levels after nerve repair, especially the pressure applied and testing protocol. Therefore, we investigated the influence of pressure applied and testing protocol (transverse or longitude measurement) on 2PD test technique.

**Methods:** 30 healthy volunteers consisting of age-matched men (15) and women (15) with a mean age of 28 years were recruited. Two examiners independently performed the static 2PD test three times with an interval of at least one day using Disk-Criminator in two regions, including the center of digital pulp, dorsum of middle phalanx in the way of transverse and longitude measurement. In addition, two examiners performed the static 2PD and mobile 2PD test applied different pressure (group 1, 0g; group 2, 10g; group 3, 20g) in the dorsum of proximal phalanx in the way of longitude measurement in 20 healthy volunteers (10 men, 10 women) aged from 24 years to 38 years. Paired t test was used for statistics. Interobserver reliability were calculated using Pearson's correlation coefficient and the interclass correlation coefficient (ICC).

**Results:** There were no difference between the two testing protocols in the center of digital pulp, whereas, the value of 2PD in the dorsum of middle phalanx using the way of longitude measurement was significantly larger than that in the way of transverse measurement ( $P < 0.05$ ). The mean values of static 2-PD test applied different pressure in the dorsum of proximal phalanx was 9.3 mm (group 1), 9.0 mm (group 2), 7.9 mm (group 3), respectively. The value of group 3 was significantly lower than that of group 1 and group 2. No significance was observed between group 1 and group 2. Whereas, the value of group 1 was significantly lower than that of group 2 and group 3. No significance was observed between group 2 and group 3. The ICC and Pearson's coefficients were all above 0.85.

**Conclusions:** The tactile gnosis is more sensitive for 2PD test using transverse measurement. And, applying a certain degree of force will affect the normal value of the 2-PD test. Therefore, detailed 2PD testing protocol needs to be reported in the studies involving the nerve recovery.

## **A-0423** INTERNAL FIXATION OF METACARPAL SHAFT FRACTURES USING MEMORY STAPLES – A NOVEL APPROACH

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### **Introduction:**

Metacarpal hand fractures comprise up to a third of all hand fractures. There is a multitude of implant options available for stabilisation of those injuries that require internal fixation. We describe our early results of using a Continuous Compression Implant (DePuy Synthes BME SPEED memory staple) in two cases of metacarpal shaft fractures.

**Case 1:** A 25-year old male presented with an injury to his dominant right hand following a blunt impact. Clinical examination revealed tenderness, swelling and some scissoring of his small finger. Plain radiographs confirmed a displaced transverse fracture of the midshaft in the small finger metacarpal. The fracture was found unstable on manipulation.

He was therefore planned for internal fixation. The fracture was approached through a dorsal longitudinal incision in a plane between the EDC & EDM. After anatomical reduction, the fracture was stabilised using one memory staple along the dorsal surface. Fracture stability was confirmed on the operating table before closure.

Case 2: A 23-year old male presented with a punching injury to his dominant right hand. Radiographs revealed a fracture-dislocation at the base of the small finger metacarpal along with a displaced transverse fracture of the shaft of the ring metacarpus. The surgical procedure was undertaken with closed reduction of the 5th CMC joint and stabilisation with a percutaneous oblique K wire. The ring metacarpus was exposed through a dorsal approach. The fracture was reduced and internally fixed using one memory staple along the dorsal surface. Fracture stability was confirmed on the operating table before closure.

Post-operative care: Both cases had soft dressings applied which were reduced on the 4th postoperative day when full mobilisation was started with the therapists. Case 2 was also provided with an intermittent Futura splint to protect the wired CMCJ. Both fractures healed well with no loosening of the implant and no loss of fracture reduction.

Discussion:

There is no consensus in literature on the ideal implant for fixation of a metacarpal shaft fracture. Evidence based data, published by the European Hand Society in 2017, was unable to arrive at a definitive conclusion. All known implants are associated with their risks and complications and the choice of fixation is dependent on the site and pattern of the fracture, as well as the operator experience and preference.

We present the use of the Continuous Compression Implant (DePuy Synthes BME SPEED memory staple) as a method of fracture fixation for transverse metacarpal shaft fractures. These staples have been shown to produce better compression as compared to lag screws and compression plates. A recent systematic review showed that they were highly successful in treatment of scaphoid fractures. The advantages of these implants include technical ease, simple and quick application, continuous compression particularly with Nitinol metal memory, and early active movement. There appears to be a lower incidence of tendon adhesions in our early experience, possibly due to the minimal amount of metalwork left in-situ. To our knowledge, this is the only description for its use in a metacarpal shaft fracture.

## **A-0424** STRUCTURE OF THE MIDCARPAL JOINT AND WRIST FLEXION/EXTENSION

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Structure of the midcarpal joint and wrist flexion/extension

Objective:

A recent study demonstrated differences in normal wrist motion between Japanese and Caucasian normal populations. Some functional variations between populations such as grip strength are a product of morphological variation (hand size). Therefore, it is reasonable to assume that the differences observed in wrist motion may also be associated with morphological differences in the joint. The purpose of this study was to compare wrist flexion and extension motion in Caucasian and Japanese populations and to evaluate the association of these values with the morphology of the midcarpal joint as viewed on plain wrist radiographs.

Methods:

Sixty-four normal Caucasian wrists with associated radiographs and 100 normal Japanese wrists in 3 separate hand

surgery units were evaluated. Included were all normal wrists seen consecutively in the hand clinic with a corresponding normal wrist radiograph.

Wrist extension and flexion were measured in clinic using a goniometer. Radiographs were evaluated for lunate type in the midcarpal joint as described by Viegas et al. to include a type 1 where there is no appreciable facet between the lunate and the hamate and a type 2 where there is a clear facet between the lunate and both a capitate and a hamate facet in the midcarpal joint.

Results:

The populations were similar in gender but differed in age: the Caucasian population was younger (mean 34.8 years  $p=0.001$ ). The Japanese population had increased wrist extension  $p<0.001$ . Both populations had more type 1 wrists than type 2 lunates: Caucasian (75%) type 1 and Japanese 83%. Midcarpal joint structure was not significantly associated with wrist flexion/extension.

Conclusions:

- We found no difference in midcarpal wrist type between Japanese and Caucasian populations
- Though this study did not find a significant association between lunate type and wrist flexion/extension arc, further study, including accounting for age difference between the groups, can further elucidate this relationship.
- Since both the midcarpal and radiocarpal joint(variably)participate in flexion and extension, the radiocarpal joint should be evaluated as well.

## **A-0425** ISOLATED NON-INFLAMMATORY FOURTH EXTENSOR COMPARTMENT TENOSYNOVITIS IN THE COVID EPIDEMIC

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Abstract:

Isolated extensor tenosynovitis of a single extensor compartment has been described, however most cases documented in the literature are associated with inflammatory conditions, particularly with rheumatoid arthritis. Very rarely, non-rheumatoid cases, specifically isolated tenosynovitis of the fourth extensor compartment, have also been documented and can present with similar manifestations of pain and restricted motion. We have observed an increase in non-inflammatory isolated fourth extensor compartment tenosynovitis during the COVID epidemic. We believe this is due to the change in work environment: increased reliance on technology and change to work from home.

While studies have often focused on diagnosis using various imaging modalities or surgical treatment, the cause has not been extensively considered. In this report we present 2 recent cases that we believe were caused by overuse of the wrist, specifically in the setting of changes to the work environment that have occurred during the COVID-19 pandemic. Both patients had a negative inflammatory workup. Considering overuse as an etiology will affect the treatment approach to these cases. We suggest a treatment algorithm that includes a trial of conservative treatment in conjunction with a rheumatologist and hand therapist. Awareness of the effect of the changing work environment on the wrist can aid in treatment and prevention of pathology.

## **A-0426** CLINICAL OUTCOME OF VOLAR ADVANCEMENT FLAP FOR FINGERTIP AMPUTATIONS

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### Introduction:

Local flap reconstruction for fingertip amputations were commonly performed to preserve length, improve cosmesis and function. Moberg volar advancement flap was classically described for coverage of thumb defect, but its use in fingertip injury, especially in lesser digits other than thumb, was seldom reported. Our study aims at evaluating the clinical outcome of volar advancement flap for fingertip amputations.

### Methods:

25 patients with volar advancement flap performed for fingertip amputation reconstruction in a single centre from 2015 to 2021 were recruited into the study. Retrospective review of patient demographics, injury details and short-term functional outcome was performed using patient records. Long-term functional outcome was assessed with QuickDASH score, grip strength measurement and objective sensory assessment.

### Results:

Volar advancement flaps were performed in all five fingers among the study cohort, with 72% being performed in lesser digits. Common complications include infection (12%) and hook nail deformity (8%). No flap necrosis or failure was noted. Fixed flexion deformity of terminal interphalangeal joint was observed in 19% of patients, with the mean extension deficit at 3.2 deg (range 0-20). Mean monofilament test at pulp is 3.74. Mean percentage power grip and pincer grip were 79.5% and 65.4% of non-injured hand respectively. Median QuickDASH score was 3.4 (range 0-18.2).

### Conclusion:

Volar advancement flap carries a risk of mild fixed flexion deformity, but is otherwise a good surgical reconstruction option in selected cases with good functional outcome and requires no microsurgical expertise.

## **A-0427** BILATERAL ULNAR LENGTH ASYMMETRY IN RADIUS MALUNION PATIENTS

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**Introduction** – The use of 3D planning in treatment of radius malunion surgery is being adopted rapidly. In 3D planning, the contralateral wrist is used as reference for the affected side. Proximally, the bones are carefully matched, to distally display the degree of malunion. In this workflow, the difference in length of the ulna is used to approximate the length of the affected radius. It is however unknown what the amount of bilateral length difference is. The aim of this study is to quantify the bilateral ulnar length differences in a population of radius malunion patients.

**Methods** – 50 patients with bilateral forearm CT scans and without (previous) pathology in either forearm apart from the radial malunion were retrospectively analysed. Bilateral length differences were measured as followed: The left ulna is mirrored and superimposed over the right ulna. In the longest ulna, a line is determined between the proximal most point of the olecranon and the tip of the ulnar dome. Midway and perpendicular to this line, the longest ulna is cut. The length axis is determined from the centre of this cut plane to the top of the ulnar dome. In the direction of the length axis, the distance between both ulnar dome tops represents the length difference. Measurements were performed by two raters with experience in 3D planning. One rater performed all measurements, the other performed 19 measurements.

These will be finalised before the 2023 congress.

Mean and standard deviation of the absolute bilateral differences were obtained, together with relative mean and standard deviation. Furthermore, inter-rater reliability was analysed using an intraclass correlation coefficient and with mean and standard deviation of the differences.

Results – Ulnar length of the dominant side was on average larger than the non-dominant side, with a mean difference of  $0.8 \pm 2.3$  mm. Absolute bilateral length differences had a mean of  $2.4 \pm 2.3$  mm and the largest observed length difference was 7.7 mm. Mean interobserver differences were  $0.0 \pm 0.4$  mm with an excellent ICC value of 0.99.

Conclusion – Substantial forearm length differences ( $2.4 \pm 2.3$  mm) are present in a population of patients with a radius malunion. This should be taken into account while planning surgery.

## **A-0428** MID TERM AND LONG TERM FOLLOW-UP EVALUATION AFTER TOTAL WRIST DENERVATION FOR WRIST ARTHROPATHY

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The goal of an ideal treatment for painful degenerative or post-traumatic wrist osteoarthritis should be: reduce pain, preserve or restore function, decrease progression of degenerative changes.

Different “salvage” surgical procedures are described in Literature, like proximal row carpectomy, partial or total wrist arthrodesis, partial or total wrist arthroplasty.

Clinical outcomes of these surgical procedures report good results but a frequent loss of articular range of movement and a significant rate of complications (non union, implant loosening).

Sometimes in these patients pain predominates and function is still good.

In cases of radiographic degenerative changes of the wrist but good residual range of movement, the hand surgeon can propose to the patient, in selected cases, the surgical treatment of total wrist denervation, a specific neurotomy of articular nerve branches to the wrist.

Personal experience of 32 cases of painful osteoarthritis of the wrist, surgically treated with Foucher Technique of total denervation is presented, with an intermediate follow-up of 5 years and a long term follow-up of 14 years.

Pre-operative diagnosis were: 20 SNAC or SLAC, 9 post-traumatic wrist arthritis, 2 DRUJ arthritis, 1 STT arthritis, with mean age of patients of 58,5 years.

Clinical results at 5 years were: grip at Jamar test 76% of controlateral wrist, DASH score from 47,2 pre-op to 10,3 post-op, VAS from 8,3 pre-op to 2,1 post-op. Patients satisfaction was excellent or good in 30/32 cases. Return to manual activity was in 48 days post surgery.

Complications were 1 transient dysetsesia dorsum pollicis. 1 superficial wound complication.

One patient underwent to second surgery for residual pain.

Clinical follow up of results at 14 years is in progress and will be presented.

Radiographic progression of arthritis was valuated in 10 patients at 7,3 years of follow-up.

In selected cases of wrist arthropaty, total wrist denervation represents a surgical solution less invasive and permits a complete preservation of functions.

In case of no resolution of pain after denervation, there are no controindication to second surgery: discussion about secondary salvage procedures should be done with the patient pre-operatively.

Ideal patient is old with predominant pain and good function of the wrist, but also in younger patients wrist denervation can be a good surgical solution when associated to concomitant surgical procedures for arthritis, like radial stilodectomy, partial arthroplasty, etc.

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### **A-0429** SCAPHOID NON-UNION: FROM ARTHROSCOPIC ASSISTED TREATMENT TO VASCULARIZED BONE GRAFT

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**Introduction:** Treatment options for scaphoid non unions vary from non-vascularized bone graft (NVBG) to vascularized bone graft (VBG). There is still a great debate in literature for the correct indication of each type of graft. The purpose of our study is to demonstrate our results with the algorithm of treatment we adopted for treating scaphoid non unions

**Materials and Methods:** 73 patients were treated in our unit for scaphoid non-union. patients were divided in 3 groups.

Group 1 were treated by arthroscopic assisted debridement of non-union site and NVBG harvest with a spine biopsy needle from lister tubercle fixation in this group varied between screw fixation or k wires. Group 2 was treated by a

VBG based on the volar carpal artery, fixation was always by k wires. Group 3 was treated by a 1,2-intercompartmental suprapretinacular artery (1,2 ICSRA ) pedicled based VBG, fixation was always by k wires. Inclusion criteria were Group 1:

scaphoid waist non-union without humpback deformity (23 patients), proximal pole non unions without necrosis of the proximal pole (12 patients); Group 2: humpback deformity (18 patients) or failure of previous surgical operation in waist

malunion (3 patients); group 3: proximal pole necrosis (15 patients) or failure of previous surgical operation (2 patients).

**Results:** All Patients were followed by serial x rays (at 6 weeks and then monthly till healing) and CT scan. Mean healing time was 9 weeks for group 1, 12 weeks for group 2 and 14 weeks for group 3. Non severe complications were seen in

our case series, all patients showed healing of the non-union site.

**Discussion and Conclusion:** Surgeons still prefer NVBG mostly harvest from the iliac crest to treat non unions of the

scaphoid even if union rates favour VBG. Arthroscopic assisted technique was described in 1997 by P.C Ho and gained popularity in recent years. The main advantage of the technique is low morbidity on scaphoid vascularization favoring

healing process even with a non-vascularized bone graft. Graft is harvest from distal radius lister tubercle with a great advantage of using one surgical site, no harvest site pain and promoting scaphoid healing by this technique is useful in

many scaphoids non-union. On the other hand, complex cases with severe humpback deformity, proximal pole vascular sufferance or in failure of previous treatments with NVBG we believe it is more secure to perform a VBG harvest from

distal radius itself, volar carpal artery based for waist non unions and 1,2 ICSRA in proximal pole non unions as they show higher healing rates in the literature. In our opinion NVBG has a still a wide indication especially if associated with an

arthroscopic technique. Vascularized bone graft is reserved for complex cases with severe deformity, necrosis of proximal pole and failure of previous surgery in which it demonstrates higher healing rates.

### **A-0430** PREDICTION OF THE OUTCOME AFTER SUPRACLAVICULAR SCALENECTOMY IN PATIENTS WITH THORACIC OUTLET SYNDROME

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Supraclavicular scalenectomy is one of the most commonly selected procedures for patients with thoracic outlet syndrome (TOS). However, the necessity for concomitant first rib resection is still under debate. This study aimed to document the outcome of supraclavicular scalenectomy in patients with TOS, and to determine its predictive factors. We reviewed 37 patients (21 men and 16 women; average age of 40 years) who underwent supraclavicular scalenectomy under the diagnosis of thoracic outlet syndrome at a single institute. We recommended the surgery for patients with sensory change in medial forearm, low placement of shoulder girdle relative to the upper thorax, abnormalities in the electrodiagnostic tests, or decrease in vascular flow to the involved upper extremity. The decrease in the vascular flow was examined at five different maneuvers (90 degrees abduction, Roos test, 180 degrees abduction, costoclavicular maneuver, and Adson test). According to the improvement in the neurologic symptoms after at least one year of follow-up, we grouped the patients into either “success” or “indeterminate” group. From electronic medical record, we compiled demographic data such as age, sex, hand dominance, and symptom duration. We compared the data between the two groups and determined the factors that were associated with the success. Twenty-nine among 37 patients were in the “success” group and the remaining eight patients in the “indeterminate” group. Age, sex, hand dominance, symptom duration, electrodiagnostic studies, and cervical spine radiographs were not significantly different between the groups. However, the vascular flow during costoclavicular maneuver had been decreased before surgery in seven among eight patients (88%) in the “indeterminate” group. Whereas, in the “success” group, the decrease was found in 11 among 29 patients (38%). The flow at other maneuvers did not differ between the groups. In conclusion, supraclavicular scalenectomy is an effective procedure for thoracic outlet syndrome. Patients with severe vascular flow obstruction might require additional procedures such as first rib resection in order for improvement in the symptom.

### **A-0431** TREATMENT ORIENTED CLASSIFICATION FOR DISTAL RADIUS MAL UNION

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**Introduction:** Malunion is quite common following a distal radius fracture, with reported malunion rates of 23.6% and 10.6% after closed reduction with casting and surgical management, respectively. Common classification system distinguishes extra-articular and Intra-articular distal radius mal unions. We believe that this classification is too general and doesn't give a clear indication for surgical treatment. The aim of our study is to introduce a more detailed treatment-oriented classification guiding the surgeon to a correct treatment of the deformity.

**Materials and Methods:** forty-two distal radius mal unions were surgically managed in our unit between 2017 and 2022. All patients were studied with x rays and a CT scan before surgery. Mal unions were then classified according to their

deformity into volar (Type 1), dorsal (Type 2), intra-articular (Type 3) and combined (intra-articular + volar, Type 4 and intra-articular + dorsal, Type 5) each group was further divided indicating the absence (A) or presence (B) of a fixation device (pins, screws and/or plate and screws).

9 volar malunions (Type 1) were treated by a volar open wedge corrective osteotomy using the Fernandez technique, 15 dorsal malunions (Type 2) were managed by a dorsal open wedge corrective osteotomy, in 12 intra-articular malunions (Type 3) an arthroscopic guided intra- and extra-articular corrective osteotomy of the malunited fragment was performed, Combined deformity was managed first with an arthroscopic guided intra- and extra-articular corrective osteotomy, reduction of the articular surface and then correction of the extraarticular deformity by a volar plate with a volar open wedge in Type 4 (2 patients) and dorsal open wedge in Type 5 (4 patients). Previous fixation device was removed in all patients (subtype B) at surgery. A modified extended volar Henry approach was used in all cases and osteotomy was fixed by a distal radius anatomical volar plate in all cases.

Results. Healing of osteotomy was seen in all cases. Patients showed a statistically significant improvement of VAS, modified Mayo score and PRWE. All patients returned to their normal daily life working and sport activities. No major complication was seen.

Discussion and Conclusion: Current classification system of mal united distal radius fracture, dividing between in extra- and intra-articular deformities, fail to guide the surgeon for a correct treatment of the deformity. This might be the reason for a relative high number of complications especially in case of correction of "intra-articular deformity". We propose a treatment-oriented classification system. Using the system, we achieved satisfying results in terms of restoring distal radius anatomy and patients' function. We believe that using our classification system will help surgeons find the more adequate treatment leading to better results.

## **A-0432** ARTHROSCOPIC ASSISTED TREATMENT OF THUMB METACARPAL BASE ARTICULAR FRACTURES

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Fracture of the base of the thumb metacarpal (M1) is a common finding in hand trauma. Closed reduction and k-wires fixation or open reduction internal fixation are traditional treatments of choice. The arthroscopic assisted technique consists in introduction of a 1.9 mm small joint videoscope to trapeziometacarpal (TMC) joint through the common access points (1U, 1R, Radial, Thenar) using a dry technique. Vertical traction and dissectors are used for reduction of fracture fragments which are fixed with k-wires or screws. Our experience with this technique in nine patients (7 Bennett's fractures and 2 Rolando's fractures). All patients achieved healing of the fracture and returned to their working and sports activities. The excellent clinical and radiological results held with the technique confirms the advantages of a minimally invasive method, that provides articular reduction under direct vision, with limited soft tissue damage and allows early rehabilitation (from day one after surgery). The technique improves intra-articular fragment reduction, and to preserve fragment vascularization and capsular and ligamentous integrity along with joint stability. Indications for arthroscopic assistance are all types of intra-articular fractures or pending malunions involving the base of M1, the trapezium or both. This technique is extremely valuable for high demanding patients like manual workers or athletes. Relative disadvantage of the technique is the technical difficulty.

## **A-0434** THE EFFECT OF SKIN TEMPERATURE ON LIGHT TOUCH SENSATION AND TWO-POINT DISCRIMINATION SENSITIVITY

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**Introduction** Light touch sensation and two-point discrimination are usually tested to evaluate and assess severity of nerve injury conditions. Skin temperature, test sites, and genders may also play a significant role in determining a person's sensitivity. This study aimed to investigate the relationship between these two sensations, including light touch sensation and two-point discrimination sensitivity, and the physical properties which are skin temperatures, test sites, and genders. It is important to understand the effect of temperature on the sensations in order to develop an optimal treatment for individual with neurological conditions.

**Materials and Methods** This study was conducted with 18 participants (9 males and 9 females). The light touch perception and two-point discrimination were assessed at 12 test sites, which were 6 areas in the upper extremity and the other 6 areas in the lower extremity. The tests were conducted at room temperature (25°C), 40°C, 15°C, and 0°C.

**Results** Light touch sensation was decreased at extreme cold temperature, whereas the tactile acuity ability was significantly higher after immersing hands and feet in an ice bath. Both hot and cold application caused the improvement of light touch perception. After applying thermal agents, upper extremities showed more obvious in changing the sensitivity than lower extremities. Almost all test sites had no significant difference in changes of both sensations between genders after applying thermal agents.

**Discussion** The findings can be suggested that inhibition of the action potential-generating machinery at extreme cold temperature can cause numbness while a cross-over effect between the lateral spinothalamic tract and the dorsal column-mediastinum system may play a vital role in increasing the discrimination sensitivity after applying extreme cold agents. The thermal intensification of light touch perception may result from direct thermal stimulation of mechanoreceptors together with the nerve conduction velocity enhancement and a decrease in both conduction latency and current tolerance of sensory nerves after applying hot packs. Higher nerve density and being more sensitive can also be the reason why hands are more affected by skin temperature than feet.

## **A-0435** FROM A CIRCULAR SAW TO THE MANCHESTER BOMBING – A SINGLE SURGEON CASE SERIES OF OPEN FOREARM FRACTURES

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### **Introduction**

Open fractures of the forearm are significant injuries with a limited evidence basis in the published literature to guide best practice. We display a single surgeon case series at an 'orthopaedic' centre and present a review of the available literature. We outline a change in practice with the introduction of the Medartis forearm locking plates and encouragement of early range of motion post operation.

### **Method**

A retrospective, single orthopaedic surgeon case analysis was carried out reviewing all open forearm fractures undergoing

operative management at Wythenshawe Hospital, Manchester between 14/12/2012 and 10/10/2022. Data collected included age of the patient, Gustilo-Anderson classification of the injury, time to theatre, time to union, infection rate, type of plate used for fixation, the use of plaster cast post operation and patient reported outcomes. A review of the literature was conducted to review existing evidence for the management of open forearm fractures.

#### Results

23 patients were identified over 10 year period with an average age of 46.2 years old. 46.2% underwent a single stage orthopaedic operation with an open reduction internal fixation (ORIF). 53.8% had external fixator (Ex-fix) initially, followed by an ORIF for definitive fixation. The average time to theatre for Ex-fix and ORIF was 16.3 and 130.2 hours respectively. Soft tissue reconstruction was required in 90.9% of cases. The average time to union was 161 days. 3 patients were lost to follow up.

3 had non-union (all with Gustilo-Anderson 3b or c). One required revision fixation and 2 were treated with Exogen device and all finally united. 1 patient suffered a post operation infection at 18 months.

From May 2017 onwards, 'Medartis locking plate' was used with a focus on early range of motion without immobilisation. Average time to union as a result improved to 134.6 days, with 2 patients lost to follow up.

NB. 'Patient reported outcomes – data collection in progress'

#### Discussion

Our case analysis highlights the need and importance of both consultant orthopaedic and plastic surgeon in the management of open forearm fractures leading to a significantly improved outcome. Our local orthoplastic pathway involves local stabilisation and debridement before transfer to the specialist orthoplastics centre for definitive management (delay up to 5 days). The data confirms the higher risk of non-union in higher Gustilo Anderson classification grades, which is reflected in the published literature. The use of stable locking fixation improves early mobilisation and earlier bony union. Revision surgery rate for subsequent non-union was reduced with the use of Exogen device (ultrasound bone healing system).

### **A-0436** ALGORITHM VERSUS EXPERT: IS A PREDICTION MODEL BETTER THAN HAND SURGEONS IN PREDICTING SYMPTOM IMPROVEMENT FOLLOWING CARPAL TUNNEL RELEASE?

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Background: Predicting clinical improvement after carpal tunnel release (CTR) might help shared decision-making and improve pre-operative patient selection, which can lead to better patient satisfaction and treatment success. While prediction models have great potential, it is important to determine whether they are of added clinical value, indicating that they better predict outcomes than the treating hand surgeon. In this study, we compared predictions made by a previously published prediction model with those made by hand surgeons to determine whether this prediction model is of added value in clinical settings.

Method: We defined clinical improvement as reaching the minimal clinically important difference (MCID) on the Symptoms Severity Scale of the Boston Carpal Tunnel Questionnaire (i.e., 0.8 points on a 1-5 scale). After the intake consultations with the patient, we asked surgeons to predict whether the patient would improve beyond the MCID six months after surgery.

The prediction model made the prediction based on the same variables available at the time of the clinician consultation. Both were compared to the actual treatment outcomes to obtain the predictive performance of the prediction model and the surgeons. We then compared the performance of the prediction model and the surgeon's predictions using discrimination and calibration. Discrimination was evaluated using the area under the curve (AUC), which is a measure of how well the model can differentiate between the patients that eventually did or did not improve, with an AUC of 0.5 being equal to chance. We used DeLong's test to test for differences between the AUC of the model and the AUC of the surgeons' predictions. Calibration is the agreement between the predicted probabilities and observed frequencies and was assessed by visual inspection of calibration belts.

Results: We included 97 patients. Of these, 25% did not reach the MCID six months after surgery. The model predicted that 26% of patients would not reach the MCID, whereas the surgeons predicted that only 3% would not reach the MCID. The prediction model showed acceptable discrimination with an AUC of 0.77, and there was a good calibration. The model had a sensitivity of 0.67 and a specificity of 0.85. The surgeons' discriminative ability was only slightly better than chance with an AUC of 0.62, and there was poor calibration. Sensitivity was 0.72 and specificity was 0.46. The DeLong's test showed no significant difference between the two AUCs ( $p = 0.053$ ).

Conclusions: Surgeons predicted the improvement following carpal tunnel release only slightly better than chance. Based on discrimination, no significant differences were found between the performance of the model and that of surgeons ( $p = 0.053$ ). However, while the model was able to reliably predict the probability of improvement, the calibration of the predictions made by surgeons was poor, and specificity was low. Our results suggest that the CTR prediction model is of added clinical value, particularly as it is better able to identify which patients will not improve after surgery.

## **A-0437** FINGERTIP TUMORS: DIAGNOSTIC PRINCIPLES AND REVIEW OF OUR SERIES

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### INTRODUCTION

Tumors are encountered frequently in hand surgeon activity; the knowledge of the oncological principles for a correct diagnosis and an adequate treatment is therefore of particular importance.

We present the diagnostic principles to hand tumors and the review of our fingertip neoplasm series.

### MATERIALS AND METHODS

From 2018 to 2021 we treated 87 patients: 82 benign tumors, 4 malign tumors and 1 metastasis.

Preoperative, X-ray and MRI have been performed in all cases; for bony tumors and malignant neoplasms, CT scan has been also performed.

Minimum follow-up considered was 1 year.

### RESULTS

84 patients healed, in 2 cases tumor relapsed and 2 patients died.

### CONCLUSIONS

Management of hand tumors does have several pitfalls: a missed or delayed diagnosis, or an improperly performed biopsy or treatment, may lead to errors difficult to remedy, with devastating consequences for hand function and patient survival.

## **A-0439** MUSCULOSKELETAL INFECTIONS OF THE HAND AND THE IMPACT OF THE SARS-COV-2 PANDEMIC. DESCRIPTIVE ANALYSIS IN A RETROSPECTIVE COHORT STUDY

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### Introduction

Nowadays, one of the most feared pathologies in orthopedic surgery in general and hand surgery in particular are musculoskeletal infections. This is due to its difficulty in treatment, the numerous recurrences and the complications that they produce. That is why the present study is carried out in a cohort of patients from the same hospital center who were admitted due to hand infections, carrying out a descriptive study of the variables under study and analyzing the influence of the (COVID-19) pandemic on both. groups.

### Methods

Retrospective collection of data from consecutive patients who were admitted to the Marques de Valdecilla University Hospital with a diagnosis of musculoskeletal infection of the hand and wrist during a 5-year period (January 2017-March 2022). Demographic variables, type of infection, and surgery if necessary were recorded. In addition, the type of antibiotics used was recorded, as well as the germ and its resistance. Burn injuries were excluded in patients under 18 years of age, patients with previous systemic infections, and those who did not give informed consent to participate in the study.

### Results

Overall, 81 patients were included: 'Pre-COVID-19' (n=43//53%) and 'During COVID-19' (n=38//47%).

In the pre-COVID group:55.8% of the patients were right-handed and 44.2% left-handed; 53.5% were men and 46.5% women; the mean age was 59 years; 18% were smokers; 9.3% were diabetic and 16.3% had some type of immunosuppression.

Regarding the type of injury:20.9% were bites, 18.6% arthritis, 7% synovitis, 18.6% abscesses, 2.3% felons, and 32.6% osteomyelitis.

The mean number of days until surgery was 6.5 days and the mean number of surgeries required was 1.3 surgeries. 39.5% of patients presented changes in antibiotic treatment, so the initial antibiotic was not the same as the final antibiotic. Finally, the mean antibiotic time was 23.9 days, 21% of patients had complications of some kind and 24% of patients had a resistant microorganism.

In the COVID group: 71% of the patients were right-handed, 26.3% left-handed, and 2.6% ambidextrous; 60.5% were men and 39.5% women; the mean age was 50 years; 21% were smokers; 7.9% were diabetic and 23.7% had some type of immunosuppression.

Regarding the type of injury:39.5% were bites, 13.2% arthritis, 7.9% synovitis, 10.5% abscesses, and 28.9% osteomyelitis. The mean number of days until surgery was 4.5 days and the mean number of surgeries required was 1.6 surgeries. 45.9% of patients presented changes in antibiotic treatment, so the initial antibiotic was not the same as the final antibiotic. Finally, the mean antibiotic time was 24.26 days, 11% of patients had complications of some kind and 32% of patients had a resistant microorganism.

### Conclusion

Infections continue to be an important reason for hospital admission within the hand surgery service, however, the number of previous and post-pandemic infections have remained stable.

Regarding the analysis of the demographic variables, it is objective that the groups are comparable since they present similar demographic characteristics.

Finally, in terms of treatment, resistance of microorganisms and complications, no gross differences can be observed between both groups.

Therefore, it is concluded that COVID 19 does not imply an increase in the rate of musculoskeletal infections of the hand.

## **A-0440** TRAPEZIOMETACARPAL PROSTHESIS AND THUMB METACARPOPHALANGEAL JOINT FUSION : IS IT COMPATIBLE ?

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The Thumb metacarpophalangeal (MCP) range of motion is variable across individual, in flexion, in particular. Trapeziometacarpal (TM) prosthesis by restoring the length of the thumb, may correct the MCP hyperextension or prevent its aggravation, if it was present pre-operatively. MCP motion in flexion can be restricted (individual lack of flexion or the consequence of the TM placement), without fear of repercussion in thumb function.

We hypothesize that In case of symptomatic MCP joint (painful unstable joint, osteo-arthritis) following TM prosthesis, the MCP joint fusion may have mechanical constraints on prosthesis and the method of fixation for MCP joint fusion may be limited by the small available space due to stem prosthesis.

### Methods

Dual mobility TM prosthesis allows an arch of mobility of the Trapeziometacarpal joint between 114 and 118°, depending of the neck size. We report three cases of definitive MCP fusion in the context of TM prosthesis and their impact on the thumb's function. The surgical indication was MCP painful osteoarthritis. A segmental MCP brace mimic the definite fusion was tested for 6 weeks before the surgery. The MCP bone fusion was adjusted, according to have a full contact between the thumb and the index pulps (functional positioning): after cartilage removal, the first phalanx was derotated, MCP in 30 degrees flexion with compression between the two bones. Fixation was performed twice with a locking plate 2.0, and one with staples. The thumb was placed in a thumb plaster (Alpine splint-type) for three months , keeping IP and trapeziometacarpal joints free for post operative mobilization.

### Results

At three months, all MCP joint had been fused. Functional use was assessed at the last follow-up of four years. Patients complained of thumb shortening. Kapandji score was at 10, thumb extension was limited at 25% in Kapandji score, strength was restored. There was a disassembly due to a breaking plate but the MCP joint healed with an asymptomatic valgus deformity. There was no short-term impact on the prostheses (loosening, polyethylene wear, dislocation, overloading) with pain-free tm joint.

### Conclusion:

- MCP joint fusion in the context of TM prosthetic arthroplasty is a solution when two joints in a row present osteoarthritic damages.
- MCP joint fusion fixation is not limited by the small available space.
- Mechanical constraints on prosthesis need to be confirmed by longer series and sufficient follow-up

Reasearch Category : Level 1

## **A-0441** LONG-TERM RESULTS AND PROGRESSION OF OSTEOARTHRITIS AFTER EXTENSION BLOCK PINNING FOR UNSTABLE PROXIMAL INTERPHALANGEAL JOINT FRACTURE-DISLOCATIONS

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**Background:** Unstable fracture dislocation of the proximal interphalangeal (PIP) joint is a challenging injury to treat. It tends to cause post-traumatic stiffness, pain, and osteoarthritis (OA). Little is known about their long-term outcomes and the progression of post-traumatic OA over time.

**Objective:** In this study, we evaluated the mid- and long-term clinical and radiological outcomes and progression of OA after extension block pinning for unstable dorsal fracture-dislocation of the PIP joint. We also aimed to identify prognostic factors for the clinical outcome and OA.

**Methods:** In 2000-2009, a series of 53 patients with 55 unstable dorsal fracture-dislocations of the PIP joint (mean articular surface involvement 49%, SD 10%) were treated with extension block pinning. The reduction of the joint was achieved intraoperatively in all cases and the mean postoperative residual articular step-off was 0.6 mm (SD 0.4 mm). In 2010 and 2021, the patients were retrospectively invited to participate in subjective, objective, and radiologic evaluations. At a mean follow-up of 5 (range 1-5 years) and 16 years (range 12-21 years), 39 patients (41 injured PIP joints) and 31 patients (33 injured PIP joints), respectively, were evaluated. Twenty-five patients (27 injured PIP joints) participated in both follow-up evaluations and their radiographs were scored for severity of OA by three hand surgeons independently in blinded fashion using the Kallman OA score.

**Results:** In 2010, the mean active range of motion (AROM) of the PIP joints was 80° with a mean 6° extension deficit, and the mean visual analog scale for digit pain was 1.5/10. In 2010, the increased pain was associated with a recurrent subluxation of the joint, increased residual articular step-off and patient's older age, whereas the decreased AROM was associated with a shorted follow-up time. In 2021, the mean AROM of the injured PIP joint was 80° with a mean 5° extension deficit, and the mean numeric rating scale for digit pain was 0.9/10. The decreased AROM and higher Kallman OA score of the injured joint were associated with an increased residual articular step-off and patient's older age. The Kallman OA score increased significantly between the years 2010 and 2021. The intra- and interobserver reliability of Kallman OA score were substantial (ICC>0.7).

**Conclusions:** The mid- and long-term clinical results of unstable dorsal fracture-dislocations of the PIP joint treated with extension block pinning were satisfactory. The clinical results remained during the 11-year follow-up time, even though radiological OA progressed. The residual articular step-off and patient age were the most important factors affecting the clinical outcome.

## **A-0443** THE EFFICACY TENDON TRANSFER TECHNIQUE IN RECONSTRUCTION OF THUMB EXTENSION AND ABDUCTION

Yosuke Ito<sup>1</sup>, Yusuke Matsuura<sup>1</sup>, Aya Kanazuka<sup>1</sup>, Yoshiyuki Matsuyama<sup>2</sup>, Takahiro Yamazaki<sup>1</sup>, Taniguchi shinji<sup>3</sup>, Kenji Kubota<sup>1</sup>, Ryutarō Iwasaki<sup>1</sup>, Atsushi Hojo<sup>1</sup>, Takashi Nomoto<sup>1</sup>, Yukari Matsuzawa<sup>1</sup>, Takuto Takeda<sup>1</sup>, Seiji Otori<sup>1</sup>

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[Purpose]

Radial nerve palsy and posterior interosseous nerve palsy disables the extensor hallucis longus to abduct the thumb which causes a severe functional disability. Riordan method and Tsuge method are widely used methods of tendon transfer

which are reasonable treatments but because of the extra-anatomic tendon placement the force of thumb extension and abduction are often not sufficient. We report a method that preserves the first compartment and transfers the short extensor tendon to the long palmar tendon with good results. The purpose of this study is to compare the efficacy of each technique to reconstruct thumb extension and abduction using fresh-frozen cadavers.

[Method]

Eight upper extremities taken from fresh-frozen cadavers were used. Models were simple traction of extensor pollicis longus tendon, tendon transfer of extensor pollicis brevis tendon to palmaris longus tendon, Tsuge method. Each model was reproduced with each arm.

The wrist joint and forearm was fixed to the fixture in intermediate position. Fastrak magnetic position sensors were attached to the thumb nail, the base of the first metacarpal, and the dorsal surface of the second metacarpal head, and the position of each site in 3D coordinates was recorded. The donor tendon was pulled using a mechanical testing machine and the tension generated (N) was recorded. The tension required to obtain 30 degrees of radial abduction angle, calculated from the 3D coordinates, was compared.

[Result]

The tension required to obtain 30 degrees of radial abduction angle was 12.1N, 9.42N, 15.5N on average in extensor pollicis longus tendon traction, extensor pollicis brevis tendon transfer and Tsuge method. There was a statistically significant difference between extensor pollicis brevis tendon transfer and Tsuge method.

[Conclusion]

The transfer of the extensor pollicis brevis tendon palmaris longus tendon was shown to be an efficient and useful technique to obtain radial abduction of the thumb.

#### **A-0444** EFFECTS OF SELF-EFFICACY, CATASTROPHIZING, FEAR OF MOVEMENT AND JOINT POSITION SENSE IN THE MAINTENANCE OF WRIST UNSPECIFIC PAIN IN ATHLETES. AN OBSERVATIONAL CROSS-SECTIONAL STUDY

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**Introduction:** Wrist pain is a highly prevalent condition in racket sport population. Although different wrist injuries have been described in the literature as more prevalent in racket sport, unspecific chronic wrist pain is common problem on amateur population.

**Material and methods:** A cross-sectional study were conducted between October 2021 to June 2022. Participants over 18 th suffered for wrist pain were recruited from different sports centers where racket sports were practiced.

**Objective:** The aims of this research was to study the relationships and the predictive power of Self-Efficacy, Catastrophizing, Fear of Movement and proprioception on the persistence of unspecific wrist pain in athlete population.

**Results:** One hundred and four athletes participated in the study (54 men and 50 women), most of them tennis and paddle players. Psychological variables were correlated ( $P < 0.01$ ) with wrist pain persistence, suggestive of complex interactions between cognitive-affective processes and wrist unspecific pain in athletes.

**Conclusion:** The results suggest that targeting high levels of Self-Efficacy, Catastrophizing and Fear of Movement could be a prognostic factor of wrist unspecific maintained pain in athlete population.

**A-0445** CORRELATION BETWEEN BOSTON QUESTIONNAIRE AND CROSS SECTIONAL AREA (CSA) IN PATIENTS WITH CARPAL TUNNEL SYNDROME (CTS) WITH AND WITHOUT BIFID MEDIAN NERVE VARIANT OF NORMALITY  
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#### OBJECTIVE

To analyze the correlation between the Boston questionnaire and the CSA ultrasound parameter in patients with CTS with and without bifid median nerve variant of normality.

#### MATERIAL AND METHOD

Descriptive prospective study carried out in our center between November 2021 and March 2022.

Inclusion criteria: typical clinical signs of CTS based on history and physical examination.

Exclusion criteria: age <18 years, atypical clinical symptoms, previous surgery or secondary cause.

The study was carried out following a diagnostic protocol for CTS based on ultrasound designed in our hospital. This protocol is based on the use of ultrasound as a complementary diagnostic test instead of neurophysiological studies.

Diagnostic protocol: patients who aim criteria for CTS, answered a Boston questionnaire and are prescribed a night orthoses for at least 6 weeks. Then, a median nerve ultrasound assesment is performed with a linear probe, measuring the CSA at inlet level, indicating also if there is any anatomical variant of the normality of the median nerve (bifid nerve, palmaris longus inversus).

#### RESULTS

69 patients are included in the study. 11 patients belong to the group with a normal variant: 10 patients with bifid nerve morphology (group 1), and 1 with reverse palmaris longus, which is excluded. 58 patients belong to the group with no variant of normality (group 2).

Group 1 (bifid nerve) (N=10) had a mean age of 51 years (41-62), 90% women, a mean Boston of 33 points (24-44), and a mean CSA of 0.16cm<sup>2</sup> (0.12-0.20).

Group 2 (no bifid nerve) (N=58) also had a mean age of 51 years (24-75), 86% women, a mean Boston of 33 points (17-53), and a mean CSA of 0.14cm<sup>2</sup> (9-23).

The Pearson correlation coefficient in group 1 (bifid nerve) was  $r = -0.02$ , with a correlation very close to 0 (no correlation).

The Pearson correlation coefficient in group 2 (without normality variant) was  $r = 0.19$ , with a positive correlation between the Boston questionnaire and the CSA.

#### CONCLUSION

There is a positive correlation between the Boston questionnaire and the ultrasound CSA in patients with CTS, but not so if they present a bifid nerve variant of normality.

**A-0446** ARTERIAL SYSTEM OF THE FINGERS: ANATOMY AND CLINICAL APPLICATIONS IN HAND RECONSTRUCTIVE SURGERY

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Introduction: Several studies have been published on the variation in the diameter of the proper palmar and dorsal digital arteries, which might determine the results on reconstructive hand surgery. The aim of this study is to macroscopically

analyse the size of both vessels in each finger of the hand.

**Materials and methods:** Six cryopreserved upper extremities were injected with latex through the brachial artery. The hands were processed either using the Spalteholz technique or a glycerine variation of it. These techniques are used to make the specimens transparent and they only let see the injected vessels, so there is no dissection artifact.

**Results:** The proper palmar digital arteries presented differences in diameter, following a predictable pattern in the index, middle and small finger. In the index and middle finger, the dominant vessel was located on the ulnar side. The pattern was reversed in the small finger, where the radial digital artery was the larger vessel. No significant differences were observed in the thumb and the ring finger. Regarding the proper dorsal digital arteries, they were visible only in the thumb and the radial side of the index.

**Conclusion:** The present findings suggest that the ulnar side of the index and middle finger, as well as the radial side of the small finger, should be preferred as a pedicle when planning for a flap. Similarly, the same vessels should be prioritized in digital replantation if possible. Nevertheless, assessment of permeability of both proper palmar digital arteries by a modified Allen test and Eco-Doppler remains essential prior to any surgical intervention.

## **A-0447** PATIENTS' PERSPECTIVES ON THE USE OF PATIENT AND OUTCOME INFORMATION IN EVERYDAY CARE. A MIXED-METHOD STUDY

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**Objective:** In recent years, healthcare providers have increasingly been collecting patient and outcome data. One goal of collecting and using patient and outcome data in clinical care is to improve healthcare quality. An important step is to appropriately translate these data into applications that can be used in daily care by both clinicians and patients. We developed five applications of outcome information, accessible through the electronic patient records: 1) visual display of patient and outcome information, including patient-reported outcome measurements (PROMs) over time, 2) the personal request for help and treatment goals, 3) screening tools for pain, function, and mental health, 4) individual predictions of recovery and treatment effect, and 5) identification and feedback on 'extreme values' with color coding. This study evaluated patients' perspectives on using these applications in everyday care and assessed which characteristics affect the general understanding and perceived value in patients treated for hand or wrist conditions, chronic pain, or stroke.

**Methods:** This was a mixed-methods study. We distributed a survey that evaluated the understanding, experience, decision-support, and perceived value of each individual application, as well as the general understanding and value of the outcome information. We also measured health literacy. Patients (N = 3,329) completed the survey following their intake or follow-up appointment in which the applications could have been used. We performed a hierarchical linear regression analysis to identify whether baseline socio-demographics, mental health status, pain and function scores, and limited (health) literacy were associated with patients' general understanding and perceived value of the applications. The qualitative analysis comprised semi-structured interviews (N = 16). The topics of the interview guide were based on the different applications. We interviewed patients until theoretical saturation.

**Results:** All applications of outcome information scored high on the survey questions on understanding, decision support, and usefulness. Each application was scored with a median of 8 or higher on each question. A longer follow-up (>6 months), male sex, average anxiety,

finger conditions, and moderate physical occupation were associated with less perceived general understanding, while needing help with completing and understanding surveys, and having difficulty completing surveys were associated with better perceived general understanding of the outcome information. Male sex, patients visiting for a second opinion, and patients not receiving treatment were associated with less perceived general value of the outcome information, while more pain, more anxiety, and difficulty completing questionnaires were associated with more perceived general value of the outcome information. The interviews reaffirm the survey findings. Furthermore, patients indicated that using the applications made them feel heard, empowered, and motivated. They gained more insight into their own health status and find the applications supportive in shared decision-making. Patients use PROMs to address topics they find difficult to discuss in person. Conclusion: Patients have a positive experience with applications of outcome information and find them easy to understand. Patients with limited (health) literacy have a better general understanding of the applications and find the applications more useful. Therefore, we urge clinicians to use outcome information in their daily practice.

## **A-0450** SCAPHOLUNATE RECONSTRUCTION WITH SUTURE TAPE AUGMENTATION

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### Introduction

There are several techniques described in the literature for reconstruction of the scapholunate ligament (SLL), with variable results and success rate. Repair and reconstruction using anchors and augmentation with InternalBrace™ (IB) is a recent technique with favourable results in cadaver studies, but there are no large clinical reviews published. The aim of this study was to evaluate the clinical, functional, and radiological results of scapholunate ligament repair or reconstruction with IB augmentation in the treatment of scapholunate instability.

### Methods

A retrospective study of patients diagnosed with scapholunate ligament injury who underwent surgical repair or reconstruction with IB augmentation was performed. We evaluated 13 patients with a mean age of 43.5 (23-64) years and a mean follow-up of 24 (6-59) months. We evaluated and registered clinical and functional data, such as, pain (Visual Analogue Scale - VAS), range of motion, grip strength, Quick Disabilities of the Arm, Shoulder and Hand (Quick-DASH) score and Mayo Wrist Score (MWS). Additionally, a pre- and postoperative radiographic evaluation was performed with measurements of the scapholunate angle and scapholunate interval.

### Results

In the follow-up evaluation, mean VAS value was 1.0 ( $p < 0.0001$ ); mean range of motion was 71.38° of flexion (85% of uninjured side) and 65.38° of extension (93% of uninjured side); mean grip strength was 34.8 Kg (95% of uninjured side). Mean Quick-DASH score was 4.73 and mean MWS 86.25%. Two major complications were recorded: extrusion of an anchor with capitate impingement and failure of an anchor in osteoporotic bone which required surgical revision. Radiographic evaluation revealed a statistically significant improvement in the scapholunate angle ( $p = 0.0034$ ) and in the scapholunate interval ( $p = 0.018$ ). The mean time to return to work was 1.86 months.

### Discussion

The advantages of using IB in hand and wrist ligament repair and reconstruction are well documented in the literature. The augmentation with a high resistance synthetic tape confers greater stability and resistance to the repair or reconstruction during the healing period, allowing for early controlled mobilization and obviating the need for prolonged immobilization

or transarticular fixation. However, to our knowledge, there is only one clinical study on its application in SLL reconstruction. In our small series, the preliminary results show a significant clinical and radiological improvement with this technique, with a reduced failure rate and an early return to work.

#### Conclusion

In our series, this procedure presents good preliminary clinical, functional, and radiological results. A study with a larger sample and longer follow-up will be necessary to highlight long-term results and complications.

### **A-0451** THE COMBINED ORTHOPLASTIC HAND & WRIST VIRTUAL FRACTURE CLINIC: A NEW OUTPATIENT CARE MODEL TO RATIONALISE THE HAND INJURY PATHWAY AT A MAJOR TRAUMA CENTRE

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#### Background:

St Mary's Hospital is one of four Major Trauma Centres (MTC) in London. Prior to the COVID-19 pandemic, only complex hand injuries related to major trauma were managed by the plastic surgery department. During the pandemic, pan-London demand for review of simple hand trauma in the face of nationwide reduced operating capacity led to expansion of the service to include review of all hand and wrist injuries. During the recovery period with trends in major trauma normalizing to pre-pandemic rates, demand-vs-capacity was exceeded within our trauma clinics. In response to this, with lessons learnt from the Trauma & Orthopaedic speciality, we introduced a new service – The Combined Orthoplastic Hand & Wrist Virtual Fracture Clinic (VFC) – to address increased wait-times from injury to specialist review for closed hand and wrist injuries. This project demonstrates the use of a quality improvement model to introduce a combined orthoplastic VFC at an MTC from two separate departments working cohesively together at a time of intense service pressure. This was led by a team of plastic and orthopaedic surgery hand consultants, a hand fellow, and a senior hand therapist. A closed-loop audit was performed referring to BOAST guidelines for VFC management.

#### Methods:

We present the results of retrospectively collected data on wait-times to clinic, clinic outcomes, and time-to-treatment one year after this service was introduced. This data was compared with data collected following the first 3 months of service introduction, following which interventions were implemented to improve patient flow and management.

#### Results:

To date, nearly 4000 referrals have been managed through the hand & wrist VFC pathway.

Within the audited period, median referral-to-review time was 12-days during the first 3 months, improving to 5 days by the 12-month mark. The most common injury referred was adult wrist injury.

55% of virtual review appointments concluded without the need to convert to a further face-to-face review to establish a working diagnosis and treatment plan. 26% of these patients were referred to the hand therapy team for a virtual consultation, while 29% were discharged with advice. Of the 45% patients who were invited for face-to-face clinical review, 8% required second line imaging modalities to confirm diagnosis where this might have significantly changed management. Just 3% required operative input, while the rest were either discharged without further follow-up or referred to hand therapy.

#### Conclusions:

With the introduction of a VFC model for management of hand and wrist injuries post- COVID-19 pandemic we reduced

face-to-face clinical appointments by 55%. This led to significant reductions in patient wait-times and cost-savings. Combining two specialties allowed cases to be consolidated by subspecialty, streamlining the patient journey. The development of reference guidelines for the management of injuries commonly referred to the service with the input of senior hand therapists including splint and mobilisation advice allowed us to standardise patient care, from emergency attendance to first review. This model has improved patient experience and helped us ameliorate delays imposed by the COVID-19 pandemic. We have demonstrated this to be a successful and sustainable model for patient care.

## **A-0452** WIDE AWAKE LOCAL ANAESTHETIC NO TOURNIQUET SURGERY IN TRAPEZIOMETACARPAL PROCEDURES, OUR EXPERIENCE AND METHODOLOGY

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### Aim:

Since it was described by Lalonde, wide awake local anaesthetic no tourniquet (WALANT), has gained traction and popularity. Our department has started using WALANT for hand surgery with increasing complexity. Muller first described the use of WALANT surgery for trapeziometacarpal (TMC) prosthesis implantation in 2018. We present our results and protocol in WALANT TMC surgery, including prosthetic replacement, trapeziectomy with suspensionplasty and TMC revision surgery.

### Method:

Seventeen WALANT surgeries on 15 patients were performed. All were female with a mean age of 65 years. 14 cases were performed for rizarthrosis, 8 trapeziectomies with suspensionplasty (Microlink™ system, ConMed) 6 TMC prosthetic replacements (Maia™ dual mobility system, Lepine) and three revision surgeries. Accessory procedures were also performed when needed, namely, volar plate reinsertion and first extensor compartment release. Revisions were performed for prosthetic loosening, arthroplasty rigidity with “Z” deformity (Implant removal and trapeziectomy with suspensionplasty were performed) and osteophyte conflict (osteophyte removal). The first four procedures were performed with an anaesthetist present, one patient needed to be converted from WALANT to conventional anaesthesia due to anxiety during the procedure. We had three post-operative complications that required revision surgery (2 under WALANT and 1 under conventional anaesthesia). There were no WALANT related complications. Mean procedure time was 81 minutes, however, this was not adequately recorded in all cases. Our protocol for TMC surgery uses a mixture based on the one described by Lalonde and tumescent injection is performed 25 minutes before surgery. Injections are performed in four strategic locations (five for suspensionplasty) that allow a 360° anaesthesia and vasoconstriction for the procedure to be comfortably carried out. Before injection the hand is numbed with a lidocaine spray to reduce discomfort.

### Results:

There were no added complications or surgery time for these procedures when compared to those described with conventional anaesthesia. There were also no WALANT related complications. Most of the procedures were performed without the presence of an anaesthetist and in an outpatient setting. We find it useful to actively engage the patients during surgery to keep them comfortable and also help the surgeons assess stability and functional result. Patient collaboration is also useful for C-arm hand positioning (reduced surgeon exposure). After wound closure, the hand is shown to the patient and he performs various tasks, such as Kapandji's score. This active involvement in their procedure is useful in rehabilitation, as the patient feels “part of the team”.

## Conclusion

TMC surgery, be it prosthetic replacement, trapeziectomy with suspensionplasty or even revision surgery is safe, reproducible, pain free and does not increase surgery time or complications with our WALANT protocol. The authors also find that including patient participation in his own surgery might be promising for post-op rehabilitation.

## **A-0454** REFERENCE VALUES FOR REVISED AND STANDARDIZED DELLON'S MODIFICATION OF MOBERG PICK-UP TEST – PICK-UP3 WITH INTER-RATER RELIABILITY

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**OBJECTIVE:** Home based therapies are more common than before, as patients are being treated in their own environment. Therapist or a home health nurse may notice something in patients hand function and need to give numeric value on it. This is to correspond on demand of measuring findings instead of just describing them.

**BACROUND:** Functional sensory testing was introduced by Erik Moberg and in the 1980's A. Lee Dellon developed his own version of the test. For modern day use this test lacked a standardized test protocol and test items were in USA measurements. With the kind permission of Dr. Dellon a detailed standardized instructions and protocol with items of metric system were written 2013 in Hand Speciality course. Our aim was to have a small, practical dexterity test for fine motor skills and prehension. Peer reviews and pilot study of Pick-up3 showed that therapists perceived this test as practical, quick and easy to use for measuring dexterity and functional sensory (2015).

**PURPOSE:** Our first aim in this research was to develop further the test but also to cover inter-rater reliability of the test as validity and reliability of assessment tools is of great importance.

The second aim was to collect normative data for reference values for healthy subjects age from 20 to 71 and above.

**METHODS:** In the first part (inter-rater reliability) total of 45 test subjects were included. The standardized procedure was used and each subject repeated test three times, once with each of three different raters. The data was analyzed by using ICC statistics.

In the second part (the normative data for reference values) data was collected from healthy subjects (N=600), from 20 to 71 years and above. Performance time in picking-up items and identifying them without vision was measured and results were classified according to age, gender and dexterity.

**RESULTS:** In this Pick-up 3 -research the ICC reliability was considered good (0.86), almost excellent. It was also found out that person picked up the items quicker when repeating the test from the first rater to second and to third rater. This finding was statistically significant. According to previous studies shorter waiting time between the measurements may have greater learning effects. In this research all three measurements were carried out during one day.

When measuring the normative values of the picking up and identifying times, some interesting results were found. There was statistically significant difference in performance time between genders. Also, the older the participant was the slower he/she was. When picking test was carried out twice it was noticed that the second test time was quicker. There was statistically significant difference between the first and second test times.

**CONCLUSIONS:** It was found out that the Pick Up 3-test has very good interrater reliability.

According to the findings (ICC value) of this study the test is suitable for research and clinical use.

Full normative results of healthy subjects (N=600), from 20 to 71 years and above, are presented.

Assessment, Dexterity, Sensory, Nerve, Research

## **A-0455** CORRELATION BETWEEN HOSPITAL LENGTH OF STAY AND PALMAR GRIP STRENGTH OF POST COVID-19 PATIENTS

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**Background:** A widespread outbreak of acute respiratory illness occurred in China in December 2019, caused by a new type of virus, SARS-CoV-2, called COVID-19. Due to the high speed of contamination, COVID-19 spread quickly, being declared a pandemic in March 2020 by the WHO. The disease can present itself in different ways, with around 20% of patients having the most severe form, with an overall mortality rate of around 2%. Thus, it is still necessary to identify the possible repercussions for treatment and rehabilitation, requiring coordinated multidisciplinary actions between several specialists. **Objective:** To correlate clinical variables during hospitalization with the post-hospitalization palmar grip strength of COVID-19 survivors.

**Method:** This is a descriptive observational study, with data obtained from clinical information contained in the patient's medical records and evaluation by manual dynamometry, in the first return visit after hospital discharge. The Palmar Grip Strength test was performed with the patient sitting in a chair with a straight back and without support for the arms, shoulder adducted and neutrally rotated, elbow flexed at 90°, forearm in a neutral position, and wrist between 0° and 30° of extension and 0° and 15° of ulnar deviation, with the Jamar® dynamometer, maintaining a period of continuous muscle contraction of 3 seconds in each measurement, repeated three times, adopting the highest value, with a rest period between measurements of, at least 1 minute, to avoid the effect of muscle fatigue.

**Results:** Sixty-seven patients with a mean age of 56 (14.46) years and mean Palmar Grip Strength of 28.58 (12.51) kg/force were evaluated, and divided into 2 groups, according to the length of stay (LoS). The group with LoS<15 days consisted of 37 patients, with a mean age of 57.05 (15.22) years, with a mean Palmar Grip Strength of 30.93 (12.70) kg/force; the group with LoS>15 days was composed of 30 patients, with a mean age of 54.63 years, with a mean Palmar Grip Strength of 25.83 (11.96) kg/force. The Spearman correlation test showed that the correlation between LoS and Palmar Grip Strength of the entire group was -0.25 ( $p=0.04$ ), for the LoS<15 group it was -0.04 ( $p=0.82$ ), and for the LoS>15 group was -0.46 ( $p=0.01$ ).

**Conclusion:** There is a moderate association between Palmar Grip Strength in patients surviving prolonged hospitalization by COVID-19, characterizing the functional loss of these patients, indicating the need for intra and post-hospital rehabilitation planning, and integrally identifying the needs of patients and multidisciplinary follow-up.

## **A-0457** TECHNIQUE MODIFICATIONS FOR WRIST ARTHRODESIS WITH A LOCKED INTRAMEDULLARY DEVICE

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**Objectives:** Dorsal plates have so far been the most widely used method for wrist arthrodesis. However, they present problems such as skin complications, extensor tendon injuries and the impossibility of controlling the final position of the wrist. The IMPLATE system (Skeletal Dynamics, FL) offers a solution to some of the problems of previous techniques. Our objective is to describe some modifications of the original technique to improve the compression capacity of the

implant and our results so far.

**Material and methods:** Cases of wrist arthrodesis using the IMPLATE device in our unit were reviewed. A modification of the surgical technique was developed for cases with loss of height of the wrist, aimed at increasing compression, reducing the need for peri-implant bone grafting, completely covering the device and reconstructing the floor of the fourth compartment, by means of a proximal implantation of the radial stem. In cases with significant distal radioulnar pathology, adjuvant procedures were performed. Consolidation, pain, ranges of motion for pronosupination and flexo-extension of the fingers and complications were analyzed.

**Results:** We present 19 arthrodeses were performed in 19 patients with a mean age of 53 years. The etiology was rheumatoid arthritis, osteoarthritis and brachial plexus paralysis. The mean follow-up was 24 months. The choice of angulation and rotation was agreed with each patient in the preoperative consultation. In 40% of the cases, procedures for the distal radioulnar joint were associated. Bone consolidation was achieved in all cases and pain disappeared completely. The ranges of motion (excluding patients with brachial plexus injury) were practically complete for both pronosupination and flexion-extension of the fingers. Regarding complications, there was migration of the distal screw in one case, which required surgical revision, and a spiral fracture of the third metacarpal in another case.

**Conclusions:** The use of the IMPLATE device is an alternative to other techniques. In our experience, it presents good rates of radiocarpal consolidation and great versatility in the position of the wrist in space. The main source of complications in our series comes from the metacarpal portion and it could be useful to have a greater variety of distal stems to adapt to the metacarpals. The proposed modification favors early consolidation by increasing compression and provides solidity in cases that generally present poor bone quality.

## **A-0459** MODIFIED LATISSIMUS DORSI TENDON TRANSFER IN OBSTETRIC BRACHIAL PLEXUS: ANATOMICAL FEASIBILITY AND DESCRIPTION OF THE TECHNIQUE

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**Background:** Transfer of the latissimus dorsi and teres major tendons to the rotator cuff is a well-documented option for the treatment of shoulder impairment in children with residual brachial plexus injury. Changes in balance of the glenohumeral joint(1), as well as limitation in midline function after combined tendon transfer(2), have been reported. Anatomical studies showed that the intramuscular neurovascular branching pattern of the latissimus dorsi muscle provides in most cases two parts (medial or superior and lateral) with independent neurovascular supplies. (3) The main branches (medial and lateral, with the latter generally being the largest) run parallel to the muscle fibers, thus two independent motor flaps can be obtained.

**Methods:** We describe a modification to the latissimus dorsi and teres major tendon transfer that employs two parts of the latissimus dorsi as two independent motor units. We wanted to explore its feasibility in patients with the most common branching pattern, which consists of a medial branch for the upper muscle and a lateral branch for the lower part. The medial part is transferred to the rotator cuff insertion to dynamically enhance external rotation and abduction. The lateral part is used as a static stabilizer of the most proximal part of the humeral head in the glenoid cavity, counteracting the action of the rest of the muscles to optimize joint balance.

**Conclusions:** We believe that the proposed technique, when possible, may be a good option to optimize the results of reconstruction of shoulder function, and especially of external rotation, in patients with brachial plexus birth injury.

- Further studies are needed to explore its long-term outcomes, progression of shoulder deformity, and ideal indications.
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## **A-0460** ACUTE COMPARTMENT SYNDROM OF THE THIRD EXTENSOR COMPARTMENT OF THE WRIST IN NON DISPLACED DISTAL RADIUS FRACTURES

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Little attention is paid to patients with non displaced distal radius fractures in emergency rooms.

Extensor tendon of the thumb can rupture in delay after non displaced distal radius fracture (DRF)

Two theories have been described - vascular and mechanical. The mechanical theory involves a prominent spicule of bone abrading the tendon, while the vascular theory highlights the importance of hematoma in the third compartment deteriorating vascular supply of the EPL tendon in the watershed region around the Lister's tubercle. Seldom studies evaluating the role of needle aspiration of the hematoma in acute non displaced DRF have been published.

We studied two groups of patients. Group one included 4 patients with acute non displaced distal radius fractures ( three adults and one adolescent with Salter-Harris I ) with acute compartment syndrome of the third extensor compartment. Group two included four patients with delayed rupture of the EPL tendon after distal radius fracture.

In group 1 bump on the dorsum of the wrist with painful limited active extension of the thumb and pain with passive flexion of the thumb interphalangeal joint were observed. Needle decompression of the third compartment with aspiration of 3ml ( 2- 4ml) of blood was performed with immediate pain relief and full restoration of thumb function. In 3 months follow-up no problems with thumb function were observed.

In group 2 we retrospectively evaluated radiographs and patient's symptoms at the time of injury. Patients reported presence of dorsal bump and troublesome thumb function. Non displaced DRF were found on radiographs. All these patients were treated with extensor indicis proprius to extensor pollicis longus transfer.

Our study supports the vascular theory and the possible role of early hematoma evacuation as prevention of the EPL rupture in non displaced fractures.

## **A-0461** ANATOMICAL STUDY OF POSSIBLE PEDICLES FOR THE FLEXOR DIGITORUM SUPERFICIALIS MUSCLE FLAP FOR THE COVERAGE OF THE MEDIAN NERVE IN THE DISTAL FOREARM

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**Introduction:** Different clinical scenarios, such as neurolysis, tumor resection or posttraumatic fibrosis require well-vascularized coverage of the median nerve in the distal forearm. Regional, distant and free flaps are the options but they suffer from higher morbidity of the donor area and time-consuming procedure. We present anatomical study to find muscular branches that allow elevation of pedicled partial FDS muscle flap.

**Materials and methods:**

Ten anatomical dissections were performed on fresh cadavers with ink injection of the ulnar artery in mid forearm. Muscular branches to flexor digitorum superficialis from the ulnar side in the distal ten centimeters of the forearm were dissected. Number, position and length of the muscular branches was evaluated.

**Results.**

In all ten specimens stable pattern of muscular branches from the ulnar side in distal 10 cm was found with mean number of 2,7 (1-4). Mean distance of the most distal branch from the proximal wrist flexion crease was 35 mm (26-40). Mean length of the most distal muscular branch was 20,4 mm (16-26).

**Conclusion:** Stable pattern of muscular branches to the FDS muscle from the ulnar artery allows elevation of the partial pedicle FDS muscle flap to cover median nerve in the distal forearm. This provides one surgical field, easy to do flap with low morbidity of the donor side.

## **A-0462** PEDICLED PARTIAL FDS MUSCLE FLAP FOR COVERAGE OF MEDIAN NERVE IN THE DISTAL FOREARM

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**Introduction:** Different clinical scenarios, such as neurolysis, tumor resection or postraumatic fibrosis require well vascularized coverage of the median nerve in the distal forearm. Regional, distant and free flaps are the options but they suffer from higher morbidity of the donor area and time consuming procedure. We present a vascularized pedicled partial FDS muscle flap as reliable alternative for these indications.

**Methods:** Authors present 10 cases of partial FDS muscle flap used for coverage of median nerve after revision and neurolysis in distal forearm performed between 2007- 2020. DRF ORIF in 9 cases, with signs of nerve scaring, compression, dysesthesia and neuroma formation ( with signs of CRPS in 5 cases) and 1 median nerve hemangioma were indications for median nerve neurolysis and in second step for flap coverage. After neurolysis distal part of FDS muscle was separated free from tendon and proximal muscle bely together with feeding artery arising from synovial tissue ulnar to the muscle. Flap was transposed and stabilised as a well vascularised nerve coverage and separation from surrounding scar tissue. In 5 cases plate removal was part of the procedure.

**Results:** In all cases under loop magnification we were able to elevate well vascularised flap with feeding artery and cover required area of nerve. The size of flaps ranged from 4 x 3cm up to 8 x 4 cm. In cases of post ORIF nerve irritation original

approach was prolonged by only 4 cm. No additional procedure was required. All patients with nerve compression and scar irritation had improvement in EMG, subjective and scar dysesthesias, sensation and hand functioning. All patients with CRPS had relief from the symptoms postoperatively.

Discussion: Postoperative scarring around median nerve after iatrogenic (DRF ORIF) or post traumatic injury in distal forearm is problem due to subcutaneous location of the nerve, its great sensitivity, diminished perfusion and tendency to compression by scarring. Neurolysis of the nerve require well vascularized coverage in visible and highly irritated location. Partial FDS vascularised muscle flap is reliable, fast and relatively easy one scar solution with very low donor area morbidity for these situations.

#### **A-0463** STUDY OF THE NEUROFUNCTIONAL UNITS OF THE FLEXOR CARPI ULNARIS (FCU) AND ITS USE IN TENDINOUS TRANSFERS

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Introduction: In the management of patients with upper limb functional defects, a deep understanding of the anatomy of the involved structures can greatly enlarge the array of technical possibilities. The purpose of this paper is to document the intramuscular innervation of Flexor carpi ulnaris (FCU) and to discuss its relevance in the performance of split-tendon transfers based on said muscle.

Material and methods: Six FCU specimens were extracted from human cryopreserved cadavers and stained following Sihler's technique. To study the vascularization, 5 of them were also injected with colored latex through the brachial artery.

Results: In all of the specimens each of the two heads of the FCU corresponded to a neurofunctional unit, and was independently innervated (Taylor's type III pattern). The 5 injected specimens belonged to either type II or type III of the Mathes-Nahai classification.

Conclusions: The divisibility of the muscle in two independently vascularized and innervated neurofunctional units allows for obtaining two tendons out of the donor muscle, which are then transferable to two different muscles, optimizing the transfer. Although in some surgical centers this idea has already been put to practice, there are few published works in the literature which graphically show the underlying anatomical basis.

#### **A-0464** FIBULA FLAP FOR CLAVICLE RECONSTRUCTION: SURGICAL EXPERIENCE AND TECHNICAL ISSUES

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Objectives: Although partial or even total resection of the clavicle has been considered as an option for recalcitrant nonunion, in some patients it may result in disabling pain and impaired shoulder function, with limited abduction and shoulder drop. Therefore, we advocate for vascularized fibula flap reconstruction of the clavicle. We present our medium and long-term results.

Methods: We retrospectively reviewed 9 cases of clavicle reconstruction with fibular free flap performed between 2013

and 2022. Medical records were reviewed and etiology, technical aspects, complications, consolidation and functional results were recorded.

Results: Among the 9 patients, there were 6 women and 3 men. The etiology was post-traumatic (78%) and oncological (22%). The bone segments measure on average between 5 and 10 cm. Microvascular anastomoses were performed to the transverse cervical vessels (55%), thoracoacromial vessels (33%), and the cervical branch of the thyrocervical trunk (12%). Osteosynthesis was performed with compression plates in all cases. 44% of patients required associated brachial plexus injuries which required subsequent procedures including neurolysis, tendon transfers, and the Eden-Lange procedure. One patient developed a postoperative hematoma requiring drainage as the only perioperative complication, and one patient required additional surgery for medial site nonunion, which was successfully treated with debridement and a new compression plate. Conclusions: Significant bone defects of the clavicle are rare, but difficult to address. We opted for the vascularized fibula flap as it offers a sound vascularization in an often extensively scarred environment, specially after multiple surgeries, infection or radiation. It provides a good basis for consolidation, reducing pain and promoting shoulder stability with good function, allowing patients to perform daily activities or go to gym.

### **A-0465** GIANT CELL TUMOR OF THE TENDON SHEATH OF THE THUMB AND ENCHONDROMA OF THE SECOND METACARPAL: A CASE REPORT

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A 50 year old man presented to our outpatient department on April 2022 complaining about a tumor on his left thumb. The patient reported oedema and numbness on the thumb over the last year.

The Xray was normal at the thumb but presented a lytic lesion at the base of the second metacarpal. The patient had no symptoms over the area of the metacarpal. An MRI was conducted supporting the coexistence of two benign tumors. Both tumors were operated simultaneously. We did an excision of the thumb tumor, with caution around the digital nerve and vessels, and excision of the metacarpal tumor using radial autograft for the metacarpal. Post-operatively the patient had a cast for four weeks followed by physiotherapy.

The histological examination reported both benign tumors-enchondroma of the metacarpal and giant cell tumor of the tendon sheath of the thumb.

To our knowledge there is poor literature reporting coexistence of giant cell tumor of the tendon sheath along with enchondroma on bone structures of the hand.

### **A-0466** ANTHROPOMETRIC 3D ANALYSIS OF THE RADIAL AND ULNAR BOWING USING THE CENTRAL LINE METHOD

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#### Objectives

Three-dimensional (3D) understanding of the combined forearm anatomy is crucial to improve anatomic fixation of forearm

fractures, enhance accuracy in correction osteotomy or refine osteosynthesis and prosthetic implants especially the ulnar head prosthesis. Most analyses use the two-dimensional surface of the bones, but not a reduce-to-point or reduce-to-line method. Likewise, no study investigating the three-dimensional correlation of the radial and the ulnar bowing.

#### Methods

CT scans of forearms of thirty healthy and asymptomatic patients were analyzed by using a three-dimensional surface calculation program. Each 3D bone model was divided along the functional forearm rotation axis into 10 equal parts to obtain 11 radial and ulnar cross-sections with a central point each. The connection of these central points led to the central line which then was analyzed in regard of bowing in the 3D space. This central-line-method allowed to find deformity planes out of the usually discussed coronal and sagittal planes as well as to analysis deviations of the anatomical axis eg. at the distal end of the ulna.

#### Results

The mean axis deviation of the radius is 6.45 mm at 52% of the total length (from proximal to distal) in the coronal plane, 1.35 mm at 38% in the sagittal plane and 7.28mm at 41% in the main deformity plane. The mean axis deviation of the ulna is 8.26 mm at 27% of the total length (from proximal to distal) in the coronal plane, 9.49 mm at 26% in the sagittal plane and 12.68 mm at 7.7% in the main deformity plane. The main deformity plane for the radius and ulna is oriented radio-dorsal with a dorsal tilt of 15° for the radius and 63° for the ulna. An average deviation of the medullary canal of 0.5° towards ulnar and 11° towards dorsal was found at 22 mm and 0.3° ulnar and 8° dorsal at 44mm from the distal ulna respectively. No strong correlation could be found between radial and ulnar bowing in the ulno-radial plane ( $R2 < 0.01$ ), dorso-palmar plane ( $R2 = 0.04$ ) or along the main deformity axis ( $R2 = 0.16$ ).

#### Conclusion

The newly introduced central line method is a strong method to describe the bowing of the forearm bones enabling as well to find deformity planes out of the standard coronal and sagittal planes. This study provides clinically relevant anthropometric data for corrective osteotomy and implantation of ulnar head prosthesis. In case of isolated increased bowing of the radius or ulna, no strong positive or negative correlation can be expected on the other bone.

## **A-0467** FUNCTIONAL OUTCOMES FOLLOWING SURGICAL FIXATION OF DISTAL RADIUS FRACTURES USING DORSAL AND VOLAR APPROACHES

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#### Background

At mid Yorkshire NHS trust a group of upper limb specialists routinely use a dorsal approach to the distal radius for fixation of fractures. Volar plating is standard in most hospitals but dorsal plating can provide significant advantages with certain fracture patterns, providing better stability and allowing easier fracture reduction in cases of dorsal comminution. Mid Yorkshire is a national leader in this and accounted for 60% of all dorsal wrist plates sold by Stryker for the year 2021 in the UK.

#### Objectives

Evaluate the functional outcomes in patients undergoing open reduction and internal fixation for distal radius fractures and compare outcomes between those fixed with volar and dorsal approach.

To audit functional outcomes of patients against published results

## Methods

Audit of all patients undergoing ORIF distal radius fractures between July 2020 and July 2021. Total population of 218 patients; 141 volar and 77 dorsal. Retrospective review of notes to determine patient characteristics and complications. Patient-Rated Wrist Evaluation (PWRE) questionnaires were sent to all patients at 12 months post op to evaluate their functional outcomes for pain and function. Aim to test the null hypothesis that there is no difference in functional outcomes between patients who undergo dorsal plating versus volar plating.

## Results

Functional outcomes were comparable for both groups with an overall response rate of 64%. Mean PWRE scores of 23.22 for volar group and 24.23 for dorsal group. This was not statistically significant with  $p=0.67448$  (Mann-Whitney test). This was also the case for the individual pain ( $p=0.50286$ ) and function ( $p=0.64552$ ) components of the PWRE score. This was despite the dorsal group having statistically significant higher proportion of patients with cardiovascular disease (25% volar to 38% dorsal,  $p=0.03$ ) and a longer wait for surgery (9 days volar vs 11 Days dorsal,  $p=0.02$ ). In other categories of age, ASA, respiratory disease and diabetes the groups were well matched. Complications (7% volar to 9% dorsal,  $p=0.6$ ) and returns to theatre (1.5% volar to 2.5% dorsal,  $p=0.6$ ) were no significantly different between the two groups.

## Conclusions

Our results support the null hypothesis that there is no difference in functional outcomes following dorsal vs volar plating for distal radius fractures. Both groups were in line with other published results. On this basis we can recommend dorsal plating for distal radius fractures in cases where a dorsal approach is felt to allow better fracture reduction and offer biomechanical advantage.

## **A-0468** PERI-PROSTHETIC OSSIFICATIONS AFTER TRAPEZO-METACARPAL ARTHROPLASTY

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## Introduction

First carpometacarpal joint prosthetic arthroplasty has become a common surgical tool for the treatment of first CMC joint arthritis, with high patient satisfaction and good 10-year survival rate. The design of the prosthesis is similar to total hip arthroplasties (ball and socket). Heterotopic ossifications are a well-known complication in the hip, but they have been infrequently reported after 1st CMC-joint prosthesis. We thought that they might have been underestimated and could play a role in postoperative CMC-joint stiffness.

The purpose of our study was to assess the incidence of peri-prosthetic ossifications and quantify their size. Our secondary objective was to evaluate potential risk factors such as: gender, age, trapezial partial resection, type of implant (single or dual mobility), arthritis stage and the time elapsed after operation.

## Methods

All patients operated between 2010 and 2020 were included. The pre-operative radiographs were analyzed for the Eaton-Littler stage of arthritis and the post-operative radiographs for heterotopic peri-prosthetic ossifications after a minimal follow-up of 5 months.

We defined them as newly bone formation of more than 2 mm around the implants on the trapezium and the first metacarpal. Ossification below this threshold was considered as normal bone remodeling after surgery, the bony surfaces getting smooth with time as would be a callus after a fracture.

Ossification measurements are performed on standardized axial views of the first CMC joint. The surface of the cup serves as a bottom line from which exceeding bone is perpendicularly measured in millimeters. In case of several ossifications, their heights are cumulated. As radiographs are not routinely scaled, we used the diameter of the cup as the scaling mark, as its absolute value is known. The cup is circular and thus its diameter stays constant on all views.

#### Results

The first results after having reviewed 90% of the cases show that 30% have an ossification, nearly half of them are present both on the trapezium and the base of the first metacarpal, the second half is located a little more often on the trapezium than on the first metacarpal. They appear to be comparatively more frequent in men than in women, contrasting with the female to male ratio in the series. Our follow-up ranges from 5 to 145 months (mean 38 months and median 28 months). The mean age at the time of surgery was 62.8 y. like that of patients with ossifications (62.6 y.). Ossifications were more frequent after single mobility than dual mobility implants.

#### Conclusion

These preliminary results show that heterotopic ossifications after first carpometacarpal joint prosthesis are more frequent than previously reported. Men are more at risk of developing ossifications. Other risk factors such as osteophytes resection on the trapezium, degenerative stage and time elapsed after the operation will further be looked for and presented.

### **A-0469** SECOND DORSAL METACARPAL ARTERY PERFORATOR (QUABA) FLAP TO RESURFACE VOLAR FINGER SOFT-TISSUE DEFECT

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#### PURPOSE:

Hand trauma injuries, burns, infections or tumor excision are usual causes of exposure of bone and tendon structures. An important challenge for the hand surgeon is repairing finger coverage defects, due to the limited availability of donor tissue in the area.

We propose the use of a vascular flap from the second branch of the dorsal intermetacarpal artery for the reconstruction of volar digital coverage defects.

#### METHODS:

A 62-year-old male, who suffered a third finger puncture with a plant some days before he arrived to the emergency department. He was diagnosed of an acute pyogenic flexor tenosynovitis. It was initially treated with oral antibiotic therapy, but after 3 weeks, due to active exudate, he precised surgical debridement (Brunner approach). The infection was controlled but the patient presents with a significant skin necrosis with volar coverage defect on the proximal and middle phalanx of the 3rd finger, with tendon exposure.

#### RESULTS:

The defect was covered with a vascular flap from the second dorsal intermetacarpal branch, which was rotated on the pedicle to cover a previously debrided volar defect. We previously checked the integrity of pulley A2.

We designed the flap on the dorsal metacarpal artery perforator closest to the defect (second intermetacarpal space).

We use microsurgical equipment and the flap was elevated under tourniquet control (only by elevation). The incision was made from proximal to distal, starting with the island of skin from the medial to the lateral border following the loose areolar tissue plane superficial to the extensor paratenon. Dissection continued to defined pivot point, which was

the distal perforator that allowed to cover properly the defect when it was rotated (at level of the metacarpal neck in the intermetacarpal space). Subsequently, the tourniquet released to observe the adequate perfusion of the flap. We rotated the flap 180 degrees, taking care of its orientation to avoid torsion or vasospasm of the perforator. We performed the primary closure of the donor defect aided by extension of the wrist.

He received intravenous antibiotic therapy for 48 hours, followed by oral antibiotic therapy for one week; weekly dry cure and subsequent rehabilitation treatment after the first month and the control of de soft tissue.

After 6 months, he has returned to daily activities with a functional range of motion: Metacarpophalangeal joint flexion 80°/extension 10°. Proximal interphalangeal joint flexion 70°/extension 10°.

#### CONCLUSIONS:

The dorsal metacarpal artery perforator flap, called as Quaba flap, is an excellent option for covering defects located in the volar area of the adjoining fingers. It features consistent vascular anatomy, minimal donor site morbidity, a good rotation arc, and a low complication rate. It allows covering defects of moderate size, with an adequate quality of the tissue.

### **A-0470** MID-TERM RESULTS OF AUTOLOGOUS FAT TRANSPLANTATION FOR CMC-1 OA

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Mid-term (5 years) results of autologous fat injection for CMC-1-OA

**Objective:** The use of intraarticular autologous fat injection for CMC-1-OA has been scientifically investigated within the last years due to the good clinical results and has been frequently discussed. We have now reviewed our treated patients regarding their clinical outcome with a median of 5 years and minimum of 3 years follow-up. We present our results of the 75 patients. **Material and Methods:** To date, we have evaluated 180 patients (m: w = 1:3; mean: 59.3 years) suffering from symptomatic CMC-1-OA, underwent autologous fat grafting into the thumb saddle joint. In 124 joints the treatment was performed more than 3 years ago. The surgical procedure was performed under local anesthesia by means of liposuction of approx. 10ml of abdominal fat tissue and subsequent radiologically controlled injection (without further centrifugation) into the thumb saddle joint. The following parameters were followed up: NRS, DASH score, MHQ and grip strength.

**Results and Conclusion:**

Included in our follow-up were finally 75 of the 124 treated joints (121 patients, 3 patients received therapy for both hands). 30% could not be reached anymore or refused a follow-up already initially after receiving therapy. We compared the results of follow-up after 12 months with those at minimum 3 years. Among responders (3 months postop significant pain reduction) continued to show very good pain reduction results at the mid-term follow-up results in terms of pain reduction were documented. The mean pain under stress 3.9 and at rest 1.3. The evaluations of the quality of life in the context of the DASH score (27.5 points) and the MHQ (75.5 points) also showed significant and existing improvements. The success of the treatment is confirmed by the patients' willingness to have the surgery again: 74% confirmed this. Only in 12 of the 75 (16%) patients followed-up had resection arthroplasty performed within the 3 years.

**Conclusion:**

The mid-term results also show that intra-articular autologous fat injection is a promising alternative treatment for CMC-1-OA. This therapeutic intervention is a relatively simple and safe procedure that can be performed in an outpatient setting. The therapy reduces pain, improves quality of life, and can initially postpone trapeziectomy.

## **A-0472** COMPARISON OF FUNCTIONAL OUTCOMES FOLLOWING RAY AND PROXIMAL PHALANX AMPUTATION OF THE FINGERS: A RETROSPECTIVE COHORT STUDY

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Ray and proximal phalanx amputations present valid surgical options for the management of severe traumatic injuries of the fingers. However, among these procedures, the superior one for optimal functionality and quality of life for patients still remains unknown. This retrospective cohort study compares the postoperative effects of each amputation type to provide objective evidence and to create a paradigm for clinical decision-making. A total of forty patients, who have received either ray or proximal phalanx-level amputation reported on their functional outcomes using a combination of questionnaires and clinical testing. We found a decreased overall DASH score following ray amputation. Particularly Part A and Part C of the DASH questionnaire were consistently lower compared to amputation at the proximal phalanx. Pain measurements in the affected hand were also significantly decreased during work and at rest in ray amputation patients, and they reported decreased cold sensitivity. Range of motion and grip strength were lower in ray amputations, which is an important preoperative consideration. We also found no significant differences in reported health condition, evaluated by the EQ-5D-5L and blood circulation in the affected hand. We present an algorithm for clinical decision making based on patients' preferences to personalize treatment.

## **A-0474** DYNAMIC ULTRASONOGRAPHY OF ACUTE CONSERVATIVE TREATMENT OF VOLAR PLATE STABLE INJURIES OF PIP JOINT

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### PURPOSE

Volar plate (VP) injuries, which are more often secondary to forced hyperextension, usually occur at the distal attachment. Conservative treatment has been proposed to stable ones. However, there is a controversia about the possibility of early mobilization in the stable VP injuries in case of the period of immobilization in a cast. We propose the benefits of ultrasound (US) to assess VP healing during our conservative but active protocol for stable volar plate lesions.

### METHODS

We describe a prospective study of 30 VP injuries diagnosed in our center, which met the inclusion criteria: VP injuries grade 2 and 3a of Eaton classification, and type I of Keifhaber-Stern classification, checked by X-Ray and ultrasound imaging. Conservative treatment included Coban bandage the 3 first days, extension dorsal block splinting (DBS) until the 6th week (with progressive reduction of flexion from 25 to 0 grades) and proprioception exercises; to end 6-10th week with buddy tape and active motion, reserving DBS only at night. We tested the protocol stage change injuries by US.

### RESULTS

Dynamic ultrasound control let us measure thickness of soft tissue aedema, (from 5 to 2 mm), gap in the distal avulsion of VP (3 to 0 mm), and grades of hyperextension movement of PIP joint (35 to 0 grades). Those cases who persisted in avulsed insertion and over displacement of joint after 10th weeks, they kept on dynamic therapy until US successfully results (10-16 week). Flexion contractures were detected in 16,6 % patients (5 cases), who were reviewed to invasive

management. 2 patients finally needed a tenoarthrolysis by Walant (6,6%).

## CONCLUSION

Ultrasound control let us adapt the extension stop and check the healing process, to defend early mobilization in conservative protocol of treatment for VP stable injuries of the PIP joint.

## **A-0475** ROBOTIC MICROSURGERY IN EXTREMITY RECONSTRUCTION, FIRST EXPERIENCES WITH A NOVEL ROBOTIC SYSTEM

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Robotic systems have successfully been used in other surgical fields for years. First attempts with different setups are being made in the field of microsurgery. The Symani® Surgical System, a flexible platform consisting of two robotic arms features motion scaling with tremor filtration to address the demands and complexity of microsurgery. Symani's NanoWrist Instruments are the world's smallest, wristed surgical instruments, intended to improve a surgeon's range of motion beyond the capability of the human hand. This combination allows surgeons to scale their hand movements while seamlessly articulating the robotic microinstruments.

We report on our first experience with this novel system.

After training on models for several hours the Symani system was used for these first 6 cases of a single surgeon. The surgeon controlled the manipulators along with the footswitch controller while sitting away from the operating table relying on either 3D visualization with an exoscope or a conventional microscope. Microsurgical anastomoses were performed in 4 patients (3 end-to-end arterial anastomoses and one end-to-site arterial anastomosis) and nerve grafting was performed in 2 patients using the Symani system.

Microvascular anastomoses were slower versus conventional microsurgery but with no technical failures. All anastomoses were patent.

Epineural coaptation showed proper fiber alignment and tissue manipulation could be kept to a minimum.

The platform has a learning curve. The time needed to perform microsurgical tasks will most likely decrease with experience. The platform's motion scaling allows the surgeon to perform precise micro-movements with only minimal tissue manipulation and hard-to-reach anatomy becomes accessible more easily. Robotic microsurgery might gain importance in the nearer future but more data will need to be collected

## **A-0476** A COHORT STUDY ON NEUROPATHIC PAIN OF THE SUPERFICIAL BRANCH OF THE RADIAL NERVE – FACTORS INFLUENCING SURGICAL OUTCOME

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### Background

Due to its partially superficial course, the superficial branch of the radial nerve is vulnerable to injury by trauma or surgery potentially leading to neuropathic pain. Different surgical techniques to treat neuroma have been described but so far no one has proven to be superior to the others. The aim of this study was therefore to identify factors influencing the outcome

of revision surgery for neuropathic pain of the superficial branch of the radial nerve in our department.

#### Methods

We reached out to all patients who had undergone revision surgery for neuroma of the superficial branch of the radial nerve between 2010 to 2020 18 patients could be recruited for a follow-up visit. A medical chart review was performed to collect patient, pain-, and treatment-specific factors. Current DASH score, MHQ score, and Pain Detect score as well as a clinical examination were performed. Outcomes were registered.

#### Results

Post-revision surgery, only 2 (11%) patients were pain-free. Pain did however improve in 16 (88.9%) of patients. Different types of surgery were performed but no superiority of a single technique could be demonstrated. Only 7 (38.9%) of patients returned to their previous field of work. Patients with a postop VAS score  $>2$  were more likely to be smokers and those patients with lesions of the main nerve trunk (as compared to end branch lesions) were more likely to have a persisting VAS score  $>2$ .

#### Conclusion

Patients with injury to the superficial branch of the radial nerve should be informed that while they might not be fully pain-free after revision surgery pain will most likely improve but there is a high risk they might not be able to return to their previous field of work. Additionally, Patients with injury to the superficial branch of the radial nerve should be coached toward smoking cessation.

### **A-0477** BILATERAL NON TRAUMATIC EXTENSOR TENDON DISLOCATION OF THIRD FINGER

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#### INTRODUCTION

Extensor tendon dislocation over the metacarpophalangeal (MP) joint is a rare condition, with a predominant degenerative etiology, especially in patients with rheumatoid arthritis. Also traumatic, congenital or spontaneous etiology has been described. We present the case of a patient with spontaneous dislocation of the extensor tendon of the 3rd finger on the MP Joint bilaterally but not simultaneously in time.

#### MATERIALS AND METHODS

Clinical case: A 55-year-old woman presented in the absence of previous trauma subluxation of both extensor tendons of the third finger, with a deficit of active extension, in a time interval of 3 years. Both hands were operated separately by a Brunner approach on the dorsal aspect of the MP Joint of third finger. Subluxation of tendon extensor toward the ulnar side was observed with active and passive flexion. Juntura tendinea was present between third and fourth extensor tendons, but absent between third and second extensor tendons. The juntura was divided and an extensor hemitendon flap was carved on the ulnar side and transposed to the radial side of the extensor hood and sutured to itself. The juntura was sutured in place and correction of the subluxation was verified. Postoperative immobilization for three weeks. As complication, adherence of extensor tendon to the scar in the left hand needed surgery for tenolysis

#### RESULTS

The patient regain full active motion of bilateral MP Joint without recurrence of subluxation. Return to her previous job (work with keyboards).

#### DISCUSSION

Spontaneous chronic dislocation or subluxation of the extensor tendon on the MP Joint is a quite rare condition, and it is

described mainly unilateral, with the third finger the most affected, and towards the ulnar side, as similar to this case. Various surgical techniques for the treatment of this pathology has been described with good results. Each patient should be treated in an individual way.

## **A-0478** COMPARISON OF TWO RELATIVE MOTION EXTENSION APPROACHES (RME WITH VERSUS WITHOUT AN ADDITIONAL OVERNIGHT ORTHOSIS) FOLLOWING ZONES V-VI EXTENSOR TENDON REPAIRS: A RANDOMIZED EQUIVALENCE TRIAL

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### Study design:

Multi-centre randomized controlled trial with two intervention parallel groups. An equivalence trial.

### Introduction:

Relative motion extension (RME) orthoses are widely used in the postoperative management of finger extensor tendon repairs in zones V-VI. Variability in orthotic additions to the RME only (without a wrist orthosis) approach has not been verified in clinical studies.

### Purpose of the study:

To examine if two RME only approaches (with or without an additional overnight wrist-hand-finger orthosis) yields clinically similar outcomes.

### Methods:

Thirty-two adult (>18 years) participants (25 males, 7 females) were randomized to one of two intervention groups receiving either 1) a relative motion extension orthosis for day wear and an overnight wrist-hand-finger orthosis ('RME Day' group), or 2) a relative motion extension orthosis to be worn continuously ('RME 24-Hr' group); both groups for a period of four postoperative weeks.

### Results:

Using a series of linear mixed models we found no differences between the intervention groups for the primary (ROM including TAM, TAM as a percentage of the contralateral side [%TAM], and Millers Criteria) and secondary outcome measures of grip strength, QuickDASH and PRWHE scores. The models did identify several covariates that are correlated with outcome measures. The covariate 'Age' influenced TAM ( $P = .006$ ) and %TAM ( $P = .007$ ), with increasing age correlating with less TAM and recovery of TAM compared to the contralateral digit. 'Sex' and 'Contralateral TAM' are also significant covariates for some outcomes.

### Discussion:

With similar outcomes between both intervention groups, the decision to include an additional night orthosis should be individually tailored for patients rather than protocol based. As the covariates of 'Age' and 'Sex' influenced outcomes, these should be considered in clinical practice.

**A-0479** ARTHROSCOPIC TREATMENT IN CMC JOINT OSTEOARTHRITIS OF THE THUMB WITH METAL ALLERGIES  
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**PURPOSE.** The trapeziometacarpal joint is a common site for osteoarthritis, especially in females in their fifth to seventh decade of life. They present pain, loss of function and reduced pinch and grip strength. A range of treatment options exists both non-operatives (splints or physiotherapy), and operatives (trapeziectomy with or without ligament reconstruction and tendon interposition, arthrodesis and total joint prosthesis). Sometimes these options are limited in cases of metal allergies. Basal joint arthroscopy is one of the more recent evolutions of small joint arthroscopy. Indications for minimally invasive procedures are increasing: quickly recovery with fewer complications than classical procedures. But we need a device to avoid collapse of the first metacarpal and to stabilize a surface that goes from saddle to flat. **METHODS.** Of our serie of 21 arthroscopic rhizartrrosis surgeries, we defend the proposal alternative in the group of three metal allergies patients diagnosed of first carpometacarpal (CMC) osteoarthritis stage II or III, who were treated surgically with an arthroscopic hemitrapeziectomy. Through ordinary CMC first joint portals, we first performed a synovectomy, removing loose bodies. Subsequently, 3–4 mm of subchondral bone and osteophytes were removed from the distal trapezium articular surface with special attention to the dorso-ulnar corner. We checked trapezium surface became a flat by fluoroscopy under traction. Finally, we fixed the joint with a suspension only-suture implant (MicroLink CONMED) which stabilizes the first metacarpal to the second, maintaining the distraction gap in the CMC. All patients were immobilized in a splint for 2 weeks before hand therapy was initiated. Intra-operative and post-surgical complications were recorded. Objective evaluation consisted of an assessment of range of motion (ROM), grip and pinch strength. **RESULTS.** There were no intra- or post-surgical complications. In one case, after final follow-up, she presented a granuloma reaction from the suture-implant and we needed to remove it after the first 9 months to avoid an osteolysis of second bone. No cases of persisting pain. We consider it is essential to remove at least 3–4 mm until cancellous bone is visualized, and the medial osteophyte between both metacarpals to avoid persistent postoperative pain. Average range of motion (compared with the contralateral) showed an improvement in palmar abduction, radial abduction and retropulsion of the CMC joint. They preserved the thumb opposition, grip and pinch strength, but without pain. VAS score improved from 8 to 2 during activity. The average final QuickDASH was 8. The average radiographic proximal migration of the first metacarpal was 1.1 mm after the final follow-up. **CONCLUSION.** Trapeziometacarpal joint arthroscopy appears to be the seat of advances in arthroscopic procedures with clinical results at least as effective as classical open surgery, but with the advantages of minimally invasive technique, with minimal disruption of the important peripheral capsule-ligament complex and a low rate of complications, and without closing other more invasive techniques. It also offers us the opportunity to use only suture implants in case of metal allergies patients, with the same satisfactory and functional outcomes.

**A-0482** ESTABLISHMENT OF A NEW CLASSIFICATION OF HAMATE FRACTURES BASED ON CADAVER LAB ANALYSIS  
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**PURPOSE:** Hamate body fractures include a wide variety of morphologic patterns, easily missed on standard wrist radiographs and associated to a complex etiopathogenesis. Many classifications have tried to resume these peculiarities. But none of them guide treatment or predict outcomes. We must understand the biomechanical mechanism of injury to adapt their management. The aim of this study is to describe a new classification of hamate fractures by comparing the anatomical patterns of injury in the lab and the prognosis of the clinical cases according to the instability criteria. **METHODS:** We present a clinical-experimental research to study the pathogenesis and biomechanics of hamate body fractures of our clinical cases: anatomical description, etiopathogenesis, injury mechanism and associated instability criteria. At the same time, the different fracture patterns are reproduced in a biomechanical study on cadavers in the anatomical department of the medical school of our university: 1) hamate dissection by planes, 2) osteotomy of the hamate body according to the classifications of Hirano and Cain, 3) injury of the insertion of the different ligaments, 4) testing the instability criteria 5) checking the influence of hand motion. **RESULTS:** We describe a new classification of hamate body fractures, based on the different clinical findings and the biomechanical behavior of each experimental patterns: 1) Fractures of the base of the hook, 2) Dorsal avulsion of the hamate, 3) Isolated dorsal intermetacarpal ligament rupture, 4) ECU avulsion on the dorsal base of the 5th metacarpal bone, 5) Displaced longitudinal fractures, 6) Articular comminution. Patients are classified according to the biomechanical patterns described in the lab. We define the instability criteria inside each group, based on our lab data. We have checked in lab a more instable mechanical behaviour depending on metacarpal position. **CONCLUSION:** Experimental trial in lab helps to understand hamate body fractures, clinical cases and their sequelae. Its classification must be governed by biomechanical parameters to propose an algorithm of treatment that achieves the best results.

**A-0483** ISOLATED TRAPEZIUM FRACTURE FIXATION USING A MEMORY STAPLE: A NOVEL TECHNIQUE

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Title:

Isolated trapezium fracture fixation using a memory staple: A novel technique

Introduction:

Trapezium fractures are rare accounting for 1-5% of all carpal bone fractures. These injuries are often missed and require a high index of suspicion for diagnosis. Undisplaced fractures heal very well with conservative treatment due to the rich vascular supply of the bone. However, displaced fractures often require open reduction to restore the articular congruity. Various methods of internal fixation have been described in case reports with varying rates of success. We describe a case of displaced isolated trapezium fracture that was treated with open reduction and fixation using a Nitinol Memory Staple (Depuy Synthes)

#### Case Description:

A 22-year old male presented with a 2-week history of injury to his dominant right thumb sustained in a rugby tackle. This had been treated with a “manipulation” on the field by the team physiotherapists followed by strapping. Examination showed tenderness over the base of the thumb with reduced and painful movements. Radiographs identified a displaced fracture of the trapezium with disruption of the articular surfaces at the carpometacarpal and scapho-trapezial joints. CT scans confirmed the radiographic findings and helped to further delineate the anatomy of the fracture.

Open reduction was performed through a dorso-radial approach between the tendons of the 1st dorsal compartment. Capsulotomy was done at the CMC and ST joints to enable adequate mobilization of the fragments under direct vision. The fracture was reduced and held with a temporary K wire. A measuring wheel was used to determine the width of the implant. Drill holes made on either side of the fracture plane using accompanying drill guide. Depth gauge was utilized to assess the final size of the implant. A Nitinol Memory Staple (Depuy Synthes) of size 15 X 10 was inserted across the fracture using the tamping device provided. Congruity of the articular surfaces was confirmed on direct vision and intraoperative images. Stability of thumb CMC joint was confirmed with passive movements. Wound closed and a plaster splint applied for rest and comfort which was discarded in 2 weeks when active mobilization was started with therapists. Check Xrays at 2 and 6 weeks confirmed the stability of the fixation. The patient was allowed to return to full activity after radiological healing of the fracture.

#### Discussion:

The memory staples are Continuous Compression Implants that have been shown to produce better compression as compared to lag screws and compression plates in biomechanical studies. A recent systematic review (Dunn et al 2017) showed that these were highly successful in treatment of scaphoid fractures. The advantages of these implants include technical ease, simple and quick application, continuous compression particularly with Nitinol metal memory, allowance for fixation of proximal or distal fragments too small to accept a screw, low risk of articular penetration, and early active movement. These implants are now regularly used in inter-carpal arthrodesis procedures with good outcomes. To our knowledge, this is the only description for its use in a trapezium fracture.

Keywords: Trapezium fracture, memory staple,

### **A-0485** COMPARATIVE ANALYSIS OF THE BIOMECHANICAL BEHAVIOUR AND CLINICAL RESULTS OF THE FIFTH CARPOMETACARPAL FRACTURES

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**PURPOSE:** Hamate body fractures include a wide variety of morphologic patterns. The reported rates of hamate body fractures are likely underestimated due to these injuries being easily missed on ordinary physical exploration and standard wrist radiographs. The objective of this study is to design an algorithm for the treatment of hamate fractures by comparing the anatomical patterns of injury in the lab and the prognosis of the result according to the instability criteria and the selected treatment in clinical cases. **METHODS:** We present a clinical-experimental research to study the pathogenesis and biomechanics of hamate body fractures, to understand their classification, decide the therapeutic indication and predict their result. We obtain an algorithm for therapeutic management of these fractures. We include 7 cases of

fracture of hamate body; they are classified according to the biomechanical patterns described in the lab, with the aim of demonstrating whether the selected treatment is appropriate to the risk of instability and to be able to analyze the results and sequelae after 6 months of follow-up. RESULTS: The best results has been obtained in the indications that comply with the proposed algorithm for open reduction and internal fixation (ORIF), especially if ligament rupture has been repaired at the same time. Deformity is associated with conservative treatment, with functional consequences in range of motion or grip strength restriction in the case of a more complex fracture (grade 4A versus 2C). QuickDASH average is worse in patients whose treatment election is disagree with our algorithm (24.4 versus 9.8 on average). We have checked in lab a more instable fracture depending on metacarpal position. No statistical significant differences have been observed in QuickDASH result, grip strength or pain depending on ORIF or percutaneous techniques. CONCLUSION: We must understand the biomechanical mechanism of injury of the hamate body fractures to adapt their therapeutical management. This new algorithm of treatment let us improve clinical results and decrease sequelae of the complex hamate body fractures and their connection with the ulnar hand pain.

**A-0486** HOW HAS COVID-19 SHAPED THE FUTURE OF HAND SURGERY: A SURVEY OF 39 UK HAND SURGERY UNITS  
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The COVID-19 pandemic led to hand surgery services across Europe adjusting their practice, to limit the spread of the virus. Elective surgery was largely suspended, and adaptations were made to trauma services, with an increased number of operations performed under local anaesthetic (LA) within a lower resource setting. Two years on, hand services are continuing to adapt and recover from the pandemic. However, the recovery of services and whether changes to hand surgery practices made during the pandemic have endured, is yet to be studied. The aim was to understand whether changes made during COVID-19 have remained, along with assessing whether hand units have returned to their pre-pandemic workload. A survey developed by the Reconstructive Surgery Trials Network (RSTN), supported by BSSH and BAPRAS, was distributed to hand units across the United Kingdom and Ireland. The survey was distributed two years after the start of COVID-19, during the COVID recovery period. The survey was completed by one consultant hand surgeon at each unit. It follows up an initial survey during the first peak of COVID-19 in early 2020. Data was collected from 39 hand units. Not all changes to hand surgery pathways made in response to COVID-19 have endured. In hand trauma, there has been a shift back towards using general anaesthesia or regional anaesthesia rather than LA and wide awake local anaesthetic no tourniquet technique (WALANT) in tendon repairs, washout of flexor tenosynovitis and fracture fixation. However, there has been an increased use of LA and WALANT in some elective procedures, compared to before COVID-19. The format of appointments has returned to pre-pandemic practices, with most units using face-to-face appointments. Although, where appropriate, some units have continued to use virtual consultations and there is more emphasis on patient-initiated follow-up. A major change that has endured, is the use of absorbable sutures for hand trauma surgery, preventing the need for suture removal. During the recovery period, nearly half of all units (46%) reported having patients waiting more than 104 weeks for elective hand surgery. To address this, some units operated in alternative settings (41%) such as private hospitals and outside normal working hours (31%) e.g. weekends. At the peak of the pandemic, waiting times for trauma cases decreased, however during the recovery period, the increase in elective cases has subsequently lengthened the waiting times for trauma care. Trainees are also struggling to achieve their indicative numbers for surgical

training in many units (72%), predominantly elective cases, during the recovery period. Hand therapy access has also decreased in 28% of units during the recovery period, compared to before COVID-19. Many of the main changes seen during the COVID-19 pandemic have not been maintained during the recovery phase, such as increased usage of remote consultations and use of LA and WALANT. It is important that we preserve the streamlined service for patients that was implemented during COVID-19, preventing unnecessary hospital visits. Impact on waiting list times and surgical training must also be considered and is necessary to consider in future service re-design.

### **A-0487** HOW MANY NEEDLE PASSES ARE NEEDED TO PERFORM A DUPUYTREN'S FASCIOTOMY; A PILOT STUDY?

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#### Purpose

This study aims to assess the number of needles passes required to sufficiently weaken a Dupuyren's cord to cause it to break. This will provide and benchmark for surgeons in the early years of training and practice.

#### Methods:

A single experienced hand surgeon recorded the number of passes of a 16 guage need required to break dupuytren's cords under local anaesthesia. The digits were manipulated, and the degree of correction was recorded as well as any complications.

#### Results:

We treated 24 patients with 33 affected digits, a total of 49 joints. Metacarpo-phalangeal joint contracture required a mean for 62 passes (range 26 – 167, median 46). Proximal Interphalangeal joint contractures required a mean of 88 passes (range 29 – 144, median 87) and where both were affected in the same digits, a mean of 45 passes (range 10 – 107, median 30) was required.

Full correction was achieved in 40 joints, partial in eight and none in one.

#### Conclusions:

In this study we give the first indication of the number of needle passes required to achieve correction of Dupuytren's contracture at fasciotomy. The data should help train and guide other surgeons.

### **A-0488** TRAPEZIUM BONE REMODELLING AFTER TRAPEZIOMETACARPAL TOTAL JOINT ARTHROPLASTY: RADIOLOGICAL COMPARISON OF SPHERICAL AND CONICAL CUPS

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Total joint replacement is a surgical treatment option for painful trapeziometacarpal osteoarthritis. Problems around the trapezium cup (loosening, fracture and ossifications) are common indications for revision surgery. There are two different cup designs: spherical and conical. Although there are theoretical differences between both cup types, it is

unclear if they are clinically relevant.

The goal of this study is to radiographically compare trapezial bone remodeling one year after implantation of a spherical or conical cup. We want to identify bone changes around the cup that might lead to implant failure.

We retrospectively evaluated radiographs of 100 patients at 1 year after trapeziometacarpal total joint replacement (Touch, Kerimedical, Geneva), operated between 2019 and 2021. Patients were selected to include 50 spherical and 50 conical cups. We evaluated the radiographs for bone resorption around the trapezium implant, subsidence, fracture, and heterotopic ossifications.

Our research demonstrates that conical cups are more prone to produce bone resorption changes and heterotopic ossifications. We hypothesize this is due to the difference in stress distribution between both cup shapes, with the spherical cup having a more uniform load distribution. This warrants further long term follow up regarding the use of both cup designs.

## **A-0489** LONG-TERM FOLLOW-UP AFTER DIGITAL NERVE RECONSTRUCTION WITH HYBRID MICRO- AND NANOSTRUCTURED SILK FIBROIN NERVE CONDUIT

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### Introduction

Multiple techniques are available for reconstruction of digital nerve defects using autograft, allograft and conduits. So far, comparative studies demonstrate variable results ranging from no difference in sensory outcomes to superior recovery with allograft and autograft reconstruction. SILKBridge<sup>®</sup>, a novel hybrid three-layered tube based on silk fibroin (obtained from the silk of *Bombyx mori*) was developed with optimized characteristics for peripheral nerve regeneration. The device has two electrospun layers (inner and outer) and an intermediate textile one. The first in-human pilot study of digital nerve reconstruction with SILKBridge<sup>®</sup> was performed in our institution and has proven its feasibility, safety and efficiency in the mid-term follow-up. We examined the long-term results in terms of function, patient satisfaction and biological behavior of the silk fibroin device.

### Patients and methods

This is a follow-up study including patients with digital finger reconstruction with SILKBridge<sup>®</sup> following traumatic injury or neuroma resection. We collected data from last follow-up during routine clinical controls. Two-point discrimination, Tinel sign, local soft tissue conditions and pain were assessed. Ultrasound examination was performed for long term evaluation of conduit integration properties.

### Results

In total four patients were included with median follow-up time of 3 years (1-3.5). All patients showed a good sensation recovery with a static 2-point discrimination of 5-12mm, a moving 2-PD of 4-10mm. No local signs of chronic inflammation or foreign body reaction were observed and a Tinel sign was absent in all patients. The scar was soft and the digital range of motion was the same on both sides. All patients were pain free and satisfied with the result, while no one reported a foreign body sensation. The silk conduit was still visible in the ultrasound but without signs of scar tethering or soft tissue reaction.

### Discussion

This is the first long-term follow-up after digital nerve reconstruction with the hybrid, multi-layered silk fibroin device

SILKBridge®. So far, functional results and patient satisfaction are excellent with no adverse events. SILKBridge® appears to be a safe and efficient alternative to nerve autografts or allografts in cases of digital nerve defects with very good long-term biological behavior.

### **A-0492** COMPLIANCE WITH WEARING A NIGHT EXTENSION SPLINT AFTER DUPUYTREN SURGERY: A PROSPECTIVE, SENSOR-CONTROLLED STUDY

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It is common practice to prescribe a finger extension splint as part of the rehabilitation protocol after surgery for Dupuytren's contracture. However, patient compliance with brace wearing is not known.

The goal of this study was to objectively evaluate this compliance and to detect factors that influence it.

We prospectively included 30 patients that were operated in our institution for Dupuytren's disease. During the first postoperative week, the patients received a custom-made thermoplastic volar extension splint. They were blinded for the fact that their splint contained a temperature sensor (Orthotimer; Balingen, Germany) that measured actual wear time. The first group of 15 patients were instructed to wear the brace every night for 3 months. The second group of 15 patients received the same instructions, but was also provided a self-monitoring schedule to daily note if they had worn the brace. After 3 months, all patients were asked to score their wear time and perceived brace comfort on a visual analogue scale. Actual wear time and patient reported wear time differed significantly. This indicates that patients willingly or unwillingly overestimate their compliance. Average splint wear time improved by utilizing a self-monitoring schedule, proving it to be a simple tool to improve patient compliance. Uncomfortable braces decrease compliance.

### **A-0493** DE QUERVAIN TENDINITIS AFTER TRAPEZIOMETACARPAL TOTAL JOINT ARTHROPLASTY: BIOMECHANICAL EVALUATION OF TENDON EXCURSION IN THE FIRST EXTENSOR TENDON COMPARTMENT

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De Quervain tendinitis is the most common postoperative complication after trapeziometacarpal (TMC) total joint replacement. Its cause remains unknown and is assumed to be multifactorial. Most ball-in-socket implants for the TMC joint have an increased range of motion compared to the normal joint. The goal of our study was to evaluate if total joint replacement increases excursion of the extensor pollicis brevis (EPB) and abductor pollicis longus (APL) tendons during thumb motion.

We conducted a biomechanical study on fresh frozen anatomical specimen. Tendon excursion of the EPB and APL tendons was measured with an electromagnetic motion detector (Patriot, Polhemus) during simulated active thumb flexion, extension, abduction and adduction, before and after TMC prosthesis implantation.

Our results demonstrate that TMC total joint replacement significantly increases tendon excursion in de Quervain's tunnel. This could predispose to the development of frictional tendinitis after surgery.

#### **A-0494** INFLUENCE OF AGE AND LYMPHEDEMA SECONDARY TO BREAST CANCER SURGERY TREATMENT IN THE HANDGRIP STRENGTH

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**Background:** Lymphedema is a chronic and progressive condition, associated with functional impairment of the body segment. It is not established in the literature whether the age or lymphedema of the upper limb resulting from surgery for the treatment of breast cancer interferes with palmar grip strength.

**Objective:** The aim of this study was to evaluate the influence of age and lymphedema on the palmar grip strength of women undergoing surgical intervention for the treatment of breast cancer.

**Methods:** A observational study, approved by the research ethics committee of the proposing institution (CAAE: 11019118.0.3001.5393), was designed with 80 breast cancer survivors divided into four groups - Adult Group ( $49.10 \pm 7.58$ ) and elderly ( $70.04 \pm 6.45$ ), affected or not by moderate lymphedema of the upper limb.

A digital dynamometer (KgF) was used to measure the maximum isometric contraction maintained for six seconds during expiration, without a valsalva maneuver, repeated three times in each upper limb, with an interval of one minute. The patient remained seated, arm adducted parallel to the trunk, elbow fused at 90 degrees, and forearm and wrist in neutral section.

The variables were organized into two blocks for the appropriate intra-group and intergroup comparisons. After the Shapiro-Wilk normality test, ANOVA was applied followed by Tukey's post-hoc. In all calculations, the critical level of 5% ( $p < 0.05$ ) was fixed.

**Results:** In all volunteers lymphedema was homolateral to the surgical incision of the breast. There was no difference ( $p > 0.05$ ) of palmar grip strength (Kg/F) for the upper limbs of the adults groups affected ( $17.57 \pm 7.50$ ) or not ( $20.59 \pm 6.34$ ) by lymphedema, as well as elderly groups affected ( $19.69 \pm 4.85$ ) or not ( $19.5 \pm 3.51$ ) by lymphedema. However, for the unaffected upper limb, there was a difference between the adult groups with lymphedema ( $20.87 \pm 6.20$ ) and without lymphedema ( $25.33 \pm 4.65$ ),  $p < 0.05$ . For the elderly groups, no difference was observed between the upper limb without lymphedema ( $20.14 \pm 5.71$ ) when compared to the lymphedema limb ( $21.34 \pm 5.43$ ),  $p > 0.05$ . Also, for the elderly groups, there was a difference in the limbs without lymphedema ( $20.14 \pm 5.71$ ) and lymphedema ( $21.34 \pm 5.43$ ), when compared to the adult group without lymphedema ( $25.33 \pm 4.65$ ),  $p < 0.05$ . In the intragroup analysis, all upper limbs of the adult (with and without lymphedema) and elderly (with and without lymphedema) groups presented lower values of palmar grip strength in the homolateral limb to surgical intervention ( $p < 0.05$ ).

**Conclusion:** Surgery for the treatment of breast cancer is a factor that interferes with grip strength, regardless of age or lymphedema of the upper limb homolateral to surgery.

## **A-0495** SIMULTANEOUS OPEN DORSAL TRAUMATIC DISLOCATION OF METACARPOPHALANGEAL JOINTS OF FINGERS 2-3-4-5. LITERATURE REVIEW AND CASE REPORT

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**Introduction:** Irreducible open dorsal dislocation of multiple metacarpophalangeal joint is an extremely rare injury with few publications in the current literature. It is generally produced by high-energy mechanisms, associated with fractures of the same affected limb.

**Objective:** Describes the case of a male 60 years old patient who presented a simultaneous open traumatic dorsal dislocation of metacarpophalangeal joints of fingers 2-3-4-5, discuss the mechanism of injury, treatment performed and a literature review in the last 20 years.

**Discussion:** The usual mechanism of injury to an MCP joint is a fall on the outstretched hand causing forcible hyperextension of the joint. Dorsal dislocations are more frequent than volar dislocations, and MCP joint dislocations are less common than interphalangeal dislocations. The most important structure preventing reduction is the displaced volar plate.

**Conclusion:**

Open dorsal metacarpophalangeal joint dislocations of the four long fingers are unusual. Based on the available case reports and our experience, we suggest addressing this injury intraoperatively with minimal delay, cause improper management of this type of injury can mean a significant compromise of hand function.

## **A-0496** THE ROLE OF PREOPERATIVE OPIOID USE IN POSTOPERATIVE OUTCOMES IN HAND SURGERY— A SYSTEMATIC REVIEW

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**Introduction:** The prescription of opioids prior to hand surgery is common amongst patients, though there lies a gap in evidence on how this affects postoperative outcomes. The aim of this systematic review was to investigate the association between preoperative opioid use and post-operative outcomes, including patient-reported measures (PROMs).

**Methods:** PubMed, MEDLINE, Embase, CENTRAL, and CINAHL were searched for relevant articles from inception to April 16, 2022. Screening (in accordance with PRISMA guidelines), data extraction and risk of bias assessment were done in duplicate. Outcomes reported included preoperative opioid use prevalence, postoperative opioid use, functional outcomes (eg. pain, PROMs) and complications (eg. ED visits, infection post-op).

**Results:** 2598 studies were screened, and 7 studies were inclusion (sample size of 136,254 patients). Studies reported that on average, 51% of patients used preoperative opioids. Most studies (71%) that reported on postoperative opioid use found patients using opioids preoperatively to be at least twice as likely to be using opioids after surgery (odds ratios ranging from 2.6-7.8). Two studies that reported on complications also found opioid-exposed (OE) patients to have higher likelihood of infection post-op. One study that reported on PROMs found OE patients to have worse satisfaction, physical function, fatigue and anxiety scores.

**Conclusion:** Preoperative opioid use in hand surgery, in line to what has been reported in other surgical subspecialties, serves as a risk factor to adverse events and opioid use post-operatively. There is still limited but growing evidence on this topic to guide hand surgeons on patients preoperative counselling and postoperative management for optimal pain control.

## **A-0497** RISK FACTORS FOR NONUNION IN INITIAL SURGERY FOR SCAPHOID NONUNION

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[Background] Various risk factors for scaphoid fracture surgery have been reported, including age, time since injury, and smoking. [Methods] In this study, we retrospectively examined the factors that led to postoperative nonunion in 78 patients (74 male and 4 female) who underwent initial surgery using free bone graft for scaphoid nonunion between 2008 and 2020. Nonunion was defined as no evidence of union on plain radiography or Computed tomography (CT) 3 months after injury. Cases in which bone union could be confirmed only by the initial surgery were defined as the union group, and those in which bone union could not be confirmed by plain radiography or CT at the final examination or those who underwent reoperation were defined as the nonunion group. Age, BMI, smoking history, time since injury, ratio of proximal scaphoid fragment volume to total scaphoid volume (Proximal Ratio: PR), presence of sclerotic or cystic changes, MRI signal changes in the proximal scaphoid fragment, source of bone graft, fixation materials, pre- and postoperative radio-lunate angle, its correction, direction of screw insertion, direction of fracture line were examined. Volume was measured using Mimics 21.0 (Materialise, Leuven, Belgium) and a 3D model was created from preoperative CT in all cases. [Result] Bone union was observed in 66 patients after the initial surgery, and the bone union rate was 84.6%. Univariate analysis showed that the source of bone graft and PR had p values less than 0.05, but multivariate analysis showed that only PR was an independent factor (OR, 0.0029; 95 CI, 1.87 e-05 -0.44, p = 0.023). [Conclusion] Small PR was the only factor that led to nonunion after the initial surgery. Both biological and biomechanical aspects seem to be involved, and further research is desired in the future.

## **A-0498** APPLICATION OF MRI VOLUME RENDERING IMAGES TO THE EVALUATION OF TENDON RUPTURE

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Purpose: Advances in magnetic resonance imaging (MRI) have made isotropic 3D MRI possible in routine medical practice, allowing visualization of even the smallest structures. However, tendons of the fingers, especially extensor tendons, are still difficult to visualize using conventional computed tomography (CT) and MRI. While CT-like bone contrast on MRI can show the bone cortex and trabeculae, FRACTURE sequence (by Philips) is superior in delineating not only the bones but also the tendons. We have used its characteristics to create volume rendering (VR) images for the evaluation of hand tendon injuries. This study was aimed at evaluating the usefulness of FRACTURE VR images in the diagnosis of tendon injuries. Methods: Patients with tendon injury who had MRI at our hospital from September 2021 were included. The imaging conditions included FRACTURE, T2WI, Proton, and T2WI-VISTA. For FRACTURE, we created VR images depicting the flexor and extensor tendons and the bone. Three hand surgeons who were not involved in the surgery evaluated all MRI images with and without FRACTURE in terms of the location and number of tendon tears and the usefulness of the images. The findings were compared with FRACTURE images of patients who actually underwent surgery.

Results: We evaluated seven cases of old extensor tendon rupture, two traumatic extensor tendon rupture, and six traumatic flexor tendon rupture. Comparison of VR images with FRACTURE of patients who did and did not undergo surgery confirmed the accuracy of VR images with FRACTURE, indicating its usefulness for diagnosis and in the preoperative

evaluation of the ruptured area.

Discussion: VR images with FRACTURE clearly depict the injured area, even in extensor tendons. These also provide a three-dimensional understanding of the injury, including information directly related to the outcome of the treatment (e.g., thickness and rupture of the donor tendon for tendon transfer and tendon grafting procedures). Thus, anatomical information can be accurately ascertained preoperatively for surgical planning.

Conclusion: Evaluation of tendon rupture using VR images with FRACTURE is useful in hand surgery.

## **A-0499** HEMIHAMATE ARTHROPLASTY FOR THE TREATMENT OF CHRONIC PIP FRACTURE-LUXATIONS

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### Background and objectives

Fracture-dislocations of the proximal interphalangeal (PIP) joint are common injuries that can cause persistent stiffness, pain and angulation. Treatment is particularly challenging when more than 50% of the articular surface of the PIP is fractured. With this degree of joint injury, the entire volar bone support is lost, which prevents dorsal subluxation of the PIP. Hemihamate arthroplasty offers a technically demanding treatment alternative for unstable fracture-dislocations of the PIP joint, which has several advantages.

Our objective was therefore to evaluate the functional recovery of the joint and to see the complication rate at 1, 3 and 6 months.

### Materials and methods

A total of 8 hemihamate arthroplasties have been performed at our unit since 2021.

Only patients with PIP fracture-luxation with more than 30% joint involvement were candidates for this approach. The operation was only performed on patients who had reached the age of majority and in both acute (within 6 weeks) and chronic cases.

The patients were followed up on an outpatient basis with radiological examinations at 1, 3 and 6 months.

All patients received the same protocol of post-operative immobilisation (immobilisation of the PIP for 7 days and of the wrist for 14 days) and physiotherapy (assisted mobilisation protocol for 4 weeks, then occupational therapy).

Data were collected on the degree of flexion-extension limitation pre-operatively and at follow-up, pain perception (VAS) pre- and post-operatively, post-operative grip strength (not assessable pre-operatively due to patient non-compliance compatible with pathology), and a subjective assessment of the degree of stability and alignment at PIP imaging.

### Results

Bone segments of 0,97 cm mean (0,8-1,4cm) were grafted, synthesised with 2 or 3 free screws (1.2 8-11mm).

8 patients reported an improvement in function (maximum flexion deficit of 15°). Pain perception was already minimal pre-operatively and remained low (mean VAS 1). Patients reported similar strength to pre-injury.

There were no graft mobilisations or recurrent back dislocations at follow-up. We found only one case of partial bone resorption, which, however, did not lead to clinical changes for the patient

There were no complications at the harvest site.

### Conclusions

Hemihamate arthroplasty has proven to be a reliable and effective method in treating chronic PIP fracture-luxations of

more than 30 per cent, albeit technically difficult. Nevertheless, the results obtained and reported by patients lead us to recommend this method and to indicate it as the first choice in this type of lesion. However, we believe that a longer, annual follow-up is necessary to definitively confirm the results.

## **A-0500** EOSINOPHILIC FASCIITIS: A NOSOLOGICAL ENTITY NOT TO BE UNDERESTIMATED

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### Background and objectives

In 1974 Shulman reported two cases of patients who manifested sclerodermiform skin induration, hypergammaglobulinemia, hypereosinophilia and diffuse fasciitis. Rodnan, a year later, reported another case where, on histological examination, there was fascial infiltration of eosinophils. Over time, this nosological entity took the name of eosinophilic fasciitis (even if a positive infiltrate is not always found), although its aetiopathogenesis remains largely unknown. It is a syndrome that mimics cutaneous scleroderma but can vary greatly in symptomatological presentation, up to and including pictures of gas fasciitis with generalised subcutaneous oedema and risk of compartment syndrome. It may evolve into systemic involvement and, albeit in rare cases, lead to anaphylactic shock. We therefore wish to report a case of complicated eosinophilic fasciitis.

### Materials and methods

The patient (B.F.), a 44-year-old man, came to the attention of the Operating Unit in 2018 for a picture of fasciitis of the right hand in the aftermath of minor dynamic blunt trauma. He had previously performed fasciotomies on his left upper limb and right forearm in 2001 and 2016. His medical history included a diagnosed eosinophilic myositis in 2010, a seminoma undergoing surgery and chemotherapy in 2013 and a pleural TB undergoing antibiotic therapy for 14 months since 2014.

### Results

From March 2018 to August 2019, the patient underwent 3 admissions for upper limb fasciotomies for compartment syndrome due to idiopathic subcutaneous emphysema and 2 admissions to the intensive care unit due to the onset of similar idiopathic subcutaneous emphysema at the cervical and mediastinal level with development of pneumomediastinum.

### Conclusions

The patient presented with further episodes of subcutaneous emphysema in 2020 and 2021 without the need for further urgent treatment.

B.F. continues low-dose maintenance corticosteroid therapy to date. He is followed by Rheumatology for fibromyalgia syndrome and by the local SERT for anxiety-depressive syndrome combined with alcohol dependence.

At regular follow-ups, he has not demonstrated any functional or stenotic deficits of the upper limbs.

## **A-0501** TOTAL TRAPEZIOMETACARPAL ARTHROPLASTY WITH DUAL MOBILITY PROSTHESIS: PRELIMINARY RESULTS OF LONG-TERM MONITORING

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### Background and objectives

Rhizarthrosis is one of the main chronic diseases afflicting the hand and leading to long-term disability. Still under discussion is what is the best type of treatment. The aim of this study is to report the long-term results of total trapeziometacarpal arthroplasty by monitoring functional recovery and implant stability over time.

### Materials and Methods

We performed 36 total trapeziometacarpal joint arthroplasties by implanting a dual mobility (Touch) prosthesis in a total of 33 patients from 2019 to 2022. Grade 2 and 3 rhizarthrosis cases without STT involvement were treated. Pre- and post-operative changes in pain (VAS), function (Kapandji, radial abduction, Jamar test, key and 2-finger pinch test) and quality of life (QuickDASH) were assessed. Radiographic evaluation was performed pre-operatively, at 1 month and then annually.

### Results

We had a statistically significant improvement (Wilcoxon test and Student t) of all investigated values, both functional and pain: VAS :  $z = -3.2958$ ;  $p = 0.00096$  ( $<0.05$ ); Kapandji  $z = -3.2958$ ;  $p$ -value  $0.00096$  ( $<0.05$ ); radial abduction t-Score: 7.0124  $p$ -Value:  $<0.00001$  ( $<0.05$ ); Jamar  $z = -2.9701$ ;  $p$ -value  $= 0.00298$  ( $<0.05$ ); key  $z = -3.1099$ ;  $p$ -value  $0.00188$  ( $<0.05$ ); 2 finger pinch  $z = -2.7954$ ;  $p$ -value  $0.00512$  ( $<0.05$ ); t-Score: 7.9853  $p$ -Value:  $0.00000219564$  ( $<0.05$ ). These improvements proved to be stable and did not present an involution in the currently available follow-up time. All patients stated that they would repeat the intervention and subjectively attested an improved hand function.

### Conclusions

These preliminary results make the trapeziometacarpal dual mobility prosthesis a good therapeutic alternative in our opinion. It remains to be monitored over time for implant reliability, secondary non-decomposition, maintenance of results and best cost/benefit in the long term.

## **A-0503** COMPARISON OF SURGICAL OUTCOMES BETWEEN DERMAL ALLOGRAFT VERSUS FLEXOR CARPI RADIALIS FOR SUSPENSION-INTERPOSITION AFTER TRAPEZIECTOMY FOR THUMB CARPOMETACARPAL ARTHRITIS

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**Introduction:** Trapeziectomy with suspension-interposition arthroplasty has proved to be an effective treatment for thumb carpometacarpal osteoarthritis. We aimed to compare the surgical outcomes between using dermal allograft and flexor carpi radialis (FCR) tendon for suspension-interposition after trapeziectomy in thumb carpometacarpal arthritis patients.

**Materials and methods:** This retrospective study enrolled 26 patients (29 thumbs) who underwent trapeziectomy with suspension-interposition arthroplasty using the FCR tendon (15 thumbs) or allograft (14 thumbs) from January 2017 through May 2021. Patient-reported outcomes (Visual Analog Scale, Disabilities of the Arm, Shoulder and Hand score and Patient-Rated Wrist Evaluation), grip strength and scaphometacarpal distance were measured at baseline, 3 months and 12 months after surgery. Additionally, the operation time was investigated by reviewing medical records. All measurements were compared between two groups.

Results: Between the baseline and 12-months postoperative follow-up, all patient-reported outcomes were significantly improved in both groups. No differences were found in patient-reported outcomes, grip strength and scaphometacarpal distance between two groups at all follow-up assessment. The operation time was significantly less in the group using an allograft ( $57\pm 12$  minutes versus  $81\pm 16$  minutes,  $p < 0.001$ ).

Conclusions: The surgical outcomes were comparable between allograft and FCR tendon after trapeziectomy for thumb carpometacarpal arthritis. However, using allograft shortened the operation time. Trapeziectomy with suspension-interposition arthroplasty using a dermal allograft appears to be a reliable alternative treatment for thumb carpometacarpal arthritis.

## **A-0505** SUTURE-BUTTON FIXATION FOR TREATMENT OF DISTAL RADIOULNAR INSTABILITY AFTER DISTAL RADIUS FRACTURE: RANDOMIZED CONTROL TRIAL

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### Introduction

Treatment for distal radioulnar joint (DRUJ) instability associated with distal radius fracture is diverse, and there is no consensus on the optimal treatment. In conservative treatment for DRUJ instability, wrist and elbow immobilization is required for 6-8 weeks. This prospective study aims to analyze the clinical effect of tightrope fixation just below the DRUJ for instability after distal radius fracture fixation. We hypothesized that fixing a tightrope just below the DRUJ would enable early rehabilitation with reduced instability.

### Methods

Among the patients who underwent volar plate fixation for distal radius fracture from March to November 2021, 20 patients whose instability was confirmed by ballottement test were enrolled in the study. Twenty were randomly assigned to the control group and the tightrope group. The Control group was immobilized for 2 weeks with a removal long arm splint after 4 weeks of a long arm cast after volar locking plate fixation. In the tightrope group, the radius and ulna were fixed with a tightrope just below the DRUJ immediately after the volar locking plate fixation. The tightrope group was immobilized with a short arm splint 4 weeks postoperatively and a removable short arm splint 2 weeks postoperatively. Disabilities of the Arm, Shoulder, and Hand (DASH) questionnaire, Modified Mayo Wrist Score (MMWS), Ballottement test, range of motion (ROM) of wrist and supination-pronation, pain visual analog scale (VAS), radiologic parameters and complications were investigated 4, 6, and 12 weeks after surgery.

### Result

The two groups had no differences in demographic data and radiologic parameters. At 4 weeks postoperatively, the tightrope group was statistically superior to the control group in the wrist ROM, pronation-supination ROM, and MMWS. (wrist ROM 62.5 Vs 94.5; pronation-supination 58.5 Vs 88.5; MMWS 37.5 Vs 51.5) At 6 weeks after surgery, the tightrope group had more stable DRUJ than the control group, but the pain VAS was higher, and DASH, MMWS, and ROM did not differ. (DRUJ instability 4 Vs 0; pain VAS 0.8 Vs 3.0) At 12 weeks, the tightrope group showed statistically superior wrist ROM, DASH, MMWS, and DRUJ stability compared to the control group. (wrist ROM 122 Vs 168; DASH 17.79 Vs 7.08; MMWS 64.5 Vs 68.0; DRUJ instability 4 Vs 0) There was no complication in any patient.

## Conclusion

In DRUJ instability accompanying distal radius fracture, tightrope application, in addition to volar plate fixation, reduces instability and has better clinical outcomes than long arm splints.

## **A-0506** PERIPHERAL NERVE LESIONS AFTER OSTEOSYNTHESIS OF UPPER LIMB FRACTURES IN CHILDREN – AN ALGORITHM FOR TREATMENT

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### Introduction

Nerve injuries following operative stabilization of upper limb fractures in children are rare. Especially in young children detection of a sensory deficit may be challenging, but in case of motor nerve injury, loss of active motion and muscular atrophy will be the first signs. Standards for examination and treatment of peripheral nerve injuries in children following osteosynthesis of upper limb fractures are lacking, therefore we present our algorithm.

### Methods

From 01/2017 to 08/2022, we treated eleven patients (ten boys and one girl between four and twelve years of age) for peripheral nerve injury after osteosynthesis of upper limb fractures in our tertiary center of pediatric surgery. Four patients had numbness at the fifth digit and the ulnar aspect of the fourth digit after PIN-fixation of a supracondylar fracture. Three children presented with deficits of motor function of the ulna nerve, two kids had an anterior interosseous nerve syndrome (AINS) and two had a decreased motoric radial nerve function. In all children with neurological findings ultrasound examination of peripheral nerves was performed. When signs of nerve compression or scarring were detected, exploration of the nerve was performed during PIN/TEN-extraction. Scarring was removed followed by decompression/epineurotomy of the affected nerve. Sensitivity training was continued after the operation as well as muscle strengthening. In three cases of severe nerve compression and muscular atrophy, we added electric nerve stimulation therapy. In case of lacking ultrasound findings of peripheral nerve compression or scarring, sensory training, splinting and muscle activation in a watch- and - wait setting was chosen.

### Results

All patients with sensory deficit of the ulnar nerve after supracondylar fracture showed full recovery three to six month after decompression. Two of three kids with lesion of motor branches of the ulnar nerve had an ulnar nerve stimulation for three month after decompression and regenerated muscle mass and strength within four to six month. One patient recovered within three months without stimulation. Sensory function was regained within five to six months. Two children with AIN-Syndrome recovered fully within three to five months. The two boys with radial nerve palsy showed a large hematoma after humerus fracture, but no signs of nerve compression. In patients without operative nerve decompression full recovery was observed within three to four month after fracture stabilization.

### Conclusion

In case of persisting sensory and/or motor deficiency after osteosynthesis of upper limb fractures in children, nerve ultrasound examination is a pain free method to detect nerve compression or scarring in the upper limb. Early operative decompression during PIN/TEN - extraction leads to fast recovering of sensory function. Signs of muscle atrophy to rapid treatment with early restoring of motor functions.

## **A-0507** RADIOLOGICAL ANALYSIS OF TRIANGULAR FIBROCARILAGE COMPLEX INJURIES IN RECREATIONAL GOLFERS

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### Background:

Although there are many recreational golfers complaining of ulnar wrist pain, there is no study that focuses on the characteristics of a golf related Triangular Fibrocartilage Complex(TFCC) injury. A TFCC injury can deteriorate a golfer's function. Our primary goal was to perform a retrospective descriptive study that reveals characteristics of recreational golfer related TFCC injury.

### Objective:

Perform a radiological analysis of Triangular Fibrocartilage Complex(TFCC) injuries in recreational golfers.

### Study design:

Retrospective case series

### Methods:

Patients eligible for inclusion were golfing patients complaining of ulnar sided wrist pain diagnosed with TFCC injury by MRI. Patients with other prior wrist injuries were excluded (e.g. distal radius fracture, hamate hook fracture). Electronic medical records were reviewed to obtain demographic information, characteristics of injury, radiologic findings, initial treatment, and outcomes. Between 2016 and 2021, 32 patients were identified as having golf related TFCC injury. Among 32 patients, 28 patients were recreational golf players and 4 patients were professional golf players. There were 25 male patients and 7 female patients, ages 21 to 87 years (mean, 47 years).

### Results:

Among 28 recreational golf players, 13 patients(36%) were affected at the lead wrist, 14 patients(50%) were affected at the trailing wrist, and 1 patient(4%) had bilateral wrist pathology. 25(86%) wrists had positive ulnar variance, 10 wrists(34%) had DRUJ instability, 5 wrists(17%) had ECU pathology, 2 wrists(7%) had ulnar styloid nonunion as a concomitant pathology. 7(24%) wrists were palmer class 1 injuries, 11(38%) wrists were palmer class 2 injuries, and 11(38%) wrists were combined class 1 & 2 injures. The most common types were Palmer 1B type and Palmer 1B + 2A complex type.

### Conclusion:

TFCC injuries in recreational golfers were most frequently associated with positive ulnar variance. The pattern of TFCC injuries was an even mix of acute and chronic injury.

## **A-0508** THE ROLE OF CORTICOSTEROID INJECTIONS IN TRIGGER FINGER TREATMENT - DO WE USE IT ENOUGH? SHOULD WE USE IT AT ALL?

Katalin Muraközy

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During the COVID pandemic access to operation rooms were very limited in public hospitals in Hungary. Due to this situation, and other safety regulations, we were obliged to use more corticosteroid injections than usual to help trigger finger patients to get along with their life and work. We had to use corticosteroids in more severe cases also which other

times would go straight to surgery.

This retrospective case series analyzed all corticosteroid injections for trigger fingers administered by two hand surgeons at a single center between January 2020 and June 2022. We overviewed the medical records of the patients. In case of unknown outcome phone consultation was initiated to record the residual symptoms of the patients. The maximum amount of injections for one affected finger was 3.

We made analysis on our results according to gender, affected finger, time of existence of symptoms before getting treatment and the stage of symptoms at the first visit. The primary outcome, treatment failure was defined as receiving surgical treatment. We also compared the effectiveness of two or three injections to a single shot.

The follow up time was minimal 6 month after the first injections so our data is still under construction at the time of the abstract submission but we can already see significant evidence to consider.

### **A-0509** COMPLEX CORONAL BODY FRACTURE-DISLOCATION “PILON-TYPE” OF THE HAMATE: A RARE INJURY PATTERN LEADING TO AXIAL CARPOMETACARPAL INSTABILITY

Eudaldo Jose Gallo del Valle, Juan María Pardo García, Enrique Peces García, Belén Pardos Mayo, Natalia Ruiz Micó  
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**INTRODUCTION:** Between carpal bones fractures, hamate fractures are rare and underreported. Thus, delayed diagnosis is not uncommon. Among hamate fractures, we distinguish two types: hook and body fractures. Hook of the hamate fractures are related with sports where a firm grip is required. Otherwise, body fractures are related to higher energy trauma such as a punch, fall or MVA and could be associated with concomitant metacarpals and carpal fractures or injuries. Body fractures are less common. The aim of our study is to review and update the actual evidence to diagnose and treat the body of the hamate fractures through a complex case of hamate's body coronal fracture “pilon type” associated with fourth and fifth carpometacarpal fracture-dislocation.

**CASE DESCRIPTION:** We present a case of a 33 year-old male who was evaluated at the emergency department (ED) due to swelling and dorsoulnar pain in his right hand after a fall. The patient was a right-handed, manual worker with clinical history of smoker. Our clinical findings at ED were: dorsoulnar deformity, swelling and pain at carpometacarpal fourth and fifth bases. Initial radiological findings showed a complex fracture of the body of the hamate associated with a fracture dislocation of the base of the fourth and fifth metacarpals. Thus, close reduction and cast immobilization were carried out and a CT scan was requested. Six days after injury, definitive surgery took place consisting in close reduction and internal fixation (CRIF) with headless compression screw and a Kirschner wire from 5th to 4th metacarpals bases.

**RESULTS:** Final follow-up at 6 months showed adequate consolidation with great articular congruence and no signs of malunion, nonunion or arthritis. Return to normal activity: four months after injury. Visual Analogue Scale (VAS) value at rest was 0 and with effort was 1. DASH score: 4.2. Grip strength similar with contralateral side (38,5 Kg /43.6 Kg). Active range of motion at the wrist was similar to the contralateral side, outstanding a loss of 5° degrees at ulnar deviation. No other complications during follow-up.

**DISCUSSION:** Unlike hamate's hook fractures, body of the hamate fracture is a consequence of a direct blow over the hypotenar eminence or a considerably dorsopalmar compression. A body fracture may also lead to an axial carpal instability or exists in the context of a wrist fracture-dislocation. This pattern is rare, unusual and underreported. Besides, because of its relation to higher energy trauma, the body of the hamate fracture diagnosis tends to be acute. Patients refer swelling, tenderness over the dorsal and ulnar aspect of the wrist. Associated deformity at the base of the fourth and

fifth metacarpals may be present as an indirect sign of the body of the hamate fractures.

**CONCLUSIONS:** We have to be aware of hamate fractures attending hand traumatism. In hamate fractures, the diagnosis must always include an oblique view of the carpal region and a CT scan due to misdiagnosis related to standard radiographs. Close or open reduction and internal fixation must be our gold standard to treat this kind of injuries due to a high complication rates associated with conservative treatment such as chronic subluxation, pain, arthritis, loss of grip strength and axial instability.

### **A-0510** COMPLEX CORONAL BODY FRACTURE-DISLOCATION "PILON-TYPE" OF THE HAMATE: A RARE INJURY PATTERN WITH AXIAL CARPOMETACARPAL INSTABILITY

Eudaldo Jose Gallo del Valle, Juan María Pardo García, Enrique Peces García, Belén Pardos Mayo, Natalia Ruiz Micó  
*Hospital Universitario General de Villalba, Spain*

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**CONCLUSIONS:** We have to be aware of hamate fractures attending hand traumatism. In hamate fractures, the diagnosis must always include an oblique view of the carpal region and a CT scan due to misdiagnosis related to standard radiographs. Close or open reduction and internal fixation must be our gold standard to treat this kind of injuries due to a high complication rates associated with conservative treatment such as chronic subluxation, pain, arthritis, loss of grip strength and axial instability.

## **A-0512 ACUTE COMPLEX INSTABILITY OF THE ELBOW TREATED WITH INTERNAL JOINT STABILIZER (IJS-E SYSTEM)**

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**Introduction:** Treatment of acute complex fracture-dislocation of the elbow has been associated with a high rate of complications. Internal Joint Stabilizer of the Elbow (IJS-E) device appears as a valid option to optimize and improve our results.

**Objective:** Analyse our results using the Internal Joint Stabilizer of the elbow (IJS-E System) in acute complex instability of the elbow.

**Material and Methods:** We present a retrospective case series of five patients treated at our institution with IJS-E System (Skeletal DynamicsR) from February 2019 to 2021. Our inclusion criteria was: patients over 18 years old surgically treated with IJS-E due to persistent elbow instability despite of a correct osteoligamentous surgical repair.

**Results:** We obtained a total of ten patients (8 males and 2 female) with an average age of 37.4 years old (24-71). The Injury pattern was posterolateral instability,TTIE in all cases. We perform a clinical review at two, four, eight and twelve weeks until elective hardware removal. The mean final postoperative MEP score was 94 points (85-100) and the postoperative DASH score was 11.78 points (4.2-20.6) with an average follow-up of 15.6 months (6-30). We described a final arc of motion of 134° with a range of flexion between 120° and 140° and a mean lack of extension of 12° (5°-20°) ,with a complete arc of pronosupination. As complications we found one case of heterotopic ossification and one case of elbow stiffness. However, no complications device-related or articular incongruence were reported during follow-up.

**Conclusions:** The IJS-E device appears as an effective alternative instead of external fixation. Nevertheless, a high rate of reoperation up to 100% is associated with IJS-E. A larger series, longer follow-up and prospective studies are needed to define properly his role in the surgical treatment of acute elbow instability.

## **A-0514 DUMONTIER GROUP 2 RADIOCARPAL FRACTURE-DISLOCATION: THE RESULTS OF OPEN REDUCTION AND FIXATION WITHOUT LIGAMENT REPAIR**

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The radiocarpal fracture-dislocations represent a spectrum of severe injury involving both the bony and ligamentous structures that stabilize the wrist joint. This study aimed to analyze the outcomes of open reduction and fixation without ligamentous repair for Dumontier group 2 radiocarpal fracture-dislocations and to evaluate the incidence and clinical relevance of ulnar translation and advanced osteoarthritis. We retrospectively reviewed 22 patients with Dumontier group 2 lesions treated in our institute. Clinical and radiological outcomes were recorded. Postoperative visual analog scale (VAS) score for pain, Disabilities of the Arm, Shoulder and Hand Outcome Measure (DASH), and Mayo modified wrist scores (MMWS) were collected. Furthermore, we divided the patients into two groups according to the condition of their ulnar translation and osteoarthritis. We presented the differences in the pain, disability, wrist performance, and ROM between both groups. There were 16 men and six women with a median age of 23 years (range, 20-48 years). The median postoperative follow-up period was 33 months (range, 12-149 months). At the latest follow-up, the median VAS score was 0 (range, 0-2); the median DASH score was 9.1 (range, 0-65.9); and the median MMWS score was 80 (range,

45-90), with six excellent, seven good, six fair, and three poor results. Ulnar translation of the carpus were recognized in four patients and the development of posttraumatic arthritis was noted in 13 patients during the follow-up period. However, neither was highly correlated with functional outcomes. The current study demonstrated that ulnar translation occurred in patients with Dumontier group 2 lesions. Therefore, intraoperative instability should be recognized when treating injury predominantly caused by a rotational force. However, the clinical relevance of ulnar translation and wrist osteoarthritis needs to be assessed in the further comparison study.

### **A-0515** OUR TREATMENT ALGORITHM OF KIENBÖCK DISEASE, BASED ON DIFFERENT SURGICAL TECHNIQUES REGARDING CLASSIFICATION SYSTEM (LICHTMAN)

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**Purpose** Our study aims to create treatment algorithm of Kienböck disease, based on different surgical techniques regarding classification system (Lichtman) and to present clinical and radiological results of minimum 12 months follow up of 22 patients.

**Methods:** We have observed clinical results after different surgical procedures regarding different stages of Kienböck avascular necrosis of the lunate and have developed our own algorithm to manage its treatment. In the period of 2015-2022 y 4 patients undergone shortening of the radius, 8 patients undergone revascularization procedure of the lunate from the radius and 10 patients undergone reconstruction with a lateral femoral condyle graft.

**Results:** All of 22 patients were followed for minimum of 12 months post op and clinical and radiological results were recorded. Radiographic parameters recorded included preoperative ulnar variance, preoperative and final follow-up of radioscaphoid angle, lunate height, lunate diameter, Stahl index and Lichtman stage.

**Conclusion:** For patients with the earliest stages, with the intact lunate is protected utilizing nonoperative measures. Second stage(Lichtmann), lunate unloading procedures should be considered. If the lunate is compromised then it can be reconstructed with a lateral femoral condyle graft. With the further collapse of the lunate we also recommend reconstruction of the lunate with lateral femoral condyle graft if articulation surface of the lunate fossa of the radius is still preserved. With advanced disease (Kienböck disease advanced collapse), the wrist is not reconstructable, so only a salvage procedure can be performed.

### **A-0516** COMPLEX REGIONAL PAIN SYNDROME (CRPS) IN THE UPPER EXTREMITY -RISK FACTORS AND OUTCOME Erika Nyman<sup>1,2</sup>, Astrid Parinder<sup>3</sup>, Ellen Lyckegård Finn<sup>3</sup>, Lars. B. Dahlin<sup>2,3,4</sup>

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Complex Regional Pain Syndrome (CRPS) is a long-lasting severe pain condition often induced by trauma, surgery, or immobilization. CRPS is distinguished between type 1 and type 2, where an injury in at least one peripheral nerve has been identified in type 2 and no evident nerve injury exists in type 1. Socioeconomic factors and other risk factors for developing CRPS are not fully understood and the knowledge about long-term outcome with sick leave and return to work is limited.

In a retrospective observational study from a well-defined health care region in Sweden, data was collected from medical records regarding subject characteristics, symptoms, treatment options, follow-up time, outcome, sick leave and return to work related to sex and type of CRPS.

In total, 149 subjects with a defined diagnosis of CRPS were identified [men n=45 (30%); women n=104 (70%); type 1 CRPS n=108 (72%); type 2 CRPS 41 (28%)]. Median age at diagnosis was higher for women and for those with CRPS type 1. Compared to a defined reference population, a larger proportion of CRPS subjects were smokers, and had less post-secondary education. Comparing the proportion of the study group, who had mental illness before diagnosis with CRPS (21%), no significant difference was found compared to the reference group, but after the onset of CRPS an 76% increase of mental illness was noticed. Most subjects had a manual work. Men more frequently smoked and had higher BMI than women. A higher proportion of women had a post-secondary education compared to men. Subjects with CRPS type 2 had a longer time from symptoms until diagnosis, longer follow-up time and more follow-up visits. Delayed diagnosis was also associated to prolonged follow-up time. Forty-five percent were on sick leave for more than 12 months and 20% were permanently incapable of ever working again.

It is impossible to predict the subjects who will get CRPS in advance, but smoking, lower educational level, being female and having a manual work are potential risk factors for development of the condition. This may indicate that socioeconomic factors play a role. A high occurrence of mental illness after onset of CRPS points out that not only physical aspects should be prioritized in treatment of CRPS, but also mental health should be judged. Subjects with CRPS have long sick leave with a risk of never returning to work, where subjects with CRPS type 2 are at risk of having a delayed diagnosis.

## **A-0517** THE ROLE OF FAT GRAFTING AFTER SELECTIVE FASCIECTOMY IN DUPUYTREN'S DISEASE. A RETROSPECTIVE CLINICAL STUDY

Cesare Tiengo, Francesco Messina, Giuseppe Matone, Benedetta Scucchi, Stefano L'Erario, Filippo Andrea Giovanni Perozzo, Alfio Luca Costa, Franco Bassetto

*Padua University Hospital, Italy*

### Introduction

Dupuytren's disease is a fibroproliferative disease that affects the palmar aponeurosis and is characterized by progressive fibrous thickening and finger flexion. Following the withdrawal of collagenase derived from *C. histolyticum* from the market, the only therapeutic options available to date are radical or selective aponeurectomy and percutaneous cordotomy with needle with and without adipose tissue graft. Despite the variety of techniques proposed by different authors, the recurrence rate at 5 years is set at 20% - 30%; complications are reported to be 30% in previous studies. Given recent discoveries about the multiple potential of adipose tissue as a regenerative organ, the current study aims to retrospectively analyze cases of selective aponeurectomies associated with autologous adipose tissue grafting at the Padua Operative Unit of Plastic Surgery to better characterize the role of the adipose organ in preventing complications and relapses in primary and recurrent cases.

### Materials and Methods

From 2009 through 2021, we examined the whole ward case series, including all patients who underwent aponeurectomy and lipofilling. We included only the patients with at least one year of follow up and ended up with 39 patients and 44 hands. The TPED (total passive extension deficit) before and after surgery, complications, recurrence rate at 1 year follow up, disease extension rate, and QuickDASH score before and after surgery were also studied. We analyzed the aggregated data and then separated the two groups into primary and secondary cases.

## Results

The overall complication rate was 24.83%, the overall recurrence rate was 34.09%, and the disease spreading rate was 11.36%. We found 10% vs. 24.5% complications when comparing primary and secondary illnesses. In terms of disease recurrence and extension to neighboring rays, we had 10% versus 31.8% and 0% vs 11.4% in the primary and secondary groups, respectively. Despite obtaining superior outcomes in primary cases, we were unable to achieve statistical significance for the parameters under investigation.

## Conclusions

Our findings suggest that adding lipofilling following a selective aponeurotomy does not result in an increase in complications and can even reduce recurrences in primary cases. The study's weaknesses include its retrospective nature and small sample size. We also feel that adipose tissue may benefit Dupuytren's patients, particularly in primary instances, although it would be more beneficial to extract a more pure fraction of adipose tissue and undertake a prospective randomized controlled trial.

## **A-0519** RECOVERY OF WRIST AND FINGER/THUMB EXTENSION AFTER NERVE TRANSFER FOR RADIAL NERVE INJURY: A SYSTEMATIC REVIEW

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**Background:** Radial nerve injury at different levels can result due to varying etiologies which, to a great extent, also direct the management plan. Traditional treatment strategies involve tendon transfers and direct nerve repair or grafting. In the past decade nerve transfer mainly from the median and ulnar nerve branches has emerged as a promising treatment modality for these patients with motor deficits. We reviewed the recent literature describing the clinical outcomes of this procedure in patients with a radial nerve injury in terms of wrist extension, and finger/thumb extension. **Methods:** PUBMED, SCOPUS, and OVID databases were searched from data inception to September 2022 using "radial nerve injury, radial nerve paralysis, radial nerve palsy, radial nerve lesion, radial nerve repair, nerve transfer, nerve graft, and nerve repair" as keywords, along with Boolean operators "AND" and "OR". With explicit inclusion and exclusion criteria, of the initial 130 results, 22 studies underwent full-text review resulting in 11 inclusions for final data extraction as assessed by two authors independently. Individual patient data were collected and pooled for final data analysis. **Result:** Wrist extension and Finger/Thumb extension of n=90 patients with a mean age of 32.94 years who underwent nerve transfer after 26.185 +/- 11.37 weeks of radial nerve injury were evaluated. While the branches of the median nerve were used as the donor nerve in n=68 patients, branches of both the median and ulnar nerve were used as donors in n=21 patients, and the long portion of triceps head to the posterior interosseous nerve in n=1 patient. Of n=82 patients whose data was available, n=16 achieved a Wrist extension power of British Medical Research Council (MRC) grade 5/5, n=51 achieved 4/5, n=10 achieved 3/5 and n=5 showed no improvement after a follow-up for 101.684 +/- 49.65 weeks following the surgery. Based on n=3 studies that reported individual muscle powers of n=8 patients, Extensor Carpi Radialis Longus showed higher MRC powers than the corresponding Extensor Carpi Ulnaris in n=3 patients while in the remaining n=5 the response of both muscles was similar. Moreover, of n=75 patients whose data was available, n=2 achieved a Finger/Thumb extension power of MRC grade 5/5, n=50 achieved 4/5, n=2 achieved 3/5, and n=16 showed no improvement after the same follow-up period following the surgery. **Conclusion:** There is poor-quality evidence suggesting a return to normal function in terms of wrist and finger/thumb extension. Median nerve seems to be the preferred donor nerve

for nerve transfer in radial nerve injury. Outcome measurements are fairly variable among different studies. Results of further prospective studies are highly anticipated in this treatment modality for radial nerve injury, comparing it with conventional strategies like tendon transfer, and direct nerve repair to lay out explicit recommendations.

## **A-0520** THE INSUCCESSSES OF CARPAL TUNNEL RELEASE. OUR EXPERIENCE AND LITERATURE REVIEW

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### Introduction

Carpal tunnel release is the most common procedure in hand surgery and has generally positive outcomes. However, previous literature typically reports a failure incidence of 0 to 25%. The definition of failure is not uniform, and we must distinguish between persistences, recurrences, and the emergence of new symptoms. Carpal tunnel release is one of our most commonly performed surgeries as a Plastic and Hand Surgery department, and we seldomly deal with revision surgery as well. We intended to conduct a systematic review of the most recent literature in order to identify the causes of failure as well as the true incidence of persistence and recurrence. We attempted to identify the most relevant findings as a secondary endpoint and used them to improve our daily practice in order to reduce the incidence of failure.

### Materials and Methods

We searched PubMed for the keywords “carpal tunnel syndrome,” “persistence,” and “recurrence” and filtered the results for the last ten years. Non-English and non-Italian papers, as well as duplicates and single case reports, were excluded. We also went back through our cases and found 990 carpal tunnel releases over the last 13 years. We examined the surgical outcomes, complications, and causes of failure for 38 of those procedures.

### Results

According to the literature, the main cause of persistence is an incomplete opening of the carpal ligament. The most common cause of true recurrences is perineural fibrosis and the formation of a scar-tissue neo-ligament. Misdiagnosis is a widespread issue in carpal tunnel surgery, as the literature reports a moderately high incidence of misdiagnosed double crash syndrome. In fact, undiagnosed secondary compression of the median nerve accounts for up to one-third of all failures. Furthermore, the frequency of persistences and recurrences is lower than in the past. Our experience corroborates these findings, as only 3.83% of our surgeries over a 13-year period were revisions of failed carpal tunnel syndrome.

### Conclusions

The prevalence of double crash syndrome and “rare” causes of median nerve compression is higher than expected. A thorough physical examination and accurate diagnosis have the potential to reduce the failure rate to near zero. Furthermore, the incomplete opening of the carpal ligament remains the primary cause of persistence, which is unacceptable in an era of super-specialization.

## **A-0521** FIRST WEB RECONSTRUCTION: A COMPREHENSIVE REVIEW OF THE RECENT LITERATURE ABOUT INDICATIONS AND TECHNIQUES

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### Introduction

The first web space is a crucial anatomical unit of the hand that is responsible for the majority of our daily movements. Human hand anomalies are extremely common, and the first web is frequently involved. The surgeon's primary goal in these situations is to provide the patient with the most functional and long-lasting reconstruction possible. Because first web defects can have a wide range of characteristics, surgery must offer a diverse set of reconstructive options. The goal of this review is to look at the most recent literature and give the reader a thorough overview of the most popular and effective reconstructive procedures for the first web of the hand.

### Materials and Methods

We searched the PubMed database for the terms "first web reconstruction," "first commissure," and "web contractures." We further filtered the results for the last ten years and found 37 relevant articles.

### Results

A wide range of reconstructive techniques for the first web of the hand are described in recent literature. These procedures range from simple skin grafts to Z-plasties and local flaps. As the complexity and size of the defect, as well as the patient's functional demands, increase, so do the reconstructions, which may include pedicled or free flap transfers. The indications are not always clear, and some are still debated, especially when the same defect can benefit from both a pedicled and a free flap.

### Conclusion

The first web is the keystone of the hand's overall functionality. It is susceptible to a wide range of deformities, including tumor excision, trauma, and burns. When it comes to first web reconstruction, there are numerous reconstructive options available, and their indications differ depending on the patient and the characteristics of the defects. The reconstructive surgeon should be familiar with all possible reconstructive techniques and, most importantly, their proper indications. A thorough understanding of these factors enables the surgeon to select the most appropriate reconstruction or to refer patients to a more specialized reconstructive unit.

## **A-0522** ARTHROSCOPIC TRANSOSSEOUS MODIFIED ULNAR TUNNEL TECHNIQUE FOR THE TREATMENT OF PAINFUL, FOVEAL-ONLY (ATZEI CLASS 3), OR COMPLETE, FOVEAL- AND CAPSULAR (ATZEI CLASS 2) TFCC INJURIES

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### Background

Treatment of TFCC injuries varies depending on the type of injury. Different suturing techniques have been introduced for capsular (distal) injuries (Atzei Class 1). Similarly, different fixation techniques are used for foveal-only (proximal) injuries (Atzei Class 3), not without complications in terms of residual DRUJ instability or transient neuropraxia of the sensory branch of the ulnar nerve. Reports of the treatment of complete (foveal- and capsular) TFCC lesions (Atzei Class 2) have

been lacking in the literature. Drilling the transosseous tunnel in the ulna has been suspected of being connected with a risk of fracture, without supporting evidence. The study aimed to evaluate the feasibility of the modified ulnar tunnel technique in treating foveal-only (Atzei Class 3) and complete TFCC lesions (Atzei Class 2) using a 3,2 mm osseous canal as a working tunnel.

#### Material and Methods

Between April 2013 and May 2020, 44 patients with foveal-only TFCC injuries and 21 patients with complete injuries were included. All patients had ulnar-sided wrist pain, positive fovea-sign, and mild to moderate instability of DRUJ. The positive hook test and visualization of the capsular tear finally established the diagnosis intraoperatively. All patients underwent a double-bundle, Fiber-wire, transosseous suture finally fixed by 2 mini PushLock anchors, proximal from the working tunnel in the ulna. Combined, the foveal- and capsular TFCC injury was sutured by placing one suture through the foveal footprint and a second through the capsular injury by an all-inside technique. The prospective evaluation included an assessment of pain (VAS score, 0-100), grip strength, range of motion, and q-DASH score.

#### Results

No peri- or postoperative complications in terms of fracture, nerve injuries, or infection occurred. All 65 patients were eligible for the follow-up, a mean of 28 months [24-48] in the foveal group, and 24 months [9-35] in the combined group. The mean VAS scores for the foveal/combined groups decreased from 62/64 to 13/15, postoperatively ( $p=0.0001/p=0.0001$ ), respectively. Grip strength increased, while the range of motion did not change. The q-DASH score improved from 41/50 preoperatively, in the foveal-only/combined group to 5/13 postoperatively ( $p=0.004/p=0.0001$ ). Six foveal patients and four combined underwent revision surgery. 60 patients presented excellent or good satisfaction scores at the last follow-up. Four remaining patients complained of persistent pain during an activity at the final follow-up, and one patient experienced annoying clicking, although full DRUJ stability was accomplished in all patients.

#### Conclusion

Arthroscopic TFCC fixation of foveal-only (Atzei Class 3) or combined, capsular-, and foveal tears (Atzei Class 2) by modified ulnar tunnel technique is feasible, improving the symptoms in >90% of the patient population of this study. Full stability of the DRUJ was achieved in all cases, without fracturing the ulna.

### **A-0523** DISTAL BICEPS TEAR. PRE OPERATIVE ULTRASOUND LANDMARK AND RESULTS EVALUATION USING A DYNAMOMETER

Alessandro Greco, Lucian Lior Marcovici, Elena Taglieri, Alessia Pagnotta

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Distal biceps tendon ruptures are common. Different fixation techniques are described and all of them appear to have sufficient strength to secure the biceps tendon t. More than six different skin incisions are described to fix tendon in radial tuberosity each of them had its own advantage and disadvantage. Objective of our study is 1) demonstrate that the pre-operative ultrasound examination helps in the choice of skin incision and 2) to evaluate results in terms supination strength using a dynamometer. From 2020 to 2022 we prospective treated 20 pt for acute or subacute distal biceps tear (16 total tear and 4 partial tear). All patients were studied with FABS-MRI. Timing from trauma to surgery was 16 days (4-56). in all case pre operative ultrasound landmark were performed. We used single incision in all case (16 traverse and 4 longitudinal). Anatomical reinsertion with endobutton was obtained in all cases. We used an early rehabilitation protocol beginning from the second week after surgery. Results were evaluated using MEPS, Q-DASH and MRC scale.

Muscle strength recovery was assessed fifth months after surgery using a dynamometer. Full range of motion was obtained within 3 months in all cases. According to MEPS, Q-DASH and MRC scale all patient obtained excellent results within 4 months after surgery. No major complications were observed. Four patient had transient parestesia of LACN and Median nerve, spontaneously resolved within 3 months. Pre-operative ultrasound exam allows to identify bone and soft tissue landmark and so it helps to accurately plan skin incision. In all cases, even after 56 days, the correct planning allowed us to obtain an anatomical reinsertion into radial tuberosity without any additional incisions. Functional elbow score appear inadequate to evaluate results because they pay attention mainly in recovery of ROM and pain during daily activity life. Evaluation of muscle strength with the MRC scale is not very useful, in fact all patients after 4-6 months easily reach the value of 5 \ 5. Moreover none of this score or scale allow a quantification of muscular strength. We introduced a dynamometer as a tool to quantify muscle strength, it represents an innovative technique not yet described. This tool allows to quantify exactly

### **A-0524** PRE OPERATIVE ULTRASOUND LANDMARK AND RESULTS EVALUATION USING A DYNAMOMETER IN DISTAL BICIPES TEARS

Alessandro Greco, Lucian Lior Marcovici, Elena Taglieri, Alessia Pagnotta

*Jewish Hospital Rome, Rome, Italy*

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## **A-0525** DERMAL INDUCTORS AND RECONSTRUCTIVE SURGERY OF THE UPPER LIMB: FROM THE BEGINNINGS TO FUTURE PROSPECTS THROUGH THE ANALYSIS OF 20 YEARS OF EXPERIENCE

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### Purpose

over the last 2 decades, dermal inductors have inevitably changed the decision scale for choosing the most suitable surgical option for skin and soft tissue coverage due to the enormous versatility, ease of use, speed of execution and expected results in the most different situations. The authors present the results of the experience of two decades and present the preliminary results of an integrated protocol that contemplates the use of dermal inducers with the subsequent addition of growth factors and / or stem cells.

### Methods

from 2002 to 2022 at the Department of Plastic and Reconstructive Surgery of Foggia 428 reconstructions with dermal inductors were performed in oncological (65%), traumatic (35%) cases, in patients suffering from epidermolysis bullosa for the partial recovery of hand functionality (3%), in burn patients (7%). Average duration of the implantation procedure (T0):  $35 \pm 15$  min. Average size of reconstructed areas:  $40 \pm 30$  cm<sup>2</sup>. Moulage: with greasy gauze or polyurethane foam. Occlusive dressing, subsequent checks at 7 (T1) and 21 (T2) days in the absence of complications. Definitive autologous skin graft at 21-42 days (T3). Evaluation of the results with the POSAS 10-point scale.

### Results

Optimal coverage of the defect: 90% cases. Complications observed: infection of the recipient site (9%), hematoma (1%), poor revascularization (2%), partial engraftment of the autologous skin graft (15%). The POSAS scale showed very low scores (between 1 and 4) for each aspect analyzed by both the patient and the observer. The extreme ease and versatility of use of dermal inductors combined with the knowledge of the right indications (which makes their use favorable even in minor hospital centers), the absence of a donor site, the ready availability, the reduction of global costs (if compared to a hospital stay for complex reconstructions), the repeatability of the procedure and its limited duration, the easy management of the postoperative period, the increased patient compliance, the extremely satisfactory results obtained (POSAS evaluation), the low percentage of complications, make dermal inductors an indispensable tool in the hands of the reconstructive plastic surgeon.

### Conclusion

we expect a lot from future prospects in particular from the implementation in the use of dermal inductors with growth factors and / or stem cells (in the last 3 years 32 patients have been treated for post-traumatic cases) able to modulate the inflammatory phase and possibly orient the growth of cell lines duly stimulated in appropriate media towards specific differentiation lines. The already numerous in vitro studies must be followed by appropriate in vivo studies.

## **A-0527** ULTRASONOGRAPHIC EVALUATION OF MORPHOLOGICAL CHANGES IN PERIPHERAL NERVES AFTER TRAUMATIC INJURY AND NERVE REPAIR– A PROSPECTIVE STUDY

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**Introduction:** In recent years, ultrasound (US) has gained importance to visualize morphological changes of injured nerves. After surgical repair, the neural structures changes over time. The correlation of morphologic changes in US with the corresponding nerve function is uncertain. The aim of this prospective study is to demonstrate a correlation of post-traumatic nerve changes with US and possible correlations with nerve function after surgery.

**Methods:** This dual center, descriptive, prospective cohort study was conducted between 05/2017 and 05/2022 and included 19 nerve lesions in 17 patients. Patients were followed up clinically, sonographically and by electroneuromyography. The primary endpoint was to determine the morphological US changes of the nerves including the response of the surrounding tissue after nerve repair. The secondary endpoint was to determine any correlation between morphological US changes and nerve function. Clinical examination included sensibility (S0-S4), pain and motor function (M0-M5). With US nerve cross-sectional area (CSA in mm<sup>2</sup>), number of traversing fascicles, potential hypo echogenicity and presence of perineural scar were analyzed at 6 weeks, 3, 6, 9, and 12 months after surgery. The US morphology at 6 weeks, 3, 6, 9 and 12 months postoperatively was as follows: CSA in mm<sup>2</sup> 20, 25.7, 26.3, 23, 25, respectively; traversing fascicles 10, 10, 15, 12, 11, respectively; hypo-echogenicity 6, 6, 3, 1, 2, respectively; perineural scar 1, 2, 2, 3, 1, respectively.

**Results:** 19 lesions (11 median and, 8 ulnar nerves) of 17 patients with intraoperatively confirmed nerve injury of at least 50% in the forearm were included. Follow-up of at least 9 months was possible in 89% (17 nerves) and 12 months in 68% (13 nerves) with a minimal follow-up of at least 6 months. Results of US are summarized in Table 1. The average CSA in mm<sup>2</sup> was over 20mm<sup>2</sup> throughout the follow-up period, compared to the opposite side where the average CSA in mm<sup>2</sup> was 10.75mm<sup>2</sup> after 6 weeks. Sensibility was at 12 months 1x S1, 5x S2, 6x S3 and 1x S4, Motor function was at 12 months M3-5 in 10 of 13 patients. There is a statistically significant correlation between the number of continuous fascicles in US at 6 months and sensitivity at 12 months ( $p=0.031$ )

**Discussion:** After a surgical nerve suture, the nerve diameter remains enlarged compared to the opposite side even months after surgery. With consistently large CSA's they do not correlate with the increasing nerve function. As early as 6 weeks after microsurgical repair, the first continuous fascicles can be seen by US. Hypo-echogenicity occurs early in the postoperative course and decreases markedly after 9 months. Overall, perineural scarring after neurorrhaphy is minimal. With US, the fascicles, well adapted by a suture, appear in continuity. The positive US examination at 6 months postoperatively may be indicative for sensitivity at 12 months.

**Conclusion:** This study supports the presence of post-traumatic morphological changes in nerve fibers with US after traumatic injury, which may be observed in a correlating sequence with postoperative time and function.

## **A-0528** PSI AND ARTHROSCOPY IN DISTAL RADIUS OSTEOTOMY - MY OWN EXPERIENCE

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Presentation describes the progress of distal radius malunion treatment from the simplest dorsal osteotomy at the beginning to planned osteotomy using computer models. In our practice cuts of the distal radius are currently performed

with the use of individually designed sterile gauges, and reposition of intraarticular fragments is arthroscopically controlled in most of the cases of the intraarticular osteotomy. Development of computer support enables the most complex especially intra-articular osteotomies to be performed, enables early planning for many days before the surgery and ensures that the surgery is performed accurately according to the assumed design in order to achieve the best treatment result. In our opinion computer-designed and arthroscopically controlled intraarticular osteotomies of the distal radius are the greatest advances in the treatment of difficult cases of distal radius malunion.

## **A-0529** A NOVEL METHOD FOR AUTOMATIC THREE-DIMENSIONAL (3D) DETERMINATION OF THE AXIS IN THE SCAPHOID, LUNATE AND CAPITATE IN FOUR-DIMENSIONAL COMPUTED TOMOGRAPHY (4DCT) DATASETS

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**Background:** Four-Dimensional Computed Tomography (4DCT) is a promising new imaging modality for diagnosing wrist injuries. Using 4DCT, wrist kinematics can be quantified non-invasively and dynamically, as multiple 3D CT scans are generated per second while the wrist is moving. A scapholunate interosseous ligament (SLIL) lesion is a common wrist injury associated with kinematic changes in the wrist. Among the parameters reflecting the disrupted wrist kinematics due to SLIL injuries are changed carpal angles. To assess these carpal angles, the first axis of the scaphoid, lunate, and capitate must be determined. Currently, these are manually drawn by the radiologist in 2D x-rays. However, manual assessment of the carpal axes and angles in 4DCT datasets is not feasible due to the large amount of generated data of 144 dynamic scans per 4DCT dataset. For that reason, the current analysis of 4DCT scans is performed by semi-automatic assessment of the carpal angles, using only a few dynamic scans instead of the high number of frames per second and losing valuable information on wrist kinematics. Furthermore, the carpal axes in CT are drawn manually in the 2D sagittal plane, possibly missing the additional information of the third dimension available in CT scans. Therefore, we have developed an algorithm for the automatic determination of the first axis of the scaphoid, lunate, and capitate in 3D in 4DCT datasets. **Method:** The dominant wrist of 31 healthy volunteers (age 20 – 40 years) was scanned. The 4DCT scanning protocol included a conventional static CT scan of the forearm and wrist, followed by two dynamic imaging runs during which radial to ulnar deviation (RUD) and flexion to extension (FE) of the wrist was performed, resulting in 144 dynamic CT scans (72 per wrist movement). Post-processing steps included automatic segmentation and registration of bones from the static scan onto corresponding dynamic positions. In the static scan, axes were determined according to radiology guidelines, and the axes were registered onto the corresponding dynamic position using transformation matrices retrieved from the registration step. The direction of the axes was visually inspected in the static scan and reproducibility was evaluated by applying the algorithm to all dynamic scans.

**Results:** 31 volunteers (16 females, 52%) were included in this study, of which 29 right wrists (94%) were scanned. Axes were successfully determined by the algorithm and registered to the corresponding dynamic position. Reproducibility, expressed in standard deviation, was  $\pm 1.8^\circ$ ,  $\pm 3.4^\circ$ , and  $\pm 3.3^\circ$  for the scaphoid, lunate, and capitate respectively.

**Conclusion:** We have successfully developed an algorithm to automatically determine the axis in 3D in the scaphoid, lunate, and capitate in 4DCT datasets in a reproducible manner. Future research will focus on comparing the position of the manual axes drawn by a radiologist, which are based on a 2D sagittal CT slice, to the automatic axes, which are based on 3D segmentation of the CT scan.

**Keywords:** 4DCT, scapholunate interosseous ligament, carpal angles, carpal axes, automatic

## **A-0530** MASSIVE BONE ALLOGRAFT ENGINEERED WITH AUTOLOGOUS VESSELS: A NEW PERSPECTIVE FOR THE FUTURE

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**Introduction:** In patients with malignant bone tumors, Wide resection is the surgical indication. Following the en-bloc resection, the reconstructive challenge often arises to restore, as far as possible, a function of the limb and consequently a good quality of life. In the case of malignant tumors involving the phalanges and / or metacarpals, an indication may be given to amputation or en-bloc resection and for the reconstruction 1st ray transplants from the foot or allograft from a cadaver are often proposed despite often undergoing infection or resorption. We propose an innovative reconstructive surgical technique that involves the “revascularization” of an allograft in order to increase the possibility of integration and to reduce the risk of resorption and infection for the reconstruction of the phalanx.

**Material and methods:** a 50-year-old man came to our observation for an increasing and painful swelling of the proximal phalanx of the 4th ray of his left hand. Imaging by means of an X-ray, CT and MRI study showed the presence of a cartilage lesion that deformed the bone with interruption of the cortex; she was then subjected to a biopsy examination which diagnosed Chondrosarcoma G3 for which a resection with wide margins was indicated; the phalanx was reconstructed using a revascularized allograft through the passage of a vein graft within the anastomosed bone proximally and distally with a digital artery and the allograft was stabilized by osteosynthesis with plate and screws and by IFP arthrodesis; the MCF joint was instead rebuilt. The patient in the follow-up underwent regular clinical, oncological and radiographic checks.

**Results:** about 12 months after surgery, bone fusion was achieved and due to a dehiscence of the wound at 14 months after surgery, the means of synthesis were removed and a biopsy of the allograft was performed which demonstrated the presence of an effective revascularization. The SPECT scan also showed local absorption similar to that of the surrounding phalanges suggesting bone viability. The patient in the follow-up at 18 months shows no signs of relapse, the ROM of the metacarpophalangeal joint is about 45 °; the patient does not complain of pain and the movement is limited to the fusion of the PIP.

**Conclusions:** the new surgical technique proposed by us seems to be a valid and interesting alternative to the techniques already used as it could favor the biological activity of the allograft facilitating bone remodeling; this technique could be applied in different bone segments if its efficacy was confirmed in a larger number of patients; however, a longer follow-up is needed to confirm good results.

## **A-0531** COMPARISON OF POSTOPERATIVE ULNAR NERVE NEUROPATHY BETWEEN NO TRANSPOSITION AND ANTERIOR SUBCUTANEOUS TRANSPOSITION OF THE ULNAR NERVE IN THE TREATMENT OF THE DISTAL HUMERUS FRACTURE

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**Background and Purpose:** Ulnar nerve management during the operative treatment of the distal humerus fracture depends on various factors such as fracture type, chosen surgical approach and surgeon's discretion for the ulnar nerve management during the surgery. Although several meta-analyses report no benefit of anterior transposition over no transposition, lots of surgeons still perform anterior transposition. The purpose of this study is to compare the rates of ulnar nerve neuropathy following no transposition versus subcutaneous anterior transposition during open reduction and internal fixation (ORIF) of distal humerus fracture in our institution.

**Methods:** A total of 46 patients with distal humerus fractures underwent open reduction and internal fixation with dual plating between 2015 and 2020 were retrospectively reviewed. All patients had no preoperative ulnar nerve symptoms. Postoperatively, the rate of ulnar nerve neuropathy and the severity using McGowan classification were compared between subcutaneous ulnar nerve anterior transposition and no transposition. In cases with postoperative ulnar nerve neuropathy, the degree of recovery was also explored.

**Results:** 17 patients underwent ulnar nerve anterior transposition (group 1) during ORIF, whereas 29 patients had no transposition (group 2). The average age of patients in both groups are 66, 68 years respectively ( $P=0.7$ ). Fracture types using AO/OTA classification were 13-A2 low transcondylar(8), A3(1) C1(2), C2(5), C3(1) in group 1 and A2 low transcondylar(17), A3(2), C1(3), C2(7) in group 2 ( $P=0.8$ ). Immediate postoperative ulnar nerve neuropathy was observed in 8 cases in group 1 and 14 in group 2(22/46 in both groups, mean incidence of 47.8%,  $P=0.53$ ). In Group 1, Ulnar nerve neuropathy was classified as McGowan grade I (4), IIb (2), III (2). In Group 2, 8 was grade I, 3 grade IIa and 3 grade IIb. two (Grade I) out of six cases recovered in the group 1 and six of 15 cases recovered in the group 2 (four grade I, two grade IIa) over the mean follow up 12.2 months.

**Conclusion:** In this study, the incidence of postoperative ulnar neuropathy was higher than reported. Ulnar nerve anterior transposition has no benefit over the no transposition in terms of postoperative ulnar neuropathy. For the severity, ulnar nerve anterior transposition revealed more severe neuropathy.

**Key words;** ulnar nerve, distal humerus fracture

## **A-0532** QUALITY OF LIFE AND WORKING CONDITIONS OF SWISS HAND SURGEONS – A NATIONAL SURVEY

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**Introduction.** Providing high-quality care for patients in hand surgery is an everyday endeavour. Inevitably questions arise about the quality of life of the hand surgeons who ensure this high quality on a daily basis. Work-life balance has become an important factor for hand surgeons. The aim of this study is to evaluate the quality of life and working conditions of Swiss hand surgeons.

**Methods.** We established a national survey. The survey was sent out via e-mail by the Swiss Society for Hand Surgery and the Association of Young Hand Surgeons. The standardised questionnaire could be completed anonymously online via an access link. The core topics were working conditions, quality of life and satisfaction with the profession as well as aspects of private life. The data were analysed as univariable and multivariable models.

**Results.** Approximately 250 hand surgeons were contacted. With 110 completed questionnaires, the response rate was 44%. The respondents are predominantly male (58%). 93% of all respondents are in a partnership, 71% have children and 9% are smokers. 43% state that they are on call 4-7 days per month. This compares to 9% who are never on call. The weekly working hours and duties have a negative impact on the quality of life. More than 50% of the respondents feel stressed by the job even during holidays/leisure time. 88% feel understood and supported by the environment. 85% feel that work affects private relationships. 83% would choose hand surgery again. There is a statistically significant gender distribution in the various positions ( $p<0.001$ ) with chief positions predominantly men (78%) and residents predominantly women (76%). There is a statistically significant association quality of life and satisfaction in terms of job/career, family life, social life and wages. The higher the quality of life, the higher the satisfaction of job/career, family life, social life

and wages ( $p < 0.001$ ). The lower the level of satisfaction in relation to social life, the higher the probability of chronic fatigue, burnout and depression ( $p = 0.018$ ). The lower the quality of life, the more likely it was that people had already thought about leaving the labor market ( $p = 0.035$ ).

**Conclusion.** The various aspects of quality of life (work, family, social) are very differently experienced depending on the position. In conclusion, the profession of hand surgeons in Switzerland is stressful and affects the quality of life. The rates of chronic fatigue, burnout and depression are similar to those reported in the literature for other surgical specialties. The majority of respondents state that a position at an acute hospital for hand surgery would be more attractive to them through fewer services and/or better compensation for working hours and services. The currently very different gender distribution in the various positions will probably decrease in the future and bring further challenges (family structure, part-time work, etc.). As a hand surgeon, you strive every day to improve the quality of life of your patients. It is time to think about your own quality of life and optimize it where possible.

### **A-0533** SURGICAL TREATMENT OF THE HUMERAL FRACTURES SUSTAINED DURING ARM WRESTLING

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**Introduction :** Arm wrestling is increasingly popular among young people because the rules are simple and it does not require any special equipment or arenas. In general, although it may seem like simple and non-traumatic, a variety of injuries can occur. Most of the injuries are soft tissue injuries such as muscular strain but more severe injuries can occur such as humeral shaft fractures.

**Purpose :** The aim of this study was to present the radiologic characteristics and the outcome of the surgical treatment of the humerus fracture sustained during arm wrestling.

**Methods :** Data of patients treated in our hospital with the diagnosis of humeral shaft fracture due to arm wrestling between 2013 and 2021 was retrospectively reviewed. Data collected included age, sex, dominant arm, type and laterality of fracture, presence of radial nerve palsy, other surgical complications, duration of union defined as the time from injury until callus was evident on the radiograph, and the range of motion of the elbow joint at the last follow-up

**Results :** Ten patients were included. Two of ten were female. The mean age at the time of injury were 23 years. Nine patients had right arm fracture and one had left arm fracture. All patients had their dominant arm fractures. All of the fractures were spiral at the distal third of the humerus and the fracture started at average 4.34cm from the medial epicondyle and exited at average 9.22cm from the lateral epicondyle. Medial butterfly fragment was present in one. Nine of the patients were 12-A1 and 1 were 12-B1 according to the AO classification. None had radial nerve palsy on admission. All patients were treated surgically (2 lateral plate, 1 posterior plate, 1 anterior plate, 6 posterolateral plate). Union duration ranged from 7 to 12 weeks with the mean  $8.6 \pm 1.5$ . Postoperatively, two patients treated with lateral plate had radial nerve palsy. These patients recovered completely at the final follow-up. Other complications related to surgery did not occur. At last follow-up, all patients had their full range of motion.

**Conclusion :** Arm wrestling is one of the important causes of humeral shaft fracture in young population. all fractures were spiral type and occurred in the distal third of the humerus starting medially. Satisfactory results can be obtained with conservative or surgical treatment. If surgical treatment was chosen, posterolateral plating is useful in case of distally located fracture for rigid fixation.

**Key words :** humeral shaft fracture, arm wrestling, surgery

## **A-0534** OUTCOME AFTER CUBITAL TUNNEL OBLITERATION FOR ULNAR NEURITIS AT THE ELBOW: A PRELIMINARY REPORT

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Osborne, in 1957, initially suggested obliteration of cubital tunnel as one surgical option for ulnar neuritis at the elbow. However, no case series has been reported since. At our institute, we performed cubital tunnel obliteration for patients with ulnar neuritis at the elbow since 2021. This study aimed to report its short-term follow-up outcome. We reviewed patients who received cubital tunnel obliteration at our institute. Demographic data such as age, sex, and symptom duration were obtained. The ulnar neuritis at the elbow in all patients was confirmed using electrodiagnostic studies. Follow-up data included pain in visual analog scale (VAS), McGowan grade, and any surgery-related complications. Because the surgical indication that was initially limited to the etiology of osteoarthritis (OA) at the elbow later extended to primary cubital tunnel syndrome (CuTS), we analyzed the patients according to the surgical indication. As results, 31 patients (18 men and 13 women) with average 50 years of age were found. Etiology of the ulnar neuritis was primary CuTS in 19 patients (10 men and 9 women; average 44 years of age) and OA in 12 patients (8 men and 4 women; average 60 years of age). Duration of symptom was not different between the groups (28.9 months vs. 40.8 months). Pain in VAS significantly improved after the surgery from 4.5 to 0.8. Improvement in at least one McGowan grade was found in 25 patients (14 patients with primary CuTS and 11 patients with OA) and no change in six patients (five patients with primary CuTS and one patient with OA). None of the patients reported of worsening of the symptom or any surgery-related complications. The average follow-up period was 10.9 (range, 6~24) months. In conclusion, cubital tunnel obliteration might be a good surgical option for patients with ulnar neuritis at the elbow, regardless of the etiology of the neuritis.

## **A-0535** SINGLE- OR BI-COLUMN FUSION VS. PROXIMAL ROW CARPECTOMY IN THE SLAC OR SNAC WRIST TREATMENT, A COMPARATIVE CASE-CONTROL STUDY

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### Background

Comparing Proximal Row Carpectomy with Four Column Fusion in the treatment of SLAC and SNAC conditions, PRC usually results in a better range of motion, while 4CF gives better grip strength. However, 4CF has far more complications due to hardware issues. Recently, 1 or 2CF techniques have been developed as a limited carpal fusion option. A comparative study between PRC and 1/2CF was needed. The present study compares the clinical, radiological, and patient-reported results between PRC and less invasive, 1/2 Column Fusion, in the treatment of painful, SLAC, and SNAC conditions of the wrist.

### Method

We retrospectively included 45 1/2 Column Fusion patients and 15 Proximal Row Carpectomy patients. The treatment of choice was decided by the treating surgeon. Besides gender proportions (1/3 in the 1/2CF group vs 2/3 in the PRC group were female), no demographic differences existed between the groups. Postoperative outcomes for pain, range of motion, grip strength, Quick-DASH, and satisfaction were assessed, and a radiological assessment was performed. The complication- and revision rates were analyzed.

## Results

With a mean age of 58 years (range 35-76), the 1/2 CF cohort had a mean follow-up of 35 months. With a mean age of 60 years (range 31-77), the PRC cohort had a mean follow-up of 42 months. The 1/2 CF group performed significantly better, compared with PRC group regarding pain, grip strength, radial-ulnar motion, and the q-DASH: (p-value = 0.002), (p-value = 0.008), (p-value = 0.003), (p-value = 0.002), respectively. Differences in volar-dorsal motion between the groups were insignificant (p-value = 0.525). A higher conversion rate to total wrist fusion was observed in the PRC Group. All the PRC patients had osteoarthritis at follow-up, whereas it was seen in 19% of the 1/2 CF patients. The patient-reported satisfaction was substantially better in the 1 & 2 Colum Fusion group.

## Conclusion

Among patients treated for SNAC and SLAC wrist conditions, the findings of pain, grip strength, and qDASH are in favor of 1 and 2 Column Fusion compared to Proximal Row Carpectomy at the short to mid-term follow-up. The ROM for the radial-ulnar movement was superior in the 1/2 CF group, while the ROM for the volar-dorsal movement was surprisingly not different. The conversion rate to total wrist fusion and occurrence of degenerative osteoarthritis was higher for the patients treated with Proximal Row Carpectomy, while patients treated with limited carpal fusion technique showed better satisfaction scores.

## **A-0537** WIDE RESECTION FOR GIANT-CELL TUMOR OF THE DISTAL RADIUS: OUR EXPERIENCE WITH VASCULARISED FIBULA RECONSTRUCTION

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**Introduction:** Giant cell tumor (GCT) is a primary bone tumor characterized by local aggressive behavior. The most frequent sites of localization are the metaphyseal regions of the distal third of the femur and proximal of the tibia. The distal third of radius represents the third site by frequency and is apparently characterized by a higher aggressiveness and recurrence rate. In 2-5% of cases, GCT can metastasize to the lung. In the case of injuries classified as grade 1 Cowbells, curettage followed by the application of local adjuvants and wading is suggested as surgical treatment; in the case of a higher grade diagnosis of Campanacci, the treatment of extensive resection of the lesion is preferred. The reconstructive techniques proposed following the en-bloc resection are divided into two main groups: arthroplasty and arthrodesis, both of which can be reached with numerous different surgical techniques. The purpose of this study is to analyze the short and long-term results of 5 patients with GCT undergoing resection and reconstruction with a free vascularized fibula flap with an arthrodesizing function.

**Material and methods:** from May 2018 to November 2021 5 patients diagnosed with grade 3 GCT according to Campanacci underwent extensive resection of the lesion and reconstruction with a free vascularized fibula flap; the reconstructive choice was performed in order to increase the possibility of consolidation by providing the greater biological power of a vascularized bone and in order to confer a more stable and strong pulse in patients with high functional demand. Of the 5 patients, 4 were treated with denosumab preoperatively and only 1 also in the postoperative period (the only patient with lung metastases). Patients underwent oncological, clinical and functional follow-up every 3 months using radiographic studies and DASH and VAS questionnaires.

**Results:** the mean follow-up was 22.4 months; none of the patients showed signs of relapse; of the 4 patients who did not have metastases before surgery, none developed and the patient who already had lung lesions did not progress in the follow-up. Fusion was achieved in all patients with a mean of approximately 9 months; pronation-supination is complete in all patients

and the DASH values improve with increasing follow-up, particularly in the 1st year. There was only one complication of the donor site with ELA deficiency and one complication of the recipient site with an outbreak of pseudarthrosis treated promptly with reclamation of the same and iliac crest graft.

**Conclusions:** The reconstruction of the distal radius following en-bloc resection for GCT represents a challenge for the reconstructive surgeon since in the face of a large resection, necessary for oncological requests, a reconstruction that is the most anatomical, functional, is sought. stable and durable as possible. Reconstructions with vascularized bone, having a biological advantage, although technically more complex, are more reliable.

## **A-0538** CURRENT TREATMENT AND PATIENT-REPORTED OUTCOMES OF FRACTURES AND DISLOCATIONS OF THE METACARPAL AND PHALANGEAL BONES OF THE HAND IN THE NETHERLANDS; A MULTICENTRE SNAPSHOT STUDY OF 1679 PATIENTS

L. de Haas, D. Salentijn, B. van Hoorn, R. van Veen, D. van der Velde, N. Schep, M. van Heijl - On behalf of the trauma, plastic surgeons of<sup>1,2</sup> hospitals in the Netherlands, from the Snapshot Handfractures Collaborative Study Group: Louise de Haas<sup>1</sup>, Hanneke van Oorschot<sup>1</sup>, Elke Arts<sup>2</sup>, Said Bachiri<sup>3</sup>, Reinier Bekes<sup>3</sup>, Leonie Blom<sup>3,4</sup>, Doeke Boersma<sup>5</sup>, Jan ten Bosch<sup>7</sup>, Floor ter Brugge<sup>8</sup>, Niels Bruggeman<sup>9</sup>, Brigitte Heijden<sup>5,6</sup>, Priscilla Jawahier<sup>10</sup>, Pieter Jooose<sup>3</sup>, Siegrid de Meer<sup>8</sup>, Amanda Nijhuis<sup>5</sup>, Jan Siert Reinders<sup>9</sup>, Luke van Rossenberg<sup>1</sup>, Dorien Salentijn<sup>11</sup>, Friso Schonk<sup>7</sup>, David Tas<sup>12</sup>, Michiel Teijgeler<sup>4</sup>, Tim Timmers<sup>13</sup>, Ruben van Veen<sup>11</sup>, Detlef van der Velde<sup>12</sup>, Stephanie Zielinski<sup>2</sup>, Niels Schep<sup>10</sup>, Ivar de Bruin<sup>14</sup>, Bastiaan van Hoorn<sup>1</sup>, Mark van Heijl<sup>1,14</sup>

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### Introduction

Despite the high incidence and economic burden of hand injuries, the optimal treatment remains controversial. This study investigates the current treatment strategies, complications and patient-reported outcomes of fractures and dislocations of the hand.

### Method

This multicentre snapshot study included all adult patients with fractures and dislocations of the metacarpal and phalangeal bones of the hand in 12 hospitals in the Netherlands, between August and November 2020. Treatment strategy per injury group (functional treatment, immobilization and surgical treatment) complication rate and Michigan Hand Outcomes Questionnaire (MHQ) three months after injury were evaluated (min-max 0-100, normative value 95.2).

### Results

In total, 1679 patients (median 40, IQR 27-59) were included, with 1862 fractures and dislocations of which 603 (32%) were treated with functional treatment, 969 (52%) with immobilization and 290 (16%) surgically. Of all immobilized hand injuries, 52% were immobilized for more than 21 days. Extra-articular metacarpal fractures of digit 2-5 were most often treated surgically; 43% (n=75) with k-wire fixation 36% with plate and screw fixation and 20% with screw fixation.

The complication rate was 2% for conservative and 5% for surgical treatment. The median MHQ score for conservative treatment was 77.6(IQR 63.4 ; 88.3) and for surgical treatment 75.8(IQR 63.3;81.9).

#### Conclusion

This is the first multicentre study worldwide describing the current treatment of these hand injuries. What stood out was the relatively long duration of cast immobilization and the variation in operative techniques. All MHQ scores were substantially lower compared with MHQ scores of healthy subjects, indicating a poor hand function three months after trauma.

### **A-0540** SIMPLIFYING MANAGEMENT OF PENETRATING INJURIES: LITERATURE REVIEW AND FAST-TRACK APPROACH PROPOSAL

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Among penetrating traumas, impalement injury are uncommon high-energy lesions caused by foreign bodies piercing and remaining interposed in body cavities or extremities. Despite their spectacular presentation impalement injuries affecting the limbs are rarely life-threatening. There is general consensus that the foreign body should be removed in protected environment (preferably the operating theatre for sterility and better pain management) and that in the pre-hospital setting any attempt should be avoided as it may aggravate haemorrhage. Preoperative radiogram is considered mandatory to evaluate the shape of the object and the presence of additional fragments. The review of the literature shows that in most cases these injuries usually have a favourable outcome without intraoperative or postoperative complications. We analysed six patients who were admitted to our hospital with impalement injury of the upper limb. All patients were classified according to age, gender, foreign body type, accident site, injury zone, treatment received, anaesthesia type, complications, wound healing time, functional recovery. We had 2 cases of needle transfixing the distal phalanx of the thumb, 1 iron fence penetrating the palm, 2 drill bits in 1 case impaling the palm and in the other one the distal forearm and 1 gun cleaning brush piercing the palm. At physical examination none of the patients presented signs of neurovascular damage or compromised function. All patients were investigated preoperatively with radiograms and in 1 case an angio-CT study was conducted. 5 cases were treated under local anaesthetic, 1 case with brachial plexus block. The surgery consisted in all cases in removing the foreign body by pulling or rotating it, in one case we also had the wound explored to check the integrity of neurovascular pedicles and tendons. Antibiotic prophylaxis with amoxicillin-clavulanate was administered in all cases and was continued in the postoperative period. One half of the patients were treated successfully in the emergency department, the other half was operated in the operating theatre. We experienced no intraprocedural complication. 5 patients were discharged just after surgery and checked in the office on the following day and then on weekly basis to rule out supervised complications. One patient was discharged on the second day after surgery. Average wound healing time was 14 days. We had only one minor complication (wound dehiscence), treated in the office. We experienced no infection. All patients had full functional recovery. There were no difference in terms of complications and outcomes between the group treated in the emergency department and the one treated in the operating room. In this time of pandemic and economic uncertainty and subsequent restricted availability of operating sessions and financial resources we think that any unnecessary procedure and hospitalization should be avoided. We think that this kind of injuries in most cases after physical examination with thorough neurovascular and motor function

assessment, detailed history collection and radiograms execution can be safely treated in the emergency room in tertiary referral hospitals with strict outpatient follow-up.

## **A-0541** DISTRIBUTION AND CURRENT TREATMENT STRATEGIES OF PAEDIATRIC HAND FRACTURES AND DISLOCATIONS: A MULTI-CENTRE SNAPSHOT STUDY OF 814 PATIENTS IN THE NETHERLANDS

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### Background

Worldwide, the hand is the second most common fracture site in the paediatric population. Despite the high occurrence, optimal management is still a matter of debate. Studies evaluating the current treatment of these fractures are limited. We aim to describe the fracture distribution and associated current treatment strategies of fractures and dislocations of the metacarpal and phalangeal bones in pediatric patients to identify areas for further research. As a second aim we compare treatment strategies within each injury group to identify if variation exists.

### Methods

A multicentre observational, resident-led snapshot study was conducted in 12 hospitals in the Netherlands over a three-month period. All consecutive patients, aged 0-17 years, with metacarpal or phalangeal fractures and dislocations of the hand were analysed. We documented the distribution of the fracture and dislocation injury groups, classified based on the AO/OTA classification system, and the adherent treatment strategies including surgical treatment, functional treatment, immobilization and duration of immobilization.

### Results

In total, 814 patients (median age 13 years, IQR 10-15) with 873 fractures or dislocations were included for analysis. The number of fractures within the 41 identified injury groups ranged from 0-164. Epiphyseal fractures of the proximal phalanx (P1) were most common (n=164, 21.8%), followed by volar avulsions of the proximal interphalangeal (PIP) joint (n=103, 13.7%) and shaft fractures of the P1 (n=90, 12.0%). Of 865 fractures and dislocations included for analysis of definitive treatment, 5.4% (n=47) was treated surgically, 34.8% (n=301) received functional treatment, and 59.8% (n=517) was immobilized. For digital phalangeal fractures and dislocations the proportion of functional treatment was high (46.9%) compared to other bones. Variation in treatment strategy was most explicit for the choice of functional treatment and immobilization and was especially observed in the most common injury groups P1 epiphyseal fractures, PIP-joint avulsions and P1 shaft fractures.

## Conclusion

Metacarpal and phalangeal fractures of the hand are common. However, the fractures are unevenly distributed over the 41 injury groups, and in a large proportion of these injury groups fractures are uncommon. This may explain the current lack of evidence based treatment recommendations. This study provides an overview of the current treatment strategies per injury group revealing variation in treatment method and duration of immobilization, highlighting the need for future studies to investigate optimal treatment methods. The results can be used to strengthen the research design and methodology of future studies (for example to evaluate feasibility and calculate sample sizes) and to support in drafting guidelines with the ultimate goal to fill the current knowledge gap in the literature and improve treatment. This study provides direction for future research by identifying variation in conservative treatment strategies for the most common injury groups; P1 epiphyseal fractures, PIP-joint avulsions and P1 shaft fractures, for which comparative studies should be initiated.

## **A-0542** UPPER LIMB PERIPHERAL NERVE TUMORS AND TUMOR LIKE LESION: OUR EXPERIENCE IN THE LAST 10 YEARS

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Peripheral nerve tumours (PNT) are rare lesion, often asymptomatic. Knowledge of the surgical treatment is mandatory to avoid neurological deficit.

We retrospective review tumor lesions and tumor like lesions in our practice in Hand Surgery, Elbow Surgery and Microsurgery Unit in the last 10 years,

The most common pathological diagnosis was Schwannoma, followed by neuroma, intraneural lipoma and neurofibroma. Complete tumor resection was achieved in all of the patients always with intraoperative neurophysiological stimulation. The most common postsurgical complication was transient sensory disorder.

Therapeutic management of benign tumors (such as Schwannomas) mainly if clinically asymptomatic still remain challenging. Don't forget malignant lesions, despite rare, requiring accurate planning thinking also about the postoperative neurological deficit. Biopsy remains a controversial procedure and no consensus found in literature we review. In our opinion, biopsy is not necessary in most cases.

## **A-0543** NOT SO EASY TO SEE: MISTAKES IN PHALANGEAL FRACTURES

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### Introduction:

Phalangeal fractures can cause considerable morbidity and reduced quality of life. Unfortunately, errors in hand management may occur in Emergency Departments and lead to serious consequences and long-term disabilities as it delays treatment. It's also one reason of potential successful claims from patients. The aim of this study was not only to provide basic principles and our treatment algorithm, but also show complications of mismanagement.

### Methods:

The authors retrospectively analysed phalangeal fractures that were mismanaged in the emergency department (ED)

and posteriorly send to our plastic surgery consultation between 2018 and 2021. Patients treated conservatively were excluded. Illustrative cases were selected.

Results:

A total 59 patients were included. The first phalanx was the bone with the high number of mismanagement and the fourth finger was the most frequent. The mistakes occurred in these 3 stages: diagnosis, reduction or osteosynthesis

Discussion/Conclusion:

Even though undesirable, hand fractures mismanagement still occurs frequently, and it may happen in any of stage treatment.

Neglect or inadequate treatment can lead to significant disability, given the intricate relationship between the flexor and extensor tendons, and the architecture of the phalanges.

Radiographs remain the mainstay for fracture assessment, radiological examination of a fracture must be performed carefully and should not be limited to one single view.

Reduction and osteosynthesis are the key to obtain better clinic and surgical results.

### **A-0544** MANGLED HAND: WHERE TO BEGIN AND HOW FAR CAN WE GO?

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The mangled hand is like a puzzle with missing pieces that will defy hand surgeons to plan and reconstruct multiple structures with extensive lesions.

Careful assessment is the first step. The physician must know when to act and should have a clear plan for how it will be done. Debridement should be done in a meticulous way, as infection remains the most important negative determinant and is prevented by emergent radical debridement.

Hand surgeons should be creative and take advantage of viable tissues that would otherwise be eliminated, to obtain the greatest possible functionality of the hand.

Bone shortening may also offer many advantages, as it avoids grafts, decreases tension on anastomoses and decreases the need for flap coverage.

Skeletal stabilization should be always addressed in the first surgery and complete soft tissue reconstruction should be one of the main concerns as tendon contracture begins very early. When we talk about hand surgery time early mobilization is essential and delaying reconstruction might have costs in joints and tendons movements.

The authors propose a set of principles that must be respected when approaching the mangled hand in the emergency department through clinical cases, to facilitate therapeutic strategy and decision-making in hand reconstruction.

### **A-0545** AN EVIDENCE-BASED ALGORITHM FOR THE APPROACH AND MANAGEMENT OF FLEXOR TENDON RUPTURES

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Objectives: While the nuances of flexor tendon repair have evolved significantly over the past decade, tendon rupture remains one of the most significant complications with published rates of rupture post repair ranging from 0 to 9.4%.

While reasons for rupture are multifactorial, there remains ambiguity on the subsequent management of these patients. We attempt to rectify this by creating an algorithm for the approach and management of flexor tendon ruptures based on a systematic review of the literature.

Materials and Methods: PRISMA guidelines were adhered to, and flexor tendon rupture mesh terms were searched for on Embase, MEDLINE, CENTRAL, and ClinicalTrials.gov without date limitations.

Articles were categorised into tendon healing biology, diagnosis, causes of rupture, timing of treatment, operative techniques, and rehabilitation. Two independent reviewers evaluated the articles for inclusion. A simplified algorithm for management was subsequently devised.

Results: 3448 articles were identified and underwent title screening to yield 155 articles that were reviewed as abstracts. 71 full text articles were assessed for eligibility and 22 studies were included. Data around patient demographics, operative management and outcomes was extracted from papers to allow for formulation of a management algorithm. We postulate that following loss of DIPJ/IPJ function post repair, the patient has high probability of rupture if they are diabetic, had a thumb FPL injury, a bulky zone-2 repair or were non-compliant/overzealous with therapy. The best modality for confirmation of rupture is high-resolution ultrasound. If less than 2-weeks post repair, immediate surgical exploration and secondary repair within 72-hours is advocated. If the tendon gap is less than 1cm, then a direct re-repair is recommended. If it is over 2-weeks post rupture or tendon gap is greater than 1 cm, a 2-stage tendon reconstruction or DIPJ/IPJ fusion has favourable outcomes. These options must be discussed in detail with the patient prior to surgery to prepare for any eventuality. Our step-by-step algorithm to patient management is pictorially displayed in a flowchart. Conclusions: Management of flexor tendon injuries and post operative rupture remains a challenge in the modern era of hand surgery. The outcome of flexor tendon rupture has a significant impact on hand function. To the author's knowledge, there is no published algorithm for the evidence-based management of flexor tendon ruptures after repair to date in the literature. Our algorithm aims to provide a simplified evidence-based guideline to promote prompt standardised decision-making and prevent disability.

1. Tang JB. Outcomes and evaluation of flexor tendon repair. *Hand Clin* 2013;29(2):251-9. (In eng). DOI: 10.1016/j.hcl.2013.02.007.

## **A-0546** MAGNETIC RESONANCE NEUROGRAPHY IN THE MANAGEMENT OF COMPLEX PERIPHERAL NERVE INJURIES

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### Introduction:

Peripheral nerve injuries (PNIs) diagnosis and therapeutic assessment are challenging and are usually based on clinical and electrophysiological examinations. Electromyography and nerve conduction studies are useful in determining the localization, pathophysiology, acuity, and severity of neuropathies. At the same time, ultrasound and magnetic resonance are the most far-reaching modalities for peripheral nerve imaging. Nevertheless, some focal lesions are difficult to evaluate with these techniques.

Optimizing magnetic resonance with volume and cinematic rendering software, magnet and coil technology, nerve-specific contrast enhancement, and diffusion and tensor imaging have led to Magnetic Resonance Neurography (MRN). These diffusion-based neurographies provide more precise details to determine microstructural alterations and grade nerve injury so functional abnormalities can be detected in patients with no relevant findings in conventional morphological studies.

#### Methods:

We present a series of 10 cases to show the usefulness of MRN in the diagnosis and management of PNIs that were not possible to assess only with physical, electrophysiological, ultrasound, and traditional magnetic resonance examinations.

#### Results:

With MRN, we have been able to diagnose and handle successfully complicated PNI cases and evaluate our surgery results with pre- and post-surgical assessments. We have observed a high correlation between the information provided by MRN and surgical findings.

#### Conclusion:

MRN allows to visualize complex nerve structures and their anatomic relations along their entire pathway in 3 dimensions, distinguishing them from surrounding vasculature and tissue in a noninvasive manner. It also gives information about the nerve's fascicular structure, local and intrinsic fluid status, contrast enhancement pattern, and muscle function.

This has allowed the progress from a morphological qualitative study to a functional, quantitative assessment that has been unified in the Neuropathy Score Reporting and Data System (NS-RADS). This scale quantifies the severity of peripheral nerve damage and can therefore be helpful to establish a prognosis, decide the most suitable treatment and monitor its effectiveness.

### **A-0547** PHYSICAL- AND OCCUPATIONAL THERAPY FOR PATIENTS WITH A PERIPHERAL NERVE INJURY IN THE UPPER EXTREMITY - AN EVIDENCE BASED CLINICAL GUIDELINE

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#### Introduction:

Peripheral nerve injury (PNI) to the upper extremity (UE) is a common trauma causing pain, discomfort and poor UE function. Consequently, patients often experience difficulties with performing daily activities and attending work. There is currently no national evidence-based rehabilitation guideline after UE PNI in Norway.

#### Aim:

To develop an interdisciplinary evidence-based guideline for physiotherapy (PT) and occupational therapy (OT) interventions.

#### Methods:

This guideline is developed according to The Appraisal of Guidelines for Research and Evaluation (AGREE) Instrument. AGREE includes scientific evidence, clinical - and patient experience. The literature search included UE PNI (contusion or laceration) with sensory and/or motor deficits. We excluded congenital disorders, nervous system diseases, brachial plexus and digital nerve injuries, compression syndromes and patients requiring replantation surgery.

Systematic literature searches were conducted across various medical databases with help from a librarian. Studies published between 2000 and 2022 were included and screened based on title, abstract and full text. Two experienced hand therapists critically evaluated relevant articles and reviewed reference lists.

Therapists across Norway (at local and university hospitals) participated in a digital meeting sharing their experiences and treatment protocols. We also discussed with therapists internationally. Additionally, three patient representatives were interviewed.

#### Results:

In total, 1762 articles were identified, 66 critically appraised, and nine were finally included based on quality and relevance.

Eight studies evaluated the outcomes of sensory relearning: three reviews, four RCTs and one qualitative study. All confirmed effects of sensory re-learning on sensory outcomes and hand function, but few were high-quality studies. The last study found improved dexterity using dynamic orthosis versus static and no orthosis after radial nerve palsy. No studies about rehabilitation after injury to the axillary nerve or the musculocutaneous nerve were identified.

The therapists at Norwegian university hospitals treated patients with nerve injury routinely, but few had local guidelines for rehabilitation. The university hospitals with established hand therapy departments reported longer follow-up periods and a more complex approach, compared to newly established and local departments where the number of patients often relied on the hand surgeon. All therapists prioritized information, passive range of motion and sensory relearning as important elements in the rehabilitation.

The patient representatives highlighted that their therapist was crucial during the rehabilitation process and the importance of individualized exercises and detailed information about injury, prognosis and treatment.

The evidence-based guideline will consist of general interventions for all PNI and specific interventions for radial, median and ulnar nerves. A leaflet for pediatric and adult patients will be developed. The guideline will be available online after final approval by Oslo University Hospital.

Conclusion:

Scientific evidence for rehabilitation interventions of UE PNI was sparse. Thus, the evidence-based guideline is mainly based on clinical experience from therapists across Norway. UE PNI are complex and requires advanced rehabilitation. The guideline will provide a framework for PT and OT in clinical care, yet individual adjustments are necessary.

### **A-0548** STAGE 3 KIENBOCK DISEASE: A NEW FIXATION TECHNIQUE FOR CUSTOM MADE LUNATE PROSTHESIS

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In stage 3 Kienbock disease, lunate excision and prosthetic arthroplasty is a valid treatment option. Recently, 3D printing was able to improve the prosthetic design, allowing a precise matching to each patient. The main controversy is the prosthesis stability and how to avoid misalignment in the carpus. In this study we present a new fixation technique that increases prosthetic stability. Starting from the original anatomical model, we created new tunnels in the distal e in the dorsal part, in order to stabilize it with 3 anchors to the surrounding carpal bones.

We treated 2 patients, a 23 years old male, and a 42 years old female, affected by symptomatic Lichtman stage 3 Kienbock disease, with lunate excision and custom made 3D printed lunate prosthesis (3D medica).

Preoperative bilateral wrist CT scans were performed to create the custom made lunate prosthesis. From the impaired wrist we recreated the lunate external shape, while the correct proximal lunate surface was obtained from the contralateral wrist. They were printed in titanium alloys, and then refined with a smooth surface. We created 1 volar and 3 dorsal tunnels, in order to fix the prosthesis to the capitate, the scaphoid and the triquetrum with 1.4 soft anchors.

Patients had x-rays and received a clinical examination preoperatively, and 6 to 12 months post op.

Surgery was performed with a brachial plexus block, and it lasted 60 mins on average.

The VAS score for wrist pain was 8 and 9 pre-operatively, and 0 and 1 at the last follow up.

Dash score was 35.5 and 65.9 pre-operatively, and 5.2 and 18.3 at the last follow up.

Jamar test showed an increase in wrist strength of 65% and 70%.

Mean wrist range of motion in flexion-extension went from 23° to 78°.

Both patients resumed their working activities. The younger patient was even able to resume his sporting activity (basketball).

In patients affected by stage 3 Kienbock disease, prosthetic arthroplasty is a valid treatment option. Short term results are encouraging, and they leave the possibility for further surgeries in the future, in case it becomes necessary. The most frequent and debated complication is the implant stability. In our patients, we achieved a good implant stability, thanks to additional prosthetic tunnels, that allow a stable fixation with bone anchors. We had no DISI or VISI misalignment, and no increased scapho-lunate or luno-triquetral spacing.

Longer follow-ups are necessary to verify long term results.

## **A-0551** HYPERACUTE C7 PALSY IN HERPES ZOSTER INFECTION IN IMMEDIATE FOLLOWUP AFTER ARCADE OF FRÖHSE DECOMPRESSION

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Herpes Zoster infection is the reactivation of a latent varicella zoster virus that caused chicken pox. It occurs in the dermatome innervated by the ganglion where the virus varicella zoster resides for life until stress, immunosuppression or some other condition and allows it to travel to the skin served by the affected nerve.

Usually it is presented with dermatologic manifestations as rash associated to pain or itching. Commonly associated complications are meningoencephalitis, myelitis, cranial palsy, gastrointestinal disorders, stroke or cardiovascular events. A less known complication to this infection is a peripheral motor palsy that is seen in 0.5 and 31% of the patients affected by this disease depending on the series described.

We present a case report of a patient that underwent to a posterior interosseous nerve decompression at the arcade of Fröhse. The patient was reviewed one week after the surgery without any concerning sign and the sutures were removed and postoperative instructions given.

Fifteen days after the operation, the patient asked for a new follow-up appointment due to pain, rash and EPL and EIP palsy on the operated arm. An herpes zoster infection was suspected and acyclovir and steroids were prescribed. Also Alfa Lipoic acid and gamma-linoleic, honokiol, selenium, vitamins B1, B2, B6 and C and E were recommended to the patient. An urgent nerve conduction studies were requested. Those studies showed a C7 hyperacute radiculopathy with limited muscle fibers recruitment in the EIP muscle, being normal other investigated muscles depending on C5-C6-C8 and T1 roots and radial nerve.

Due to the normality in the neurotrophic sensitivity of the superficial branch of the radial nerve, a preganglionic lesion of the C7 root was diagnosed due to herpes zoster infection.

We point surgery as a stressing factor to develop an Herpes Zoster infection

## **A-0552** WIDENING THE INDICATIONS OF INTRAMEDULLARY CANNULATED HEADLESS SCREWS IN THE TREATMENT OF METACARPAL AND PHALANGE FRACTURES AND MALUNIONS

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### Introduction

Intramedullary cannulated headless screws (ICHS) have been proven to be an effective and less aggressive treatment method for selected fractures and malunions of metacarpals and phalanges compared to previous methods of fixation. This technique has been proven for unstable transverse and short oblique fractures and extraarticular malunions of metacarpals and phalanges.

This technique is contraindicated in open epiphysis or infection; and is not recommended for long oblique fractures or when partial cortical continuity cannot be re-established in diaphyseal fractures. We have not found evidence of whether this technique should be used in intraarticular fractures or malunions or children.

### Material and Methods:

We present a series of 3 cases to show that the indications of this technique can be broadened to some selected cases. The first case is a phalange fracture in a 14-year-old child treated with a closed reduction and fixation with ICHS. The other two cases are malunions after intraarticular phalange fractures that are corrected with osteotomy and ICHS fixation.

### Results:

All cases presented a satisfactory evolution, and patients were able to return to their academic and professional life. No complications were observed.

### Conclusions:

Unstable transverse or short oblique fractures with different degrees of comminution in the phalanx and metacarpal are amenable to intramedullary ICHS fixation. In the case of malunions, this technique has been recommended for extraarticular malunions.

It has been determined in the literature that absolute contraindications for using the ICHS include the presence of an open epiphysis or an infection. This method has been discouraged for the treatment of long oblique fractures, marginal or diaphyseal fractures when partial cortical continuity cannot be re-established.

No evidence suggests whether ICHS has an age limit for its use. Also, we have not found any evidence of malunions secondary to intraarticular fractures that have been corrected with this technique. Therefore, we believe that the ICHS technique's indications should be further studied so that this minimally invasive and effective technique can spread its indications.

## **A-0555** LONG-TERM OUTCOMES OF TARGETED MUSCLE REINNERVATION FOR THE TREATMENT OF NEUROPATHIC PAIN: A CROSS-SECTIONAL STUDY

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### Background:

During targeted muscle reinnervation (TMR), sensory or mixed motor nerves are transferred to motor branches innervating

nearby redundant muscle. TMR has shown effectiveness in preventing the onset of neuropathic and phantom limb pain when used prophylactically at the time of limb amputation but has also been gaining popularity in the treatment of neuropathic pain. However, there is limited literature on the long-term outcomes of TMR in treating neuropathic pain.

#### Methods:

In this cross-sectional study, we invited all patients that underwent TMR to treat neuropathic pain in the upper- or lower extremity with a follow-up of  $\geq$ six months to fill out Patient Rated Outcome Measures (PROMs). The primary outcome was pain on the 10-point Visual Analog Scale (VAS). Secondary outcomes were the presence of neuropathic pain (score  $\geq$ four on the Douleur Neuropathic 4 (DN4) questionnaire), function of the upper- (PRWHE questionnaire) and lower (LEFS questionnaire) extremity, and quality of life with the EQ5D questionnaire.

#### Results:

Fourteen patients were included, with 22 performed TMRs. Eight patients underwent TMR in the lower extremity and six in the upper extremity, with a median follow-up of 24.5 months (IQR 9.75-35). The median VAS score was 3.5 (IQR 0-7.0), with 7/14 patients scoring  $\leq$ 3. Six out of seven patients with a VAS  $\geq$ 3 reported the presence of neuropathic pain (42.9%). Patients reported median LEFS scores of 18.0 (IQR 5.8-42.0) and PRWHE scores of 27.3 (IQR 13.8-44.9). EQ5D profiles showed deficits in quality of life that was most pronounced in the dimensions of mobility, pain/discomfort, and ability to participate in daily activities.

#### Conclusions:

TMR offers a novel treatment in the management of neuropathic pain in the upper or lower extremity. PROMs reported in this relatively small cross-sectional study indicate that TMR achieves sustained absence of neuropathic pain in approximately 60% of patients.

## **A-0556** ARTHROSCOPICALLY ASSISTED TREATMENT OF SCAPHOID NONUNION. SHORT-TERM RESULTS

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### Background

Nonunion is one of the most common and challenging complications of scaphoid fractures. Since scaphoid fractures occur more commonly in young individuals, appropriate treatment is necessary in order to restore carpal biomechanics and prevent the adverse sequelae of scaphoid nonunion advanced collapse that ultimately leads to wrist arthritis. Wrist arthroscopy is a minimally invasive technique that causes minimal damage to the soft tissues and enables the direct visualization of the fracture site, the evaluation of the need for autologous grafting and the compression of the fracture under direct visualization.

### Objectives

The aim of the present study was to assess the functional outcomes of patients that underwent arthroscopically-assisted scaphoid nonunion fixation with autologous grafting.

### Patients and Methods

This was a retrospective study. The data of patients with scaphoid nonunion that underwent arthroscopically-assisted fixation with autologous grafting from 2019 to 2021 at our center were collected and analyzed. The sample size consisted of 17 patients (14 males – 3 females). The mean age of the patients was 27 years of age (range=18-44). Diagnosis was made with x-ray and computed tomography (CT) imaging. In 12 patients the fracture was located at the waist and at 5

patients at the proximal pole. Autologous graft was used in all cases (7 from iliac crest, 6 from radius, 4 from olecranon). The average time from injury to surgery was 12 months (range=2-60). Surgery performed under mini C-arm fluoroscopy. Closed reduction was achieved and the screw was inserted percutaneously. The minimum follow-up was set to 6 months, with monthly radiological and clinical evaluation. The parameters that were included in the study were the time to union, post-operative pain with Visual Analogue Scale (VAS) score, the range of motion (wrist flexion and extension deficits) and functional outcomes measured with Mean Disabilities of the Arm, Shoulder, and Hand (DASH) and MAYO Wrist score (MWS).  
Results

Demographic data showed that at 29.4% of the patients the dominant hand was involved, at 41.18% the right extremity and that 52.94% of the patients were high demand manual workers. The mean follow-up was  $12.9 \pm 6.8$  months (range=6-23). Union was achieved at 94.1% of the sample (16 of 17 patients) at a mean of  $12 \pm 2.6$  weeks. Union was confirmed with radiologic evaluation for most patients and CT was needed for 3 patients. The extension deficit was  $18 \pm 3.2$  degrees and the flexion deficit  $10 \pm 3.6$  compared to the contralateral side. Functional outcome was significantly improved with mean DASH decrease from  $27.32 \pm 9.32$  pre-operatively to  $4.99 \pm 5.21$  ( $p < 0.001$ ) and mean MWS increase from  $52.63 \pm 18.3$  to  $87.22 \pm 13.25$ ,  $p < 0.001$ . Pain was, also, significantly decreased from  $4.82 \pm 1.3$  to  $1.77 \pm 1.56$ ,  $p < 0.001$ .

#### Conclusions

The results of the present study are in line with current literature, indicating that wrist arthroscopy is a valuable tool in the setting of scaphoid nonunion, providing satisfactory functional outcomes.

## **A-0557** ANATOMY OF THE SUPERFICIAL RADIAL NERVE AND ITS TARGET NERVES FOR TARGETED MUSCLE REINNERVATION: AN ANATOMICAL CADAVER STUDY AND CASE SERIES

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#### Background

Targeted muscle reinnervation (TMR) is a surgical procedure for treating symptomatic neuroma, in which the neuroma is removed and the proximal nerve stump is coapted to a donor motor branch innervating a nearby muscle. This study aimed to identify optimal motor targets for TMR of the Superficial Radial Nerve (SRN).

#### Methods

Seven cadaveric upper limbs were dissected to describe the course of the SRN in the forearm and motor nerve supply – number, length, diameter, and entry points in muscle of motor branches - for potential recipient muscles.

#### Results

The radial nerve provided three (3/6), two (2/6) or one (1/6) motor branches to the brachioradialis (BR) muscle, entering the muscle  $21.7 \pm 17.9$  to  $10.8 \pm 15$  mm proximal to the lateral epicondyle. One (1/7), two (3/7), three (2/7) or four (1/7) motor branches innervated the extensor carpi radialis longus (ERCL) muscle, with entry points  $13.9 \pm 16.2$  to  $26.3 \pm 14.9$  mm distal from the lateral epicondyle. In all specimens the posterior interosseous nerve gave off one motor branch to the extensor carpi radialis brevis (ECRB), which divided in two or three secondary branches. The distal anterior interosseous nerve (AIN) was assessed as potential recipient for TMR coaptation and had a freely transferable length of  $56.4 \pm 12.7$  mm.

## Conclusions

When considering TMR for neuromas of the SRN in the distal third of the forearm and hand, the distal AIN is a suitable donor target. For neuromas of the SRN in the proximal two thirds of the forearm, the motor branches to the ERCL, ERCLB, and BR are potential donor targets.

## **A-0559** ARTICULAR INVOLVEMENT WITH RETROGRADE HEADLESS COMPRESSION SCREW FIXATION OF THE METACARPAL

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**Purpose** Retrograde headless compression screw (RHCS) fixation for metacarpal fractures can lead to metacarpal head articular cartilage violation. This study aimed to quantify the articular surface loss after insertion of the RHCS and determine the functional range of motion (ROM) of the metacarpophalangeal (MCP) joint at the point of contact between the proximal phalangeal (P1) base and the articular defect.

**Methods** Ten fresh-frozen cadaveric hand specimens were analyzed for preinsertion MCP joint ROM. After screw insertion, the ROM at which the dorsal portion of the P1 base begins to engage the screw tract defect, as well as the ROM at which the midsagittal portion of the P1 bisector engages the screw tract defect, was recorded. The distal axial articular surface of the metacarpal and the defects from screw insertion were measured using a digital image software program.

**Results** Nine men and one woman (mean age, 69 years) were examined. The preinsertion mean extension-flexion arc for all MCP joints ranged from 1 degree to 85 degrees. After screw insertion, the mean MCP ROM at which the dorsal P1 articular surface first engaged the screw tract was 31 degrees. Only 7 digits had screw tract engagement with the midsagittal bisector of the P1 base at a mean flexion angle of -18 degrees (18 degrees of hyperextension). Mean articular surface violation increased from the index finger moving ulnarly, with an average of 3.9% involvement.

**Conclusions** Articular surface loss of the metacarpal head following RHCS insertion is negligible in a cadaveric model, with minimal engagement between the corresponding defect and the P1 base during functional ROM.

**Clinical relevance** Retrograde headless compression screw fixation of metacarpals inevitably damages the cartilage. However, the actual defect is small in proportion to the articular surface area and not engaged during functional activity. These biomechanical features may mitigate the surgeon's concern about joint destruction, while ensuring the benefits of early rehabilitation and minimal invasiveness of this technique.

## **A-0560** TARGETED MUSCLE REINNERVATION FOR THE SURGICAL TREATMENT OF PAINFUL NEUROMA IN NON-AMPUTEE PATIENTS

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## Background

Neuromas may form after traumatic or iatrogenic injury to nerves and can cause considerable and debilitating pain. Targeted Muscle Reinnervation (TMR) is a relatively new surgical treatment for peripheral neuroma, where the neuroma

is excised, and the distal stump is coapted to a motor branch of a nearby expendable muscle. Secondary TMR has been primarily used at the time of limb amputation to prevent neuropathic pain, or as a treat painful neuromas following limb amputation. The aim of this study was to prospectively determine the efficacy of TMR in the treatment of symptomatic neuromas in non-amputee patients.

#### Methods

A prospective cohort study was conducted at the Erasmus Medical Center in the Netherlands of non-amputee patients undergoing TMR for symptomatic neuroma in the upper or lower extremity. Patient-Reported Outcomes Measurements (PROMs) were used to assess (neuropathic) pain, limb function, quality of life, satisfaction with treatment results, and return to work preoperatively, at three months and 12 months postoperative.

#### Results

Nine TMR patients completed the 12-month follow-up. Six patients underwent TMR in the upper extremity and three patients in the lower extremity. Pain levels significantly decreased, from a median VAS of 7.0 (IQR 6.0-8.0) preoperatively to 3.0 (IQR 1.5-6.0) at 12 months follow-up ( $p = 0.020$ ). Five out of nine patients experienced a reduction in pain level of  $\geq 50\%$ . Lower extremity functional scores (LEFS) and upper extremity functional scores (PRWHE) improved from 27.0 (IQR 20.50-39.25) to 50.0 (IQR 36.0-50.0) ( $p = 1.0$ ), and 29.0 (IQR 21.0-40.8) to 31.5 (IQR 18.5-33.5) ( $p = 0.35$ ), respectively, but this was not significant. On the EQ5D questionnaire for quality of life, disability scores in the pain/discomfort dimension improved significantly from 4.0 (IQR 3.5-4.0) to 3.0 (3.0-3.5) ( $p = 0.034$ ).

#### Conclusions

In this prospective cohort study of limited sample size, TMR significantly decreases pain levels when used to treat painful neuromas in non-amputee patients.

## **A-0561** OUTCOMES FOLLOWING DISTAL RADIOULNAR JOINT ARTHROPLASTY IN THE SETTING OF TOTAL OR PARTIAL WRIST FUSION

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**Hypothesis:** Higher complications rates are seen following primary ulnar head or total distal radial ulnar joint (DRUJ) arthroplasty in patients who have a partial or total wrist fusion.

**Methods:** We conducted a retrospective review of 33 primary DRUJ implants in 31 patients that had a partial or total wrist fusion. Follow up time was an average of 67 months. There were 11 partial and 22 total wrist fusions with 22 ulnar head prosthesis and eleven total DRUJ implants. The mean age of the patients was 49 years. Eighty-one percent had previous surgeries with an average number of 4.6 previous wrist procedures. Pre and postoperative pain levels were recorded. Mayo Wrist Scores were calculated. Grip strength, range of motion (ROM), and post-operative complications were noted. **Results:** The pain scores improved in 67 percent of the patients. The Mayo Wrist Score improved significantly from a mean of 39 preoperatively to 51 postoperatively. The grip strength and pro-supination remained stable. The wrist ROM also remained stable in the patients with partial wrist fusions. During the follow up period, 10 (30 percent) of the DRUJ implants were explanted, with a trend towards higher explantation rates in the total wrist fusions with one in the partial fusion group and nine in the total wrist fusion group. Four of the explantations happened in the first postoperative year. 61 percent of patients required a second surgery for a DRUJ implant related complications, this was similar between the

partial and total fusion groups.

Conclusions: DRUJ arthroplasty in the setting of a wrist fusion improved Mayo Wrist Scores and pain in the majority of patients. Functional wrist parameters remained stable. Complication rates were high, and 61 percent required secondary surgery for DRUJ implant-related complications

## **A-0562** A COMPARISON OF POSTOPERATIVE HEMI-HAMATE AUTOGRAFT ARTHROPLASTY REMODELLING OVER TWO YEARS

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A palmar cortical step between the graft and metaphysis is often evident after hemi-hamate arthroplasty (HHA) for unstable palmar lip fractures of the proximal interphalangeal joint (PIPJ). Emphasis has traditionally been on using the hamate osteochondral graft to re-establish the buttressing effect of the palmar lip to prevent recurrent subluxation. However, there has been little discussion on long term remodeling or resorption of non-vascularized hamate autografts used in HHA. We assessed the degree of graft resorption at long term follow up in our patient series of HHA.

A retrospective review of clinical records and PACS radiographic images of all patients with dorsal PIPJ fracture dislocations managed with HHA at a regional centre between January 2013 and December 2020. Pre- and post-operative measurements of radiographs were taken using the PACs measuring tool and an algorithm designed for radiological assessment. Postoperative radiographs were assessed for subluxation, indicated by presence of a V-sign between the dorsal surfaces (Light, 1981) and evidence of graft resorption, defined as the difference between any palmar cortical step on the initial and most recent postoperative radiographs. Postoperative range of motion (ROM) and complications were collated from clinical records and Quick Disabilities of the Arm, Shoulder and Hand (QuickDASH) scores (Beaton et al., 2005) were assessed at a telemedicine follow-up.

Thirteen consecutive patients were included with a mean middle phalanx articular surface involvement of 51%. Seven patients had at least two postoperative radiographs performed  $\geq 6$  months apart allowing interval comparison of grafts. Median radiographic follow up was 24 months (range 6-33 months, IQR 7-26). Mean graft resorption was 1.0mm (range 0.2-2.0mm) representing a 47% average reduction in the initial palmar step (15-100%). Two patients had resorption of the palmar step leaving a flush cortex and five demonstrated between 15% and 52% resorption of the original step. No patient had complete resorption of the graft or resorption of the articular surface. Final graft depth was not measurable accurately as the bone had united.

Early PIPJ range of motion (ROM) was documented in 12 patients and demonstrated a mean of 68° at 6.6 month clinical follow up. Four patients underwent HHA  $>30$  days from injury and achieved below expected postoperative PIPJ ROM, compared with those treated  $<30$  days from injury (66° vs 72° respectively (95% CI -6.5 to 19.3, t-test  $p=0.8$ )). Late follow-up (median 3.6 years) was available for eight patients who had a mean PIPJ ROM of 61° and Mean QuickDASH scores of 2.3. One patient reported a subjective sensation of occasional instability on rotational force but no subluxation. No patient demonstrated radiographic evidence of subluxation.

Our data would suggest that the HHA osteochondral graft may remodel to the shape of the native phalanx according to the stresses across it in accordance with Wolff's law. This casts doubt over the widely accepted tenet of the significance of both graft size and shape. Graft remodelling or partial resorption of approximately 1mm in the sagittal plane at a median of 2 years should be considered when planning follow-up duration.

## **A-0563** AN OPEN AND SHUT CASE? SHOULD WE BE TREAT DISTAL PHALANX TUFT FRACTURES AS PRO-ACTIVELY AS ALL OTHER OPEN FRACTURES?

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### Introduction:

Distal Phalanx fractures account for 30% of hand injuries and 67% of open hand fractures<sup>1</sup>. While shaft of distal phalanx fractures as generally managed as open fractures<sup>1</sup>, tuft fractures tend to be considered under the umbrella of nail bed injuries and are often managed as such.

### Aims

To review management of fingertip fractures

To assess for differences in management and clinical outcomes between tuft fractures and shaft of distal phalanx fractures

To establish if there is a case for managing tuft fractures of the distal phalanx as open fractures

### Methods

Data relating to all presentations to hand trauma clinic that had either a nail bed injury or an open fracture extracted from eHands, a dedicated hand trauma patient management system.

Patient presenting with either an open tuft or shaft of distal phalanx fracture was extracted manually.

Time period searched for was 1/1/2021- 31/5/2022

Data relating to patient demographics, fracture type, associated injury, procedures performed and complications was extracted after a manual search .

Data was tabulated and analysed using Excel.

### Results

A total of 222 distinct cases of distal phalanx fractures of any sort were identified over the time period noted. 81.98% (n=182) were male and 16.67% (n=37) were female with a mean age of 45.5 years.

Overall, 79.28% (n=176) of patients underwent surgical management of their injuries while 20/72% (n=46) did not. 63.96% (n=142) underwent a surgical washout, with 45.95% (n=102) undergoing an additional surgical procedure. 50.0% (n=111) were documented as having received antibiotics. A Minority of patients, 17.11% (n=38) required admission for surgery of IV Antibiotics.

Radiology of distal phalanx fractures was reviewed, and patients were categorised in to tuft or shaft of distal phalanx fractures.

Notes were reviewed to establish comparative rates of surgical washout in each group and rates of re-presentation or complications was reviewed between the two groups.

The study was limited by its retrospective design and the potential for confounding factors such as associated nail bed injury requiring repair.

### Conclusions

This study highlights an avenue for research into fingertip injuries and suggests we consider conventional wisdom around the management of open distal phalanx fractures.

1 Metcalfe D, Aquilina AL, Hedley HM. Prophylactic antibiotics in open distal phalanx fractures: systematic review and meta-analysis. *Journal of Hand Surgery (European Volume)*. 2016;41(4):423-430. doi:10.1177/1753193415601055

## **A-0566** AN UPDATE ON HOW TO PRESERVE CARPAL KINEMATICS WHEN REPLACING THE SCAPHOID WITH A PATIENT SPECIFIC PROSTHESIS

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### Purpose

The main goal when replacing the Scaphoid by a patient specific prosthesis is the preservation of carpal alignment, -stability and -kinematics. These goals can be reached by using a patient specific design and a reconstruction of the intrinsic and extrinsic stabilisers of the scaphoid and first carpal row. We present latest research results on how to design and suspend a PSI-Scaphoid prosthesis based on in vitro and in vivo four-dimensional computed tomography (4D-CT) results.

### Methods

As previously described, we CT-scanned and segmented cadaveric wrists. A patient specific scaphoid prosthesis was designed and produced based on the segmented polygon models of the native Scaphoid.

The design has been modified at the distal and proximal entrance and exit of the channel to allow for stress-free entrance and exit of the fibre tape-augmented Flexor carpi radialis tendon strip. The native wrist before implantation of the prosthesis was moved in a hand-shaker and scanned during flexion/extension and radial- and ulnar abduction. Motion was assessed using 4D-CT. From the 4D-CT data the kinematics of the bones were estimated by registration of the carpal shapes to the individual time frames. Subsequently, the prosthesis was implanted by experienced hand surgeons using the technique for anatomical front and back ligament reconstruction (ANAFAB) described by Sandow in 2020.

After implantation of the prosthesis, the 4D-CT scan was repeated using the same handshaker, scanning protocol and analysis method.

### Results

Qualitative and quantitative results showed an equal motion pattern compared with the native Scaphoid. Carpal stability especially of the scapholunate interval could be observed during Flexion/Extension and Radial-/Ulnar abduction. These results were repeatedly obtained, and the updated concept of design and suspension has been proved.

### Conclusion

In comparison of our previously presented research results we could improve the design and suspension and prove this concept using 4D-CT assessment of carpal kinematics. These promising preclinical results can now be transferred into the patient. First implantation using the new design and suspension are planned and results will be presented.

## **A-0567** DYNAMIC CT FEATURES OF THE SPECTRUM OF SCAPHOLUNATE INSTABILITY

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### Purpose

The purpose of this study was to objectively describe the spectrum of scapholunate instability (SLI) using 4D CT.

## Methodology

Dynamic CT scans of 17 patients with non-arthritis SLI were selected. Motion sequences studied were extension to flexion and ulnar to radial deviation. Image segmentation followed by 3D registration techniques were used to calculate the displacement field between scaphoid and lunate models in each time point. The Euler angles and the centroid translations of the scaphoid and the lunate relative to the radius were measured during the neutral wrist position followed by wrist motion. Individual patients graphs were compared with the normal graphs established using a pool of 17 normal wrists.

## Results

In the neutral position of the wrist SLI scaphoid is flexed ( $66.5^{\circ} \pm 13.1^{\circ}$ ) and internally rotated ( $21.2^{\circ} \pm 10.6^{\circ}$ ). The lunate is extended (SLI  $32.0^{\circ} \pm 20.9^{\circ}$ ). The scaphoid centroid is translated radially (position  $7.2 \pm 1.3$  and the lunate centroid ulnarly (position  $8.5 \pm 1.4$ ) with reference to the radius coordinate system. Inter-centroid distance was  $15.7 \pm 1.0$  and the minimum 3-dimensional distance between the scaphoid and the lunate was  $3.0 \pm 1.6$ . With wrist ulnar to radial deviation SLI scaphoid had a flexion arc of SLI  $9.1^{\circ} \pm 5.6$  and the SLI lunate had a flexion arc of SLI  $10.9^{\circ} \pm 3^{\circ}$ . With extension to flexion the when the capitate moved from  $40^{\circ}$  extension to the neutral position, the scaphoid flexed  $36.8^{\circ} \pm 4.9^{\circ}$  (92% of the capitate motion, represented as scaphoid capitate index).

Within this basic pattern we observed a spectrum of changes.

A patient with grade II SLI arthroscopically had the angular displacements within the normal limits. However, he demonstrated changes in the centroid translation at the terminal radial and ulnar deviation. The normal lunate radial translation in ulnar deviation and the normal scaphoid ulnar translation in radial deviation were not observed in this patient. Grade 04 SLI demonstrated features of terminal instability with flattening of the flexion curve of the scaphoid during radial deviation with vacuum sign appearing in the dynamic scan. Within grade IV SLI patients there were varying degrees of dissociation between the scaphoid and the lunate. One patient had complete dissociation between the scaphoid and the lunate with the lunate showing negligible flexion and negligible radial angulation with the wrist radial deviation. Other patients had partial dissociation with some flexion and radial angulation of the lunate, however, the lunate flexion and radial angulation were significantly less than the normal lunate.

The scaphoid demonstrated a quantifiable dissociation from the proximal carpal row with increased association to the capitate with a progressive increase in the scapho-capitate index. The partial and complete scapholunate dissociation were reflected as partial and complete scapho-capitate association.

## Conclusion

We have demonstrated objective parameters defining SLI using dynamic CT scans. These parameters can be used to identify a spectrum of changes in patients with SLI.

## **A-0568** HISS SCORE AND MODIFIED VASCULAR HISS SCORE CORRELATION WITH SHORT AND LONG-TERM OUTCOMES IN COMPLEX HAND INJURIES: A RETROSPECTIVE PRELIMINARY STUDY

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**Objectives:** Complex hand traumas (CHT) are critical injuries that involve three different structures in the same digital ray at least or one structure in two digital rays at least. These lesions are very difficult to approach and even if they are subject to immediate and correct surgery, outcomes are scarce due to the complexity of injury. The aim of the present study is to verify the incidence of CHT and to investigate the hand injury severity score (HISS) correlation with short and

long terms outcomes in these patients.

**Methods:** From 2016 to 2020, we treated 227 CHT patients arrived in our department. Patients were classified by age, sex, traumatic mechanism, involved digital rays and type of surgical treatment. For each class of traumatic mechanism, we verified HISS score and its correlation with qDASH score recorded at follow-up. We also verified if HISS score might be a short-term prognostic factor.

**Results:** Among all 227 CHT patients, we counted 201 males and 26 females. The average age when trauma occurred was 49 for males and 47 for females. The most common mechanism of trauma was crushing (125 occurrences). Trauma were mostly pluri-digital (52%). Specifically, we focused on avulsion as mechanism of trauma which concerned 33 patients, accounting for 48 fingers in total (2 were excluded because they were ring finger avulsions). Amputation was performed immediately in 11 patients and in 4 cases at the second look. Eighteen where did not receive this treatment. Patients were classified retrospectively according to HISS score. Residual disability was evaluated with qDASH score at average time of 22 months after trauma. Statistical analysis was performed with Spearman's test and it shows a positive correlation between HISS score and qDASH ( $p=0.85$ ,  $p=0.001$ ). We also propose a modified HISS score (modified vascular HISS score, mV-HISS) with additional parameters for vessels examination, and we investigated its possible usefulness as short-term prognostic factor.

**Conclusion:** CHT are serious injuries with significant economic and social consequences for patients and represent a great challenge for hand surgeons. For avulsion as mechanism of injury, HISS score had a statistically significant prognostic factor in long terms outcomes for patients. mV-HISS score might be a valuable prognostic tool in understanding short terms outcomes in CHT.

## **A-0569** HANDS ON THE CLOCK: IMPACT OF NEW UK GUIDELINES ON TIME TO THEATRES AT A TERTIARY HAND TRAUMA CENTRE

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### Introduction

New UK-wide guidelines on the management of hand trauma published by the BSSH and RCSEng aim to standardise time to theatres for various types of hand trauma. They recommend time to theatres of 24 hours, 4 days and 7 days for open fractures, open injuries and closed fractures respectively.

We describe the impact of these new guidelines on practice within our tertiary hand trauma unit.

### Aims

To assess compliance with and the impact of new BSSH/ RCSEng Standards for management of hand trauma.

To evaluate rates of complications before and after introduction of new guidelines within the department.

### Methods

Data relating to all patients presenting to our hand trauma clinics requiring any subsequent procedure, were extracted from our dedicated electronic hand trauma patient management system, "eHands". Data extracted included patient demographics, mechanism of injury, time to theatres and incidence of related complications.

Amongst other changes, as part of the continual review process, there was a need to implement a new "Open Fracture Pathway" and reprioritise theatre lists to aid adherence to the timeframes. Prospective audit and reaudit was performed March and May 2022, and has been continued since then, assessing the need for further refinements in practice.

The impact of introduction of the guidelines was quantified, as well as identifying complication rates with retrospective comparison to the month prior to introduction of the guidelines.

#### Results

Open fractures and joints were washed out within 24 hours in 67% (n=8) of cases in November 2021 and 41% (n=9) in March 2021 and 44% (n=12). Open injuries were operated on within 4 days in 94% (n=49) of cases in November 2021, this was 77% (n=46) in March 2022 and 87% (n=55) in May 2022. Closed Fractures requiring surgical management had definitive surgery within 7 days in 83% (n=10) of cases in November 2021, 27% (n=3) in March 2022 and 88% (n=22) in May 2022.

The drop in compliance rates was largely related to an unexpected surge in referrals to the service from Nov 2021 to May 2022. There were 395 distinct episodes of attendances in November 2021, this increased to 446 in March 2022 and remained high at 434 in May 2022. This represents a 12.91% increase in service use between November 2021 and March 2022. Rates of re-attendance and complications over the months were reviewed

#### Discussion and Conclusions

The drop in compliance with audit standards is important to have identified. Multiple local factors to account for this, including increased demands on the service, and ongoing departmental changes. Continual audit of services, proved beneficial in flagging areas of improvement and allowing for re-prioritisation of limited resources to ensure impact on patient care was minimised

The service will potentially require more resources in the long term. In the short term, new pathways and increasing awareness of standards in addition to proactive planning of trauma lists helped improve compliance with audit standards overall on the third audit cycle.

## **A-0570** KINEMATICS OF SCAPHOLUNATE INSTABILITY. AN IN VIVO STUDY

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#### Purpose

The purpose of this study was to describe the in-vivo kinematics of the scaphoid and the lunate in patients with scapholunate instability (SLI) compared to the normal wrist using dynamic computed tomography (4D CT).

#### Methodology

Dynamic CT scans of 17 participants with no history of wrist pathology and 17 patients with SLI without degenerative changes were selected. Motion sequences studied were extension to flexion and ulnar to radial deviation of the wrist. Image segmentation followed by 3D registration techniques were used to calculate the displacement field between scaphoid models in each time point. The Euler angles and the centroid translations of the scaphoid and the lunate relative to the radius were measured during the neutral wrist position followed by wrist motion. Capitate motion was used as a surrogate for wrist motion. Comparisons were made between the normal wrist and the SLI wrist.

#### Results

In the neutral position of the wrist SLI scaphoid is flexed (Mean and standard deviation, SLI  $66.5^{\circ} \pm 13.1^{\circ}$  Vs Normal  $47.8^{\circ} \pm 13.2^{\circ}$   $p=0.0002$ ) and internally rotated (SLI  $21.2^{\circ} \pm 10.6^{\circ}$  Vs -Normal  $30.6^{\circ} \pm 7.7^{\circ}$   $p=0.0059$ ).

The SLI lunate is extended (SLI  $32.0^{\circ} \pm 20.9^{\circ}$  Vs Normal  $18.2^{\circ} \pm 12.4^{\circ}$   $p=0.0258$ ). The SLI scaphoid centroid is translated radially (SLI  $7.2 \pm 1.3$  Vs Normal  $6.2 \pm 1.2$   $p=0.0384$ ) and the lunate centroid ulnarly (SLI  $8.5 \pm 1.4$  Vs Normal  $7.4 \pm 1.5$   $p=0.0319$ ).

Inter-centroid distance (SLI  $15.7 \pm 1.0$  Vs Normal  $13.7 \pm 1.2$   $p=0.001$ ) and the minimum 3-dimensional distance between the scaphoid and the lunate (SLI  $3.0 \pm 1.6$  Vs Normal  $1.3 \pm 0.6$   $p=0.0002$ ) is increased.

With wrist ulnar to radial deviation SLI scaphoid had significantly less flexion (SLI  $9.1^\circ \pm 5.6^\circ$  Vs Normal  $19.2^\circ \pm 6.9^\circ$   $p=0.0001$ ). Internal rotation and radial angulation were not significantly different. The SLI lunate had less flexion (SLI  $10.9^\circ \pm 3^\circ$  Vs Normal  $20^\circ \pm 7.3^\circ$   $p=0.0001$ ) and less radial angulation. In patients with SLI the lunate did not flex beyond the neutral position during wrist ulnar to radial deviation.

With extension to flexion the SLI When the capitate moved from  $40^\circ$  extension to the neutral position, the scaphoid flexed  $36.8^\circ \pm 4.9^\circ$  (92% of the capitate motion). In the normal wrist the scaphoid flexed  $28.8^\circ \pm 5.6^\circ$  (71%,  $p=0.0002$ ).

With wrist radial deviation scaphoid centroid translated proximally and the lunate centroid ulnarly. With wrist extension to flexion the scaphoid centroid translated proximally and volarly. The lunate centroid translated dorsally. There was no difference between the two groups.

### Conclusions

The SLI scaphoid is more flexed in the neutral position and had less flexion arc during wrist ulnar to radial deviation. The SLI lunate is extended and had less flexion arc and radioulnar arc. The SLI scaphoid had increased flexion arc with wrist extension to neutral position, conforming to capitate position closely. The SLI scaphoid is radially translated and SLI lunate is ulnar translated with increased inter-centroid and 3D distance. The above differences between the SLI and the normal wrist help understand the 3D kinematics of SLI compared to the healthy wrist.

## **A-0571** THE OUTCOME OF FLEXION STRAPPING OF SPIRAL PROXIMAL PHALANX FRACTURES

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The aim of this study was to assess the outcome of removable elastic strapping of spiral proximal phalangeal fractures in adult.

### METHODS

Patients were recruited from all new referrals to fracture clinic at this study's centre (a district general hospital in the UK). All patients  $\geq 18$  years of age, presenting with spiral fractures of the proximal phalanx over a time period of three years (2019 to 2022) were selected. 19 patients were treated; 17 with amnium follow-up of 6 months were reviewed.

### Data collection

Subjectively we assessed patients using the PEM and asking "how normal is your hand".

Objectively we assessed ranges of motion and undertook photographs for cosmesis,

### RESULTS

We reviewed 15 patients. There were 12 women and 3 men with a mean age of 43 (range 18-74). The patients injured one middle, ten ring and four little fingers. There all received strapping within 10 days of injury and stopped strapping after 4 weeks. Most patients did well. The mean PEM scores were a mean of 17 (range 13 – 22). On the score of "How normal is your hand" six scored 9 or 10 (out of 10). The median score was 8. One patient scored 2 due to persisting pain. All fractures healed. All but two fractures healed with less than 10 degrees of dorsal angulation. One fracture was angulated radially by 12 degrees. There was no functional malrotation. All achieved functional ranges of motion; 7 had full RoM. Most patients had very good or excellent cosmetic results save the one patient with a residual 12 degree radial malunion. There were no complications save longer term pain; one patient received a steroid injection after 6 months.

## CONCLUSION

Spiral strapping is a simple and typically reliable treatment of spiral fractures of the proximal phalanx with comparable results to surgical treatment and much reduced costs. But there is a subgroup of patients who do appreciably less well. These outcomes are comparable to surgical treatment with lower risks.

## **A-0573** WRIST AND HAND FUNCTION IN PATIENTS WITH OBSTETRIC BRACHIAL PLEXUS INJURIES

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The aim to report the outcome of wrist/hand function following OBPI

### Methods

All were reviewed by senior author. Inclusion criteria: OBPI with a permanent upper limb deficit. Data recorded: age; sex; side of the injury; patient/family reported hand preference; reports of altered sensibility; wrist and hand ranges of motion assessing; hand and digit sizes; grip strength (Jamar dynamometer); Narakas grading; Raimondi grading; operative procedures.

### Results:

93 patients - mean age 12 (range 5 to 24) years; 48 females and 45 males; right side in 55; left in 37 cases and bilateral 1. Narakas grading (90): grade 1 – 23; grade 2 – 44; grade 3 - 13 ; grade 4 - 10.

Almost all lacked some active wrist motion; eight had full active wrist movement. (Narakas 1 or 2). Most had > functional wrist RoM. Complete injuries (Narakas 3/4): 11 of 23 lacked functional wrist motion. Only 2 (Narakas 4) had active wrist flexion < 100.

Hand movement was full in all incomplete injuries and in 4 of 24 patients with complete injuries and never in grade 4 injuries; 46% of grade 3 injuries had full or nearly full. (46%). Raimondi grading largely did not apply to incomplete injuries, i.e. they were too good for the grading. For complete OBPI the Raimondi gradings were: 4 were better than grade 5; the remainder were 11 grade 5, five grade 4, three grade 3 (all Narakas 4)

18 reported hand preference on the side of injury; mostly only if grip  $\geq$  67%.

Grip strength followed grading: grade 1 - 84% (65-125%); grade 2 - 73%( 27-124%), grade 3 - 45% (0-79%) and grade 4 - 19 % (0-57%).

### Conclusion

Patients with incomplete OBPI generally regain good hand function; grip strength appears particularly important. Most patients with complete OBPI have limited hand function.

## **A-0574** THE “SEAMLESS START”: MAXIMISING THEATRE EFFICIENCY BY RE-ESTABLISHING “THE GOLDEN FIRST PATIENT”

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### Aim

To demonstrate the impact upon hand trauma theatre commencement time & overall efficiency when reintroducing “The Golden First Patient”.

## Methods

The “Seamless Start” pathway was introduced in January 2022 for all of the hand trauma lists at the Queen Elizabeth hospital, Birmingham. This is a simple means by which to streamline the start of the theatre session in order to reduce time inefficiencies and thus enable more operating time on any given list. Fine-tuning of the process was continually undertaken over the next few months until the majority of problems limiting its full effectiveness had been addressed. Prospectively collected data on timings was compared from May 2022 with the same data collected in November 2021. Principal data included the time of the first patient arriving into the anaesthetic area and the subsequent “knife-to-skin” time. Data were compared using  $\chi^2$  and K sample median tests.

## Results

A total of 100 cases were performed during the study period (49 in November 2021 and 51 in May 2022). Following implementation of the pathway, the median time of sending for the first patient improved from 08:45am to 08:24am ( $p<0.001$ ), as well as the proportion of patients sent for before 08:30am (November: 4.1% vs May: 76.5%,  $p<0.001$ ). Furthermore, the median knife-to-skin time was earlier in May (09:49am), relative to November (10:04am,  $p=0.028$ ), with more procedures commenced before 10am (May: 66.7% vs November: 44.9%,  $p=0.028$ ).

## Conclusions

The introduction of the “Seamless Start” pathway led to improvements in theatre start times. It is a simple but effective measure that is transferrable to all hand trauma centres. Future audit cycles are ongoing with the intention of further improvements on timings, thereby enabling more operating on each trauma list. The development and instigation of the pathway and subsequent gain in momentum at the start of the operating day has anecdotally improved team morale and so as a by-product, has fostered a closer knit theatre team that communicates better and is generally more unified and efficient. Ultimately, the Seamless Start pathway improves theatre utilisation and efficiency on acute hand trauma lists.

## **A-0575** SHOULDER CONTRACTURE FOLLOWING OBPI

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The aim of this study was to review the outcome for the shoulder in patients with OBPI

## Methods

We recorded: age, sex; hand dominance; active and passive ROM, strength using MRC grading, Narakas grading and surgical interventions both nerve and shoulder surgery.

The shoulder ROM was assessed by a single clinician not involved in the treatment of the patients. We assessed forward flexion, abduction, external rotation with the arm at the side (in adduction – ER 0), external and internal rotation in 90 degrees or maximal abduction and combined extension and internal rotation.

## Results

94 patients - mean age 12 (range 5– 24) years. 37 males and 47 females. The right side affected 47; left 30.

Pain was present in almost all with stretches but only 11% at rest and 6% continuous. When present almost always around the shoulder

All except one had some shoulder stiffness.

There were: 24 grade 1 injuries mean age 13 (range 5-21); 45 grade 2 mean age 12 (range 5-24); 15 grade 3 mean age (range 5-21); 10 grade 4 mean age 11 (range 7-23). There were 30 nerve operations (2 grade 1; 10 grade 2; 8 grade 3; 10

(all) grade 4). There were 47 primary shoulder operations with 20 revision operations (10 for grade 1; 27 for grade 2; 6 for grade 3; 4 for grade 4).

The active external rotation in adduction was a mean of 20 degrees (passive 40), the mean external rotation in abduction 55 degrees (passive 85) and mean internal rotation in abduction 35 degrees (passive 45). As a percentage the reduction in IR in abduction was comparable to the reduction in ER in adduction which were both appreciably less than the ER in abduction.

#### Conclusion

The study shows that almost all patients with OBPI (excluding those who make a full recovery) have some stiffness of internal rotation of the shoulder; this has rarely been recognised. It is comparable with the stiffness in external rotation in adduction. The stiffness is present whether or not the patient had had shoulder surgery. This further supports that shoulder stiffness in OBPI is not due primarily to muscle imbalance but is primarily a contracture process.

Shoulder release surgery in the UK appears not to be very reliable.

### **A-0576** TRAPEZIOMETACARPAL EXTERNAL FIXATION UNDER LOCAL ANAESTHESIA FOR THE TREATMENT OF COMMUNUTED INTRA-ARTICULAR THUMB METACARPAL FRACTURES. EVALUATION OF CLINICAL RESULTS AND LONG-TERM PATIENT SATISFACTION

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#### Background

Many internal or external fixation techniques have been described for the treatment of Rolando fractures, but the optimal fixation method has not been clearly defined.

#### Purpose

The aim of the study was to describe the results and the long-term functional outcome of the application, under local anaesthesia, of an external fixation system for the treatment of Rolando fractures.

#### Patients-Methods

Twenty-two consecutive patients (16 men) underwent surgical treatment for Rolando fractures by using a two pair of pins external fixator. All procedures were performed with local anaesthesia (Xylocaine 2%) only. Patients were evaluated at regular intervals postoperatively and contacted by phone for long-term follow-up. Functional outcome was assessed using the validated Quick Disabilities of the Arm, Shoulder and Hand (QuickDASH) tool.

#### Results

The mean age was 39.8±14.2 years. The mean time from injury to surgery was 4.1±2 days. The mean operative time was 24.3±8.1 min. All fractures were healed and no loss of fracture reduction was observed postoperatively. One patient developed wound erythema without requiring early removal of the implant and another one experienced temporary numbness at the distribution of superficial radial nerve. Twenty out of the 22 patients who were available for long-term follow-up did not report any complaints and could perform the daily activities without restriction. The average follow-up was 6.5±1.2 years and the mean QuickDASH score was 1.8±3.

#### Conclusion

The two pair of pins external fixator is an excellent option for the treatment of Rolando fractures and can be easily, quickly, and effectively applied under local anaesthesia.

## **A-0577** DUPUYTREN'S DISEASE: LIMITED FASCIECTOMY, NIGHT SPLINTING, AND HAND EXERCISES - LONG-TERM RESULTS

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### Background

Dupuytren's contracture (DC) is a fibroproliferative disorder of palmar fascia that causes flexion contractures of one or more digits. There is currently no gold standard operative and postoperative protocol for reducing recurrence rates. We propose a combination of surgical intervention, night splinting, and home hand exercises as a treatment protocol.

### Methods

Thirty patients were included in our study, diagnosed with DC Tubiana grade II–IV. Our treatment protocol was limited fasciectomy followed by a 24-week night splint application, combined with home hand exercises for eight weeks. The outcomes were recurrence, QuickDASH score, extension or flexion deficit, and grip strength. The mean follow-up was 4.9 years (range 2–11 years).

### Results

Recurrence of DC occurred in two patients (7%), who had discontinued the use of the splint within two months postoperatively. All other patients had complied with the postoperative protocol. The mean QuickDASH score improved from 61.5 (SD 2.1) to 8.6 (SD 2) postoperatively ( $p < 0.001$ ). Grip strength did not differ significantly in the operated hands (37.9 kg, SD 1.3) when compared to the healthy hands (40.2 kg, SD 1.3,  $p = 0.035$ ). The recurrence was not significantly correlated either with the Tubiana grade ( $p = 0.7$ ), or with the patients' age ( $p = 0.27$ ).

### Conclusions

This study shows that limited fasciectomy followed by a 24-week night splint application, combined with home hand exercises for at least eight weeks, is a viable protocol which reduces the rates of recurrence of DC.

## **A-0578** DIGITAL ARTERY INJURIES OF THE HAND - A CLINICAL COMPARISON BETWEEN ONE AND TWO-ARTERY REVASCULARIZATION

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Despite the excellent skills and expertise of microsurgeons, the revascularization or reconstruction of injured digital arteries of the hand is associated with intensive effort and increased operation time. The need to use a vascular graft may even result in an increased risk of donor site morbidity. The most important question regarding these surgeries is under what conditions should a unilateral severe digital artery injury of the hand be reconstructed? A total of 16 patients with injuries to the neurovascular bundles of the fingers were examined as part of a cross-sectional study. In nine cases, the affected finger was supplied by only one digital artery. In seven cases both digital arteries were sutured. In all 16 patients, the nerves that were also injured were coapted. The usability of the fingers and hand was examined using the DASH questionnaire. Furthermore, the function, sensitivity and existing pain of the affected hand were recorded by standardized examination of the hands. Finger perfusion was examined and analyzed using a thermal imaging camera (Flir) and Laser Speckle Contrast Analysis (LASCA). The average age of the patients included in the study was 49 years.

No significant difference was determined between the two groups (single vs. two-vessel supply) taking into account the usability of the hand, finger mobility, sensitivity and pain. The perfusion investigations of the thermal imaging camera and the LASCA did not show any significant difference between the two groups. According to the present study, a complex reconstruction of the digital artery (e.g. using a vein interposition) with an intact one-vessel supply to the finger does not appear to be absolutely necessary. In our opinion, however, if both stumps of the digital artery of a finger are injured on one side, immediate microsurgical suturing is recommended.

### **A-0580** PAIN CATASTROPHIZING AND ANXIETY AFFECTS POSTOPERATIVE OUTCOMES AFTER SURGERY FOR WRIST OSTEOARTHRITIS

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In recent years there has been an increasing awareness that psychological factors may influence outcomes after surgery or rehabilitation. Most previous studies on the impact of psychological factors have been cross-sectional or with a short follow up.

The primary aim of this prospective longitudinal study of 50 patients is to analyse the impact of preoperative presence of anxiety and pain catastrophizing on postoperative Patient-Rated Wrist Evaluation six and twelve months after scaphoid excision and midcarpal fusion in patients with SLAC or SNAC osteoarthritis. Secondary aims are to analyse the effect of psychological factors on quality of life, grip strength and range of motion, and to analyse whether the absolute improvements in PRWE score differs between pain catastrophizers / patients with anxiety disorders compared to non-affected individuals. Pain catastrophizing is measured by the Pain Catastrophizing Scale (PCS) and Anxiety is measured by the Hospital Anxiety and Depression Scale (HADS). Patients with a PCS score above 30 are classified as pain catastrophizers and those with a HADS anxiety score above 8 as having a suspected anxiety disorder. Generalized estimating equations are used to analyse the impact of psychological factors on outcomes.

### **A-0581** DOES UNDERTAKING A SINGLE PROCEDURE OVER A WHOLE DAY OPERATING LIST RESULT IN THEATRE EFFICIENCY AND EDUCATIONAL BENEFITS?

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We undertook a case series review of 9 cases of 1stCMC joint replacement using same implant (Touch Keri Medical), all of the cases were undertaken on the same all-day list on our Elective Hub.

Performing a new procedure can be challenging both to theatre staff and surgical trainees due to unfamiliarity and our premise was that repeating the same procedure would help resolve these challenges.

10 patients were identified from the waiting list as suitable cases to undergo 1st CMCJ replacement on the same day. One patient subsequently was cancelled due to contracting COVID one day prior to surgery.

The surgical team consisted of 2 surgeons, 1 surgical trainee, 2 theatre scrub members, 1 theatre assistant, 1 anaesthetist and 1 operating department practitioner (ODP). Apart from the principle surgeons the remainder of the team were unfamiliar with the procedure and the instruments and implants.

All of the patients were already on a waiting list for the same procedure. They therefore had already had received an explanation of the proposed surgery and aftercare. In addition they all attended a pre-consent appointment 10 days prior to the surgery. At the same appointment they undertook pre operative X-rays and hand assessment scores which were carried out by the same hand therapist.

Both the surgical trainee and the scrub team had a demonstration of the kit and explanation of the surgical technique (with company support) at beginning of the day prior to the WHO brief.

Half of the cases had the second surgeon as the assistant and the other half had the surgical trainee as the assistant.

Progression of the cases over the day, demonstrated a significant reduction in the recorded procedure time with repetition as the scrub team and surgical trainee became more more familiar with the procedure. As this procedure is undertaken regularly in our main unit we were able to compare the procedure time with lists where single procedures of this type were undertaken and were able to demonstrate a reduction in procedure time of up to 50%. No surgical complications were encountered on the day.

The surgical trainee was given the opportunity to carry out the final case on the day under direct supervision after assisting and observing the previous cases. They have given very positive feedback on their ability to understand a new procedure and carry it out under supervision with more confidence compared to other lists where there may only be a single case and they may need to wait some time to perform the procedure again.

Current 18 month follow up showed good outcomes with high patient satisfaction and no early complications. There was no difference in the outcome according to the order of the patient on the list.

When waiting list are very long we feel that this model has advantages in driving theatre efficiency and therefore reducing waiting times . In addition there are considerable benefits to training and education to both surgical trainees and the theatre team.

## **A-0582** PREVENTABLE HAND INJURIES; A NATIONAL AUDIT

Jennifer C.E. Lane, Anna Loch Wilkinson, Grey Giddins, Maxim Horwitz on behalf of the Hand Injury Prevention Collaborative Oxford Hospitals, Oxford, UK, Chelsea and Westminster Hospital, London, UK, Royal United Hospitals, Bath, UK

**Aims and objectives**  
The aim of the study was to assess the type and incidence of preventable wrist and hand injuries at a national level in the UK. The study aimed to highlight the common causes of preventable injury, to identify key areas potentially amenable to intervention, and to understand the cost to the NHS and the burden of injury upon society.

**METHODS**  
Data source  
Volunteer Consultant Orthopaedic, Plastic or Hand Surgeons were sought throughout the United Kingdom, willing to undertake an audit of preventable hand injuries over a two-week - 22.02.21 to 07.03.21.

Each hospital recorded the injuries of all consecutive patients presenting to their department over the two-week period. The inclusion criteria were all patients with a hand injury requiring a referral to a secondary care Orthopaedic, Plastic or Hand Surgical team. The exclusion criteria were patients whose injuries were sufficiently mild that they did not require a referral on  
Population  
The data gathered included patient demographics, types and mechanisms of injury including whether the patient admitted intoxication and whether the injury was considered preventable or not, based upon the above criteria. Sporting injuries were excluded as the effects of surgery were considered to outweigh the risks.

**RESULTS**  
Data were available from 28 hospitals representing a reasonable geographical spread throughout the UK. There were 1909 patients, including 184 children under 16 years of age. 1118 men, and 789 women. There were slightly more injuries on the right (955 versus left 919); bilateral in 35. The median age was 40 (Interquartile range IQR

25-59) years; the median age adults was 44 (IQR 29-61) years and of the children was 10 (IQR 6-12) years. The five most commonly recorded injuries were: fractures of the wrist; single phalangeal or metacarpal fractures; fingertip injuries; Mechanical falls and manual labour being the commonest causes of injury. 50.5% of injuries were considered to be preventable.

**DISCUSSION**

**Principle findings**

This study demonstrates that it is possible to measure preventable injuries in patients. Data were collected from the 28 hospitals covered an estimated catchment of 14 million people. Extrapolating this across the UK, we estimate 4200 preventable injuries occurring each week; over 200,000 per year. Although no formal cost analysis has been performed De Putter et al. estimated that the medical and societal cost of hand injuries was \$740 million in the Netherlands each year. Based upon a preventable injury rate of 50.5% we estimate reducing preventable injuries by as little as 10% would potentially save around \$157 million. Accurate estimates of costs and potential savings are unfortunately not possible within the data collected here. This is the first extensive survey of preventable hand injuries and shows how common they are in a representative sample of 28 NHS trusts (approximately 12.5% all trusts) in the UK. Preventable hand injuries are common and potentially quite costly. Investment in reducing them would appear worthwhile.

## **A-0583** LENGTH OF THE ULNAR STYLOID AS A RISK FACTOR IN ULNAR STYLOID FRACTURE ASSOCIATED WITH DISTAL RADIUS FRACTURE

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The aim of this study was to review radiographs of distal radius fractures and to assess for any correlations with USP fractures and in particular ulnar styloid length.

### Methods

We reviewed the radiographs on the hospital PACS system of 181 consecutive patients with extra-articular distal radius fractures during the period from January 2019 to January 2020.

We measured multiple parameters including demographics, the length of the USP using the PACS system and the patterns of the distal radius fracture lines. Where there was a displaced USP fracture we measured the length of each fragment of the best fracture reduction, i.e. on original or subsequent radiographs. We also recorded the level of the fracture and we classified them into basal, middle and tip fractures of the USP.

Twenty measurements were repeated by the first author, 3 months apart to test for intra-observer variability. Twenty scans were also measured by the second author to assess inter-observer variability.

### Statistical analysis

We assessed the null hypothesis using t- test for association between the USP length and risk of fracture. We also assessed the inter-observer and intra-observer variability using the intra-class correlation coefficient.

### Results

There were 181 patients; 12 men and 169 women with mean ages of 66 (range 37 - 83) years (men) and 69 (range 21 - 94) years (women). 108 had a concomitant USP fracture.

The USP lengths were a mean of 4.7 (range 2.1 - 6.6) mm. There was a clear correlation with USP length and the likelihood of a USP fracture We compared two groups statistically; USP 2.1- 4.0 mm and 4.1 -6.6 mm. Fractures were significantly more common in the latter group ( $p < 0.0001$ ).

We found no association between any of the demographic parameters or the radiological parameters of the distal radius

and the presence of a USP (tables 4, 5).

The intra-class coefficient for intra-observer variability was 0.95 implying a high level of reproducibility and thus reliability. The intra-class coefficient for the inter-observer variability was 0.88.

#### Conclusion

In this study we have shown a clear link between ulnar styloid length and the presence of a USP fracture. There was not obvious link with other parameters.

Ulnar styloid fractures appear to represent a radiographic representation of an ulnar sided wrist injury which is always present; it is more common with a longer ulnar styloid.

### **A-0585** METACARPAL FRACTURES TREATMENT: COMPARISON BETWEEN KIRSCHNER WIRE AND INTRAMEDULLARY SCREW

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**Introduction:** Metacarpal fractures are common and can be treated surgically using Kirschner wires or intramedullary fixation with compression screws. **Objectives:** Analyze the postsurgical results from the treatment of the metacarpal extra-articular fractures through the retrograde Kirschner wire technique, and compare it with the intramedullary compression screw fixation. **Methods:** Retrospective and quantitative studies to analyze patient's medical records, and a postsurgical evaluation questionnaire given to the patients, who were divided in two groups: K-wire and IMCS. **Results:** The period of immobilization with a splint took six weeks for the K-wire group, and four weeks for the IMCS group. The average time for consolidation took, respectively, fifty-seven days and forty-seven days. The first group could restart their activities twenty-two days after the other, and the average force value of the treated hand, when compared with its contralateral, was 93,9% and 95,4% respectively. Between the operated hand and its contralateral, there was a difference of 16° in the total measures of the metacarpophalangeal and interphalangeal joint's range of movement among the K-wire group, and 5° among the IMCS group. **Conclusion:** The patients who participated in this study showed excellent results after surgery, and both treatments were proven to be safe and reliable. Evidence level III. Retrospective comparative study.

### **A-0586** APL RESECTION-SUSPENSION ARTHROPLASTY IN PATIENTS WITH EITHER ISOLATED CMC1-OSTEOARTHRITIS OR WITH ASSOCIATED OSTEOARTHRITIS OF THE SCAPHOTRAPEZIOTRAPEZOID JOINT: A COMPARISON OF LONG-TERM RESULTS

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We treated CMC1-arthritis and an associated STT-arthritis with an RSA according to Wulle and with an additional partial

resection of the trapezoidium as well as an interposition of a PL-tendon graft to fill the defect between the scaphoid pole and the remaining part of the trapezoidium.

The aim of our study is to compare the mid-term results after an RSA as described by Wulle in an isolated CMC1-arthritis with those after an RSA adapted for the associated STT-arthritis.

Patients who were operated at our department after 2016 are examined after a minimal postoperative period of 1 year. 22 female and 2 male patients were identified as candidates for the study, with a mean age of 55,4 and a range of 34 – 75 years. While isolated cases would have been preferable the majority of our patients have associated hand pathologies. Pre- and postoperative VAS-scores are collected, the degree of disability and it's perception by the patient is assessed using the DASH questionnaire. ROM of the wrist, MCP1- and IP1-joints, as well as abduction in the plane of the hand and 90° to that plane, the Kapandji score, grip and pinch strength, as well as lateral pinch strength are assessed.

Data is currently being collected, with the current comparison based on 10 female patients, equally divided between the CMC1- and STT-groups, with a mean age of 55,2 and a range of 35 – 63 years. For the current comparison we first calculated the differences between the operated and non-operated hands in each group and compared the change in each parameter between both groups. Patients with an associated STT-arthritis show a moderately greater reduction of wrist ROM (extension/flexion -10° (8%), abduction/adduction -7° (-11%) and IP1 (-20° (-26%)) when compared to the patients with an isolated CMC1-arthritis. The Kapandji score remains largely unchanged. Thumb abduction and MP1 ROM increases in the STT-group, whereas a slight reduction is observed in the CMC1-group, with a difference of 9–16° (19-30%) for abduction and 8° (15%) for MP1 ROM between both groups. A greater reduction in grip (-9%) and pinch strength (- 17-25%) is noted in the STT-group. Mean VAS reduced after surgery from 8,22 to 5,18 in the isolated CMC1-group and from 7,42 to 2,72 in the STT-group (a 54,6% greater reduction in the STT-group). The mean postoperative DASH-score was 50 in the isolated CMC1- and 36 in the STT-group (difference of 27,9%). Data collection and evaluation of all 24 patients will be completed until the end of the year, so that the complete results can be presented and discussed. For the final data evaluation, an unpaired t-test will be used.

The presented technique seems a reliable and safe one-stage treatment option for CMC1- and STT-arthritis, showing comparable results with an isolated RSA. A detailed discussion of the results will follow when the complete data set is evaluated. With this study the authors hope to shed insight into the treatment of STT-associated CMC1-arthritis and stimulate further research focusing on a larger number of treatment modalities.

## **A-0587** PERSISTENT SYMPTOMS AFTER CARPAL TUNNEL RELEASE; LACERTUS SYNDROME, DIAGNOSIS AND TREATMENT

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Introduction - Carpal tunnel syndrome (CTS) is a well-known and frequent diagnosis with a 6% prevalence. Less well-known is lacertus syndrome, a more proximal median nerve compression distal of the elbow by the lacertus fibrosis (biceps aponeurosis). Lacertus syndrome shows symptoms similar to CTS, but is often underrecognized as the cause of symptoms. Specific for the lacertus syndrome is compression of the anterior interosseus nerve (AIN) due to the proximal location of the lacertus fibrosis. The strength of AIN innervated muscles (FPL and FDP2) can be measured in the tip pinch grip. Weakness of these muscles result in dropping objects from the hands. The Scratch Collapse Test (SCT) is a noninvasive test able to differentiate between different nerve compressions (negative predictive value 73%). Electromyography (EMG)

and ultrasound offer poor diagnostic accuracy for assessment of recurrent CTS or lacertus syndrome. Broad awareness of the lacertus syndrome is crucial since symptoms endure after carpal tunnel release (CTR) in 5% of the patients. This results in unsuccessful redo CTR. This study shows the first results of our cohort study regarding the diagnosis and treatment of lacertus syndrome.

**Methods** – We retrospectively collected data of patients undergoing lacertus release between September 2021 and September 2022 in our hospital with a minimum of 6 weeks follow-up. If the SCT was positive over the carpal tunnel a CTR was performed concurrently. We describe patient characteristics, symptoms, history of CTR, clinical findings, neurological examination and the results after lacertus release including symptoms, clinical findings and complications.

**Results** – 61 lacertus releases were performed in 48 patients. The mean age was 59 years [range 27-78 years], and the majority were female (35/48; 73%). On average 2 CTR were performed on the affected side in the past. Clinical examination showed a weak tip pinch grip in 70% of the cases. The SCT was 100% positive for the lacertus syndrome and in 11% also positive for the carpal tunnel resulting in 7 concurrent CTR. Neurological examination showed an aberrant EMG in 57% and nerve ultrasound in 62.5% of the arms. The lacertus release was effective to release symptoms in 77% (n=47) with an average follow-up of 5 months [range 0-14]. Tingling resolved in all these cases (47/61). 70% (43/61) gained strength and the SCT was negative in 92% (56/61) postoperatively. Two patients developed seroma two weeks postoperative. A pressure bandage for 3 weeks prevented further seromas. No other complications were described. A substantial proportion of ineffective lacertus releases were performed in patients with an extensive (hand- and wrist) medical history.

**Conclusion** – Lacertus syndrome was found to be the cause of the median nerve compression in a majority of patients with persistent symptoms after CTR. A lacertus release demonstrates to be a safe and effective treatment. Broad awareness of this diagnosis and its treatment are crucial to prevent futile CTR.

## **A-0588** ENDOSCOPIC TRANSRETINACULAR CARPAL TUNNEL RELEASE - A NEW PROCEDURE

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### Introduction

We present a new type of endoscopic carpal tunnel release with the aim of avoiding potential risks of established endoscopic procedures, like pressure increase in the carpal canal due to insertion of bulky devices and insufficient visibility during the cutting procedure.

### Material and Methods

The principle of the method is the selective splitting of the transverse carpal ligament (TCL) in its plane under complete visual control and without penetrating the carpal tunnel or damaging structures located palmarly to the ligament. The transection of the TCL is carried out using a pediatric urethrotome (3.8 mm diameter) equipped with a 0° optic and a miniature ceramic scalpel (2 mm).

The procedure is performed under WALANT. A 10 mm skin incision is carried out in the distal wrist crease, the forearm fascia is exposed and incised longitudinally for a few millimeters. The endotome is now docked directly onto the TCL, and the transverse fibers which appear in high magnification are gradually cut with small advancements (1-2 mm) of the scalpel under continuous irrigation, until the TCL is completely transected.

59 patients (37 F, 22 M) with clinically and electroneurographically verified CTS underwent this treatment and were followed with repeated questionnaires (Boston Levine Carpal Tunnel Questionnaire – BCTQ), preoperatively and at 2 weeks and 6 months postoperatively.

## Results

The age of the patients averaged 64.0 years(33-90). The mean operation time was 21.6 minutes (range 13-33 minutes), including 6.4 minutes (4-11 minutes) for the endoscopic part of the procedure.

All patients reported rapid recovery and could resume their daily activities within a few days. Pain subsided in all patients within the first days after surgery. Neurapraxia was not observed in any case.

The symptom severity score of the BCTQ improved from 2.83 ( $\pm 0.27$ ) preoperatively to 1.21 ( $\pm 0.13$ ) 2 weeks postoperatively, fading out at 1.19 ( $\pm 0.14$ ) after 6 months . The functional status score dropped from 1.84 ( $\pm 0.20$ ) to 1.40 ( $\pm 0.21$ ) at 2 weeks and to 1.27 ( $\pm 0.23$ ) at 6 months.

## Conclusion

The results of this limited series of procedures indicate that higher selectivity, optimized visibility and the fact of not having to insert volume displacing devices into the narrow carpal tunnel and thus avoiding exposure of the median nerve to additional pressure, might contribute to reduce the incidence of iatrogenic complications of established ECTR methods. At the same time, it maintains the advantages of shorter recovery and fewer scar-related complications, compared to OCTR. Comparative prospective studies on larger cohorts are, however, required to further assess the value of the method.

## **A-0589** FINGER FLEXORS RIGIDITY IN THE HEALTHY POPULATION

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**Background:** The involvement of the hand flexors in trigger finger is not clear, and currently the common hypothesis is that in cases of advanced trigger finger there is also a pathology in the flexor tendon in addition to the narrowing of the first pulley. This study aims to examine the rigidity of flexor tendon area in the first pulley territory in the hand, by using ultrasound in the healthy population, and to create a reference scale for these values in order to compare to their condition in trigger finger.

**Methods:** We tested 24 healthy volunteers using linear ultrasound transducer 20-6Mhz, Hockey stick type, Gray scale, Sonoelastography, and color Doppler methods. Rigidity level below the first pulley were examined and compared between the different fingers in the hand. The relationship between rigidity to the gender and 3 different age groups between 18-80 years old was evaluated.

**Results:** No significant difference was found between the rigidity of the flexors tendon at the A1 pulley territory in the different fingers and between the gender and age. The rigidity values of the tendons ranged between 442-513 kPa.

**Discussion:** The rigidity level of the flexor tendons in the hand, in the healthy population is not known. Now, following this study, it is understood that rigidity of the flexor tendons is identical between the fingers and with a defined range of values in the healthy population. This base scale can be compared to different pathologies, among them patients with trigger finger. Additionally, we demonstrated a non-invasively way to evaluate a pathology of the flexor tendon and even to plan the surgical treatment according to these findings.

## **A-0591** BIOENGINEERING AND REGENERATIVE SURGERY FOR RECONSTRUCTION OF COMPLEX DEFECTS OF THE UPPER EXTREMITY

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**Background:** Soft tissue deficiencies represent a challenge for the Plastic Surgeon especially when associated with exposed tendon and absent paratenon which make it difficult to select the proper procedure due to tendon adhesions, poor range of motion (ROM), poor cosmesis and donor site morbidity. The Integra Dermal Regeneration Template DRT (Integra® Lifesciences, Plainsboro, NJ, USA) is a skin substitute already used in reconstructive surgery, including the incidental coverage of tendons. Integra® dressing's post-operative functionality of the tendons, anyway, has not been well documented. We present our results using Integra DRT for soft tissue reconstruction covering tendons with loss of paratenon in the upper extremity.

**Materials and methods:** We reconstructed 52 patients (45 men and 7 women, ages ranged from 58 to 92 years old, mean ages 81.5 years) with exposed tendons due to trauma (n = 47), cancer excision (n = 2) or chronic wounds (n = 3) using the Integra® DRT. Results obtained in a prospective manner including age, gender, wound location, wound size, time to final closure, operative time, follow-up length, split-thickness skin graft percentage taking and active post-operative ROM. Medline engine was used for a literature research of current surgical techniques for the treatment of exposed tendons and the results compared with our results.

**Results:** All patients healed with an average split-thickness skin graft take rate of 92.5% (SD 6.1; range 80 - 100%). The 42 patients not lost to follow-up achieved an average ROM of 91.2% (SD 6.5; range, 80 - 100%).

**Conclusions:** Integra® DRT offers an ideal, efficient operative technique with minimal morbidity, assuring good morpho-functional results. Thus, the Integra dressing may offer an alternative, valid option for immediate tendon coverage in the upper extremities reconstruction.

**Keywords:** Bioengineering, Regenerative surgery, Dermal substitutes, Soft tissue defects

## **A-0593** EXERCISE THERAPY FOR HAND AND WRIST TENOSYNOVITIS: A SYSTEMATIC REVIEW

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**Study design:** a systematic review

**Background:** Recent literature describes the efficacy of exercise therapy in tendinopathy. The role of exercise therapy is still not widely explored in patients' hand and wrist tendinopathies.

**Purpose of the study:** Determining whether exercise therapy may be considered an effective treatment in the conservative management of hand and wrist tenosynovitis.

**Methods:** A literature search of MEDLINE, Cochrane Library, PEDro and EMBASE was undertaken until April 10th, 2022. Two independent reviewers analyzed and included the studies that satisfied the inclusion criteria in the review. Inclusion criteria were: hand or wrist tenosynovitis and exercise therapy intervention. Stretching and only passive mobilization was not considered exercise therapy intervention; for this reason, articles that cited only those two therapies were excluded.

Results: Five case reports, three case series and a randomized controlled study were included and methodologically evaluated, obtaining a low score for all the analyzed studies. The type of proposed exercise was vast and often not well described: from eccentric forearm training to Mobilization With Movement (MWM) passing through strengthening exercises, grip proprioception training and self-management exercises according to the McKenzie method. Even the posology was often not precise, making it difficult to reproduce the therapeutic proposals.

Conclusion: Future research about hand and wrist tenosynovitis exercise therapy is strongly recommended. It would increase the chances of obtaining more reliable results, as we already have for exercise therapy in other districts with tendinopathy.

## **A-0594** TREATMENT OF ACUTE ACROMIOCLAVICULAR JOINT DISLOCATION WITH AUTOLOGOUS TENDON GRAFT

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### Introduction

Injury to the acromioclavicular (AC) joint accounts for 9% of all shoulder injuries and is most common in men between the ages of 20 and 39. The direct contusion to the shoulder that causes these injuries typically occurs in high-collision sports or motorcycle accidents. Using the Rockwood classification, injuries are categorized based on their severity. The surgical solutions for acute injuries include coracoclavicular (CC) looping with high-strength artificial materials and hook plate fixation.

### Aim

This study performs a comprehensive analysis of the outcomes of anatomic reconstruction of coracoclavicular ligament using a semitendinosus or gracilis tendon graft in a tertiary Orthopaedic department in Greece.

### Material and methods

We conducted a retrospective study of all patients with acute acromioclavicular joint dislocation who underwent anatomic reconstruction of the coracoclavicular ligament from 2017 to 2021. Clinical and functional outcomes were assessed postoperatively by the Simple Shoulder test, QuickDash and VAS for pain scores, and radiographic evaluation was assessed for loss of reduction.

### Results

Seven male patients with a mean age of 37,3 years (range 23-64) were enrolled in the study. According to the Rockwood classification, two patients experienced a type III, two a type IV, and three a type V dislocation. All patients underwent coracoclavicular and acromioclavicular ligament reconstruction. During the latest follow-up, mean duration 33,8 months (12-64), postoperative functional scores showed great results - Simple shoulder test 91,7 (75-100), QuickDash 3,95 (11,4-0) and VAS score 1 (0-3). A partial loss of reduction was observed in two patients (28,5%) by measuring the coracoclavicular distance (7 and 8mm); however, none of them displayed discomfort or activity limitations that necessitated a surgical revision. Minor complications were one wound dehiscence and two patients referring persistent numbness at the incision site.

### Conclusion

Anatomic reconstruction of coracoclavicular ligament using a semitendinosus or gracilis tendon graft for the treatment of acute acromioclavicular joint dislocation resulted in excellent clinical and satisfactory radiological results.

## **A-0595** SEVERE INJURY OF FLEXOR TENDONS AND SKIN LOSS IN 4 DIGITS: SURGICAL STEPS FOR COVERAGE AND FLEXOR RECONSTRUCTION

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**Introduction:** As it is well known, flexor tendon reconstruction is very challenging, especially when there is a severe flexor injury involving several fingers and when it is associated with severe skin loss.

**Case report:** A 50-year-old right-handed woman suffered a burn in the volar aspect of her index, middle, ring and fifth digits of her dominant hand with a consequent severe skin loss and associated with flexor tendons loss of middle, ring and fifth finger. In first place, an initial surgical debridement was done. After a conscious preoperative planning, a reconstruction of the pulley system was performed using 3 plastic rods and the volar aspect of the 4 fingers was covered with a single free perforator artery fibular flap. 2 subsequent surgeries were performed to individualize the 4 fingers and perform a defatting without risk of flap loss. After, the second stage of the reconstruction of the flexor tendons was done substituting the rods for tendon autografts. The patient needed a surgical tenolysis that was executed under wide-awake local anesthesia technique without tourniquet.

**Results:** After a total of 5 surgeries and at 12 months of follow-up, the final result is a complete flexion of the triphalangeal fingers achieving to make a fist, lack of extension of proximal interphalangeal joint of  $-55^\circ$  except the index finger  $-30^\circ$ , effective pinch with all the fingers and a moderate loss of grip strength.

**Conclusions:** In case of volar skin loss of the fingers associated to flexor tendon severe injury, a coverage with a single free flap and a 2-stage reconstruction of the flexor tendon can be a valid option of treatment.

## **A-0596** MEDIUM AND LONG-TERM CLINICAL AND RADIOLOGICAL OUTCOMES OF RADIAL SHORTENING OSTEOTOMY IN KIENBÖCK'S DISEASE

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**Introduction:** Kienböck's disease is a progressive condition of the wrist; its prompt surgical treatment, aiming to promote revascularization of the lunate, offers better results than conservative treatment.

**Aim:** This study aims to assess the effectiveness of radial shortening osteotomy for managing Kienböck's disease in the early stages.

**Material & methods:** Over a 10-year period, we retrospectively recorded 13 patients (6 men-7 women) with a mean age of 40.5 years with Lichtmann stage II-IIIb disease treated with radial shortening osteotomy. In 53.8% (7) of the patients, the disease concerned the right, and in 30.7% (4 patients) the dominant upper limb. In 2 patients, the disease is bilateral (the surgical treatment of the other limb is pending). Patients with stage I and IV disease or those treated by an alternative technique were excluded from this study.

**Results:** The mean postoperative follow-up of the patients was 25.3 months. 76.9% (10) of patients reported returning to their daily activities without pain. Postoperatively, there was an improvement in the QuickDASH score from 67.4 (52.3-81.8) to an average of 9.8 (0-18.2) and VAS from 8.5 (6-9) to an average of 1.1 (0-3), congruently with imaging findings. During the patients' follow-up period, one patient developed De Quervain tendosynovitis; however, there were no other

significant complications.

Conclusion: The radial shortening osteotomy is an effective method to treat Kienböck's disease.

### **A-0597** DEVELOPMENT OF VIBRIO ALGINOLYTICUS COLLAGENASE IN TREATMENT OF DUPUYTREN DISEASE. DATA FROM LABORATORY TO CLINIC

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Objective: Dupuytren contracture (DC) is highly prevalent hand affection in which contracted fingers compromise hand function. It is a benign fibroproliferative condition affecting the hand palmar fascia with deposition of excess matrix proteins in the extracellular space of the palmar aponeurosis in particular type III over type I collagen. The standard treatment for Dupuytren's contracture ranging from percutaneous release to dermatofasciectomy. Minimally invasive options, such as percutaneous niddle aponeurotomy and collagenase clostridium histolyticum (CCH), have been developed albeit with the presence of short-term success and high rate of recurrence. *V. Alginolyticus* collagenase (CVA), moreover, is a new enzyme that is fully active on the collagen filaments, whereas is inactive on other components of the dermal extracellular matrix with a less aggressive effect. The aim of this study is to evaluate the safety and effectiveness of an intra-lesional injection of CVA on an animal model of subcutaneous fibrosis mimicking the pathological anatomy of the cord of Dupuytren's disease. Materials and Methods: We performed an in vitro study on 27 subjects that were randomized into four groups, and we evaluated macroscopic and microscopic analysis. Results: In all cases no skin necrosis, skin tears or wound dehiscences were recorded demonstrating the safety of the CVA in contrast to group D where had full-thickness skin necrosis and this is confirmed by the microscopic analysis of the samples treated with CVA, where no hematomas are found around the fibrotic area with absence of PMN leukocyte infiltrates and macrophages. Conclusion: CVA is confirmed to be selective for collagens I and III, reducing the risk of vascular lesions or skin ulcerations. Moreover, the presence of hyaluronic acid seems to positively affect this selectivity. No side effects have been reported or self-inflicted injuries by the animal due to itching or pain in the CVA group. Hyaluronic acid combined with *V. Alginolyticus* collagenase produces a derential effect, controls the release of the enzyme and makes the dissolution of fibrosis more gradual and homogeneous.

### **A-0599** EFFECTIVENESS OF DIFFERENT CONSERVATIVE TREATMENT OPTIONS IN PATIENTS WITH DE QUERVAIN'S DISEASE: A SYSTEMATIC REVIEW AND META-ANALYSIS

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Objective

The first step in standard care for De Quervain's disease is conservative treatment with corticosteroid injections, splint immobilization, or a combination of both. However, a superior conservative treatment regime has not been determined

in current literature. The aim of this meta-analysis was to compare pain reduction between corticosteroid injections, splint immobilization, or a combination of both.

#### Methods

A systematic search was performed in Embase, Medline Ovid, Web of Science Core Collection, Cochrane Central Register of Trials, and Google scholar. Studies regarding the conservative treatment of De Quervain's disease that reported pre- and post-treatment pain on the visual analog scale (VAS) were included. To estimate the pooled reduction in VAS score, we performed a meta-analysis using a linear Random-Effects Model.

#### Results

Twenty-two studies, including 15 randomized controlled trials, were included. The selected articles reported on 1085 treated hands. Based on the meta-analysis analyzing the results for all treatment options separately, the overall mean decrease on the 10-point VAS pain scale after monotherapy with corticosteroid injections was 5.2 points [95%CI 4.61; 5.85]. No effect of corticosteroid injection dose on pain levels was seen. After splint immobilization, the VAS score decreased by 4.0 points [95%CI 2.42; 5.54] and by 6.0 points [95% CI 3.17; 8.75] after combination therapy with corticosteroid injections and splint immobilization. A meta-analysis of randomized controlled trials comparing corticosteroid injections monotherapy with combination therapy showed a mean difference of -1.05 [95%CI -1.88; -0.21] in favor of the combination therapy. A comparative analysis between splint monotherapy and combination therapy could not be made due to absence of direct comparative studies in the literature.

#### Conclusion

This meta-analysis of direct comparative randomized controlled trials has demonstrated that combination therapy is more effective than monotherapy. Additionally, this effect was also mirrored in non-comparative prospective studies using combination therapy, as they reported a greater reduction in VAS pain score than studies using monotherapy. We, therefore, recommend always offering patients a splint when a corticosteroid injection is given for DQ.

## **A-0600** A NEW PROTOCOL FOR RELEASING OF PSEUDOSYNDACTYLY IN RECESSIVE DYSTROPHIC EPIDERMOLYSIS BULLOSA (RDEB) USING MICROSURGERY AND A DERMALREGENERATION TEMPLATE TAYLORED GLOVE

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#### INTRODUCTION

Epidermolysis bullosa (EB) comprises a heterogeneous group of rare genetic diseases associated with skin blistering caused by minimal trauma. A major and common EB subtype, recessive dystrophic EB (RDEB), is characterized by altered wound healing, inflammatory dysbalance and fibrotic changes associated with reduced to absent collagen VII. Because of its exposed position and its continued use in daily activities, the hand is constantly at risk of microtrauma and is therefore one of the organs most affected by the disease with highly disabling deformities that represent a challenging field in hand surgery practice. The authors present their experience using the microsurgical technique associated to a taylored dermal regeneration template glove of INTEGRA® for releasing of pseudosyndactylies.

#### MATERIALS AND METHODS

From January 2001 to March 2022, a total of 37 procedures were performed on 30 RDEB patients with hand deformities. The endpoints analyzed were: healing times, hospital stay time, discomfort for the patient, free-recurrence interval, follow-up range and major complications

## RESULTS

Compared with the dressing with vaseline gauze, microsurgery followed by application of dermal regeneration template tylored gloves allowed a significant reduction of hospital stay, healing time, and dressing pain as well as an increased recurrence-free interval. We present summary statistics as means with standard deviation (Std). The continuous data were assessed for normality of distribution using a Kolmogorov–Smirnov test that revealed a normal Gaussian distribution. Comparison of the two treatment groups was performed using a Mann–Whitney U test for continuous consequent variables. An expert bio-statistician performed the statistical analysis using Statistical Package for Social Sciences (SPSS version 16.0). A value of  $p$  less than 0.05 was considered statistically significant.

## CONCLUSIONS

The microsurgical approach, associated to our new protocol described in the study, has been beneficial in providing consistent and successful long-term results for these patients, opening new perspective in order to improve both the quality of life and long term release from recurrence of pseudosyndactyly.

Keywords: Dermal regeneration template; Epidermolysis bullosa; Hand; Pseudosyndactyly

## **A-0601** FUNCTIONING BI-POLAR LATISSIMUS DORSI MUSCLE FLAP FOR COMPLEX TISSUE DEFECTS OF THE ARM, INCLUDING BICEPS AND/OR MUSCLE-CUTANEOUS NERVE

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### Introduction

Elbow flexion is extremely important for the functionality of the upper limb: with normal shoulder function, 1200 of flexion is required for placing the hand to the mouth, and 750 for placing the hand to the perineum. In patients with arm tissue loss, including the biceps muscle and/or muscle-cutaneous nerve, the latissimus dorsi muscle flap (LD) can be successfully used as a bi-polar island pedicle flap.

### Material and method

We performed this procedure in 7 patients presenting both large and complex tissue defects of the arm, including the biceps muscle and/or muscle-cutaneous nerve. In one of the patients also presenting a bone defect of the humeral shaft, a chimeric flap including latissimus dorsi, serratus anterior and a vascularized rib segment was used.

### Results

All flaps survived and the elbow flexion strength was M4 in 3 cases and M5 in 4 cases.

We describe our surgical technique, the rehabilitation steps, and patient's outcome.

### Conclusions

The use of functioning LD transfer is a safe and efficient procedure, which can provide both complex tissue defects reconstruction and functional restoration of the elbow flexion.

## **A-0602** REINVENTING POLLER TECHNIQUE FOR PHALANGEAL FRACTURE FIXATION WITH CANNULATED SCREW

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The purpose of our study is to present this new technique, the indications, and outcomes of complex proximal phalangeal fractures. We retrospectively reviewed all patients whose proximal phalangeal fracture has been treated with intramedullary screws applying the Poller-blocking-principle.

It consisted in using an additional cannulated- screw on the transverse plane to provide a stronger fixation while avoiding axial displacement.

The technique is based on the premise that Poller-blocking screws are an important adjunct for intramedullary fixation for metaphyseal-diaphyseal fractures in long bones.

In our cases we used one screw intramedullary as described by Piñal et al, and another screw in the sagittal plane to control extension deformity and interfragmentary reduction.

All our patients returned to their normal previous activities at an average of 17 days. The range of motion achieved was completely functional in all our patients. None of our patients needed additional procedures such as tenolysis or refixation.

In conclusion, unstable proximal phalangeal fractures can be treated with this new technique obtaining great functional results with minimal morbidity. We found it to be a useful alternative to the more conventional methods of managing this kind of fractures (ORIF with locking plate,k-wires).

## **A-0603** THE HEAVY POSITIVE ROLE OF ADIPOSE DERIVED STEM CELLS (ADSC) IN THE HEALING PROCESS OF DIGITAL ULCERS IN PATIENTS WITH SCLERODERMA: OPENING OF A NEW PERSPECTIVE

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### INTRODUCTION

Scleroderma is characterized by severe connective fibroplasia associated with microangiopathy. In the hand skin ulcer is a highly marking sign of the disease and affects 50% of patients. The distinctive features of ulcers are:long lasting, pain, healing difficulty, severe functional impotence, evolutionary tendency towards infection or gangrenedrivng to amputation. Medications and dressings are currently the standard of care management. In our experience, the local use of ADSCs, with pro-angiogenetic, anti-inflammatory, analgesic, and restoring activity, has restarted and accelerated the blocked healing processes, leading to rapid spontaneous resolution of the clinical picture, with no recurrence.

### MATERIALS AND METHODS

Between May 2017 and September 2022 in our Department, 52 patients between 42 and 58 years, averaging 49 aa. M 19 and F 31, were admitted to our protocol under Day Service; a total number of 87 ulcers was treated. With tumescent technique the fat was taken with 10cc syringes. and 3mm cannulas from the abdomen or trochanteric region, in a quantity varying from 10 to 15 cc,centrifuged at 3000 rpm for 3 mins, eliminating the fluid and oily component, emulsified by 30 passages and injected, under local anesthesia, with a micro-cannula of 2 mm around and/or proximally to the ulcers trough 2 to 3 holes of 2 mm at the back of the IFP in the fingers, in a subdermal plane, avoiding the distal area in the more severe fibrotic forms.The treatment was performed in patients with chronic ulcers present since the last 6 to 12 months, with ingravescet evolution.

## RESULTS

No complications or adverse events were observed.No recurrence was observed up to day. All patients underwent complete and spontaneous healing of the ulcers in an average of 37 days.In all cases reduction of pain to zero was observed associated with reduction to suspension of painkillers, marked reduction of cyanosis, improvement of skin texture and vascularity.The longest healing time (45 days) occurred in a 52-year-old patient with systemic sclerosis lasting over 5 years, with severe signs of microangiopathy. All patients were satisfied, would undergo again the treatment and would recommend it to other patients.

Capillaroscopy performed showed marked increase in tissue perfusion.

## CONCLUSIONS

Digital ulcers in patients with scleroderma represent a highly disabling condition at high risk of digital amputation. Surgical treatment belongs to the history. In our series the local use of ADSCs showed to have a positive effect on digital ulcers, leading to definitive healing in all cases, with no recurrence. Our experience encourages the use of this mini invasive approach with highly positive impact.The method, in expert hands, proved to be safe, effective, risk-free,without complications,withreduced healing time, improving sensitivity, functionality, vascularization and district trophism.

Keywords: scleroderma, lipofilling, ADSC, digital ulcers

## **A-0604** TETRAPLEGIA UPPER LIMB ACTIVITY QUESTIONNAIRE, TUAQ - DEVELOPMENT AND INITIAL PSYCHOMETRICS

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### Introduction

SCI-specific ADL instruments are not specific enough to capture changes in Upper limb and ADL instruments specifically for hand injuries include items that are not relevant to people with SCI. A questionnaire of daily activities dependent on upper limb relevant for people with tetraplegia is therefore needed.

### Method

The Tetraplegia Upper Limb Activity Questionnaire (TUAQ) was developed in a collaboration between Sweden, Australia and New Zealand. The development and psychometric testing involved item generation, pilot testing of items and scoring system and psychometric testing (internal consistency and dimensionality, construct validity, reliability and responsiveness). Persons with stable C5-C8 SCI were recruited. Data were evaluated using exploratory factor analysis and Rasch analysis.

### Results

Items were generated from 708 identified activities by COPM assessments the 12 most common and relevant activities were chosen. The pilot testing defined recommended scale. Rash analysis showed no misfitting items or persons however a number of items demonstrated local dependence. Three items were subsequently removed. Due to a number of disordered thresholds response the scale were decreased from a 10 to a 5-point scale. Following this, TUAQ demonstrated a good fit to the Rasch model. TUAQ is unidimensional and well targeted, demonstrates good reliability and validity, is well targeted regardless of age, gender, spasticity or time post injury and effective in detecting change in upper limb activities in people with tetraplegia.

## Conclusion

TUAQ has the potential to be an important patient reported outcome measure used for clinical and research purposes in this population.

**A-0605** OUTCOME AFTER DIAGNOSIS AND TREATMENT OF COMPLEX REGIONAL PAIN SYNDROME (CRPS) IN THE UPPER EXTREMITY - A CROSS SECTIONAL STUDY OF PHYSICAL SYMPTOMS AND PSYCHOLOGICAL HEALTH IN LONG-TERM Lars. B. Dahlin<sup>1,2,3</sup>, Ellen Lyckegård<sup>1,2</sup>, Astrid Parinder<sup>1,2</sup>, Erika Nyman<sup>3,4</sup>

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Complex Regional Pain Syndrome (CRPS), divided by if a nerve injury is present (CRPS type 2) or not present (CRPS type 1), is a difficult condition to diagnose and to treat. The knowledge about long-time outcome and influencing factors of outcome of CRPS, including any differences between CRPS type 1 and CRPS type 2, is limited. Our aim was to evaluate outcome and associated factors, focusing on physical symptoms and psychological health, in individuals with CRPS type 1 and CRPS type 2 through a cross sectional survey study.

Individuals, identified through medical charts (ICD-codes G907, M890, G905, G906 and G564) at two regions in Sweden (i.e., Region Skåne and Linköping University Hospital) were sent seven validated survey forms and complementary questions [Disabilities of the Arm, Shoulder and Hand – Quick version (QuickDASH), a Specific Hand Surgery Questionnaire-8 questions (HQ8), EuroQol 5 Dimensions 3 levels (EQ-5D-3L), Hospital Anxiety and Depression Scale (HADS), Life Satisfaction Questionnaire (LiSat-11), Pain Catastrophizing Scale (PCS), and Antonovsky's Sense of Coherence-29 (SoC-29)].

Among 238 identified individuals, 99 responded to the survey (response rate 42%; responders older than non-responders,  $p < 0.001$ ; 59.0 [52.0–66.0] years; CRPS type 1  $n=71$  (72%); CRPS type 2  $n=28$  (28%); time since diagnosis median 59.0 [34.0–93.5] months; QuickDASH score 46 [21–71]; no difference type 1 and type 2  $p=0.35$ ). The responders reported improved disability over time, where individuals with CRPS type 1 improved more than CRPS type 2 ( $p=0.006$ ). Around 60% of responders had problems in daily activities, 49% had sleeping problems and 90% experienced moderate to extreme pain, where 23% were still on sick leave. In addition, in the HADS survey 33% had a significant score (9–21 points) for anxiety and 24% for depression compared to a reference population. Individuals with a low sense of coherence score (SoC score) and high pain catastrophizing score (PCS) had a higher QuickDASH score and were less satisfied with their life and their physical and psychological health, but SoC and PC scores did not differ between CRPS type 1 and type 2. A higher level of education was associated with more improvement of disability and those with more anxiety was associated with worsened disability.

We conclude that individuals with CRPS suffer in long-term from pain, sleeping problems and limitations in daily activities with occurrence of anxiety and depression, where disability improves less in CRPS type 2. Individuals are generally unsatisfied with many aspects of their life. Low sense of coherence and high pain catastrophizing are associated with a worse outcome, whereas education level and presence of anxiety are associated with worsened disability.

## **A-0606** HUMERAL SHAFT ENORMOUS CHONDROSARCOMA IN A PATIENT WITH MULTIPLE HEREDITARY EXOSTOSES

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### Objective

A case of enormous osteochondroma in the humeral shaft transformed into chondrosarcoma after 13 years is presented and the treatment protocol is analyzed.

### Methods and Materials

A 26-years old male presented in our outpatient department complaining of a huge mass in the anteromedial side of his left humerus. The patient is suffering from multiple hereditary exostoses with three confirmed lesions located in the left humeral shaft and left tibial shaft. The humeral lesion debuted 13 years ago. He otherwise has an unremarkable medical history. The clinical examination revealed a rigid painless mass with some discomfort during daily activities. The shoulder and elbow joints maintained a full range of motion and neurovascular status was intact. X-rays disclosed non-well-defined calcified lesions with additional cortical thickening/expansion and endosteal erosion as well as intralesional "popcorn" mineralization. Ct-scan, Magnetic resonance imaging (MRI), and bone-scan confirmed the diagnosis of chondrosarcoma. A ct scan-guided needle biopsy was scheduled for the identification of the histological type and grade of the tumor. A angiography was performed preoperatively to determine the anatomical relationship between the tumor and neurovascular structures of the humerus. Finally, staging of the tumor with a full body ct-scan was done.

### Results

The biopsy revealed a low-grade chondrosarcoma and wide surgical excision was performed. The lesion was removed en-block and the vessels of the tumor were ligatured. The intraoperative fast-track biopsy and the postoperative histological examination of the tumor confirmed the negative margins of the excision. The bone deficit was replaced with a humeral endoprosthesis with flexible sizing and rotation alignment due to multiple hereditary exostoses. The perioperative and postoperative treatment was uncomplicated and the patient was satisfied by the function of his upper extremity. Regular MRI monitoring was recommended for the lesions of the tibial shaft. There was no recurrence at two years follow-up.

## **A-0608** SCHWANNOMAS OF THE HAND: CASE REPORT

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**Background:** In hand Schwannomas, the radial nerve is involved in only 5% of the cases. Symptoms are mostly based on moderate localized pain, and time progression varies from days to years. Clinical diagnosis is suspected with pain, nerve entrapment symptoms and specific nerve assessments as Tinel's sign. Ultrasound usually shows cystic lesions with clear margins. Magnetic resonance imaging is considered when malignant behavior is suspected. Surgical excision is early considered based on discomfort or to make a complete histological evaluation. In our unit, we register only one hand schwannoma case in the last 3 years, so this work brings us an opportunity to review some important aspects on the topic.

**Methods:** This was 64-year-old male, that notice a spontaneous mass growing 12 years before. There was no history of pain or compression symptoms. He attends to our unit for exclusive cosmetic reasons. At the clinical assessment, we found a soft round mass 4 cm proximal to the radiocarpal joint. We found remarkable loss of sensibility at the dorsal aspect of

the thumb and Tinel's sign was negative. Ultrasound showed a compatible image with an epidermoid inclusion cyst and no nerve involvement was reported. We performed a precise dissection, finding an entrapment of the superficial branch of the radial nerve. After excision histological analyze was requested.

Outcomes: Histological analyze reported a tumor with a fibrous capsule and Verocay Cells alignment, with further immunohistochemistry revealing a myxoid Schwannoma. The patient wound evolution was excellent, and 4 weeks after the procedure the patient presented full sensibility at the dorsal aspect of the thumb compared with the contralateral hand.

Discussion: In sonography, Schwannomas have a great similarity with ganglion cysts, therefore closeness to a nerve pathway should be intentionally searched to clarify the diagnosis. There is always remarkable concern about possible nerve injuries during the resection. The tumor growing usually respects interfascicular nerve spaces and a full nerve recovery may be achievable. Despite schwannomas include nerve entrapment, we believe that fine and meticulous surgical techniques may determine the patient's prognosis.

### **A-0609** PURE DISLOCATION OF ULNAR FOUR CMC JOINTS: A RARE ABERRANT CASE

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Title:

Pure dislocation of ulnar four CMC joints: A rare aberrant case

Introduction

Carpometacarpal (CMC) Joint injuries represent less than 1% of all hand injuries but can have a severe incapacitating effect on the functional status of the hand. Involvement of multiple CMC joints in a hand is very rare and results from high-energy trauma. The few cases reported in literature are all associated with a concomitant fracture to the carpus or metacarpals. We present a very rare case of pure dislocation of all four Ulnar CMC joints.

Case Description:

A 21-year old strongly built male presented with swelling and deformity over the dorsum with reduced range of movements after an injury to his dominant left hand sustained after punching a wall in anger. AP Radiographs showed an overlap of the metacarpals at the CMC joints on the AP view. Lateral views identified a dorsal dislocation of the ulnar four CMC joints without any obvious accompanying fractures. Retrospective history and examination did not reveal any evidence of hypermobility. A CT scan was performed which confirmed the injury to be a pure dislocation with no associated fractures. The index, middle and small finger CMC joints were reduced closely under regional block and transfixed with k wires. The ring finger metacarpus was secured with a transverse wire to the adjacent metacarpus. A plaster splint was applied for rest and comfort.

The splint and wires were removed in the clinic at 6 weeks. Full mobilization was commenced with therapists at this stage. He made a complete and uneventful recovery.

Discussion:

Carpometacarpal joints are inherently stable having bony architecture with multiple articular facets providing intrinsic natural stability. The volar, dorsal and inter-metacarpal ligaments strengthen these further against subluxations and dislocations. The long flexors, extensors and intrinsic muscles provide additional dynamic stability to these joints. A very high-energy trauma with severe axial load is required to injure them as seen in Road Traffic Accidents, fall from significant heights and punching. Pure dislocation involving all four joints is very rare, especially in the absence of any

hypermobility syndromes.

These injuries can be easily overlooked when associated with other life-threatening injuries and require a high index of suspicion for early diagnosis. Radiographic assessment including PA, oblique and true lateral views which helps in classifying these injuries as dorsal (commonest), volar and divergent. CT scans are vital in identifying any occult fractures of the carpus. Treatment options described in literature are varied. Closed reduction and splintage seem to work for some, while others require open reduction and internal fixation. The choice of implant is usually dictated by the associated fractures. We were able to achieve satisfactory reduction with closed manipulation in our patient. We chose percutaneous K wires for internal fixation so as to allow the ligamentous injuries to heal and prevent re-dislocation.

In summary, this is a very rare presentation, which was identified early and treated appropriately to provide an optimal outcome for a potentially disabling injury.

Keywords: carpometacarpal dislocation, ligamentous injury, pure dislocation,

### **A-0610** LUNATE SHIFT INDEX (LSI): A NEW PARAMETER FOR THE EVALUATION OF RESIDUAL ULNAR SIDE WRIST PAIN IN PATIENTS WITH WRIST OSTEOARTHRITIS UNDERGOING THREE-CORNERS ARTHRODESIS VS FOUR-CORNERS ARTHRODESIS. A RETROSPECTIVE COMPARATIVE STUDY WITH MINIMUM 2 YEARS F

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#### INTRODUCTION:

Wrist arthritis is usually secondary to post-traumatic sequel and may result from a nonunited or malunited fracture of the scaphoid or scapholunate ligament injury. This clinical condition generates two clinical and radiological patterns of wrist degenerative changes known as scaphoid non-union advanced collapse wrist (SNAC) and scapho-lunate advanced collapse wrist (SLAC). SNAC and SLAC wrist both at stage II-III are common indications for limited wrist fusions including four-corners fusion (4CF) and three-corners fusion (3CF).

The aim of this study is to assess the clinical and radiological outcomes in patients undergoing 3CF vs 4CF. A new radiological index called Lunate Shift Index (LSI) is developed to evaluate the importance of the lunate displacement relative to the radiolunate joint.

It has been hypothesized that there exists a correlation between the lunate displacement relative to the lunate facet of the radius and residual ulnar side wrist pain.

#### MATERIALS AND METHODS:

Twenty-eight patients undergoing 3CF (13 SNAC, 16 SLAC) and forty patients undergoing 4CF (26 SNAC, 14 SLAC) were clinically evaluated using the MAYO wrist and PRWE score. The radiolunate angle, the carpal height and the LSI were recorded radiographically. The LSI corresponds to the ratio between the distance from the lunate center to the middle of the intermediate column and the length of the intermediate column of the distal radius.

#### RESULTS:

A statistically significant correlation was observed between LSI and clinical outcomes. The lunate displacement is associated with an increased incidence of wrist ulnar pain. No statistically significant differences were observed between 3CF and 4CF in all outcomes measures.

#### DISCUSSION:

The osteoarthritis of piso-triquetral joint has been identified as the cause of wrist ulnar pain in patients undergoing 4CF,

determined by an increased overload of the ulnar column following the fusion of the proximal carpal row in extension. Regarding this, it has been demonstrated that 4CF prevents distal translation of the triquetrum during ulnar deviation movement. The lunate correct positioning allows to maintain the carpal height and to increase the contact area at the level of the radiolunate joint. A good reduction of the lunate could be obtained more easily with the 3CF compared to 4CF thanks to the removal of the triquetrum.

#### CONCLUSIONS:

This study shows how proper realignment of the lunate following mediocarpal arthrodesis correlates with a better clinical outcome. In accordance with literature, it is emphasized the importance of reducing functional overload of the ulnar spine by preventing the occurrence of postoperative ulnar pain.

### **A-0612 RESECTION OF HIGH FLOW VASCULAR MALFORMATIONS WITH TRANSOPERATIVE SUPERSELECTIVE EMBOLIZATION**

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**Background:** The treatment of some vascular anomalies is a challenge. High-flow Arteriovenous Malformations (AVM) can be frustrating for the hand surgeon commonly ending in amputations. Otherwise, its embolization plays an important role, but it involves the risk of occlusion of the distal circulation. The objective of this work is to present a novel alternative including a multidisciplinary approach.

**Methods:** We select 2 cases of high-flow AVM with a challenging scenario. The first case was an AVM affecting the deep palmar arch of the right hand, and the second case was an AVM affecting thoracic arteries. We treat both with our multidisciplinary approach. It started with surgical protection of viable distal flow with a temporary vascular clipping. Transoperative embolization was performed with hemostatic gelatin. We continued with an immediate surgical resection of the AVM. After the resection, we used a transoperative arteriography to demonstrate the absence of AVM and distal vascular pathways integrity.

**Outcomes:** Our method turned out to have great advantages with a successful result in both cases. For the endovascular intervention, it allows a superselective embolization. It protects vascular structures distal to the clipping, and decreases the inflammatory reaction caused by other embolization materials. For the surgeon, it facilitates resection and reduces transoperative bleeding avoiding blood transfusion. It also allows immediate revascularization if required.

**Conclusion:** Nowadays treatment of high flow AVM stills a challenge and further research is required. Our multidisciplinary treatment may become an outstanding strategy in the treatment of high-flow AVM that were once considered unresectable.

## **A-0613** THE DOUBLE-OPPOSING ADIPOFASCIAL INTERPOSITION FLAP: A NOVEL TECHNIQUE TO PREVENT SCAR TETHER AND SYMPTOMATIC NEUROMA OF THE SUPERFICIAL RADIAL NERVE AFTER TRAUMA

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### Introduction:

The superficial radial nerve (SRN) is vulnerable to injury in hand trauma patients. Aberrant repair mechanisms can result in neuromas or scarred, tethered nerves with resultant neurostenalgia. Current management techniques focus on neurolysis and proximal repositioning of neuromas into bone or muscle, with recent shift to using local, regional or free flaps to protect the injured nerve.

Clinical studies have demonstrated that fascial wraps improve gliding and provide nutrition and mechanical support to the nerve thus, favouring neurochemical and electrical stability while reducing irritability and scar adhesion. To date, this technique is only described as a revision surgical procedure in cases of established neuroma; there is no published evidence studying its use during the index operation prophylactically. Here we describe a case series of a novel double-opposing adipofascial interposition flap following repair of the superficial radial nerve to prevent scar tethering and symptomatic neuroma.

### Methods

We identified 5 patients presenting with traumatic lacerations to the dorsal wrist involving the SRN and 1 or more neighbouring tendons. Surgical repair involved extension of the wound in a lazy-S incision and repair of injured tendons and microscope-assisted SRN repair. Two triangular adipofascial flaps were raised from the skin and interposed between the repaired tendons and nerves. The resulting flap enveloped the nerve repair site to create a new non-irritant gliding plane that was separated the recovering nerve from the healing tendons. Post-operatively, patients were offered regular follow up.

### Results

All the patients were male, with a mean age of 35.8 (range 22 - 56). Patients attended with a mean follow up duration of 3.5 months (1-8 months, n=4). In our review the most common mechanism of injury was glass laceration which occurred in two of the five patients. Other mechanisms of injury included accidental angle grinder injury, accidental hand saw injury and self-harm. Associated tendon injuries were present in all 5 patients with EPB being the most commonly injured tendon in our series. All follow up patients showed no symptoms of neuroma or neurostenalgia and demonstrated improving Tinel's sign on serial examination. All patients underwent hand physiotherapy and were discharged without re-referral or further surgery. No patients requested further referral to the hand specialist team following discharge.

### Conclusion

Neuromas and neurostenalgia following SRN repair causes significant morbidity to affected patients. Thus far, techniques have only been described to treat these issues after they arise and are plagued with recurrence and treatment failure in this specific nerve. Newer techniques have begun looking at protective barriers to protect injured nerves. Our case series demonstrates promising results using an adipofascial interposition flap to insulate the repaired nerve and reduce neurostenalgia and is proposed as a prophylactic measure in traumatic injuries to reduce traction neuritis and neurostenalgia. Further prospective study is needed with a larger study group and increased post-operative surveillance with use of recognised outcome scores measured against a comparison group.

## **A-0614** EFFICACY OF DISTAL NERVE DECOMPRESSION AFTER PROXIMAL PERIPHERAL NERVE INJURY SECONDARY TO COVID PRONING: A CASE SERIES

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### Introduction:

Covid-19 proning is a known risk factor for compressive peripheral nerve injury (PNI). Following an axonotmetic injury the regenerating nerve must negotiate anatomically confined spaces at natural compression points which may interrupt intracellular transport or interfere with conduction in the neo axon with immature myelination.

The hypothesis for this study is that the compression may be sufficient to impair conduction and may create a double crush phenomenon such that further regeneration and functional recovery are impaired. Interval decompression of regenerating nerves may provide an improved environment for further recovery and regeneration that may be clinically detected.

### Methods:

We performed a retrospective review of patients presenting with Covid-19 proning plexopathy from February 2020 to November 2021 at our specialist center for peripheral nerve injuries. 13 patients met the inclusion criteria which was any proned Covid-19 patient who developed an axonotmetic PNI affecting a mixed nerve and subsequently underwent distal decompression of the regenerating nerve. Exclusion criteria included concomitant surgery that could affect the functional assessment and patients for which outcome data was not available.

Patient demographics, as well as site and severity of the injured nerve at presentation were recoded. Data was obtained from hospital electronic records. Baseline clinical and neurophysiological features were compared to early follow-up (less than 6 weeks) outcomes, to exclude recovery unlikely to be related to the decompression alone. Nerve injuries were graded at presentation as high, intermediate, or low-grade injuries and outcomes were based on motor and sensory recovery. Outcome measures that formed part of the grading scale included motor function using the British Medical Research Council (BMRC) grade, sensory function using the ten-ten score +/- Semmes-Weinstein monofilament pressure thresholds, two-point discrimination testing, the Tinell's sign, a Visual Analogue Scale (VAS) pain score (0-100), and a relevant patient reported outcome measure (PROM).

### Results:

12 of the 13 patients had bilateral disease and all patients presented with multi-level and multi-site compression with the total number equating to 53 injured nerves. 16 of the 53 (30%) injured nerves were decompressed, eight of which were decompressed at more than one site along their course. Surgical decompressions performed in this cohort included: 12 cubital, eight Guyon's and four carpal tunnel decompressions. Of the 16 decompressed nerves, seven were classified as high-grade injury and nine as intermediate-grade, with no low-grade injuries requiring decompression.

The mean PROM score improvement in the early post-operative period was 26.25%. Of the high-grade injuries, one excellent, one good, one fair and two poor outcomes were achieved, while in the intermediate group there were six excellent, one good and two fair outcomes at early follow-up. No post-operative complications were documented.

### Conclusion:

This study demonstrates the heterogeneity of Covid-19 proning injuries with regards to nerve type, location, and severity. Only a limited number of decompressed nerves achieved substantial improvement at early review, however, the complication rate is low and patient satisfaction is high. The preliminary data supports the development of a large randomized controlled trial of distal nerve decompression during the regeneration phase following proximal PNI.

## **A-0615** STRATIFIED REHABILITATION REGIMEN AFTER UO00BTENDON LENGTHENING IN THE SPASTICU000BUPPER LIMB: U000BFEASIBILITY AND PATIENT OUTCOMES

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### Background

Spasticity is a common secondary complication after injuries to the central nervous system (CNS). Non-surgical treatment is not always sufficient why surgical solutions have gained increased popularity.

### Purpose

The aim of the study was to evaluate the feasibility and patient outcomes of a treatment concept with stratified rehabilitation regimen after spasticity-correcting surgery.

### Method

Patients with problematic spasticity in the upper limb (UL) due to CNS injuries who underwent surgery between February 2017 and June 2019 were included in the study (N=58). Depending on residual UL function, patients were assigned a high-, low- or non-functioning treatment regimen (HFR, LFR and NFR) prior to surgery. The surgical intervention comprised lengthening of tendons and/or releases of muscles based on individual needs. The rehabilitation started the first post-operative day and the therapy content varied between the three regimens. Typically, treatments such as dynamic and/or passive activation of the antagonist muscles, wrapping and application of custom-made splints were included. Three weeks after surgery, the patients returned for physical and occupational therapy according to the regimen specific protocol, including activities of daily living, relearning of movement patterns and resting positions.

Assessments were made before surgery and six months post-surgery. The primary and secondary outcomes differed among treatment regimens. For HFR, the ability to use the arm in unilateral activities as measured by the Grasp and Release Test (GRT), served as primary outcome measure. In the LFR, the ability to actively use the arm in bilateral activities as measured by section B of the Arm Activity Measure (ArmA) served as primary outcome measure. In the NFR, section A of ArmA (facilitation of basic/passive aspects of care) served as primary outcome. Spasticity was measured across all three groups with the Modified Ashworth Scale (MAS).

### Results

Patients received treatment according to HFR (N=18), LFR (N=27) and NFR (N=13). 51 out of 58 patients adhered to the regimen. Mean change in the composite MAS score across all three groups collapsed revealed significantly reduced MAS score from 3.2(± 0.9) to 1.1 (± 1.1);  $p < 0.001$ . The primary outcome measures improved significantly; For the HFR group, this implied an increase (mean [SD]) in GRT (19.6 [±19.0];  $p = 0.001$ ). For the LFR group, this implied a decrease (median [IQR]) in activity limitations in the hand, as measured by ArmA B (-5.0 [-12.5 to -1];  $p = 0.01$ ). For the NFR group, this implied a decrease (median [IQR]) in passive activity limitations in the hand, as measured by ArmA A (-12.0 [-14 to -10];  $p = 0.02$ ).

### Conclusion

This study provides data in support of a stratified rehabilitation regimen for patients undergoing spasticity-correcting UL surgery. The treatment concept was found feasible and produced gains in active and passive aspects of UL function. This stratification may be used to guide clinician and patient expectations and may facilitate tailored selection of UL rehabilitation goals based on patients' capacity for improvement.

### Take home message

The algorithm with stratified regimen specific rehabilitation seems feasible

The algorithm can be used to guide expectations and facilitate treatment goals based on the individuals capacity

**A-0616** ASSESSING THE CATEGORIZATION OF TRAPEZIUM-1ST METACARPAL ARTICULATE SURFACE – A PILOT STUDY  
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**Introduction:**

The understanding of bone morphology is associated with joint kinematics and the etiology of osteoarthritis. Both observation and quantitative analysis on the morphology of trapezium concluded shape deviations among the asymptomatic population. A recent study observed 1233 trapezium specimens and classified the trapezium-1st metacarpal (TM) articulate surface into three categories: “quadrilateral”, “bean”, or “heart” (Flanagan, C. D., et.al., 2022). The goal of this study was to challenge the reliability of this classification with a new dataset of asymptomatic trapeziums. Clear and comprehensible categorization of bone shape can provide insight in future clinical practice.

**Method:**

Two hand surgeons were invited to classify images of 51 bilateral asymmetric trapeziums in random order. Bone models of left hands were mirrored along the sagittal plane. The images presented the trapezium-1st metacarpal articulate surface when the ulnar direction points to the left side of the images. The invited surgeons learned the classification criteria (Flanagan, C. D., 2022) before starting the questionnaire. The answers were analyzed based on Fleiss’ Kappa analysis using SPSS(v28.0.1.1) to assess the agreement between the raters.

**Results and discussion:**

Among the 102 bone models, the two raters had an agreement on 46 models, almost half of the dataset: 8 as “quadrilateral”, 15 as “bean”, 23 as “heart”. However, the Kappa value was  $k=0.15$  (95%CI, 0.01 to 0.29),  $p=0.04$ , indicating low agreement between the two raters. For the paired bones, the two raters classified 31 and 21 over the 51 pairs into the same categories. “Bean” shape was involved when the bones of two sides were in different shape categories. Both surgeons indicated unconfidence during the questionnaire. Categorizing the trapezium into “quadrilateral”, “bean”, or “heart” shapes, following the criteria proposed by the groups of Flanagan, was still challenging for specialists without pre-training on these criteria.

**Conclusion:**

This is a pilot study to evaluate a new classification of trapezium for only two hand surgeons without pre-knowledge of the criteria. Further research is essential and will be extended. An update of the classification criteria with better instruction can benefit future morphologic and etiology studies on thumb-base joints.

**Reference:**

Flanagan, C. D., Tamer, P., Cooperman, D. R., Crisco, J. J., Ladd, A. L., & Liu, R. W. (2022). An anatomical evaluation of the trapezium and its relationship to basilar joint osteophytic change. *HAND*, 17(4), 714-722.

**A-0617** PRIMARY DIAGNOSTIC ERROR IN COMPARTMENT SYNDROME DUE TO EXTRAVASATION OF IODINATED CONTRAST IN THE HAND

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The complications due to extravasation of iodinated contrast are described and widely known. However, the appearance of these complications locally in the hand can differ, hence making its diagnosis more easily mistaken.

We present the case of an 80-year-old woman transferred to our traumatology emergency room initially diagnosed as an allergic reaction due to extravasation of iodinated contrast in the left hand during a scheduled CT scan for a tumor in the angle of the mandible, which took place 5 hours before. The patient, diagnosed with dementia, simply reported itching in her hand without pain. Upon examination, her left hand was swollen with the impossibility of closing the fist and with the presence of blisters both on the back and on the palm of the hand. Suspecting compartment syndrome secondary to contrast extravasation, emergency surgery was performed with dorsal and ventral fasciotomies in the hand and forearm, requiring secondary surgery upon 72h for skin closure. She presented good evolution with complete functional recovery of the hand, without pain 2 months after the injury.

Compartment syndrome in the hand is fairly rare, but we must always bear in mind this condition as a possible complication due to extravasation of iodinated contrast. Pain is the most commonly occurring symptom, although in elderly patients or patients with mental illnesses, the hand appearance upon physical examination should always alert us. A mistake in its early diagnosis can result in limb loss or important functional sequelae in the hand.

## **A-0618** OUTCOMES OF SUPERCHARGED END TO SIDE (SETS) ANTERIOR INTEROSSEOUS NERVE TRANSFER FOR ULNAR NERVE LESIONS-IN-CONTINUITY: A CASE SERIES

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### Introduction:

In-continuity lesions of the ulnar nerve refer to irritation, compression or traction injuries of the nerve and are seen frequently in the peripheral nerve outpatient department. Cubital tunnel syndrome in particular, is the second most common entrapment neuropathy worldwide. Supercharged End to Side (SETS) nerve transfers for anterior interosseous nerve (AIN) to deep motor branch of the ulnar nerve (MUN) are gaining momentum in the literature base since first performed in clinical practice in 2012. Our tertiary peripheral nerve injury unit has been performing this technique for the past 10 years in patients presenting with ulnar nerve transections and lesions-in-continuity. This study provides a review of the outcomes of SETS nerve transfers performed for in-continuity lesions during this time.

### Methods:

This is a retrospective review of 12 patients with ulnar nerve lesions-in-continuity who underwent a cubital tunnel decompression and an AIN to MUN SETS transfer during the period 2011 to 2022. Non-in-continuity nerve lesions and any lesions managed operatively with end-to-end (ETE) or Hemi-ETE nerve transfers were excluded. Data including demographics, injury details, adjunctive surgical procedures and outcomes were collected. Severity was graded pre-operatively in all patients using the Modified McGowan classification and SETS was indicated as an adjunctive procedure in patients graded as McGowan 2 or 3. Outcome measures searched for included intrinsic motor recovery graded using the British Medical Research Council (BMRC) scale, key pinch strength, tripod pinch strength and the patient-rated ulnar nerve evaluation (PRUNE) score which is a validated patient reported outcome measure (PROM).

### Results:

Twelve patients met the inclusion criteria, with 13 limbs operated on. The mean age at operation was 48 years (range 23- 65 yrs) The mechanism of compression in nine of the patients was due to primary cubital tunnel syndrome, with four patients presenting after Covid-19 related long intensive care stays with plexopathy affecting the ulnar nerve predominantly.

The median interval between presentation and surgery was 17-months. Patients had a median follow-up of 22-months post operatively. In patients with pre- and post-operative PRUNE scores, a mean improvement of 35.5% was seen at last follow up. BMRC grading for motor improvement was the most consistently measured outcome measure. In our case series a mean uplift of power of 3 MRC grades was seen in the intrinsic motor function, with 6 patients achieving grade 4 + or better intrinsic power post operatively.

Conclusion:

SETS nerve transfers have shown favourable outcomes in recent literature and in our case series and is becoming an important and more frequently employed tool in the nerve surgeon's armamentarium. Difficulty in the interpretation of outcomes in SETS is due to the heterogeneity of outcome reporting in clinical practice. There is a lack of consensus on appropriate motor recovery grading and PROM use in this group of patients. While individual case reports are promising, a prospective, matched RTC of SETS AIN to MUN transfers is needed before SETS can be incorporated into standard practice.

## **A-0619** ARE WE SPEAKING THE SAME LANGUAGE? SUPERCHARGING END TOSIDE NERVE TRANSFER FOR ULNAR NEUROPATHY: REDEFINING NOMENCLATURE AND RECOMMENDATION FOR STANDARDISATION OF SURGICAL TECHNIQUE Chane Kulenkampff<sup>1,2,3</sup>, Samuel George<sup>1,2,3</sup>, Dominic Power<sup>1,2,3</sup>

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Introduction:

Supercharged End to Side (SETS) nerve transfers have been described for surgical treatment of high grade in-continuity ulnar neuropathy since 2012. In recent years there has been an increase the literature surrounding SETS, however, there is inconsistency in the nomenclature used to describe the relevant anatomy and the microsurgical technique. With SETS transfers growing in popularity, it is now necessary to obtain consistency in nomenclature and technique to allow for future evaluation of outcomes in prospective randomised controlled trials (RCT)s.

The aim of this study is to provide a review of the literature on the SETS nerve transfer technique and to offer an overview of the technical nuances to facilitate standardisation of this technique.

Methods:

A review of the literature on the SETS technique with an extrapolation from 10 years of experience in SETS nerve transfers in a tertiary peripheral nerve unit in the UK was undertaken.

Discussion:

A SETS nerve transfer for ulnar neuropathy involves coaptating the cut end of the anterior interosseous nerve (AIN) to the side of the deep motor fascicular bundle of the ulnar nerve (MUN). Options for donor nerve preparation can be broadly divided into 3 techniques. In addition, different options for recipient nerve preparation have been described with other specifications including suture or suture-less repair alternatives.

Variables surrounding the donor nerve harvest and coaptation:

In the original description of SETS for AIN to MUN transfer by Barbour et al, the donor AIN is harvested using sharp neurectomy proximal to its branching point. Mackinnon elaborates on this in her response letter to Isaacs describing that fascicles of the cut end of the AIN can be "fanned out" prior to coaptation. A third alternative to this technique includes dissection of individual nerve branches distally and coaptating branches individually to the side of the MUN through multiple epineural windows.

Variables surrounding the recipient nerve preparation:

The anatomical level of dissection through and beyond the epineurium is not standardised with some surgeons advocating for coaptation through an epineural window alone while others specify that scoring of the perineurium is required for axonal propagation. Much of the research refers to scoring the perineurium when, in fact, it may be that a true perineurial breach is not commonly achieved and that it is rather the interfascicular epineurium that is breached in most reported cases. The size of the epineural and perineural window is also not agreed upon and recommendations vary anywhere from 2 to 5mm in recent publications by Walker et al and others. Currently there is no agreed number, depth or technique of suture placement widely recommended for the coaptation. The additional or alternative use of fibrin glue in SETS transfer is also suggested.

Conclusion:

Consistency in nomenclature used to describe SETS microsurgical technique is needed before a case series measuring outcome can be reliably interpreted. Standardisation of this technique will allow for reproducibility and facilitate future evaluations of outcome in prospective RCTs.

## **A-0620** SUPERCHARGED END TO SIDE NERVE TRANSFER FOR ULNAR NEUROPATHY: A SYSTEMATIC REVIEW

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Introduction:

The Supercharged End-to-Side (SETS) nerve transfer for anterior interosseous nerve (AIN) to deep motor branch of the ulnar nerve (MUN) has become a popular choice for management of severe ulnar neuropathy lesions since first performed in clinical practice in 2012. In-continuity lesions of the ulnar nerve refer to irritation, compression or traction of the nerve and are seen frequently in the peripheral nerve outpatient department. The aim of this review is to analyse the literature for outcomes of SETS nerve transfers for in-continuity lesions of the ulnar nerve.

Methods:

The Preferred Reporting Items for Systematic Reviews and Meta-Analyses guidelines were used when conducting this review. A search was undertaken using PubMed, MEDLINE, and Ovid databases. Keywords searched were: Supercharged-End-to-Side, Reverse-End-to-Side, and anterior interosseous to ulnar nerve transfer. The search was conducted in September 2022, for studies published in any year. Duplicates, animal studies, descriptive studies, studies not relating to AIN to MUN nerve transfer, and studies reporting only on ulnar non-in-continuity lesions or end-to-end and hemi end-to-end nerve transfers were excluded. Outcome measures analysed included pre-operative and post-operative motor function measured by intrinsic MRC grade of Adductor Digniti Minimi (ADM) and First Dorsal Interossei (FDI), grip strength and key pinch, Electromyography results (Compound Motor Action Potentials) (CMAPS) for intrinsic muscles, and DASH score.

Results:

Our literature search retrieved 166 articles from the search criteria, of which ten studies met the inclusion criteria. Seven were retrospective case series, one prospective cohort study and two case reports. A total of 230 patients were included of which nine patients with transection injuries could not be excluded from grouped outcome measure assessments. Nerve compression accounted for 185 cases and other in-continuity lesions accounted for the remaining 36 cases with

82% of all pathologies occurring at the elbow. Average post operative follow was 14-months.

The results that follow address patients for which outcome data was available. In 160 patients there was a 36.8% increase in key pinch strength, rising from a mean of 2.13kg pre-operative to 4.04kg post operatively. There was an increase in average grip strength in 100 patients (18kg to 22kg). Eighty patients had MRC grading of their ADM, demonstrating a 1.77x increase (1.18 to 3.27), whilst 47 patients had measured a 1.34x increase in FDI power (1.37 to 3.20). CMAPS measured in ADM, increased by 29% across 50 patients, from 2.1mV to 3.2mV. There was also a 29% improvement in DASH scores postoperatively for 135 patients.

Conclusion:

The number of published cases of patients with in-continuity lesions of the ulnar nerve who underwent AIN to MUN SETS nerve transfer has almost doubled in the last year, attributing to the popularity of this recently described intervention for compressive ulnar neuropathy. The outcomes following this technique are widely positive with low complication rates. However, heterogeneity in outcome measures make interpretation difficult. Future development of a large randomised controlled trial looking at standardised outcomes for patients with ulnar neuropathy undergoing SETS nerve transfer is now warranted.

## **A-0621** RELATIVE MOTION ON LUMBRICAL MUSCLE TEARS IN SPORT CLIMBERS: A PARADIGM SHIFT?

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**INTRODUCTION:** The principles of relative motion (RM) have not been only widely used in the management of surgical tendon repairs, but also in other conditions causing hand or finger pain. Lumbrical muscle tears are described as rare injuries occurring in sport climbing athletes. Patients suffering from this injury describe sudden palm pain not only while climbing, but in their activities of daily living (ADL) too. Symptoms can be assessed clinically with the lumbrical stress test, which reproduces the injury mechanism: a shear acting on the origins of the bipennate muscle on the tendons of the flexor digitorum profundus. As long as hand therapy seems important on its management, no specific protocols have been proposed in literature. RM orthoses could be used, as their effectiveness has been proved in similar hand conditions.

**OBJECTIVE:** This study aimed to analyze the effectiveness of a RM protocol in the management of patients who suffered from a tear of the 4th lumbrical muscle, regarding on the symptoms during the lumbrical stress test, the disability in their ADL and the sports-specific function.

**METHODS:** A prospective intervention study was performed on 50 adult climbers suffering from an injury of the 4th lumbrical muscle. They wore during 3 weeks a 5th finger extension RM orthosis, while pain-free sport activities were permitted using a 4th and 5th fingers buddy-taping. After three weeks, patients were told to progressively remove the splint and, after six weeks, the splint was totally removed. Symptoms in the lumbrical stress test were evaluated during the 6 weeks period using an adapted Jamar<sup>®</sup> handgrip dynamometer on a climbing hold. The climber was told to pull on the hold until the pain started. Finger flexion metacarpophalangeal (MCP) joint goniometry of the 5th finger was also measured during the same test. Finally, Quick DASH questionnaire was also analyzed. Statistical significance (p-value<0,05) was assessed using Mann Whitney U test.

RESULTS: While using the RM splint, pain disappeared immediately in all the subjects. After 6 weeks, improvements in the lumbrical stress test measurements were recorded: more weight could be loaded before pain started (mean 8,56kilograms; SD 5,52; p value=0,0001) and pain-free MCP flexion range of motion increased (mean 46°; SD 25,85; p value=0,0001). Finally, the Quick DASH questionnaire showed that disability decreased (Quick DASH: mean -17,56%; SD 14,06; p value=0,0001; Sports/Performing Arts module mean: -46,34%; SD 26; p value=0,0001). After 6 weeks, all the subjects stopped using the splint successfully and were advised to only use a RM taping for climbing, to prevent re-injuries. CONCLUSIONS: This RM protocol could be effective on the management of lumbrical muscle tears, providing immediate improvements on symptoms and hand function. Following the principles of pain-guided healing and preventing excessive scar tissue formation, the RM concept could avoid long immobilization periods or sport breaks, as well as increase patients' quality of life.

## **A-0622** RAPS: RADIAL NERVE PALSY SCALE- A NOVEL APPROACH TO CLASSIFYING RADIAL NERVE INJURY AND RECOVERY

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### Introduction:

The radial nerve is commonly injured in orthopaedic trauma due to its vulnerable position in relation to the humerus and other sites along its course in the upper limb. Late referral or intervention limits treatment options for these patients. Previous classification systems concentrate on severity but do not give an indication of recovery which guides management decisions. A novel approach would be to classify these injuries into functional anatomical levels that indicate the chronology of recovery and can be used to guide management throughout the patient's journey up to discharge. We present a case series of radial nerve injuries and propose the RADial nerve Palsy Scale (RAPS).

### Methods:

A retrospective review of patients with radial nerve injuries presenting to a single tertiary peripheral nerve injury service between January 2019 and August 2022 was performed looking at mechanism of injury and the chronology of recovery as well as intervention offered. A review of the current literature was undertaken for comparison.

### Results:

27 patients with a median age of 51 years (range 17-85 yrs) were included. The injury levels were supraclavicular in one patient, infraclavicular in five patients, humeral in eight patients and at the posterior interosseous nerve (PIN) in six patients. Mechanism was traction in eight patients, five transections, five crush, one compression and one neuritis. A predictable pattern of recovery was seen on average at 3-monthly time points, depending on mechanism and level of injury. High transection injuries showed resolution of wrist drop at 9-months, with antigavity extensor pollicis longus (EPL) function returning at 15-months, while traction injuries at the same level showed resolution of wrist drop by 3-months and antigavity EPL function within 12-months on average. A full table of results will be presented along with the proposed classification system to guide management.

### Discussion:

The sequence of radial nerve recovery follows a predictable clinical recovery trajectory. From our series and the corresponding literature, the classification level proposed corresponded well to a 3 monthly time interval to next level

of recovery, depending on severity. The RAPS follows five levels relating to the functional anatomical level of recovery. Differentiating clinical features help distinguish between levels of the classification. In summary, a level-five radial nerve injury is a very high injury affecting triceps function and loss of cutaneous sensation in the forearm and 1st webspace with no distal function. Level four has intact triceps with a wrist drop. Level-three is a posterior Interosseus nerve (PIN) injury with radially deviated wrist extension while level two sees some recovery of finger extension with centralising wrist extension. A level one injury is isolated weakness/paralysis of the EPL and the extensor indicis proprius muscles.

#### Conclusion

We propose the RAPS as a tool to identify both the level and severity of radial nerve injury and provide a means to monitor recovery as the patient evolves from a level five to a level one during treatment. This will provide clinicians with a prognostic indicator allowing for better documentation and communication between clinicians, patients, and the multidisciplinary team.

### **A-0624** LUMBRICAL MUSCLE TEARS IN SPORT CLIMBERS: PREVENTING SCAR TISSUE FORMATION AND PROMOTING HAND FUNCTION

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**INTRODUCTION:** Finger injuries are the most common in sport climbing. Although lumbrical muscle tears can often occur, this injury remains poorly studied. The rupture happens when a climber adopts asymmetric hand positions, for example, two-finger pockets or three-finger pockets. A shear force acts on the origins of the bipennate muscle in the flexor digitorum profundus (FDP) tendons, during the quadriga effect. The lumbrical stress test is used for the diagnosis and aims to reproduce this injury mechanism. If the patient refers hand palm pain, the test is considered positive. Different conservative approaches have been proposed, as buddy-taping or relative motion splints.

**OBJECTIVE:** A cadaveric study was designed to analyze the effects of load during the 4th lumbrical injury mechanism. The aim was to determine the amount of FDP tendon gliding in the pathomechanics. After the rupture, the in vivo effects of different conservative treatment options were analyzed.

**METHODS:** Ten fresh-frozen cadaveric specimens (ten non-paired forearms and hands) were used in this study. The specimens were placed on a custom-made loading apparatus. FDP of the 4th and 5th fingers were exposed and dissected separately at the forearm previously. While the 4th finger was maintained in extension, the FDP of the 5th finger was loaded progressively using a dynamometer. First, FDP tendon gliding was evaluated, measuring the millimeters (mm) of distance between the two FDP tendons at the forearm, when rupture occurred. Then, after the rupture, a 200 grams (g) load was applied to the 5th FDP again, and the same tendon gliding measurement was done in three different situations: (1) in a control situation, (2) with a relative motion splint in place, and (3) with a buddy-taping. Statistical significance ( $p$ -value $<0,05$ ) was assessed using Mann Whitney U test.

**RESULTS:** While loading the 5th FDP in the cadaveric model, rupture of the 4th lumbrical muscle occurred. A mean of 9,23mm of proximal tendon gliding of the 5th FDP related to the 4th FDP was needed (standard deviation (SD) 3,55). After the rupture and under a load of 200g, a mean of 25,86mm of proximal tendon gliding of the 5th FDP was possible (SD 13,76), while the relative motion and the buddy-taping allowed only 5,56mm (SD 3,58) and 0,83mm (SD 0,48), respectively. The statistical analysis showed significant differences when comparing the three groups ( $p$  value= 0,0001 in all of them).

**DISCUSSION:** Understanding the biomechanics of FDP is important in the study of pathomechanics of lumbrical muscle injuries. Previous studies had showed successful results while using different approaches in its conservative treatment. Principles should be reducing pain, improving hand function, promoting the healing process and preventing excessive scar tissue formation.

**CONCLUSIONS:** The analysis of FDP tendon gliding is important in the study of lumbrical muscle tears. Both relative motion concept and buddy-taping would prevent the injury mechanism in injured patients, but only the first one would allow certain quadriga effect, allowing healing process to happen while preventing the excessive scar tissue formation at the same time.

## **A-0625** MACHETE WOUNDS, A SPECIFICITY OF THE HAND SURGERY DEPARTMENTS IN THE FRENCH WEST INDIES

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### Introduction

The machete is an extremely common instrument in the West Indies, primarily an agricultural tool, but occasionally used as an improvised weapon. Almost every inhabitant of the West Indies has a machete at home, or in his car. In this regard, our Hand Surgery Department receives a large number of machete wounds on the hand and upper limb. The mechanisms are varied, these wounds occurring in both work and domestic accidents, or following an attack. The severity varies greatly, from a simple superficial wound to complete amputation. Our presentation is an analysis of machete wounds treated by our Service over the past three years.

### Material and Methods

Our study comprises 131 machete wounds treated in our Hand Surgery Service between January 2019 and December 2022. We aimed to perform a comparative study between the mechanical impact of a saber, a cutlass and a knife, completed by a statistical assessment of the wounds, according to their localization and severity (cutaneous, tendinous, neurovascular, open fracture, poly-digital, multilevel, hemisectioned, complete amputation) and their results.

### Results

Machete wounds are clean cuts, with a better prognosis than crush or contuse wounds. On the other hand, the machete is a heavy, well-sharpened instrument, which can therefore cause very deep wounds, even amputations, including the forearm. The wounds can be multiple, thus in the context of an attack, we were able to see up to 38 wounds all over the body, on the same patient. We had to suture main nerves or arteries, up to three different levels. In terms of severity, the postoperative prognosis will depend on the depth and on the multilevel degree of the wounds.

### Discussion

Our discussions focus on the mechanical impact of the machete, compared to a saber and a knife, and on the management type related to the severity degree: (wrist hemisection, fingers or hand complete amputation, and multilevel wounds).

### Conclusion

The machete is a dangerous instrument causing many work accidents in agriculture or during domestic gardening, but most often, these are brutal attacks generating serious consequences.

**A-0626** THE VASCULARIZED MEDIAL FEMORAL CONDYLE CORTICOPERIOSTEAL BONE FLAP IN LONG BONE NON-UNIONS. OUR EXPERIENCE

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Long bone non-union of upper and lower limb is a infrequent but significant problema becoming a challenging pathology to be treated by the orthopaedics surgeon.

We examined our experience using vascularized medial femoral condyle periosteal bone flap (VBF) in 17 patients from 2010 to 2022. The average age was 57 years (34 to 75) Location fo the non-union were : 6 tibia, 3 humerus, 1 ulna, 1 ankle arthrodesis, 4 radius, 2 femurs. All except for one patients were secondary to traumatic fracture. The time period of non-union prior to the VBF was 35 months (range 5 to 149 months). Regarding post-operative complications, one patient suffered a medial femoral condyle fracture that finally required a knee arthroplasty, one patient presented a healing complication of the recipient site requiring use of TPN, and one patient had an EPL tendon rupture that required reconstruction. Donor site morbidity (except in the case of the femoral fracture) were minimal. 94,1% of healing in our series.

The VBF is a valid option for treatment of long bone non-unions.

The combined approach of both microsurgeon and orthopaedic surgeon lead to the optimal results (almost 100% of healing) in our series.

**A-0627** GLOMUS TUMOR OF THE INDEX FINGER - A CASE REPORT

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Glomus tumor is a benign mesenchymal tumor of the soft tissue, with incidence of 1,5 to 2 % of all soft tissue tumors. The most of them are seen in the soft tissue of upper and lower distal extremity. We present a case report , 34-year-old female patient with painful swelling in the proximal phalanx of the index of the right hand. Before the operation, we made an MRI. An MRI show a well-defined soft tissue mass of the palmar aspect of 2 digit along the proximal phalanx. We made the operation under local anesthesia. There was no need of rehabilitation after the operation. We report this case due to its rarity.

**A-0628** CHEILECTOMY OF THE DIP JOINT: AN EFFECTIVE ALTERNATIVE TO DIP JOINT ARTHRODESIS IN PATIENTS WITH SYMPTOMATIC OSTEOARTHRITIS?

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*Dr. Kuyperskliniek Hoorn, the Netherlands*

E posterrnCheilectomy of the DIP joint: an effective alternative to DIP joint arthrodesis in patients with symptomatic osteoarthritis?  
For the DIP joints of the finger, arthrodesis is commonly the surgery of choice in painful osteoarthritis. Stable bone union is essential for a successful arthrodesis.  
In practice we see it takes a long time before it is properly consolidated, or it does not consolidate at all, especially in the case of elderly patients. Despite of that, a big part of this

group experienced no pain, and despite limited movement they experienced the joint as pleasant. This gave us the idea to perform a cheilectomy on DIP joints of the fingers. Cheilectomy of the hallux rigidus is a known surgery with good results. When should you opt for a cheilectomy of the DIP joint? Patients with pain Patients where bad consolidation is expected based on age and health. Patients with a deformed joint can also be corrected. Patients who wish to preserve joint motion. Surgery dr. Kuyperskliniek located in Hoorn: Is a clinic for plastic -and hand surgery. A group of 50 patients had surgery from 2018-2022 with 68 DIP joints of the hand mostly DIP 2,3 or 5. Execution of a cheilectomy : cleave extensor, osteophytes and subchondral resection. Postoperative Treatment : \*immobilized with plaster for 2 weeks (total finger) \*After 2 weeks start with a dip brace for protection for 2 weeks \* 4 weeks after surgery start light exercises to get a good grip of the finger, dip brace for protection the joint by daily activities. Advantages cheilectomy : Reduced pain score. Preservation of joint motion, ( A joint motion average of 30 degrees). Cheaper (cost K wire or screw). Much faster recovery and return to daily activities or work. No re-operations were performed during the follow up period for our patient group. 3 postoperative infections or other complications were noted during the follow up period.

## **A-0629** IN VIVO ANALYSIS OF TRANSLATIONAL MOTION OF THE PROXIMAL RADIOULNAR JOINT IN FOREARM ROTATION

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**INTRODUCTION:** It is well known that pronation and supination of the forearm leads to a physiological dorso-palmar shift in the distal radioulnar joint (DRUJ). However, little is known about the translational movement in the proximal radioulnar joint (PRUJ) during pronation and supination. Therefore, the primary objectives of this study are to demonstrate the existence of an anterior-posterior translation in the PRUJ, its degree, and directionality during forearm rotation based on an in vivo motion analysis.

**METHODS:** This study recruited 15 healthy adult volunteers with no reported history of pathology that might affect the rotational movement of the forearm. Each participant underwent an ultra-low dose computed tomography (ULD-CT) of both forearms in a neutral position, pronation, and supination. Bilateral 3-dimensional surface models of the radius and ulna were generated from the ULD-CT slides by segmentation of the bones in the image data. The models were then superimposed on each other, the axis of rotation was determined, and the degree of dorso-palmar translation of the radial head center was measured.

**RESULTS:** Fifteen volunteers (7 females, 8 males) with a mean age of 34 years (Range: 26-55 years old) were included in the study. Study participants were right-handed in 73% (11/15) and left-handed in 27% (4/15). In all participants, an anterior translation of the radius in the PRUJ during supination was found and posterior translation during pronation was observed. The mean anterior-posterior shift was 2.5 mm (Range: 0.4 mm – 4.4 mm) on the right side and 2.6 mm (Range: 0.9 mm – 5.5 mm) on the left side.

**DISCUSSION & CONCLUSION:** Overall, the results of this preliminary study indicate that anterior-posterior translation during forearm rotation clearly exists within the proximal radioulnar joint (PRUJ). Specifically, the PRUJ demonstrates a posterior shift of the radial head in pronation and an anterior shift in supination.

These in vivo findings contradict previous studies describing the translational motion in the PRUJ. As such, these findings redefine specific aspects of the complex spatial relationship between the radius and ulna during forearm rotation. The additional understanding conferred by our findings have clinically relevant implications for reconstructive procedures in restoring normative range of motion in the PRUJ.

**A-0630** IS THE LOSS OF FIRST RAY HEIGHT AFTER TRAPEZECTOMY AND SUSPENSION WITH A BUTTON ASSOCIATED WITH A DECREASE IN POSTOPERATIVE PINCH AND GRIP?

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**Introduction:** Basilar Thumb Arthritis is one of the most common degenerative pathologies of the hand. After failure of nonoperative treatment, surgery is an option in symptomatic patients

The aim of this study is to evaluate the relationship between the loss of height of first ray height as a consequence of trapezectomy procedure followed by suspensionplasty with a radiopaque device (Microlink All-Suture Button ConMed) and functional assessment of pinch and grip strength.

**Methods:** A prospective study with patients who underwent trapezectomy and suspensionplasty with Microlink All-Suture Button ConMed for basilar thumb arthritis over a period of 18 months was done

Demographics, pre- and postoperative clinical data (at 6 months of follow-up) were evaluated, in which we measured the grip and pinch strength in these two moments. Parameters such as pre- and postoperative trapezoidal heights were evaluated, measured on the oblique incidence of plain x-rays.

**Results:** In our study a total of 36 patients were included, with a predominance of females (86%), with a mean age of 59.7 (45 - 73) years. The right hand was intervened in 58%, being the dominant hand in 53%.

Regarding the grip and pinch scores, an average of decrease in strength at 6 months of 37% and 46% respectively was recorded. In this group of patients 6,5 % had an Eaton and Littler grade II, 71% a grade III and the remaining 22,5% an Eaton and Littler grade IV. In the postoperative period, we reported an average residual height of 56% of the original trapezoidal space height, corresponding to a subsidence of 44%.

We did not find a statistically significant relationship between the loss of height and the variation of grip strength ( $p=0.496$ ) or with the variation of pinch strength ( $p=0.675$ ). No statistical significance between the remaining height and the final force of either grip( $p=0,805$ ) or pinch( $p=0,512$ ) was found.

**Discussion:** The operative treatment can be divided into trapezium-sparing (carpometacarpal denervation, metacarpal extension osteotomy, carpometacarpal arthroscopy, carpometacarpal arthrodesis, and prosthetic arthroplasty) and trapezium- sacrificing procedures (with tendinous interposition, resection arthroplasty using Kirschner wires or Suspensionplasty suture). The selected technique depends on patient-related factors and surgeon preference.

The trapezectomy and suspensionplasty has the advantage of obviating the risks of arthroplasty (infection or instability), does not need tendon interposition (no additional incision or loss of function of structures used as autografts) and does not have the risks associated with using kirchner wires (infection or migration).

We theorized about the possibility of the rate of subsidence of the trapezoidal space after this procedure being related to the loss of strength, however, this was not demonstrated in our study.

**Conclusion:** In the technique of trapezectomy and suspensionplasty with a radiolucent device and at 6 months follow-up there is no correlation between the loss of trapezoidal space height and the rate of loss of pinch and grip strength.

## **A-0632** WALANT WRIST ARTHROSCOPY

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**Introduction.** Elective surgery for wrist pathologies such as triangular fibrocartilage complex lesions, scaphoid pathology, basal thumb arthritis, intercarpal ligament damage, Kienbock or Preiser disease, capsular adhesions, ganglion cysts, chondral lesions, loose bodies, synovitis and other explained or unexplained causes of wrist pain and dysfunction can be approached using arthroscopy by the trained surgeon. Growing experience with wide-awake local anaesthesia non-tourniquet techniques in wrist pathologies has encouraged extending its use in arthroscopic surgery.

**Materials and Methods.** A total of 17 patients from January 2018 to October 2022 spanning a wide range of wrist pathologies have been treated or diagnosed using arthroscopy with the WALANT technique for ulnar, median and radial nerve, consisting in a solution of lidocaine, sodium bicarbonate and epinephrine.

**Results and Discussion.** All patients that underwent wrist arthroscopy with this technique had no complications. The method significantly decreased preoperative preparation time, costs and allowed for a degree of active movement at the end of surgery for postoperative clinical tests. The method also prevented any comorbidity associated with axillary block and discomfort caused by the over-night motor block also leading to the immediate discharge of the patient. Only 4 patients experienced minimal discomfort during the operation.

**Conclusions.** Extending the indications of WALANT technique in wrist arthroscopy can minimise perioperative patient and surgeon discomfort, with the added benefits of postoperative active motion tests and immediate patient discharge.

## **A-0633** LIMITATIONS OF ARTHROSCOPIC CARPAL FUSION AND GUIDELINES TO IMPROVE THE TECHNIQUE. RETROSPECTIVE CASE SERIES AND REVIEW OF THE LITERATURE

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**Purpose:** Partial wrist fusion is a limited arthrodesis mainly indicated in post-traumatic arthritis that affects only parts of the joint (SLAC / SNAC). By effectively controlling the pain and preserving useful wrist motion, it appears to be an interesting “semi conservative” technique. The traditional open procedures are invasive and associated with significant postoperative stiffness and loss of grip strength.

Arthroscopic partial wrist fusion (APWF) has become increasingly popular for the last decade. It may decrease soft tissues aggression and lead to optimal functional outcome.

However, the series published in the literature showed number of limitations: long surgery time, non-union rates, and hardware complications.

**Objectives:**

Based on our series and a review of the literature, we tried to answer 3 questions:

- 1) How to optimize surgery time?
- 2) Is the graft necessary?
- 3) What is the best percutaneous hardware?

**Methods:** We present a retrospective series of APWF cases. Surgery time, bone grafting, fixation hardware, time to return to work, non-union rate, and second surgery rate were considered. Pain on the visual analog scale (VAS), grip strength,

range of motion and Quick Dash were also reported before surgery and at one year.

Results: 15 cases of APWF were included. The initial diagnosis was SLAC III in 8 cases, SNAC III in 3 cases, midcarpal arthritis in 3 cases and SNAC II in 1 case. Mini open scaphoidectomy (or mini open excision of the distal part of the scaphoid) and fixation with percutaneous screws were performed in all the cases. Four bones fusion technique was used in 6 cases, 3 bones fusion in 5 cases, and capitulum fusion in 4 cases.

Radius metaphyseal bone graft was used in 6 cases. Nine procedures were performed without bone grafting.

Mean surgery time was 104', 103' in the group without graft, and 105' in the group with graft. Two nonunions were observed, one of which required a second surgery. Time to return to work was 8,5 months in average. Mean Quick Dash decreased by 79,8%. Mean VAS decreased by 82,15% and grip strength increased by 88%.

Discussion: The relative short mean surgery time and the low rate of nonunion in our series may be explained by some surgical principles that are systematically followed.

Conclusion:

Based on our results and the studies already published, we advise to improve APWF technique as following:

- 1) Level skill in wrist arthroscopy should ideally be advanced. It may be recommended to use dry or semi-dry arthroscopy in the beginning of the learning curve if a long-time surgery is expected.
- 2) Most of the time, graft is not mandatory if subchondral economic resection preserving midcarpal bones shape is performed.
- 3) If graft is used, already described percutaneous device is useful to save surgery time.
- 4) Open scaphoidectomy (or open excision of the distal part) is recommended. Total arthroscopic scaphoidectomy is correlated with radio scaphoid impingement and increases surgery time.
- 5) Screws should be used to stabilize the arthrodesis as often as possible to decrease the nonunion rate and avoid complications of K-wires.

## **A-0634** ARTHROSCOPIC TREATMENT IN MID-STAGES OF BASAL THUMB ARTHRITIS

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Introduction. Basal thumb arthritis patients failing conservative treatment are regularly addressed surgically by arthroscopic partial or open total trapeziectomy with either ligament reconstruction tendon interposition (LRTI) or gelatine sponge interposition (GSI) in order to restore proper function and patient Quality-of-Life. Both techniques have proven their efficiency in numerous studies, while having differences in costs, duration and biological impact.

Materials and Methods. A total of 28 patients with mid-stage basal thumb arthritis were treated between January 2018 and October 2022, excluding patients without 6 weeks of follow-up. 15 patients were treated using arthroscopy by partial trapeziectomy with GSI and 13 had undergone open total trapeziectomy and LRTI (6) or GSI (7).

Results and Discussion. The 15 patients treated using arthroscopy had shown a significant reduction in postoperative VAS pain scores, faster return-to-work times, with minimal to no postoperative hand therapy and no splinting. All patients had one day admissions with immediate discharge and no special preparation required, significantly improving patient comfort while decreasing costs. No revision surgery was required, potentially delaying salvage solutions for all the patients, to be observed in further long-term studies.

Conclusions. Arthroscopic treatment is becoming our go-to practice for mid-stage basal thumb arthritis, improving outcomes, comfort and accessibility for our patients, while maintaining all salvage options in case of treatment failure.

**A-0635** FIRST DORSAL METACARPAL VENOUS FLAP: A CASE REPORT OF AN INTRAOPERATIVE SALVAGE OF AN ISCHEMIC FDMA FLAP BY ARTERIOVENOUS SUPERCHARGING

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We report the case of a 56-year-old male patient with a G1 squamous cell carcinoma of the dorsal-ulnar surface of the left thumb of about 2.8x2.6 cm without bone involvement.

Under plexus anesthesia and tourniquet ischemia, excision was carried including the tumor and about 5 mm of surrounding healthy tissue along with the paratenon of the Extensor Pollicis Longus resulting in a defect of 4x3.5 cm on the dorsal surface of the thumb with tendon exposure. FDMA flap was considered the best reconstructive option.

A skin island, slightly larger than the defect, was marked on the dorsal aspect of the proximal phalanx of the index. The flap was raised from distal to proximal and from radial to ulnar aspect, respecting the paratenon of the first dorsal interosseus muscle. A couple of superficial venous stumps emerging from the skin island were dissected, ligated and left long enough for venous congestion drainage. The incision was prolonged along to the radial border of the second metacarpal bone to expose the vascular pedicle that was meticulously dissected in a suprafascial plane over the first dorsal interosseus muscle until the origin of the FDMA. Then, the flap was transferred to the recipient site under a skin tunnel for the inset. After tourniquet release flap ischemia occurred.

At this stage, the available options were: no further procedures with high risk of flap failure and need for second operation, reconstruction with a second local or distant flap, or venous arterialization by microsurgical anastomosis.

An intraoperative salvage of the flap was attempted by changing it in a venous flap. Both collateral digital arteries of the thumb were dissected and a T-T anastomosis of the radial digital artery and T-L anastomosis of the ulnar one were performed with the veins stumps previously preserved, resulting in a first dorsal metacarpal venous (FMDV) flap and a slight revascularization was highlighted.

The postoperative course was uneventful. During the first week after discharge flap developed venous congestion and some blisters on its surface, subsided with spontaneous resolution. Patient returned to his normal daily activities with no functional sequelae.

FDMA flap is a versatile and reliable option for dorsal thumb reconstruction allowing full preservation of its length and ensuring good functional and cosmetic results. Despite a constant vascular supply, unexpected intraoperative flap ischemia caused by surgical injury or anatomical variations can result in flap loss and need for further reconstructions. Regardless the surgeon's experience, including some long venous stump arising directly under the skin island is always suggested. During flap dissection ligation of venous vessels instead of their cauterization is mandatory. Flap venous congestion is not so uncommon and the possibility to create a further venous outflow by micro-anastomosis could be important. On the other side, as demonstrated in our case, a couple of vein stumps was the solution of an ischemic issue. Despite the longer operative time it takes, this procedure allows a one-stage reconstruction without sacrificing other donor site and at the same time maintaining the original benefits of the FDMA flap.

## **A-0636** THUMB METACARPOPHALANGEAL ULNAR COLLATERAL LIGAMENT: OUR CLINICAL RESULTS OF RECONSTRUCTING IT WITH MITEK ANCHOR

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### Introduction:

Injuries to the ulnar collateral ligament of the thumb's metacarpophalangeal (MCP) joint are very common. The most frequent mechanism for a thumb ulnar collateral ligament (UCL) rupture is the forced abduction and hyperextension of the MCP joint of the thumb. This may cause partial ruptures, that can be treated with immobilization. Nonetheless for total ligament tear, such conservative treatment frequently results in instability. The study evaluated the surgical and clinical outcome of the surgical repair of total thumb collateral ligament ruptures using mini MITEK suture anchor.

### Method:

We retrospectively analysed the patients submitted reconstruction of pollicis ulnar collateral ligament with mini MITEK GII anchor between 2015 and 2020 by the authors. Only patients with total lesion of the ligament were included. Patient perception was evaluated with 10-point pain visual analog scale (VAS). Clinical evaluation and measurements were compared with those from the contralateral hand. Surgical postoperative complication were recorded.

### Results:

A total of 76 patients were included. Mean age was 39.9, 75% male. No postoperative complication was registered. All patients reported excellent pain relief. Average grip, prehension, and range of motion were also similar in both groups. Regain of joint stability, radial deviation less than 10° (stress test) and good recovery of D1 MF flexion-extension movement were obtained in most cases. No migration of the anchor was observed.

### Conclusion:

With good clinical outcomes and a lower complication rate, surgical reconstruction ulnar collateral ligament with ligament reinsertion with mini MITEK anchor seems to be a safe and effective surgical technique in the management ulnar collateral ligament tears.

## **A-0637** SCAPHOID RECONSTRUCTION IN PREISER'S DISEASE (SCAPHOID AVASCULAR NECROSIS) WITH OSTEOCHONDRAL MEDIAL FEMORAL CONDYLE FLAP: A CASE REPORT

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**Objective:** The aim of this presentation is to report the technique applied to reconstruct a scaphoid defect in Preiser disease in a 26 years old woman after the resection of the necrotic proximal pole.

**Methods:** After 2 years of pain in the wrist without a traumatic history and multiple medical consultations, x-rays are requested, in which an increased density of the scaphoid is observed. MRI and CT are requested due to the suspicion of avascular necrosis and with a view to staging the lesion (Herbert-Lanzetta III and Kalainov II)

Diagnostic arthroscopy was performed to assess the joint surface, proximal pole bleeding and perforations. As the patient did not improve clinically, given the absence of degenerative changes and the age of the patient, it was proposed to

perform reconstructive surgery.

Discussion and Results: Dorsal approach was chosen and after resecting the avascular zone of the scaphoid, a defect of 10x10x5 mm was obtained. Flap extraction was performed on the contralateral knee.

The descending genicular artery and its transverse branch were dissected free from the origin at the superficial femoral artery to the articular medial condyle. An osteochondral flap was designed with a size slightly larger than the defect.

Anterograde 2.5mm cannulated screw synthesis was performed to maintain stability. Donor site was reconstructed by fitted bone allograft without fixation.

One artery and two veins were found, the length of the pedicle was sufficient to perform the end-to-side anastomosis on the radial artery and the end-to-end anastomosis of the two veins on the venae comitans of the radial artery in the anatomical snuffbox.

The patient was immobilized for 6 weeks with a splint and later with an orthosis intermittently. During follow-up, consolidation was observed at 3 months.

At 12 months, the patient presented no pain and mobility of 45° in extension and 60° in flexion.

Conclusions: Preiser's disease is extremely rare and, together with the absence of a proven specific treatment, makes it difficult to manage successfully.

Reconstruction of the proximal pole using an osteochondral flap emerges as a promising option in the treatment of this disease.

## **A-0638** ASSESSMENT OF CENTRAL AND PERIPHERAL SENSITIZATION, AND PAIN MEDIATORS AND HEALTH STATUS IN THE WORK-RELATED THUMB PAIN AMONG PHYSIOTHERAPISTS. A CASE-CONTROL STUDY COMPARING WORKERS AND STUDENTS

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ClinicalTrials.gov Identifier: NCT05345496

Introduction: Work-related thumb pain is the major musculoskeletal problem (WMSDs) recognized by the World Health Organization for physiotherapists. About 70.8% of physiotherapists experience thumb pain at least once in their life. Among those practicing manual therapy, thumb pain can induce the use of compensatory strategies or the impossibility to practice the desired manipulation strategies. It has been estimated that 1 in 6 physiotherapists end their careers because of WMSDs. Several studies have analyzed the distribution of mechanical forces, kinematics, and kinesiology of the thumb in this clinical condition. However, the data available in the literature on biomechanics for this phenomenon do not allow to define a proper causal relation between the pain mechanisms involved, the impact of mediators off pain chronification, and the health status.

The purpose of the present research is to investigate the relationship between thumb pain and phenomena of central and peripheral plasticity phenomena among physiotherapists (exposed) and compare this data to physiotherapy students (not exposed). In particular, we aim to identify the relevance of each biological variable, chronic pain mediators described in the literature and the health status.

Methods: A case-control study is being performed (44 physiotherapists with thumb pain and 44 physiotherapy students).

The sample size of 44 subjects per group (10% dropout) was estimated a priori, with a clinically relevant effect size of  $d = .80$  and with an estimated power  $(1 - \beta) = .95$  and  $\alpha = 0.05$ . Muscle strength and endurance of the hand have been assessed (manual muscle test and Jamar Hydraulic Pinch Gauge). Heart rate at rest and its variation while performing the Vagus nerve neurodynamic test (VN-NDT) were measured to assess any autonomic change related to chronic stress. Assessment of peripheral sensitization phenomena has been performed with validated clinical tests. It has also been assessed the health status through the minimal ICF core set, pain intensity, and through validated questionnaires the central sensitization, anxiety, depression, catastrophization, kinesiophobia, and self-efficacy.

Results: preliminary analysis have shown a significantly lower strength of Abductors Pollicis Brevis et Longus in physiotherapists ( $p < .001$ ;  $d = 0.286$ ). Also a significant higher pain intensity ( $p < .05$ ;  $d = 0.308$ ) was observed for the wind-up on the skin of the left thumb distal phalanx, showing a process of central sensitization among workers. Moreover, the heart rate at rest was significantly lower of in physiotherapists of 7.8 beats per minutes ( $p < .01$ ).

Conclusion: The results of this study can improve the knowledge of the pain mechanisms involved and the complexity of this work-related disabling condition following a multifactorial biopsychosocial model. Results could also improve the prevention of thumb pain in physiotherapists with a relevant impact on this work-related disease.

Keywords: thumb pain, central sensitization, peripheral sensitization, modulating factors, ICF, disability

## **A-0639** PRECISION IN FOREARM ROTATION – INTRODUCING A NOVEL, SMARTPHONE-BASED, GONIOMETER

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INTRODUCTION: Measuring the exact range of pronation and supination in the clinical setting is challenging due to the constraints of time, wide variability in results, lack of precision instrumentation, and many others. However, accurately measuring forearm rotation is a valuable clinical tool, especially for patients with upper extremity trauma, congenital malformations, and other situations where surgical intervention may be appropriate.

The primary objective of this study is to validate a new smartphone-based technology for forearm rotation measurement based on a 3D bone model.

METHODS: An analog protractor was integrated into a 3D bone model of a forearm after the axis of rotation was calculated and visualized. The model was 3D printed, and a smartphone holding device was attached over the dorsal aspect of the distal radius to allow for a comparison of analog and digital rotation measurements. Two groups of assessments were performed. For each group, integers were randomly generated by a statistical software tool to mimic possible pronation/supination angles. Each measurement was performed by an examiner and then cross verified by a second examiner. In the first group of measurements, a series of 100 random integer pairs were generated to represent possible angles of pronation and supination. During this series, the forearm model was placed in a constant position.

In the second group, the forearm position was changed to a pre-determined position after ten pairs of rotation measurements. The assignment of a pronation/supination pair to a specific forearm rotation axis was also random and dictated by the statistical software.

Additionally, within the second group, pronation/supination was measured while a dynamic motion of the whole forearm model was added (elbow flexion/extension and upper arm rotation) to assess how these interference factors influence the overall measurement results.

RESULTS: While the rotational axis was in a static position, measured values demonstrated a high rate of concordance

(99.25%) between the observed and expected values with a small average variance (mean = 0.01)

While the rotational axis was in a dynamic motion of the forearm (flexion/extension), this altered the result for pronation and supination each up to +/-1.3%. However, this did not affect the overall range of rotation.

**DISCUSSION & CONCLUSION:** Measurement of forearm rotation obtained by a novel smart phone app demonstrated a high degree of accuracy, precision, and reproducibility. Unlike prior attempts to develop a smartphone-based goniometer, the accuracy of measurements provided by this novel app are not influenced by the spatial arrangement of the rotational angle. Importantly, while measuring the forearm rotation, concomitant elbow flexion/extension of the forearm bone model of 10° results in a measurement deviation of  $\leq 1.3^\circ$  which is clinically negligible.

Further studies are currently underway to demonstrate the accuracy and precision of this novel app for measuring forearm rotation in human subjects and its practical utility for varied clinical use.

#### **A-0640** CUSTOM MADE RECONSTRUCTIVE STRATEGY IN ZONE 3 EXTENSOR HIGH ENERGY TRAUMA

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The anatomy of the extensor apparatus is very complex, the tendon is trifurcated to reach P2 and then P3. The lesion in zone III causes imbalances that can lead to en boutonniere deformity, the surgical treatment of which is very complex and sometimes disappointing. Tendon injuries in zone III can occur as a result of closed trauma with forced and sudden flexion of the IPP joint resulting in a partial or complete lesion of the central band, with tendon section or avulsion of a bone fragment at the insertion of the strap. In case of high energy trauma isolated lesion of central band is uncommon, with frequent involvement of lateral bands, bone, joint and ligament components. There are many strategies to treat in one stage these kind of complex wounds.

We examined patients with complex trauma involving extensor tendon in zone III who underwent surgery from November 2019 to June 2022. Inclusion criteria were every kind of complex lesion involving extensor tendon in zone III. Tendon reconstruction was achieved with suture, bone anchoring, tendon overturning or transfer from close finger. Skin, bone and joint lesions were treated at the same time. Functional recovery and total range of motion were evaluated with a mean f-up 8 months.

In all cases ROM was never comparable to the healthy side with the worst results among elderly patients. Even if bone or joint involvement were associated to not perfect x-ray imaging, none of the patients needed a second articular surgical treatment. Most of the problems were associated to tendon imbalance or secondary rupture. Tendon reconstruction can be performed with many techniques as bone and joint lesion should be approached with different methods in respect of the whole finger conditions. Many alternatives as straight suture, overturning, trans-osseous pullout, anchor, tendon transfer or adjacent tendon strip are available. Bone and joint lesion should be treated in order to allow a fast motion recovery and a strong tendon reconstruction is mandatory for this purpose. Tendon imbalance after reconstruction is quite always present after first surgery. Global reconstruction strategy should be custom made in respect of the entire IPP zone in order to have the best result preserving tendon strength, excursion and balance, bone stability and joint freedom.

## **A-0641** TACKLING THE CHALLENGES OF HAND AND WRIST REHABILITATION DURING COVID-CONFINEMENT AND BEYOND. PRELIMINARY DATA OF A NEW INTEGRATED DIGITAL PLATFORM FOR REMOTE REHABILITATION

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Rehabilitation is a central part of the treatment of hand and wrist conditions and it represents the most time-consuming part. Normally, rehabilitation take place partially in the office under the control of the therapist and partially alone at home. This second part is left to the compliance of the patient in term of number of sessions per week and of quality of the exercises. During the COVID confinement everything was more complicated since patients were not allowed, or not willing, to visit the therapy. Remote rehabilitation can be a good solution to overcome these problems if a feed-back loop can be established between all the involved stakeholders. ReHub<sup>®</sup>, a new digital platform for remote rehabilitation that connects the surgeon, the therapist and the patient was developed to fulfil these needs. Based on the clinical information given by the physician, the therapist creates a personalised programme. The platform allows for an automatic tracking of the movements, the data recorded during the exercise are uploaded in the cloud and are used to monitor the improvements. The patient can answer to different questionnaires (PROMs). During the exercise the patient can interact with the platform to learn and monitor the right way to perform the exercises.

### Methods and Patients

In 2021-2022. 50 patients, 52 +/-12 years old, were treated with ReHub<sup>®</sup> for different upper limb pathologies. Patients received a programme of three sessions a week for 4 weeks. The number of sessions executed, the Quick-DASH and the pain levels were measured at the beginning of the programme, after 2 weeks and after 4 weeks. Patients' satisfaction was recorded at the end.

### Results

The diagnosis most often treated with ReHub<sup>®</sup> were distal radius fracture (n=15), carpal tunnel release and synovitis (n=10), wrist sprain (n=5). In total 5000 exercises were planned and the compliance rate was 66%. The platform was used for a total of 6980 minutes and the drop-out rate was 6%. 34 patients filled the QuickDASH and its normalised score improved in all cases of at least 15 points. Pain decreased steadily with an overall reduction of moderate (VAS 4-6) and intense (7-10) from 30.3% at the beginning, to 23.2% at 2 weeks and 6.9% after 4 weeks. Global patients' satisfaction was 84%.

### Discussion

The ReHub<sup>®</sup> digital platform demonstrated a very high compliance among patients with a very low drop-out rate of only 6%. QuicDASH value improved and pain was reduced significantly. These findings reflect the high satisfaction rate of this new digital tool. Physicians can follow-up the improvements of the patients, not only with the automatic movement recognition tool, but also through the PROMs filled out by the patients. The therapists can evaluate the compliance in term of time spent exercising and the quality of the movements. The patients can choose the best time for the rehabilitation session without losing extra-time and additional out-of-the-pocket expenses.

The system proved effective in the rehabilitation of common upper extremity conditions, with a high compliance and patients' satisfaction

## **A-0642** USE OF VASCULARIZED COSTOCHONDRAL GRAFTS IN UPPER EXTREMITY SURGERY

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Costochondral grafts are well-known for their use in reconstructions of craniofacial defects, for example the temporomandibular joint. In this area of application, the literature solely describes the non-vascularized utilization of the costochondral graft. Just in one case report from 1992 the usage of a vascularized costochondral graft was described after a traumatic facial injury. In the upper extremity, the use of costochondral grafts has been described in reconstruction of proximalization after trapeziectomy and reconstruction of the radial head, however non-vascularized. Evidence suggests vascularized bone grafts may lead to a higher union rate and the fastest time to union compared to nonvascularized reconstructions. Most research to this topic was performed in scaphoid reconstruction surgery.

We describe the case of upper extremity reconstruction in which we have used a costochondral graft for reconstruction of a third metacarpal head.

A 62-year-old male presented with a cartilage defect of the third metacarpophalangeal joint based on Dieterich or Mauclairs disease. Two years before, in another clinic, an arthroscopy was performed combined with a cancellous bone graft. Upon presentation in our clinic a defect of the metacarpal cartilage and head of 7x4 mm was seen in an MRI. The cartilage of the base of the first phalanx was adequate. We performed a reconstruction using a vascularized costochondral graft with a microsurgical anastomosis of the intercostal artery to the intermetacarpal artery of the second commissure and arthroscopic shaving of the cartilaginous part. After rehabilitation, the patient is pain free and could reach full fist closure without any problems. He returned to his daily activities in his supervising profession within three months.

Our experience is positive in that we could sufficiently treat not only the bony defect of Mauclairs disease but also the cartilaginous component using a vascularized costochondral graft. We would recommend further development of this technique and a wider area of application for this type of microsurgical vascularized reconstruction.

## **A-0643** COMPONENTS OF FOREARM ROTATION

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**INTRODUCTION:** Presently, the published literature has not established a consensus regarding the normative values of forearm rotation. Understanding why this discrepancy exists is meaningful for clinicians and as a benchmark for use in future research. Principally, it has been suggested that this discrepancy may arise from the different ways that various studies measure forearm rotation. Therefore, a clinical and practical need exists to harmonize the methods and tools to measure forearm rotation.

To that end, the primary objectives of this study are to analyze and quantify pronation and supination of the radius and ulna, as well as the carpal and metacarpal bones based on 3D bone models. We intend to utilize this objective information to propose a standardized nomenclature system for describing rotation in the distal upper extremity.

**METHODS:** In this observational study, a total of 15 healthy adult volunteers with no known forearm pathology were recruited. An ultra-low dose computed tomography (ULD-CT) of both forearms in pronation and supination was completed for each participant.

Bilateral 3-dimensional surface models of the radius and ulna were generated by segmentation of the bones in the

image data. Commercial software was applied for segmentation. The models were then superimposed on each other, the axis of rotation was determined, and the degree of rotation of the radius and ulna as well as carpal and metacarpal bones was calculated.

RESULTS: Fifteen volunteers (7 females, 8 males) with a mean age of 34 years (Range: 26-55 years old) were included in the study. The mean rotation of the radius was 145 degrees (Range: 117 degrees – 178 degrees) for the right side and 147 degrees (Range: 107 degrees – 186 degrees) for the left side. The cumulative rotation (measured from a rod held in the closed fist) was 171 degrees (Range: 142 degrees – 205 degrees) for the right side and 184 degrees (Range: 130 degrees – 229 degrees) for the left side.

DISCUSSION & CONCLUSION: Overall, our results indicate that pronation and supination measured at the level of the hand show a significantly higher rotation than measured at the level of the distal forearm.

Therefore, the nomenclature of pronation-supination should be differentiated. We suggest the following wording: (1) Pure forearm rotation (radio-ulnar pronation and supination), (2) Additive forearm rotation (Carpo-metacarpal pronation and supination), (3) Cumulative forearm rotation (Pure and additive rotation).

## **A-0646** PATIENT HANDOVER, AN OVERLOOKED COBBLESTONE IN PATIENT CARE - IDEAS TO CONSOLIDATE THE STRUCTURE

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### Background:

Patient care is a continuous process that is never entitled to a single physician, but rather shared and accomplished by team members and inter team coordination, that's why patient's information should be safely and accurately shared and transferred between those involved in their care. Patient handover is one the means to implement this continuity and coordination of care, which is one of the GMC guidelines of good medical practice and an integral part of the process of patient care. It has been shown by several studies that lack of formal system for patient handover causes chaos and miscommunication between team members which not only impair quality of care but can even lead to patient harm.

### Objectives:

To assess the implementation of continuity and coordination of care in our practice through handover, to study the effect of speciality cross covering on it, and to suggest new recommendations

### Methods:

A prospective pre-implementation study was conducted on March 2019. and 2 post- implementation studies were conducted on May 2019, and May 2022. All studies included manual data collection and analysis of handover sheets of plastic department in the Countess of Chester hospital over 1 month period. Handover sheets included patients assessed, managed by and referred to plastic on call team as well as patients admitted to plastic department.

### Results:

60 % of Patients had missed information on the handover sheet in the pre-implementation study. A formal training given and a structured handover template was introduced and implemented on April 2019 in plastic surgery department. Study conducted on May 2019 after change implementation and introduction of the new handover sheet showed 100% complete and safe transfer of patient data. However, in the last post-implementation study conducted on May 2022, 88% of Patients weren't safely handed-over and their information was incomplete in the handover. As plastics are cross

covered by ENT speciality doctors, Cross covering effect was studied in the last study and the outcome was the ratio of Plastics: ENT missing fields in the Hanover is 1.036.

Conclusion:

Continuity and coordination of care is a vital cobblestone in the the structure of patient care, which is often overlooked by medical practitioners. The implementation of the handover template and the formal teaching given was associated with 100% improvement of the outcomes. However it hugely declined after a long duration of absence of formal teaching and induction of newly joined doctors to the department, and with the overlooking of the necessity to monitor the implementation process and measure outcomes. These findings endorse that not only the lack formal system or structured tool for the handover impedes continuity of care, but also a continuous process of formal training and monitoring is as important as the tool.

One of the study outcomes was introduction of a new empty handover template for receiving referrals, and a re-audit is planned to measure the outcomes and effectiveness of the tool.

### **A-0647** MULTIPLE COMPRESSION SYNDROMES OF THE SAME UPPER EXTREMITY: PREVALENCE, RISK FACTORS, AND TREATMENT OUTCOMES

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Purpose: Multiple nerve compression syndromes can occur simultaneously and can cause unsatisfactory treatment results after a single decompression. Currently, little is known about this coexistence, especially about potential risk factors and surgical outcomes. Therefore, this study aims to describe the prevalence of multiple nerve compression syndromes in the same arm requiring surgical treatment and determine risk factors. Additionally, patient-reported outcome measures of concomitant treatment were studied.

Methods: The prevalence of multiple nerve compression syndromes requiring surgical treatment within one year between 2011 and 2021 was assessed via electrical patient records review of a prospectively maintained database. All possible combinations were noted. To determine potential risk factors for developing multiple nerve compression syndromes multivariable logistic regression models were used. Patient characteristics, comorbidities, and baseline scores of the Boston Carpal Tunnel Questionnaire (BCTQ) were considered risk factors. To determine treatment outcomes of simultaneous treatment, patients who underwent concomitant carpal tunnel release (CTR) and cubital tunnel release (CubTR) were selected. Treatment outcomes were BCTQ at intake, three and six months postoperatively, satisfaction six months postoperatively, and return to work within the first year.

Results: A total of 7867 patients underwent at least one nerve decompression. Of those patients, 2.9% received multiple decompressions for the same upper extremity within one year. The combination of CTR and CubTR was most common (67%), followed by CTR and a radial tunnel release with 12%. Risk factors of this were severe symptoms, younger age, and smoking. In contrast, diabetes, sex, or severity of occupation were not found to be risk factors. Furthermore, BCTQ outcomes and satisfaction rates of concomitant CTR and CubTR did not differ from single CubTR. Median time to return to work after concomitant treatment was six weeks. Patients who received either single CTR or CubTR returned to work

after four weeks ( $p = 0.09$ ).

Conclusions: Almost 3% of patients who require surgical treatment for a nerve compression syndrome will undergo another decompression within one year. Patients who report severe symptoms at intake, are younger, or smoke are more at risk to belong to this population. Patients suffering from carpal and cubital tunnel syndrome may benefit from decompression within one procedure. Their treatment outcomes and complication rate are comparable to patients who received a single CubTR. Furthermore, if patients undergo CTR and CubTR simultaneously, the total time to return to work will be less than if they underwent decompressions in separate procedures.

## **A-0648** WHAT IS COMMON IN ORIF CASES OF DISTAL RADIUS FRACTURE?

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In our previous study we have proven that in case of distal radius fracture, the better the quality of reduction is, the better the function will be.

### Aim

In our study we were searching for the common preoperative records and influencing factors in the distal radius fracture cases where the postoperative x-ray showed multiple imperfections in reduction. We compared these findings with the perfectly reduced cases.

### Methods

All distal radius fractures treated with volar plating from 1 January 2020 to 30 June 2021 were involved in the study. Both preoperative and postoperative x-rays were examined. Patient data, type of the fracture and the operating doctor were registered. The quality of reduction was evaluated by two hand surgeons. Points were given for every millimeter of dislocation, every 10 degrees of remnant tilt, shortening or incongruency on articular surface. We distributed patients to two groups: Group A had perfect reduction or only one point of imperfection, Group B had two or more points of imperfection.

### Results

We had 239 patients in group A and 33 patients in group B. The mean age was 61 years in group A and 68 years in group B. The male-female ratio did not differ. For surgeons operating a lot of distal radius fractures, 80-85% of cases were operated without relevant imperfections. Surgeons operating less than 1 case per month had worse postoperative x-rays. The ratio of perfect reduction for them was 66-77%. There was only one surgeon who had more cases with multiple imperfections than without.

In group A the order of the different fracture types (AO) were the following: C1 (38%), A2 (33%), C3 (10%), C2 (10%), A3 (7%). In group B: C1 (40%), A3 (18%), C2 (15%), A2 (15%), C3 (12%).

The most common mistake in group A was remnant radial shift and decrease of radial inclination. In group B the most common imperfection was remnant radial shift and dorsal tilt.

### Conclusion

Surgeons operating more than one distal radius fracture per month, had better results. In case of elderly patients, more imperfections were found. Type A2 fractures were recorded more often in group A and fracture types C2 and A3 occurred more often in group B.

Based on our results, for better postoperative radiological results the ideal setup would be a younger patient, with a fracture type A2, operated by a surgeon who operates more than one distal radius fracture per month.

## **A-0649** SCAPHOID FRACTURES, WHAT IS THE BEST METHOD FOR DIAGNOSIS? – A CASE REPORT

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**Introduction:** Scaphoid fracture is the most common cause in patients with referred pain to the radial side of the wrist after a trauma with wrist in hyperextension. These fractures are notorious for being difficult to diagnose. They commonly occur in young men between the ages of 15-25. Commonly patients complain of pain in the anatomical snuff box, in the scaphoid tubercle and on axial compression of the thumb.

The imaging investigation is initiated by radiography with dorsopalmar and lateral views of the wrist in neutral position and additionally Stecher's view. However, it has limited sensitivity for detecting scaphoid fractures (70%). Traditionally, in cases of suspected scaphoid fracture with negative radiographs, the wrist is immobilized in a plaster cast and clinical and radiographic reassessment is carried out after 2 weeks. This attitude can lead to overtreatment, because only about 20% of cases will present a fracture. More and more authors have pointed magnetic resonance imaging (MRI) as the gold-standard for the diagnosis of acute scaphoid fractures, also allowing the assessment of ligament integrity. However, MRI is not yet immediately available in many centers, and in these cases the study by Computed Tomography (CT) is recommended, although with a lower sensitivity.

**Case presentation:** The authors describe a case of a male, with 29 years old, who went to the emergency department, 2 days after a direct trauma in hyperextension of the wrist, due to maintained pain, disability and swelling of the wrist. On evaluation, he had pain over the entire dorsum of the wrist, especially in the scapholunate region, pain on the anatomical snuff box, and a positive Watson test. In the radiographic study, no acute lesions were identified. Due to the degree of suspicion and the unavailability of an MRI study in the emergency room, a CT scan was requested, where no acute injuries were identified. The patient underwent diagnostic arthroscopy, and a fracture of the proximal pole of the scaphoid were identified. Given the reduced dimensions of the fragment, percutaneous fixation with Kirschner wires was performed.

**Discussion/Conclusion:** Fractures of the proximal pole of the scaphoid have inherent instability due to their reduced size and insertion of the scapholunate ligament. Together with the deficient blood supply to this region of the scaphoid, they justify the increased risk of pseudarthrosis.

In this sense, MRI can be very useful in the diagnosis of these fractures, given its high sensitivity. In cases of unavailability, and with high degree of suspicion, wrist arthroscopy can also be a useful resource, as it allows the diagnosis of fractures or ligament injuries and their appropriate treatment with low morbidity for the patient.

## **A-0650** THE CHAMPAGNE STUDY: A RANDOMIZED CONTROLLED TRIAL COMPARING THE EFFECT OF A DYNAMIC LUCERNE CAST VERSUS IMMOBILIZATION WITH A STATIC INTRINSIC PLUS CAST IN ADULTS WITH METACARPAL FRACTURES

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**Background:** It has been shown that functional treatment for fractures of the fifth metacarpal neck bone is the most optimal treatment resulting in less stiffness and earlier return to work with concomitant lower costs. However, there is no consensus concerning the optimal treatment of other metacarpal fractures in adult patients. This study compares

patient related outcome of a dynamic Lucerne cast with a static cast in the intrinsic plus position in adults with metacarpal fractures. Additionally, a cost-effectiveness analysis will be performed.

Methods: This multicenter randomized superiority trial compares functional outcome in patients with metacarpal fractures treated with a dynamic Lucerne cast versus a static intrinsic plus cast. Inclusion criteria are adult patients ( $\geq 18$  years) with a single fracture of metacarpal bones II to IV (neck, shaft and intra-articular) or a fracture of the fifth metacarpal bone other than neck fractures requiring non-operative treatment. Patient related outcome expressed by the Michigan Hand Questionnaire at three months follow up is defined as the primary outcome. Secondary outcomes are disabilities expressed as a change on the Patient Specific Functional and pain Scales, range of motion, quality of life assessed with the EQ-5D-5L questionnaire, cost-effectiveness and complications. Sample size calculation showed that 106 patients must be randomized. The estimated time for inclusion will be 20 months.

Results: a total of 109 patients have been included thus far and the first results will be available in november 2022. Since the deadline for this abstract is in october we cannot provide the results yet but if accepted the results will of course be presented during the oral presentation on the FESSH 2023 congress.

Discussion: The Champagne study will provide evidence whether functional treatment with a Lucerne cast results in a better patient related outcome and reduced costs compared to treatment with a static intrinsic plus cast in adult patients with fractures of metacarpal bones II to V.

Trial registration: registered in the Dutch Trial Registry on January 23rd 2019 with registration number NL7712.

## **A-0652** A RARE CASE OF A PAROSTEAL LIPOMA OF THE FOREARM – A CASE REPORT

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Introduction: Lipomas are the most common benign mesenchymal tumors and are composed of adipose cells that are often located in the subcutaneous tissues of the head, neck, shoulders, and back. Lipomas have been identified in all age groups but usually first appear between 40 and 60 years of age. However, parosteal lipomas are rare neoplasms situated in a proximity to bone. These tumors often follow a benign course, but when located in depth (atypical location) the possibility of being a malignant lesion should always be suspected, requiring an investigation and eventual early excision. Patient Concerns: Authors present case of a 52-year-old female patient complaining of pain and swelling in the left lateral forearm without history of trauma.

Diagnosis: A magnetic resonance imaging of the region revealed an intramuscular fat intensity mass. Apparently on bony projection forearm diaphyseal cortex and periosteum was not involved neither osseous reactive changes are present. The radiological features suggested the diagnosis of parosteal lipoma.

Intervention: After the diagnostic suspicion of a parosteal lipoma, the patient was offered a total surgical excision of the mass.

Outcomes: intraoperatively, the mass presented macroscopic appearance of a lipoma and was on the dependency of the posterior interosseous nerve. The mass was removed successfully. Histopathology showed mature benign adipose tissue bordered by thin fibrous septa confirming the diagnosis of parosteal lipoma. On follow-up patient had complete resolution of complains.

Discussion: Parosteal lipomas usually develop in the diaphysis of long bones. The most common sites of parosteal lipomas

in order are the femur, radius, tibia, and then the humerus. Depending on the size, location of the tumor, and the presence of adjacent neurovascular structures, nerve compressions may develop thus causing deficits in sensory or motor functions and leading to muscle atrophy. Many cases, as in our case, reported the compression of the posterior interosseous nerve (PIN). In this type of lipomas, complete surgical excision of the tumor is the optimal method of management, especially in the presence of nerve compression, crucial to reduce the chances of permanent nerve damage or muscle atrophy.

Conclusion: Distinction of the features of parosteal lipomas is needed to establish the accurate diagnosis, discriminate it from malignant lesions, predict potential neurovascular compromises, and follow up until a curative action is planned.

### **A-0653** THE TENDOCOIL DEVICE - A NEW TOOL FOR FLEXOR TENDON REPAIR - PRELIMINARY RESULTS

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TendoCoil is a new device which acts as an adjunct for flexor tendon repair. The device has been used successfully in a series of six clinical cases wherein flexor tendon injury in zones 1 and 2 was treated by surgical intervention. We present our preliminary results and the device evolution by use of three-dimensional printing as an adjunct to device design and build. The TendoCoil device is placed at the distal end of the digit following suture of the severed tendon with use of a modification to the Kessler sliding grasping suture (Professor Kessler was the former head of our department). We then tie the protruding suture ends into the dedicated area in the device, maintaining suture tension. Moreover, the device allows tensioning of the suture repair site several days and even weeks should dehiscence or gapping be suspected.

Our initial series consists of six repairs with no failures and a residual limitation in range of motion in merely two cases. Ultrasound assessment of the tendon suture site revealed healing and ultimate tendon remodeling similar to normal tendon with no residual bulkiness or suture material following device and suture removal.

We believe the initial results presented here with the use of the TendoCoil device and technique are promising and lay the path to a revolution in flexor tendon repair and rehabilitation.

### **A-0654** BILATERAL CARPAL TUNNEL INFECTION IN A YOUNG PATIENT

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#### INTRODUCTION:

Carpal tunnel syndrome is the most common compression neuropathy in the extremities. Surgical decompression is the Standard treatment. Complications are rare, and infection occurs in less than 0.5 %. When infection occurs, Staphylococcus aureus is the most commonly recovered organism.

We report a case of postoperative bilateral infection.

#### CASE REPORT:

A 44-year-old male underwent an open right carpal tunnel release in June 2022. The procedure was performed under Walant procedure. Chlorhexidine was used as the skin preparation. Surgery time was standard. A soft occlusive dressing was applied. He was diabetic.

One week after the surgery he starts with erythema, swelling and pain in the wound. We started treatment with oral antibiotics (Augmentine®) for 1 week. His evolution was satisfactory.

In September 2022 he underwent an open left carpal tunnel release. 48 hours after the surgery he starts with swelling, erythema and intense wound pain. His white blood cell count was elevated and also was PCR. We started with empiric antibiotic (Augmentine®). Once empiric antibiotic treatment was established, the patient referred improvement of his pain but, 48 h later he worsened. Therefore, a surgical debridement of the wound was scheduled and performed. CT-scan studies were requested before surgery without any sign of gas on it. Pus was found during the debridement. Tissue samples and cultures were sent to microbiology. Intravenous piperaciline-tazobactam and vancomycin were initiated. However, 2 days later, the patient worsened again and a new surgical debridement was required with new samples sent to microbiology. Antibiotic was changed for Intravenous meropenem. New surgical debridement was performed but this time more aggressive under suspicion of necrotizing fasciitis.

Patient's clinical course improved. Within 48 h of the incision and drainage, the white blood cell count had been reduced and PCR too.

Postoperatively, cultures were negative.

Antibiotic was continued for 14 days per infectious disease recommendations. His wound healed without problems and sutures were removed 10 days after the last procedure. He has had relief of paresthesia and has no hand problems.

#### CONCLUSIONS:

Factors increasing the risk of surgical infection include increasing age, diabetes, liver cirrhosis, arterial insufficiency, and immunosuppression.

Treatment consists of a combination of antibiotics, aggressive surgical debridement, and hyperbaric oxygen at times.

Infection is a rare complication following carpal tunnel release. Bilateral infection is more rare.

Even though we had negative cultures, the suspicion was infection due to *C. Perfringens* because of the clinical evolution.

Fast treatment is important to avoid future complications.

## **A-0655** SURGERY AND THERAPY FOR THE TREATMENT OF COMPLEX FINGER STIFFNESS

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**Introduction.** The proximal interphalangeal joint is a highly complex structure composed of articular bony elements, capsule, ligaments, tendons and soft tissue. Damage to any of these components, managed incorrectly, can significantly alter patient outcomes and recovery. Yet even with proper treatment, a high incidence of stiffness may prevail. Common lesions leading to such stiffness include flexor tendon laceration, especially in flexor zone 2 - "No Man's Land", fracture-dislocations of the PIPJ aggravated by volar plate rupture and crush injuries. Strains of the PIPJ treated excessively as well as prolonged splinting both generate stiffness.

**Materials and methods.** From 2020 to 2022, a total number of 27 patients, initially treated in various emergency care hospitals nationwide by emergency trauma teams, presented with PIPJ stiffness. Rudimentary treatment of lesions, extensive splinting and lack of a dedicated rehabilitation follow-up contributed to severe stiffness and hand disability. Approaching stiffness required an extensive range of surgical maneuvers - tenolysis, arthrolysis, capsulotomy, check-rein ligament release, scar tissue excision and soft tissue management. Immediate post-op rehabilitation was mandatory in all cases, with both passive and active movement under supervision of a dedicated hand therapist.

Results and discussion. PIPJ stiffness remains a major challenge in hand surgery. Patients are emotionally affected by the prolonged time to achieve satisfactory results. Final outcome are highly dependent upon active patient involvement in the rehabilitation program and home exercises. PIPJ scarring and soft tissue retraction remain major issues. Intermittent night time splinting help in maintaining achieved results. The introduction of lipofilling to prevent recurrence of scar tissue adhesion to underlying structures is to be further investigated.

Conclusions. A dedicated hand surgery and hand therapy team is key to a good recovery. The importance of proper training of young hand surgeons as well as abiding to strict protocols can be a key factor to improving outcomes.

### **A-0657** THE TENDOCOIL DEVICE - A NEW TOOL FOR COLLABORATION BETWEEN SURGEON, THERAPISTS AND PATIENTS IN FLEXOR TENDON REPAIR - PRELIMINARY RESULTS

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TendoCoil is a new device which acts as an adjunct to the surgery and affords better rehabilitation in flexor tendon repair. The device has been used successfully in a series of six clinical cases wherein flexor tendon injury in zones 1 and 2 was treated by surgical intervention. We present our preliminary results and the device evolution by use of three-dimensional printing as an adjunct to device design and build as well as how the use of the device by the rehabilitation team, surgeon and patient may prove it to be a gamechanger in tendon surgery altogether.

The TendoCoil device is placed at the distal end of the digit following suture of the severed tendon with use of a modification to the Kessler sliding grasping suture (Professor Kessler was the former head of our department – and invented the widely used Kessler suture). We then tie the protruding suture ends into the dedicated area in the device, maintaining suture tension. Moreover, the device allows tensioning of the suture repair site several days and even weeks should dehiscence or gapping be suspected. Better yet, in its current embodiment it relays actively the tension experienced by the suture material during all phases of rehabilitation.

Our initial series consists of six repairs with no failures and a residual limitation in range of motion in merely two cases. Ultrasound assessment of the tendon suture site revealed healing and ultimate tendon remodeling similar to normal tendon with no residual bulkiness or suture material following device and suture removal.

We believe the initial results presented here with the use of the TendoCoil device and technique are promising and lay the path to a revolution in flexor tendon repair and rehabilitation. This device incorporates the use of a dedicated Cellular phone application which incorporates input from the patient, rehabilitation team and surgeon.

### **A-0658** IS THE UNION RATE INCREASED IN PROXIMAL POLE SCAPHOID FRACTURES TYPE B3 AFTER FIXATION WITH TWO HERBERT SCREWS?

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Introduction: Localization in the zone of the proximal pole (type B3 according to Herbert's classification) is one of the main reasons for nonunion of the scaphoid fractures. The causes of the problem are well known: 1. the fracture is always

unstable (even undisplaced). 2. the poor blood supply of the proximal pole very often can be interrupted after fracture. 3. the fracture is always intra-articular and the synovial fluid influence the inflammatory hematoma. 4. the small size of the proximal fragment make the immobilization very difficult. Because of all that reasons above 90 % from conservative treated fractures achieved to nonunion. For operative treated fractures the percentage is less but not enough. One of the reasons is insufficient interfragmentary compression, results from one Herbert screw. This fact compromises revascularization and occurrence of bone union. The purpose of our retrospective follow -up study was to compare clinical outcomes from two groups of patients with acute fractures of the proximal pole of the scaphoid treated operatively with one or two Herbert screws (HBS).

**Patients and Methods**–In retrospective follow up study for a period of 8 years (2012-2020) were evaluated 15 patients with acute proximal pole scaphoid fractures type B3. All patients were operated from the same surgeon. For 7 of them the fixation was with one HBS and for 8 –with two HBS. All patients were followed up for a period of minimum 1.5 years. The main surgical technique was open reduction and surgical fixation with HBS.

The following data was collected for each patient–age, gender, fracture location, mechanism of injury, dominant hand, surgical technique, time to union, rate of complications. Results were evaluated by radiographic /CT-scan and clinical criteria. Clinical assessment included range of motion (ROM), Visual analogue score (VAS), grip strength, Mayo wrist score, DASH score -Bulgaria. Radiographic/CT-scan evaluation included time to union, osteoarthritis, dorsal intercalated segment instability (DISI) and humpback deformity.

**Results**

In this study were evaluated 15 patients (14 men:1 woman) The mechanism of injury was low-energy for 9(60%) patients and high-energy for 6(40%) patients. The mean age at time of injury was 33.5 years. Final extension /flexion was 50 degrees/75 degrees for the one-screw group and 52 degrees/75 degrees for the two screws group. Average values of pain were 1.5 for one HBS and 2.0 for two HBS. Union rate for the group with one HBS is 72% and for two is 86%. Mayo Wrist Score shows excellent result for 4 patients (58%) and good result for 2 (28%) and bad for 1 (14%) from one HBS. For the patients operated with two HBS it was excellent result for 5 (62.5%) and good for 3(37.5%) patients.

**Conclusions**

Between the two groups of patients there are no statistically significant differences. Based on the results the stability of fixation is greater and the most part of the fracture line is covered with two HBS technique. The presented retrospective follow-up study shows that two HBS technique creates higher union rates compared to one HBS. From our point of view it is a safe method with equal clinical outcomes compared to one HBS technique.

## **A-0659** COMPARATIVE ANALYSIS OF THE MODIFIED TURN-OVER SPLIT TENDON LENGTHENING (THE G.I.V.I.S.S.I.S PROCEDURE) VERSUS INTERCALATED TENDON AUTOGRAFTING IN THE TREATMENT OF FLEXOR TENDON DEFECT RECONSTRUCTION: A RETROSPECTIVE COHORT STUDY

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### Objective

In flexor tendon defect reconstruction, due to frayed tendon ends resulting in gap, different techniques have been suggested to bridge the gap, such as lengthening, turnover lengthening, grafting and tendon transfers. We have modified the turnover lengthening technique (The GIVISSIS procedure – Tendon Gap Incorporated Via Intercalated Split Segment Intratendinous Surgery –) and compare it with the traditional use of intercalated tendon autografts.

## Methods

A retrospective analysis was conducted, reviewing data from 12 patients who underwent flexor tendon defect reconstruction the last 10 years. Six patients (Group A) had an intercalated tendon autograft while the rest (Group B) underwent the GIVISSIS procedure, where an enhancement with one 4-0 prolene suture was applied to the proximal donor site and one at the turn over area, in order to prevent further splitting of the tendon. No tubularization or additional sutures are applied to the tendon. In all patients tendon reconstruction was performed in one stage. In both groups, we recorded patients' demographics, injury characteristics, post-operative complications, and functional outcome measured by grip strength, total active range of movement (AROM) and completion of the disabilities of the arm, shoulder and hand (DASH) questionnaire.

## Results

The majority of patients (n=8) had a closed tendon rupture left untreated for more than an average of 9 weeks and 2 of them had attrition of the FPL on plates and screws. The rest (n=4) recalled an open injury but presented with delay. Mean time between injury and day of surgery was 7 weeks in Group A and 13 weeks in Group B. The level of tendon division was in zone 1 (n=5) or in zone 2 (n=7) and it involved flexor digitorum profundus (FDP) (n=10) and flexor pollicis longus (FPL) (n=2). All patients had an uneventful postoperative period and both techniques resulted in successful restoration of digital flexion as reported by total AROM, grip strength and DASH questionnaire.

## Conclusions

The modified turn-over split tendon lengthening (The G.I.V.I.S.S.I.S. procedure) is a safe and easy technique with comparable outcomes to traditional techniques, such as intercalated tendon grafts. Most importantly, it can be used when palmaris longus is absent or hypoplastic and it avoids the morbidity caused by other tendon donor sites.

## **A-0660** SOCIO-ECONOMIC EFFECTS OF MISDIAGNOSED AND MALTREATED SCAPHOID FRACTURES AND WRIST LIGAMENT INJURIES, A SWEDISH NATIONAL INSURANCE REGISTRY STUDY

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## Purpose

Misdiagnosed and maltreated scaphoid fractures (Sfx) and wrist ligament injuries (WLI) filed to the Swedish National Patient Insurance Company (LÖF) 2011-2018, were studied in terms of annual numbers of filed and settled claims, complications, reasons for avoidance, concomitant injuries, demographics, indemnity for disability and direct/indirect costs for society.

## Methods

All filed claims to LÖF are registered in a database, encompassing more than 200,000 claims since 2000. This database was assessed in June 2019 in terms of the wrist injury - ICD10-SWE-diagnoses (S62.0, S63.3, S52.5). Age, gender, side, occupation, localization, and type of injury (Sfx, SL, LT, TFCC), as well as type of complaint was analyzed. The number of filed claims for Sfx and WLI 2011-2018, were reviewed and compared to all filed claims, using trend analysis. Reasons for

avoidance, type of complication, type of correcting surgical procedures and post-operative results were assessed. Direct/indirect costs for society were calculated.

#### Results

The median age for the noted 128 patients with SFx was 24 years and for the noted 231 WLI 38 years. Men represented 76% (SFx) versus 43% (WLI). Sports injuries were present in 47% (SFx) versus 31% (WLI) and 48% were blue-collar workers.

Sixty-one percent (SFx) versus 42% (WLI) were judged as avoidable injuries. This could be compared with 42% approved patient injuries of all notified injuries.

Concomitant injuries with SFx were found – distal radius fracture (DRF) n=7, SL n=5. Isolated TFCC-, or SL injury dominated (n=185, 80%) as type of WLI. Concomitant DRF (n=126, 55%) and SFx (n=9, 4%) were noted in the WLI sub-cohort.

Seventy-two (56 %) of the 128 claims on SFx and 127 (55%) on WLI were filed because of delayed diagnosis and consequently delayed treatment. Pseudoarthrosis dominated as complication (n=70, 55%) for SFx and late diagnosis with SLAC-wrist (n=57, 25%) for WLI. Up to 7 (median 1, range 0-7) secondary surgical procedures/patient were performed and 60% (SFx) versus 30% (WLI) had medical invalidity as consequence of the avoidable injury. Complications and disability were more severe if patients needed more than one corrective surgery.

There was a trend towards decreasing numbers of filed claims for both SFx and WLI over time (p=0.021 versus p=0.002). This contrasts with the total number of filed claims to LÖF, as it has increased by an average of 6% annually for a cumulative increase of 60% during 2011 to 2018 (p=0.011).

The total costs for misdiagnosed and mistreated cases of SFx and WLI were calculated to €3,429,594 (direct costs: €1,240,258, indirect costs: €2,189,336).

#### Conclusions

The decreasing numbers of filed claims of SFx and WLI could perhaps be due to increased knowledge and coping-strategies with the presented treatment algorithms of these injuries in the literature. However, SFx and WLI are still misdiagnosed and maltreated, leading to a significant socio-economic impact - with a cost of €3,429,594 during 2011-2018 - and patient disability.

## **A-0661** SUPER ELDERLY PATIENTS WITH DISTAL RADIUS FRACTURES: A REGISTER BASED STUDY EVALUATING MORTALITY

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#### Background:

With a rapidly ageing population, the number of wrist fractures will rise dramatically in the super-elderly (>80 years) group. In previous published studies regarding mortality after wrist fractures elderly are often defined using a rather wide age-span, the threshold has been set to somewhere between 50-70 years. However, elderly defined as a group this way is probably too imprecise. Differences between a 50- and an 80-year-old patient hypothetically exist regarding expectations, demands and prerequisites for a successful outcome. Our aim was to evaluate the short- and long-term mortality after a distal radius fracture in the super elderly. We also wanted to correlate overall survival to non-fracture related factors

#### Methods:

Patients were extracted from the Lund prospective distal radius fracture register. Included patients were 80 years or older at the time of fracture and were having their fracture between 2010-2012. 1- and 5-year death rates were calculated and compared to the age- and gender adjusted standard Swedish population. Cox regression analyses were performed to calculate the hazard ratios for overall survival related to the non-fracture related factors: comorbidity, according to the Charlson comorbidity index (1), independence (living independently in their own home, living with home assistance, or living in a nursery home), use of walking aid as well as medication.

#### Results:

The overall 1-year mortality was 5.0 % (n=12/240), compared to an expected age- and gender adjusted 1-year mortality of 11% (n=113/1000) in the Swedish standard population (95% CI 0.20-0.68). The overall 5-year mortality was 48% (n=115/240), compared to an expected value of 56.5% (n=565/1000), (95% CI 0.69-1.01). Patient autonomy had the highest impact on mortality. Living in a nursery home had the poorest prognosis (HR 3.2 95% CI 1.8-5.6).

#### Discussion:

Our study analyzes the mortality rate in the super-elderly DRF patients as a separate group and our main finding was, quite surprisingly, that the super elderly patients with wrist fractures had a substantially lower mortality 1 year after fracture compared to the age matched standard population. One can speculate if a distal radius fracture is an indicator of a more active lifestyle or a better balance and a functioning reflex system enabling the patient to fall on the extended wrist instead of landing on e.g. hip or shoulder.

It becomes apparent that age alone is a rather inexact tool for triaging the super elderly to offer the best possible treatment. The patients range from healthy independent patients with high demands and high expectations to dependent patients with dementia, unlikely to cooperate in strenuous rehab. Therefore, an individualized treatment protocol appears to be necessary for the superelderly.

#### Conclusions:

This study analyzes the 1- and 5-year mortality rate in the super-elderly distal radius fracture patients. Our main finding was that the super elderly patients had a substantially lower mortality one year after fracture compared to the age and gender matched standard population.

(1) Charlson ME, Pompei P, Ales KL, MacKenzie CR. A new method of classifying prognostic comorbidity in longitudinal studies: development and validation. *J Chronic Dis* . 1987, 40: 373-83.

## **A-0662** DISTAL PHALANX ADIPOSE FLAP: TECHNIQUE FOR FINGERTIP RECONSTRUCTION

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Fingertip amputations represent an important spectrum of injuries, and most of all are avulsions or crushes trauma. There is no consensus about one single standard treatment, and a wide number of techniques are available. The authors present distal phalanx adipose flap (P3 flap), as an option, for covering fingertip defect with bone exposure, avoiding painful scars in the pulp area, without donor site.

Our study included twelve fingertips with amputated segment not available for replantation. Volar oblique fingertip defects and transverse amputations, not more proximal than Hirase Zone IIB, with bone exposure were included, defect < 2 cm. The patients were followed for an average of six months. The aesthetic, functional outcomes and fingertip

discrimination recovery were evaluated at 6 months by the static 2-pd test and DASH score (quick version). The average postoperative 2-PDs test at 6 months was 5.9 mm (range from 5 to 8 mm). The mean healing time of the fingertip was 4 weeks. Nail deformity was reported in three cases with level IIB of amputation. None of P3 flaps failed and local infection was not reported. The average DASH score at 6 months was 1.1. The mean time to return to work was 38 days (range from 30 to 53).

The P3 flap proposed in this study demonstrates a reliable single-stage technique, performed under local anesthesia, for fingertip defect reconstruction avoiding skin incision, scars in the pulp region and preserving digital length and nail bed.

## **A-0663** RECOVERY 6 AND 12 MONTHS AFTER DIGITAL NERVE REPAIR IN COMPLEX HAND INJURIES

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**Objective:** The digital nerve as a sensing organ is crucial for hand function, and protective sensation is vital in recognizing harmful stimulus and avoid tissue damage. Finger injuries involving nerves may greatly impact the patients' daily lives, and knowledge about the expected outcome is therefore important. There is a lack of studies prospectively investigating change in sensibility after surgery of digital nerve injuries. The aim of this study was to examine sensory recovery the first year after primary digital nerve repair in complex hand injuries, change in sensibility from six to 12 months after repair and to identify factors associated with improved outcome.

**Materials and Methods:** Sensory recovery was measured with Semmes-Weinstein monofilament test in 152 digital nerves (63 patients) six and 12 months after end-to-end epineural cooptation. We included patients who had undergone primary nerve repair combined with tendon surgery and/or bone repair; aged  $\geq 18$  years. The patient sample consisted of 84 % men, mean age 47 years. Twenty-three of the patients had their nerves repaired during replantation. The most common tools of damage were power saws (37 %), sharp objects such as knives and scissors (25 %) and woodchoppers (19 %). Patient-reported outcomes included the Disability of the Arm, Shoulder and Hand (QuickDASH) questionnaire and McCabe Cold Sensitivity Severity scale (CSS). Return of protective sensation was compared in groups based on age, injury mechanism and level of injury. Nerves that had been sutured during replantation, was compared to those without simultaneous vessel repair.

**Results:** At 12 months, 79 % of the nerves had obtained protective sensation while 56 % had even better sensation. Sensibility improved significantly from six to 12 months. Of the 40 nerves without protective sensation at six months, 32 % had so at 12 months. Nerves showing diminished light touch or normal sensation (filament 2.83-3.61) increased from 40 % to 56 % and nerves with no sensation (filament  $\geq 6.65$ ) reduced from 7 % to 1 %. At 12 months, better sensation was obtained at age  $< 40$ , in sharp injuries and in nerves sutured without simultaneous vessel suture (replanted fingers). There was no difference regarding level of injury. There was a significant improvement in QuickDASH-scores, but no change in CSS-scores.

**Conclusion:** The study demonstrates good recovery and improved sensation from six to 12 months after primary nerve repair. Patients with protective sensation at six months had lower QuickDASH- and CSS-scores compared to those with poorer sensation, indicating better upper extremity function and less cold hypersensitivity at better sensation. From six to 12 months there was a small significant improvement in upper extremity function (QuickDASH), whereas cold sensitivity (CSS-scores) remained stable.

**Clinical significance:** Patients with digital nerve injuries have a good chance for improved sensation six to 12 months

post-operatively. Some may expect to advance from no to some protective sensation.

Keywords: digital nerve; neurorrhaphy; sensory recovery; monofilament test.

## **A-0665** RARE TRAUMAS OF THE HAND: ACCIDENTAL INJECTION OF FLUIDS AT HIGH PRESSURE

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### Purpose

High-pressure injection (HPI) injuries although appear benign, often mask the severe underlying trauma. These injuries require early recognition and prompt review by senior surgical teams as they represent surgical emergencies.

### Material and Methods

Case 1. A 31 yo young with HPI injury of heated plastic (hydraulic gun). Initial evaluation revealed a small entry point on the volar 4th MPJ, edema in Pirogov-Parona (P-P) and on the hand dorsum and 3 mm exit point on dorsum of 4th MPJ, pain, paresthesia and positive Kanavel sign. Exploration extended towards P-P with carpal tunnel release. Collateral digital bundles release and foreign material excision. Revision at 48 and 72 h, closure of wounds on 5th day. Good evolution and early functional reeducation allowed return to work at 3 months.

Case 2. A 45 yo mechanic, at 5 h from injury with 3 small wounds –on the volar side of P1 3rd finger and two palmar with 3rd digit ischemia and HPI with engine oil. Exploration, infiltrated tissue excisions, resection of the sinovial sheet down to P-P. Vessels revealed lesions in continuity (ribbon sign) with microthrombosis with indication of amputation at 3rd MPJ level, fasciotomies. At 48h revision a defect exposing denuded extensor tendons. At 5 days, defect coverage with a inguinal McGregor pedicled flap. At 5 weeks, flexion and extension of digits 2,4,5 with progressive functional reeducation is possible, returning to work in 3 months.

### Results

Chemical properties of the substance injected (nature, volume, viscosity, toxicity and pressure of injection) are important factors in HPI. High volume, low viscosity substances produce the most severe inflammatory response with diffusion along anatomical structure and even ischemia, sometimes far from entry point. Site of injection dictates the damage of structures and latency time from accident to treatment increase risk of amputation and damage to hand function. Broad-spectrum antibiotic coverage is mandatory. Surgical treatment must be performed immediately, with decompression, debridement and some reconstructive procedures.

### Conclusions

HPI injury may appear small but with severe damage to the underlying tissue. The severity of the lesion is determined by a series of factors.

## **A-0667** INTERNAL SPLINTING AFTER A4 PULLEY RELEASE AND RECONSTRUCTION

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### Background

When approaching flexor tendon repairs, especially in zone 2 lesions, a pulley release can be useful or even necessary. Several techniques of pulley release and reconstruction have been described, usually followed by a ring splinting protection during rehabilitation time. The ring splint can be quite uncomfortable because of the wound healing process and its employment adds some difficulties in managing the rehabilitation by hand therapists. On this basis, we propose to add an internal splinting procedure after pulley reconstruction, in order to avoid the external ring splinting during rehabilitation.

### Methods

Once the pulley has been reconstructed, whichever technique is used, it is usually possible to place a “cavalier” medium term absorbable suture over the pulley. The suture is anchored on both sides of the pulley base, where it is inserted to the phalanx. This is a quite strong and reliable fibrous zone in continuity with the periosteum. In order to prevent the future dilatation of the reconstructed pulley during the tendon gliding, the stitch is then tied over the pulley. A usual rehabilitation protocol after flexor tendon repair is then applied with no further protection or special care about the pulley such as ring splinting. We employed the internal splinting technique in five cases of flexor tendon repair so far.

### Results

In all cases where internal splinting was performed, all patients were able to follow the usual rehabilitation protocol. The care of the wounds was easy and comfortable either for the patients and hand therapists since no further device was bothering. The outcome of all patients was found to be within the average of the patients who followed a rehabilitation protocol with the use of a ring splinting, and we haven't found any complications, especially secondary ruptures of the reconstructed pulleys.

### Conclusions

The internal splinting technique we propose allows to protect the pulley system after its releasing and reconstruction, with no need for a special care during rehabilitation time, such as the use of traditional ring splinting. This leads to some advantages such as simplifying the wound care, reducing the hand therapists work and increasing the comfort of the patients as well. Even though we employed this technique in a limited number of cases, the absence of complications such as secondary rupture of the pulley is reassuring.

## **A-0668** COMPLICATIONS OF AN INITIALLY UNTREATED DEEP FLEXOR SECTION OF THE LITTLE FINGER. A CASE REPORT

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We present the case of a 14-year-old boy who consulted us for no active flexion of the distal interphalangeal joint of his little finger of the right hand; following an incised wound of less than 1cm in zone 2 with a knife 4 months prior. This was initially treated as a superficial wound with skin sutures. He presented active flexion of the proximal interphalangeal joint, with no associated vasculonervous alteration. Given the time of evolution, 1-stage tendon reconstruction surgery was performed with an intercalary graft of palmaris longus as there was a preserved flexor canal with competent pulleys.

Pulvertaft suture was performed proximally, and reinserted distally with a tendon remnant on the distal phalanx with a 1.0mm harpoon. Despite a very satisfactory initial evolution, the patient suffered tendon rupture 2.5 months after while playing hockey. Revision surgery was performed, observing the maintenance of the sutures performed and a rupture in the central area of the graft used. A first-step Hunter technique was performed by placing a silicone spacer in the canal suturing distally with distal tendon remnant after removal of the harpoon placed in previous surgery. After 4 months of occupational therapy, a second-step Hunter procedure was performed, using heterologous tendon grafting, with a new Pulvertaft type suture proximally and with placement of a new 1.0mm harpoon in the distal phalanx, having to implant it more distally than initially required as the base of the phalanx had poor support for the harpoon, since the area had been previously used in surgery. In order to better maintain the harpoon, a cross loop was made around the phalanx with the harpoon threads used to suture the tendon graft. Patient evolution was again satisfactory. However, 2 months after the new surgery, he presented a local infection at the base of the nail with an associated fracture of the distal phalanx, maintaining correct function of active flexion of the distal interphalangeal joint. Surgical cleaning was performed and granuloma associated with the harpoon was observed and removed. The patient was kept under targeted antibiotherapy, with resolution of the infection. After immobilisation of the fracture with an orthosis for 4 weeks, active movements were restarted, with the nail falling off and the new one growing. Three months after the cleaning surgery, he presented functional mobility and strength in the finger, with no pain and healing of the fracture of the distal phalanx. Penetrating wounds in the palmar area of the fingers require a detailed physical examination to determine the presence of injuries to the flexor tendons and digital collateral nerves. However, an inexperienced professional or misdiagnosing it as minor injuries because of their size may result in diagnostic failure in tendon injuries. These errors may condition the mobility of the fingers, requiring complex tendon reconstruction surgeries that often have worse results than primary repair.

**A-0669** CHANGES IN TREATMENT PRACTICE AFTER THE INTRODUCTION OF COLLAGENASE FOR DUPUYTREN'S CONTRACTURE. A REGISTER STUDY BASED ON 23,752 PATIENTS FROM THE SWEDISH NATIONAL PATIENT REGISTER  
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### Objective

Dupuytren's disease is a common malady with an estimated prevalence of 12% in those aged 55 years and 29% in those aged 75 (11), and many of the afflicted develop bothering contractures in the fingers. In 2011 Collagenase Clostridium histolyticum (CCH) was introduced in Sweden and around the same time percutaneous needle fasciotomy (PNF) was also being popularised. These treatments offered minimally invasive alternatives to the traditional open fasciectomy (OF). The aim of this study was to investigate trends in the treatment of Dupuytren's contracture on a nationwide scale in the years following the introduction of minimally invasive treatments

### Methods

We obtained data from National Patient Register in Sweden on patients treated for Dupuytren's contracture from February 1, 2009, to December 31, 2016. Patients were identified by the ICD-10 code M720 and primary surgical codes (KVÅ) used nationwide and the procedures were divided into four categories: OF, CCH, PNF and additional procedures (e.g. arthrolysis and amputation). The data search was de-identified by the National Board of Health and Welfare and the code key was destroyed after three months. The trial was approved by the regional ethical review board of Gothenburg (EPN 2018:611-18)

## Results

A total of 35,247 procedures in 23,752 individuals were identified. There were 19,445 (81.8%) men and 4,327 (18.2%) women resulting in a male-to-female ratio of 4.5 to 1. In 2009 a total of 2,911 procedures were performed due to Dupuytren's Contracture. This gradually increased and the number of procedures peaked in 2013 with 5,709 procedures in 2013 and then stabilized at around 5,000 procedures per year after that. In 2009, OF was the most common procedure. After that, a marked decline in OF was observed in both absolute and relative numbers. In 2009, OFs part of the total number of procedures was 93 percent and it decreased to 26 percent in 2016. This decline was matched by an increase in PNF and CCH. In 2016, the proportion of CCH was slightly more than 50 percent making it the most common procedure. In comparison, the treatments with PNF were 20 % of the total number of procedures. A majority, 16,567 (67%) persons underwent only one procedure, 4,947 (21%) did two procedures during the study period. Relatively few 2,208 (12 %) underwent three or more procedures. Among persons whose first operation was open surgery, 76 percent did only one operation during the study period (Figure 3.) The corresponding number for CCH and PNF was 50 percent and 77 percent, respectively.

## Conclusion

Minimally invasive methods have to a great extent replaced traditional open surgery, and more patients than before are treated for Dupuytren's Contracture.

## **A-0670** PRELIMINARY STUDY ON THE USE OF INDOCYANINE GREEN IN THE DECISION-MAKING ALGORITHM OF COMPLEX HAND TRAUMA

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## Introduction

Assessment of tissue perfusion is an essential diagnostic criterion during upper limb salvage procedures.

Currently, the most popular method consists of physical examination and clinical judgment, highly dependent on the surgeon's experience, while objective instrumental tests are not routinely used. On the other hand, indocyanine green fluorescence angiography is a consolidated tool for the intraoperative assessment of tissue perfusion. It is a dye that emits a diffuse fluorescence when exposed to light with wave frequencies close to infrared (NIR). The device has a camera that allows you to evaluate the current tissue perfusion in real-time. In trauma surgery, the hand surgeon encounters devascularization, crushing, tear, and avulsion injuries where further aid in defining tissue vitality may be helpful. This preliminary study aims to investigate the possible applications of indocyanine green in the diagnostic and decision-making algorithm in hand trauma.

## Methods.

The indocyanine green angiography device was used as a diagnostic aid in 10 complex traumas of the upper limb, including an amputation trauma with partial uncovering of the first finger, two avulsion injuries, and five subamputations at different levels in hand. In the suspicion of complete or partial devascularization, it was used preoperatively as an aid to the physical examination to define the degree of complexity of the intervention and guide the anesthetic choice (truncular or plexus) of the surgery. In traumas where tissue suffering was likely, it was used to guide the debridement of non-viable tissues.

## Results

Indocyanine green angiography has shown comparable results to surgical exploration in investigating the lesion of

vascular peduncles in devascularization, while it has been successfully used to evaluate the viability of tissues mortified during trauma that did not require further debridement.

### Conclusions

In this preliminary study, we highlight the use of indocyanine green in situations where soft tissue perfusion of the upper limb is difficult to determine. ICG angiography allows for rapid, non-invasive tissue assessment. It can confirm a clinical diagnosis, present new information on tissue viability, and aid in informed consent and clinical decision-making. Although we believe this technology can help successfully in intraoperative decision-making, further studies are needed to evaluate the ability of ICG angiography to predict tissue viability in upper limb trauma.

## **A-0671** DOUBLE RAY AMPUTATION IN CASE OF HIGH-GRADE SARCOMAS OF THE HAND

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In case of malignant hand tumors ray resection is often the only way to achieve negative resection margins in order to reduce the chance of local recurrence and improve overall survival rate, while maintaining an acceptable hand function. Our study presents three cases of double ray resections due to high-grade sarcomas. In two cases the second and the third ray was resected, in one case the fourth and fifth. Patients were reviewed at 6 weeks, at 3 months, and then every 3 months during the first year, the further follow-ups are planned as every 6 months for the next 4 years.

First case: 44 years old woman, who was referred to our department after the removal of a soft tissue mass in the second intermetacarpal space of her dominant right hand. Histologic examination revealed a high-grade synovial sarcoma, with infiltrated resection margins. The staging examinations did not find any metastasis. A double ray resection of the second and third ray was performed at our institution. Histologic examination confirmed a Grade III monophasic synovial sarcoma with negative resection margins. The onco-team decided that considering the radical surgical therapy, adjuvant therapy is not necessary, however the patient needs close observation. The patient managed to return to her works as a kindergarten teacher without limitation in her daily hand function.

Second case: 59 years old man, who had a tumor above the proximal phalanx of his index finger on the dominant right hand. The tumor was removed in another hospital, the histologic examination found a spindle cell sarcoma, the tumor bed was excised. Staging examination did not find any metastasis. 4 months after the first surgery a recurring tumor appeared above the proximal phalanx and also in the second intermetacarpal space, and patient was referred to our department, where we performed a double ray resection of the second and the third rays. Histologic examination confirmed a Grade III, recurring double centered myofibroblastic sarcoma, with intact resection margins. The onco-team decided to continue the treatment with adjuvant chemotherapy. The patient was not able to continue his heavy manual work, but he has a good tip and key pinch to assist in bimanual activities.

Third case: 44 years old man, who was referred to our department because of a partially removed chondro-fibromyxoid sarcoma on the proximal phalanx and fourth intermetacarpal space on his dominant right hand. Previously he was operated because of a suspected infection in the mentioned area, but during the operation tumor mass was found. En bloc resection was not possible, the histological examination identified the tumor as chondro-fibromyxoid sarcoma. MRI of the hand and staging examination was performed. After the fourth and fifth ray resection the margins were clear, close observation was recommended by the onco team. Although double ray resection results in worse functional outcome than single ray, good key, tip, and tripod pinch can be preserved. In our cases it resulted in an acceptable hand function, resulting in a better functional outcome than complete hand amputation.

## **A-0672** THE POSTOPERATIVE MANAGEMENT OF DUPUYTREN'S DISEASE AFTER OPEN PALM TECHNIQUE

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The treatment of Dupuytren's disease with the open palm technique, has been reported to produce optimal outcomes with virtually invisible scars, mild oedema, and fast functional recovery. We present a series of 22 patients with early Dupuytren's disease treated with this technique and we focus on the post operative protocol and the results.

**Materials and Methods:** From January 2019 to June 2021, 22 patients with Dupuytren's disease were treated in our centres with the open palm technique. There were 17 men and 5 women for a total of 23 hands. There were 37 rays operated. Three rays were stage 0 and were next to more severe contracted rays. There were 15 5th rays, 19 4th rays and 3 third rays. Twenty-one rays were stage 1 disease, 9 rays stage 2 and 2 rays stage 3.

All 22 patients were operated with a transverse incision at the palm and one or two more transverse incision at the digital transverse creases, accordingly to the presence of the disease in the fingers.

All patients were treated post operatively by a hand therapist and seen twice a week for the first two weeks after the operation and then once a week for further 6 weeks. Change of dressing with humid dressing was performed by the therapist at every appointment. Exercise of active and passive mobilization were started immediately one or two days after surgery. Focus was given immediately to passive hyperextension exercises. Strengthening of the hand was started after 2 weeks. A compressive bandage was used immediately after surgery. A Thermoplastic night splint in extension was used for the first 8 weeks. We recorded early and late complications. We also recorded the satisfaction of the patients and the tolerance towards the open wound in the hand. At the last follow up at 16 months (range 11-25) we measured the range of motion, strength and any visible recurrence.

**Results:** All patients eventually healed with no complications and with complete correction of the Dupuytren's contracture. At the last follow up the range of motion and the strength were recovered. No recurrence was observed. All patients were satisfied with the results and highly satisfied with the scar but one patient with a stage 3 disease complained about the long healing time. Regarding the rehabilitation protocol, we observed 13 male patients with vasovagal reaction at the time of the first change of dressing. None of them show any further adverse reaction at the following appointments. All patients showed an initial diffidence in stretching completely the fingers, for fears to open the wound further. Nevertheless 11 patients reported to be using the hand for heavy works after 7 days after surgery.

**Discussion:** The open palm technique for Dupuytren's disease produces excellent scars and high patients' satisfaction. Care should be taken in the first change of dressing for vasovagal reaction. A night splint and immediate hyperextension exercises seem to be necessary to counter patients' tendency to avoid early full fingers extension.

## **A-0673** BIOMECHANICAL EVALUATION OF THREE MODIFIED KESSLER METHODS FOR FLEXOR TENDON REPAIR: SUITABLE FOR EARLY ACTIVE MOBILIZATION?

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**Objective:** Surgical management of flexor tendon injuries is challenging, with lack of consensus on which suture repair technique and suture material to employ. An ideal repair would be technically feasible whilst providing sufficient strength to allow for early post-operative mobilization. The aim of this study was to evaluate the biomechanical properties of 3 modified Kessler repair methods that utilize two different suture materials: a conventional 2-strand- and modified 4-strand-Kirchmayr-Kessler repair using 3-0 Prolene® (2s-KK-P and 4s-KK-P respectively), and a 4-strand-Kessler-Tsuge repair using 4-0 FiberLoop® (4s-KT-FL).

**Methods:** Thiel-embalmed human flexor digitorum profundus (FDP) tendons were retrieved. For each tendon, a full-thickness cross-sectional incision was created and the ends were re-attached by either a 2s-KK-FL (n=30), a 4s-KK-FL (n=30) or a 4s-KT-FL repair (n=30). The repaired tendons underwent a quasi-static (n=45) or a cyclic testing protocol (n=45). Maximum load force (Fmax), 2-mm gap force (F2mm), and primary failure mode were evaluated.

**Results:** In both quasi-static and cyclic testing groups, FDP tendons repaired by a 4s-KT-FL method generated higher Fmax and F2mm compared to 2s-KK-P or 4s-KK-P repairs. Fmax was higher with 4s-KK-P versus 2s-KK-P repairs, however, F2mm was not significantly different. For 4s-KT-FL repair, suture pull-out was the primary failure mode; 2s- and 4s-KK-P repairs primarily failed by suture breakage.

**Conclusions:** FDP tendons repaired with a 4s-KT-FL method demonstrated greater strength in biomechanical testing parameters of Fmax and F2mm in comparison to 2s- and 4s-KK-P repairs. Moreover, 4s-KT-FL repairs failed because of suture pull-out and not by suture breakage which was the case for 2s- and 4s-KK-P repairs. Taken together, the 4s-KT-FL method could potentially lower the clinical risk of gapping and re-rupture when compared to 2s-KK-P and 4s-KK-P repairs during early active mobilization.

## **A-0674** WIDE AWAKE LOCAL ANAESTHETIC NO TOURNIQUET (WALANT) IN GREECE- OUR 5 YEAR EXPERIENCE

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### Introduction

WALANT is becoming more popular worldwide during the last few years. We use this technique in our centre over the last 5 years. We have started with simpler procedures and have expanded our practice to more complicated ones, as our experience grew.

### Materials and methods

We have performed 567 operations with WALANT over the last five years. All the procedures were performed by the same consultant or under his supervision. When injecting around digits we prefer to stay in the midline avoiding to inject around the digital nerves and arteries. The most common operations are carpal tunnel decompression, trigger finger release, ulnar nerve decompression, flexor and extensor tendon repair, tenolysis, arthrolysis, tendon transfers, phalangeal and

metacarpal fractures fixation. Due to lack of the premix we create it mixing adrenaline, normal saline and xylocaine. We have only used xylocaine with adrenaline in our practice and we dilute it further in cases where more volume is needed. We have not used WALANT in trauma cases in which a digit was already not well perfused.

#### Results

We did not inflate the tourniquet in any of the 567 cases. After the first three years of experience we have stopped putting it on. Especially for tenolysis and arthrolysis the advantage is that one can test the progress by active motion. Tendon repairs can be checked for their strength. In tendon transfers it is easier to get the tension right. During our experience there was only one adverse event (vasovagal episode). We had no ischaemic type complications. In our experience haemostatic result is much better in about 25 minutes after the injection of the local anaesthetic.

#### Conclusions

WALANT is a safe technique that eliminates tourniquet pain for the patient and time pressure for the surgeon. It is cheap and can be performed without the presence of an anaesthetist. Patient satisfaction is better with WALANT. In some cases such as tendon repairs, tendon transfers and operations for stiffness it is preferable as one can test the results intraoperatively with active motion. This also motivates the patient for the rehabilitation. It is a good alternative when general anaesthesia is not an available option for any reason.

### **A-0675** SINGLE INCISION IN SURGICAL APPROACH FOR SIMULTANEOUS DECOMPRESSION OF THE MEDIAN AND ULNAR NERVE TO THE WRIST

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**Objective.** The anatomical relationship between Guyon's canal (G) and the carpal tunnel (CT) facilitates the transmission of high intracompartmental pressure between these compartments to such an extent that a simultaneous compression syndrome on the median and ulnar nerves at the wrist is possible. The high pressure can be transmitted between compartments leading to a concomitant compression syndrome of both the median nerve (MN) and the ulnar nerve (UN). We proposed a surgical approach through a single incision, in a "reversed J" shape, which allows simultaneous decompression of both nerves.

**Methods.** Between 2010 and 2021 - 304 patients aged 27 to 73 years were treated for ulnar nerve neuropathy, 112 (31%) elbow patients, 127 (35.1%) elbow and Guyon patients, and 123 (33.88%) patients with (GC) of which 48 (39.80%) showed signs of simultaneous compression of NU and NM. All patients had clinical findings that correlated with electrodiagnostic studies: the presence of compound muscle action potentials (CMAPs) that are of good amplitude even though low conduction velocities are present suggests the need for concomitant ulnar and median nerve decompression at the wrist. Release of Guyon's canal, isolation of the sensory and deep motor branch, which can be compressed by the adductor pollicis observed in 60 (49.0%) of the patients. Patients with Guyon tunnel were McGowan grade II-III. The decompression of both nerves was done through a single surgical approach, in the form of a "reverse J" associated with a "Z" towards the midline at the meeting with the flexion fold of the fist near the pisiform. On the same approach, return to the vicinity of the pisiform by taking off obliquely Transverse Carpal Ligament (TCL). After the antebrachial fasciotomy, the bottoms of the Pirogof-Parona synovial sac and the median nerve are highlighted, which is isolated up to the Boekel line, which corresponds to the point where the "reverse J" incision ends. In this way, it is possible to decompress both ulnar and

median nerves .

Results. The patients were followed clinically and by electrodiagnosis at 3, 6 months, 1 year only 75 (61.0%) of the patients, 36 patients (47.61%) with EG, motor and sensory recovery with very good results. We saw an average improvement in grip strength from 54% to 92% of the unaffected side, pinch resistance from 56% to 89%, Quick Dash score from 62.48 to 12.9%, and 2PD from 9, 4 mm to 6 mm. Only 18 patients (17.4%) with advanced intrinsic hypotrophy recovered postoperatively with poor results.

Conclusions. Concomitant compression of at Guyon and MN - TCS is a common clinical entity, with a frequency of 39.8% of cases requiring simultaneous release, and this is possible through a single "reverse J" incision. The presence of clinical signs associated with good-amplitude CMAPs and low conduction velocities indicate surgical treatment. Case selection based on clinical and electrodiagnostic criteria guides the surgeon to perform simultaneous Guyon canal decompression intervention as well as stratum elbow and Guyon tunnel release along with simultaneous wrist release.

### **A-0676** ULNAR NERVE DECOMPRESSION AND ANTERIOR TRANSPOSITION USING AN ADIPOFASCIAL FLAP: CLINICAL OUTCOMES FOR PRIMARY AND RECALCITRANT NEUROPATHY

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Purpose: To evaluate the clinical outcomes of ulnar nerve decompression and anterior transposition using an adipofascial flap reconstruction for primary and recalcitrant ulnar neuropathy at the elbow.

Methods: A retrospective cohort undergoing primary or revision ulnar neuroplasty with anterior transposition using an adipofascial flap technique between 2006 and 2021 was evaluated for a single surgeon across two institutions. Inclusion criteria included patient age > 18 years, follow up greater than one year, and completion of routine clinical assessments. Exclusion criteria included history of concomitant open injury, gunshot injury, associated ulnar nerve repair or reconstruction, or history of thoracic outlet syndrome. Pre- and post-operative visual analogue pain scales, physical examination, and modified McGowan classifications were used for assessment.

Results: 56 procedures met inclusion criteria including 34 primary and 22 revision cases with a mean follow-up of 18 months (range: 12 - 48 months). Compared to preoperative assessment, there was notable improvement in subjective sensibility, intrinsic strength (4.0 versus 4.7 / 5), visual analogue scale for pain (mean 5.8 to 0.9;  $p < 0.001$ ), and in modified McGowan classification scores for 47/56 cases ( $p < 0.001$ ). No patients had worsening of their pain scores post-operatively. There were no major perioperative complications or revision surgeries for the ulnar nerve.

Conclusions: Use of the adipofascial flap for anterior transposition of the ulnar nerve at the elbow generally provided patients with significant improvement in measured clinical outcomes, even in the revision setting. Ulnar nerve sensibility and intrinsic strength improved postoperatively, and consistent improvement in subjective pain rating scores was observed. In patients for whom ulnar nerve decompression with anterior transposition is indicated, anterior transposition using an adipofascial flap may be a valuable method for improving nerve function and for improving overall patient outcomes.

## **A-0678** GREATER ARC REVERSE (ULNAR-SIDED) PERILUNATE INJURY - A SYSTEMATIC REVIEW AND CASE REPORT. TIME TO QUESTION THE MAYFIELD CLASSIFICATION AGAIN?

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### INTRODUCTION

Perilunate dislocations and fracture-dislocations of carpal bones are uncommon, high-energy injuries that necessitate early diagnosis and appropriate management to prevent progressive carpal instability and posttraumatic osteoarthritis. The mechanism is hyperextension, ulnar deviation, and intercarpal supination of the wrist, and may cause dislocations or fracture-dislocations. A much more uncommon mechanism that starts from the lunotriquetral (LT) ligament and proceeds radially in an opposite direction than the classic mechanism, may cause a reverse or ulnar-sided perilunate dislocation. Limited cases of greater arc injury that starts ulnarly and progresses radially indicating greater arc reverse perilunate injury have rather seldom been described in the literature. The purposes of this study were: 1. To present an uncommon case of greater arc reverse (ulnar-sided) perilunate dislocation with fractures of the ulnar styloid, triquetrum, and the body of capitate, and 2. To conduct a systematic review that aims to evaluate the current evidence on the reverse (ulnar-sided) perilunate injuries.

### METHODS

A 42-year-old male patient presented at our institution 20 days after a fall from height. The diagnosis of greater arc ulnar-sided perilunate dislocation with acute median neuropathy warranted immediate surgical intervention. Reduction and anatomic fixation of the subluxated fractured capitate were performed with a headless compression screw from a dorsal approach. A volar incision was used to release the carpal tunnel and decompress the median nerve. The volar part of LT was repaired through the volar approach. LT fusion was performed through the dorsal incision due to the comminution of the radial part of the fractured triquetrum.

We conducted a systematic review to evaluate the trauma mechanisms and treatment options of reverse (ulnar-sided) perilunate injuries. Two independent reviewers searched PubMed, EMBASE, Scopus, and Google Scholar databases. The following terms "wrist dislocation", "reverse perilunate", "carpus", "ulnar-sided perilunate", "dislocation", "instability", and "perilunate fracture-dislocation", were used alone and in combination with Boolean operators AND and OR. The modified Coleman methodology score (mCMS) was used to evaluate the methodological quality of the included studies. A narrative analysis was conducted. Publication bias was assessed using the ROBIS tool.

### RESULTS

At 12 months follow-up, the carpal alignment was maintained, and fracture/fusion healed. The patient had slight pain (visual analog pain score 1/10) and grip strength of 73 lb (contralateral healthy: 106 lb); the wrist range of motion was 30° flexion, and 60° extension. Flexion deficit measured < 2 cm. The patient graded his wrist as good compared with before surgery and has returned partly/fully to work and leisure life respectively.

The systematic literature review identified seven case reports, one cadaveric study, and one combined cadaveric/clinical case (6 cases) related to reverse perilunate injuries. mCMS revealed poor methodological quality among the included studies. Mechanisms of injury and treatment options were heterogeneous among them.

### CONCLUSIONS

The systematic review revealed poor methodological quality of the available literature. Evidence is lacking in the mechanism

of injury and treatment of this injury. However, following the management principles of wrist dislocations leads to satisfying functional results, with no major complications as shown by our case.

**A-0679 DUPUYTREN TREATMENT EFFECTIVENESS TRIAL (DETECT): SHORT-TERM RESULTS FOR A RANDOMIZED, CONTROLLED, MULTICENTRE TRIAL COMPARING THE EFFECTIVENESS OF CLOSTRIDIUM HISTOLYTICUM, PERCUTANEOUS NEEDLE FASCIOTOMY AND LIMITED FASCIECTOMY IN TREATMENT-NAIVE DISEASE**

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**Background:** Dupuytren's contracture is a common hereditary fibroproliferative disorder affecting palmar fascia in middle-aged and elder male population. There is no cure for the disease, but hand function improves when the contracture is released. Percutaneous needle fasciotomy, collagenase injection and surgery are used to treat Dupuytren contracture of the hand. There is limited evidence which treatment method is the most effective. There are no previously published RCTs comparing all three interventions in one trial.

**Methods:** We performed a multicentre, randomized, controlled, outcome assessor blinded, superiority trial, in which participants with treatment-naive mild to moderate degree (20-130 degrees of extension lag) Dupuytren's contracture were randomized to receive either percutaneous needle fasciotomy, collagenase injection or surgery. We stratified the participants according to the dominantly affected joint (metacarpophalangeal or proximal interphalangeal joint). We assessed the outcomes at three months after the intervention. The primary outcome was the rate of success (defined as > 50% contracture release and participant reached patient acceptable symptom state).

**Results:** A total of 302 participants were randomized (101 for needle fasciotomy; 100 for collagenase injection and 101 for surgery) and 292 (97%) completed the follow-up. The success rates were 74% for needle fasciotomy, 73% for collagenase injection and 70% for surgery. The corresponding risk differences were -0.00 (CI -0.13 to 0.12; p=0.96) between needle fasciotomy and collagenase injection; -0.03 (CI -0.16 to 0.09; p=0.59) between percutaneous needle fasciotomy and surgery; and -0.03 (CI -0.10 to 0.16; p=0.63) between collagenase injection and surgery. The secondary outcomes supported the findings from the primary analysis with no statistically significant or clinically relevant differences between the treatments.

**Conclusions:** There seems to be no difference in effectiveness between the three treatment methods: needle fasciotomy, collagenase injection and surgery among people with mild to moderate treatment-naive Dupuytren's contracture in short-term follow-up. Low-cost needle fasciotomy may be preferred as the first line treatment, but there is a need for long follow-up trial, particularly regarding recurrence rates, assessing long-term cost-effectiveness of the different treatment strategies.

## **A-0680** ARPE TOTAL JOINT ARTHROPLASTY FOR TRAPEZIOMETACARPAL OSTEOARTHRITIS: 71 THUMBS IN 65 PATIENTS WITH A MINIMUM OF 15 YEARS FOLLOW-UP

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### Introduction

Trapeziometacarpal (TMC) arthroplasty is an increasingly used surgical solution in patients with symptomatic TMC joint arthritis, resistant to conservative treatment. The Arpe prosthesis (Zimmer-Biomet Warsaw, IN, USA) is one example of these TMC arthroplasties.

### Methods

In this single-center cohort study, radiographic and qualitative outcomes were evaluated after a minimum of 15 years follow-up. Visual analogue pain scores (VAS) in rest and with exercise, QuickDASH scores and patient satisfaction were assessed for 71 thumbs in 65 patients.

### Results

A total of 39 patients were found eligible for inclusion: 37 unilateral and two bilateral arthroplasties. The female to male ratio was 35:4. Seven failures were registered, of which five during the first three years after initial surgery. Revision was done for cup loosening (5) or dislocation (2) and consisted of trapeziectomy. The mean follow-up time was 200 months (range 180 - 278). The mean survival at 15 years was 84.55% (95% Confidence Interval (CI), 83.22-85.88). The VAS decreased with 6.69 at rest (95%CI, 5.94-7.44) and with 7.41 at exercise (95%CI, 6.82-8.00). QuickDASH reduced with 44.95 (95% CI, 38.86-51.05). Radiographic analysis of the 34 prostheses still present, showed no anomalies compared with the initial postoperative X-rays.

### Discussion

More long-term follow-up studies on TMC prostheses are reported. In this study, we determined that survival declined mainly in the first years. Pain and functional outcome remained significantly better, even after 15 years. No radiological anomalies presented within the follow-up period. Thumb arthroplasty is a reliable long-term solution for thumb base arthritis, with good subjective outcomes.

## **A-0681** BRACHIAL PLEXUS INJURIES ASSOCIATED WITH VASCULAR LESIONS: PRIMARY OR DELAYED EMERGENCY VS SECONDARY REPAIR

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### Purpose

Vascular lesions associated with brachial plexus injury (BPI) pose decisional problems regarding treatment. Treating this kind of lesions at the same operative time has some advantages and should be regarded as standard.

### Materials and Methods

82 cases of BPI, 27 had associated vascular lesions treated by a mixed team: vascular surgeon – microsurgeon. Artery reconstruction was done with saphenous vein interposition grafts (25 cases) and PTFE grafts (2 cases). In 21 cases vascular reconstruction was performed immediately and in 6 cases after 24-48 h, delayed emergency. Nerve lesions were located

at the level of cords in 19 cases, 3 retroclavicular and 5 supraclavicular lesions. Retro- and infraclavicular nerve lesions were treated primarily in 19 cases by external neurolysis and neurography, for the other 2 through secondary nerve grafting. Elongation and avulsion injuries required secondary combined reconstruction techniques: nerve grafts, nerve transfers (intercostals  $\pm$  phrenic) and palliative muscular transfers (one pectoralis major, two latissimus dorsi and two triceps). Patients follow-up at 6, 12 and 36 months. The average posttraumatic surgery interval was 6-9 months. Emergency repair patients presented M3-4 results on BMRC scale compared to secondary reconstruction patients with results M1-2.

#### Results

Neurological recovery was better in primary compared to secondary reconstructions due to reduced scarring and the risk of iatrogenic lesions.

Emergency repair of both vascular and nervous lesions is mandatory. Even if the evaluation of the nerves defect is difficult in emergency, the clinical experience allows a reasonable evaluation of nervous tissue defect. Lesions evaluation in mixed team is the best surgical attitude avoiding scared tissue and allowing good anatomy viewing and restoration. Primary reconstruction avoids difficult scar tissue dissection, large nerve graft reconstruction

#### Conclusions

Combined lesions should be treated by a mixed team with primary repair of all structures in immediate emergency after vessel repair or in delayed emergency (5-7 days) after patient stabilisation, can lead to better results than secondary reconstruction. This strategy avoids iatrogenic injury to the vascular graft and the difficult dissection in secondary brachial plexus repair. Primary repair guarantees the best functional results in complex cases.

Keywords: brachial plexus, vascular lesions, nerve repair

## **A-0682** A FINGER ON THE PULSE: A SYSTEMATIC REVIEW OF LITERATURE AND MANAGEMENT ALGORITHM FOR DIGITAL ARTERY ANEURYSMS

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#### Introduction and Aims

True aneurysms of digital arteries are rare. A systematic review of literature revealed 22 published cases of true digital artery aneurysm with no consensus on diagnosis or management of the same.

We present a systematic review of published case studies and an algorithm for management of digital artery aneurysms based on published literature and our own departmental experience.

#### Methods

A systematic review of literature was performed using PubMed and Embase search for "digital artery aneurysm". Further studies were added to the search results by reviewing references of articles found in the initial search.

25 articles were identified and underwent abstract screening to yield 17 articles, two were excluded based on lack of availability of full text article 15 full text case reports and series describing a total of 22 cases were ultimately included.

Data around demographics, mechanisms of injury, management and histology was extracted and tabulated.

#### Results

The mean age of presentation was 43.4. Where details were available, 27.8% of patients were women (n=5/18) while 72.2% of patients were men (n=13/18). Recorded occupations included a range of skilled and semiskilled jobs that did not require hard manual labour but did predispose patients to repetitive hand movements. Where recorded, a majority

92.3% (n=12/13) of patients were noted to be right-handed.

Aneurysms were more likely to present on the right hand 68.8% (n=11/16) than the left 31.3% (n=5/16) suggesting some influence of hand dominance on presentation. The thumb was the most common digit to be affected by true aneurysms. Symptoms at presentation included a palpable mass in 100% of cases (n=18/18), associated pain 66.7% (n=12/18) and pulsatility 16.7% (n=3/18).

Of the 22 published cases, 10 underwent investigation prior to surgery. Investigations performed included Ultrasound (n=5), Radionuclide scanning (n=3), Angiography (n=1), MR Angiography (n= 3), CT (n=1 and MRI (n=1).

#### Discussion

While digital artery aneurysms are rare, it is often difficult to differentiate these without some form of imaging or surgical exploration. We suggest pulsatility to be a good indicator of the lesion being a vascular in nature. We suggest adequate preoperative imaging allows for easier planning and reassurance to the patient. Angiography provides the most detailed mapping of vasculature of the digits and should be considered where available

We suggest minimising intervention in the region if perfusion is adequate intra-operatively. We suggest a modified Allen's test intra-operatively to confirm collateral perfusion to the digit. If collateral perfusion is confirmed our recommendation is to proceed with simple ligation and excision of the aneurysm avoiding vein grafting to reconstruct the artery.

#### Conclusions

We suggest our algorithm allows for early surgical planning, minimises surgical time and allows for early mobilisation of the finger reducing the risk of stiffness within the digit. To our knowledge, no evidence-based algorithm for management of digital artery aneurysms exists. We aim to provide a simplified, evidence baes approach to management of these lesions to allow standardisation of care, allow efficient decision making and ultimately optimise patient outcomes.

## **A-0683** ARTHROSCOPIC RESECTION ARTHROPLASTY AS TREATMENT OF RADIAL COLUMN ARTHROSIS OF THE WRIST

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#### Background

Arthrosis of the radial column of the wrist can occur as a result of scapholunate ligament injury or scaphoid non-union (SLAC and SNAC wrists). Traditional treatment has been extensive surgery such as scaphoidectomy and four corner fusion (4CF) or proximal row carpectomy (PRC). We propose that arthroscopic resection of the radial column of the radius could be a valid less invasive treatment option to the above mentioned procedures.

#### Material and method

Data was collected retrospectively on 16 wrist in 16 patients that underwent arthroscopic resection arthroplasty of parts or the whole scaphoid facet of radius joint surface in the period between 2016 to 2021. Average age was 52 years (28-68), 11 men and 5 women. Indication for surgery was SLAC in 7, SNAC in 4 and Morbus Preiser in 1 case. 4 patients got a cast postoperatively for an average of 15 days (10-21), the remaining patients got only soft bandage.

#### Results

Follow up period was between 4 and 77 months. 3 patients have gone through revision surgery, 1 with PRC and 2 with PRC and resurfacing capitate pyrocarbon implant (RCPI). One patient suffered a trauma to her operated wrist with consequent worsening during follow up and is also waiting for revision surgery. These patients are excluded from further functional

analysis. QuickDASH improved from average (SD) 39,4 (12) to 14,2 (9,2), PRWHE from 51,6 (20,2) to 13,3 (9,5), VAS from 3,4 (1,6) to 1,3 (1,3); all of these changes were statistically significant. Grip strenght improved from 36,8 (14,1) to 38,2 (14) kg, from 79 (19) to 82 (15) percent of the other side. Extension-flexion range of motion improved from 107 (31) to 110 (17) degrees, from 73 (17) to 85 (13) percent of the other side. These changes were not statistically significant except for in the range of motion percentage.

#### Conclusion

Arthroscopic resection arthroplasty in the radial column of the wrist is a technically simple procedure which maintains range of motion and grip strength. The patients report significant subjective improvement, however in some cases further procedures could be necessary. This procedure does not limit the possibilites to do further salvage surgery if needed and should be considered as a valid minimally invasive treatment option.

### **A-0684** THE EFFECT OF MOBILE GAMING ON WRIST PROPRIOCEPTION IN HEALTHY ADULTS: A PILOT STUDY

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#### Background

The smartphone is one of the indispensable parts of our lives today. They can be used in the hand rehabilitation process, as a source of intervention in the rehabilitation of various problems or to support the intervention. Certain mobile applications are preferred in order to eliminate client-specific deficits and to support the achieving client-centered rehabilitation goals. There are some mobile applications that can motivate the client to perform exercises that can support the development of wrist proprioception.

#### Purpose

The purpose of this study was to investigate the effect of mobile gaming on wrist proprioception in healthy adults.

#### Methods

Twenty healthy individuals (12 women, 8 men) were enrolled to the study. They played the Labyrinth game on their own phones for 20 minutes, twice a day, for a total of 40 minutes, every day for 15 days. Conscious wrist proprioception was tested via a standardized active joint position sense (JPS) method at different joint positions (flexion, extension, radial, and ulnar deviation). The target angle was taught to individuals' dominant hands by a goniometer. The difference between the target angle and the angle shown by the individuals was recorded as reposition error (RE). Joint position sense tests were applied by the therapist before and after the gaming intervention. The difference between the pre-intervention and the post-intervention RE means was compared.

#### Results

Reposition error was significantly reduced in all joint positions after intervention ( $p < 0.05$ ). The change after the intervention were observed for the measurements as follows: Flexion RE:  $10.8 \pm 2.82$  ( $p = 0.002$ ); Extension RE:  $5.8 \pm 1.7$  ( $p = 0.004$ ); Radial deviation RE:  $3.6 \pm 1.5$  ( $p = 0.01$ ); Ulnar deviation RE:  $5.2 \pm 1.6$  ( $p = 0.007$ ). The development in the flexion direction was better than in the extension. The improvement in the ulnar deviation was more than the radial deviation.

#### Conclusions

The changes in the flexion and ulnar deviation direction after the application were found to be more than the other directions. This may be due to the fact that flexion and ulnar deviation are used more frequently in activities of daily living and are more functional. A skilled hand therapist can choose the mobile game that the individual needs and this

game can be used effectively to achieve rehabilitation goals in the intervention.

Keywords

Smartphone application, Proprioception, Hand therapy intervention, Gaming

## **A-0685** REVISION OF FAILED AO C3 DISTAL RADIUS FRACTURES TREATED WITH DOUBLE PLATING AND BONE GRAFT Ezequiel Zaidenberg<sup>1</sup>, Belén García Medrano<sup>2</sup>, Ignacio Rellán<sup>3</sup>, Carlos Zaidenberg<sup>1</sup>

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C3 Distal radius fractures (DRF) present a challenge for which different fixation techniques (volar plates, fragment-specific fixation) have been reported with similar results. However, these techniques are sometimes not successful and C3 fractures evolve with postoperative joint collapse, increasing the complexity of its revision.

The primary objective of this study is to report the clinical and radiological results of a series of patients with C3 DRF treated with volar locking plates who suffered postoperative joint collapse and were revised using a combination of a dorsal and volar locking plates plus bone graft. The secondary objective is to compare the results of double plating plus bone graft with an alternative salvage procedure as radioscapholunate fusion.

Methods

We prospectively analyzed 14 patients who were fixed with a double plating technique plus iliac crest bone graft due to failed AO C3 DRF previously treated with a volar locking plate within 6 months of their initial surgery (group 1). These patients were compared with a retrospective cohort of 10 patients treated with an alternative salvage technique such as radioscapholunate fusion (group 2).

In group 1, eight were male (mean age 51 years; range 27-65) while in group 2 seven were male (mean age 50 years; range 30-67). The average follow-up was 3 years (range 2-5) in group 1 and 2 (range 2-4) in group 2. The average time lapse between the first surgery and its revision in group 1 was 4 months (range 2-6).

An objective clinical examination (range of motion and grip strength) as well as a subjective evaluation of function and pain (Quick DASH, PRWE and visual analog scale (VAS)) was performed. Additionally, Xray and CT-scan were performed at the end of follow up to assess for degenerative changes according to the Kellgren-Lawrence classification in group 1. Complications and further surgeries were recorded in the same group.

Results

In group 1, the final wrist range of motion was: flexion-extension 74% and grip strength was 91%, while in group 2 was: flexion-extension 48% and grip strength 66 % compared to the contralateral wrist. The average Quick DASH was 11 (range, 0-60) and the PRWE was 32 (range, 0-70) in group 1 while in group 2 the average Quick DASH was 11 (range, 15-70) and the PRWE was 36 (range, 21-68). Average pain was 0 (range 0-2) in group 1 while in group 2 was 1.2 (range 0-6). Additionally, CT-scan analysis showed correction of previous articular gaps in all cases. In group 1, 6 out of 14 patients evolved with Xray degenerative changes at the end of follow-up. Additionally, four patients requested implant removal. Conclusion Revision osteosynthesis with double plate plus autologous bone graft showed satisfactory results and can be considered as a surgical option to treat failed C3 DRF.

## **A-0687** INFLUENCING FACTORS OF OUTCOME IN EXTENSOR TENDON REPAIR

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### Aim

To find the relevant factors that affect the outcome of acute extensor tendon injuries.

### Method

We registered every extensor tendon repair in our unit between 1 January 2021 and 28 February 2022. We focused on the concomitant injured tissues, level of injury (Verdan zones), open or closed injury, type of repair and the place of reconstruction (outpatient unit or operating room). Patients were asked to fill out a QuickDASH (QD) questionnaire and report the level of satisfaction on VAS (1-10).

### Results

160 patients were treated for extensor tendon injury in the examined time period. Only 55 of them filled out our questionnaire. 7 of them had partial injury. Their QD score was 2,27 and the mean level of satisfaction was 9,71. Patients with complete injury reported 6,72 QD score and satisfaction level of 8,74 VAS.

There were 13 closed injuries, all of them in zone I. Their QD score was 4,2, satisfaction level 7,77 VAS. 42 patients had open injuries. Their QD score was 6,81 and level of satisfaction 9,19 VAS. Regarding the localization, we had 3 patients with zone I injuries, 6 patients with zone II injuries, 4 patients with zone III injuries, 5 patients with zone IV injuries, 9 patients with level V injuries and 2 patients with level VI injuries. Thumb extensor injuries were registered in 12 cases. Concomitant fracture was registered in 17 cases. Their QD score was 9,09 and satisfaction level 8,05 VAS. Without fracture the patients' QD score was 4,9 and satisfaction level 9,21 VAS.

K-wire fixation can be used in some zone I and II injuries. If the temporary joint fixation was necessary (15 cases) QD was 9,39 and level of satisfaction was 8,4 VAS. Without K-wire fixation (10) QD level was 8,63 and level of satisfaction was 8 VAS. Treating the patient in the outpatient clinic or in the operating room should not influence the functional outcome. Patients' satisfaction was 9,21 VAS if treated in the outpatient clinic and 8,35 VAS when treated in OR.

### Conclusion

Patients with an open injury were more satisfied with the treatment and the result even though their functional results were slightly worse. The difference was not clinically significant. The presence of fracture affected negatively the functional results and the patients' satisfaction as well. Using temporary K-wire transfixation did not make any relevant difference neither in function nor in level of satisfaction. Patients treated in the outpatient clinic were more satisfied with the treatment and results.

## **A-0689** CONSERVATIVE TREATMENT OF PROXIMAL PHALANX FRACTURES USING A TRACTION SPLINT

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### Introduction

Fractures of the proximal phalanx are quite common. Their treatment is challenging as operative treatment has quite a high complication rate especially with stiffness and hardware irritation, while conservative treatment always carries the risk of redisplacement. Our aim was to investigate whether a traction splint can help achieve and maintain satisfactory reduction.

## Materials and methods

The splint is made with the use of a Zimmer splint and tape to apply traction to the finger. Reduction manoeuvre is performed under local anaesthesia and the splint is applied with the MCP joint in flexion. We have followed up 12 cases that were treated with the use of this traction splint. We obtained weekly x-rays. Splint was removed at three weeks and active range of motion exercises were started

## Results

Radiologically, there was a mean of 7 degrees of dorsal displacement with a maximum of 15. One case was converted to open reduction and internal fixation because of poor compliance of the patient which resulted in an unacceptable angulation. We had no significant rotational deformity in any of the cases. At three month follow-up all of the cases had regained full range of motion.

## Conclusion

Our results show that traction splint is a good option in treating proximal phalanx fractures, as it yields good results with a low complication rate. The percentage of conversion to ORIF was quite high (8%), but this was due to bad compliance. In cases where reduction is lost one can always go to operative treatment. We recommend the use of a traction splint for the treatment of these fractures in cases where close reduction is possible. However we suggest weekly follow-up with x-rays to avoid malunions

## **A-0692** NERVE TRANSFERS FOR RESTORING ELBOW FLEXION IN BRACHIAL PLEXUS PALSY

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## Introduction

The nerve transfer (NT) techniques consists in sectioning a donor nerve, to connect it with the distal stump of a receptor nerve, whose function was lost. We used different NT in in brachial plexus palsy (BPP) for recovery elbow flexion: the phrenic nerve (PhN), the intercostal nerves (ICN) and Oberlin's technique. The aim of this retrospective study is to evaluate the results of this procedure in BPP.

**Material and Methods:** From 78 BPP, in 21 were used ICNT (17 biceps and 4 triceps) and in 7 was used Oberlin technique and in 3 was PhNT. Patients were reviewed at 6, 12 and 36 months after NT. The average age of the patients was 29 years. The average time to surgery after occurrence of the injury was 6-9 months. Reinnervation of the biceps and triceps were evaluated according to BMRC scale.

**Results:** The averaged time required for biceps reinnervation was 12–14 months after ICNT and 8-9 months after PhNT; for triceps was 9 months after ICNT and in Oberlin technique was 4-6 months. After Oberlin technique was no motor or sensory deficit related to the ulnar nerve.

After ICNT to biceps, 12 patients achieved M3-M4 elbow flexion, 3 patients with M1-M2 and 2, M0. For triceps, two patients achieved M3-M4 elbow extension – to which we performed Carroll transposition for elbow flexion recovery - one M1-M2 and 1 M0. From 7 patients using Oberlin technique, 5 achieved M4, one M3 and one M1-2. Only on case recovery biceps reinnervation at M2–M3 after PhNT and M0-M1 in 2 cases.

**Conclusions:** NT is an important goal in BPP. ICNT into the nerve of biceps for elbow flexion recovery is a reliable procedure in BPP. ICNT for triceps offers a positive alternative (Carroll transposition). Oberlin technique is simple and offers a better

results in short time and is an effective and safe option.

Keywords: Brachial plexus palsy; nerve transfer; microsurgical procedures; upper extremity function.

### **A-0693** P FRAME A SIMPLE HANDMADE EXTERNAL FIXATOR TO IMPROVE SYNDACTYLY RELEASE

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**Introduction:** syndactyly is the most common congenital anomaly in the hand. The most common complication of syndactyly release is web migration. This problem is especially important in younger children and smaller fingers for example in brachydactyly. We use a simple handmade external fixator called P Frame in hand fracture from 5 years ago. We extended its indication to keep the separation of the fingers after syndactyly release in small fingers.

**Material and Method:** From March 2016 to May 2021 we use this fixator on 10 patients for 12 web release. In 6 patients with brachysyndactyly and 4 patients with simple syndactyly. 7 third web, 3 second web and 2 fourth web were released and kept separate with P Frame. Immobilization of the hand was limited to a bulky wet dressing which changed after two weeks. Fixator was removed after four weeks.

We did not have any web migration or complication with external fixator either pin tract infection or premature loosening of the fixator.

**Conclusion:** We proposed to use of this simple, available, low price external fixator in syndactyly release specially in patients with small fingers.

### **A-0694** IRREDUCIBLE ELBOW DISLOCATION: A RARE INJURY

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Elbow dislocations usually result from a high-energy traumatic event . The majority of simple elbow dislocations are commonly treated in the emergency department by closed reduction. Only four cases of simple elbow dislocations requiring open reduction have been described.

We present the case of a 19 year old man who sustained an irreducible posterolateral elbow dislocation.

A 19 year old right handed man presented to our emergency room department with a painful deformed left elbow after a motorcycle accident with a fall on his outstretched left arm. On examination he had an obvious deformity to his left elbow and no ability to flex or extend the joint. He presented with no neurovascular injury and both ipsilateral shoulder and wrist examination were normal. A radiograph of the left elbow revealed a simple posterolateral dislocation with no associated fractures. Due to a cooperative patient, closed reduction was attempted twice in the emergency department and then again under general anesthesia in the operating room, with no success. Open reduction was then performed via a lateral Kocher approach to the elbow joint. Dissection of the lateral forearm fascia revealed a protruded radial head, posteriorly and laterally, through the lateral collateral ligament complex and joint capsule. Care was taken to maintain the arm pronated in order to prevent a posterior interosseous nerve injury. Upon releasing the joint capsule, the ulnohumeral and radiocapitellar joints were successfully reduced. Lateral collateral ligament was then repaired. Intraoperative fluoroscopy confirmed elbow joint reduction. Patient was immobilized with an above the elbow posterior

splint with the elbow flexed 90 degrees for two weeks. At 6 weeks post-op there was no pain nor elbow instability. Motion ranged between 10 to 140 degrees - extension/flexion.

Dislocation of the elbow joint is less common than other dislocations of the upper limb, constituting 11 to 28% of all elbow injuries. Most elbow dislocations are reducible by closed means via traction on the forearm and counter-traction on the upper arm. It is extremely uncommon that a simple elbow dislocation cannot be reduced in closed manner, most cases being associated with fractures. Orthopaedic surgeons should be aware of this rare variant of elbow dislocation to appropriately manage such injury.

## **A-0695** 4TH EXTENSOR COMPARTMENT ARTERY VASCULARIZED BONE GRAFT FOR KIENBÖCK'S DISEASE. MID-TERM FOLLOW-UP RESULTS

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### BACKGROUND/PURPOSE

The fourth extensor compartment artery (ECA) anastomoses in most cases with the dorsal intercarpal arch which is used as a source of retrograde arterial flow and allows use of the 4th ECA vascularized bone graft (VBG) from dorsal distal radius. The use of 4th ECA VBG is limited because the retrograde blood flow and graft pedicle is in close relationship to the site of capsulotomy. The objective of the study is to describe the mid-term results of our surgical technique for harvesting the 4th ECA VBG from distal radius for Lichtman stage II and III Kienböck disease.

### MATERIAL AND METHODS

Five patients (mean age at operation 31years, range 27-37) with Kienböck's disease (three patients Lichtman stage II, 1 stage IIIA, and 1 stage IIIB) were treated with 4th ECA vascularized dorsal radius bone grafts. All patients had neutral ulnar variance. Dorsal radiocarpal ligament sparing capsulotomy directly over the lunate is performed. An L-shaped capsular flap is created over the lunate in order to avoid damage of the anastomotic branches that give retrograde blood flow from the dorsal intercarpal arch to the 4th ECA VBG. The 4th ECA VBG is centered 1.1 cm proximal to the radiocarpal joint to include max number of nutritive vessels. The viability of the graft is checked intraoperatively by releasing the tourniquet. Temporary pinning of scaphocapitate joint for 7 weeks was applied for all patients, and for one of them additional temporary pinning of the graft for 4 weeks. Pain, wrist range of motion (ROM) and Modified Mayo Wrist Score-MMWS were evaluated pre and postoperatively. Postsurgical magnetic resonance imaging with iv contrast agent was performed to examine revascularization of the lunate. Radiographs were performed to examine any disease progression.

### RESULTS

At a median follow-up of 45 months (range, 42-47) pain VAS score improved from 7.3 (7-8) to 2 (1-3) postoperatively, flexion-extension ROM improved from 63° (55-70) to 79° (69-84), and radial-ulnar inclination ROM from 18° (10-27) to 29° (15-35). The average Mayo wrist score was improved in 75 (65-85) from 55 (50-65). Evidence of lunate revascularization was shown 6 months postoperatively. At final follow up radiological progression of disease from stage II to stage IIIB was noted for one patient. No donor side morbidity was noted.

### CONCLUSIONS

The 4th ECA vascularized bone graft is an effective method to treat Kienböck's disease Lichtman stage II and III that demonstrated favorable functional outcome in the mid-term follow up and may aid in lunate revascularization. The technique should aim to a capsulotomy that spares the anastomotic branches between the dorsal intercarpal arch and 4th ECA.

## **A-0696** RARE MALIGNANT SKIN TUMORS OF THE HAND

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Skin cancers represent the most common primary malignancies of the hand.

Rare malignant cutaneous tumors deserve special diagnostic attention, because most of them are exceedingly rare and may be once-in-a-lifetime encounters, resulting in a high yield of misdiagnoses. They like to camouflage behind a seemingly innocent inflammatory or tumor pattern, and they often exhibit striking morphological overlap with other malignant tumor entities. Unfortunately the patient pathways are not always clear, which can lead to a delay in the treatment.

In our presentation we retrospectively analyzed the malignant skin tumors in our department from 2017 to 2022, with a special focus on the rare malignant skin tumors.

We treated 35 patients with malignant skin tumor on the hand in the last 5 years. As rare tumors, we found 5 Merkel cell carcinomas, two cases of dermatofibroma protuberans, one patient with hydradenocarcinoma and one patient with digital papillary adenocarcinoma and two cases of subungual melanoma malignum. Unfortunately Merkel cell carcinoma represent a very aggressive tumor with increasing incidence, and it is associated with high rates of local recurrence, regional lymph node spread, and distant metastases. Among our 5 cases, all were men from 65 to 80 years old, we performed one forearm amputation, three ray resections (one second ray, two middle ray), one wide excision, with sentinel lymph node biopsy. The oncoteam recommended irradiation in two cases, the others had close observation in the first two years, every three months. We had two local recurrence, one was treated with humeroscapular amputation, the other patient had forearm amputation.

We performed wide excision in hydradenocarcinoma and sentinel lymph node biopsy, the patients with subungual melanoma malignum had amputation of the distal phalanx and the patient with digital papillary adenocarcinoma had a middle ray resection.

Early recognition and accurate diagnosis are essential to proper management in rare malignant skin cancers. The team work between the dermatooncologist, the pathologist and the hand surgeon is essential, and hand surgeons must be aware of the oncologic principles that guide proper treatment of these rare malignancies.

## **A-0697** "P FRAME" A SIMPLE HANDMADE MINI EXTERNAL FIXATOR FOR HAND, FRACTURES AND OTHER CONDITIONS

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Introduction; Pin is the most popular device in hand fractures. It has its disadvantage like migration, rotationally instability and low resistance for axial collapse. To improve the function of pin, it has been augmented somehow as an external fixator by many authors. We introduce our P Frame as a simple handmade external fixator for hand fractures and other conditions need external support.

Material and method: We use the metal part of "Electrical terminal connector" to connect two or more 1 to 1.5 mm pins and include them to construct an external fixator for hand fractures and also when we need an external support in fingers and metacarpal. We reviewed all of our patients who underwent P Frame insertion from March 2016 to May 2021. Inclusion criteria were, insertion in hand including fingers or metacarpal in patients with mature skeleton. Indication for

P Frame insertion, duration of fixation, location of external fixator support was evaluated. Complications including pin tract infection, premature removal and final lag of motion of the fingers were reviewed.

Results: 35 ray in 32 patients were supported with P Frame. 7 P Frame inserted in first ray including one P2, three IP, one P1 and two metacarpi. 27 frame inserted in other rays included four P2, sixteen PIP, three P1 and four metacarpi. With respect to the type of functions, 14 frames acted as static external fixator and 5 frames as dynamic external fixator for fracture and fracture dislocations. 6 frames acted as additional stability for the pins, 5 frames as rotationally stabilizer, 3 frames as extra-articular stabilization of the joint and one frame as compressive external fixator for treatment of non-union. We had three pin tract infection, one non-union in our patients. Range of motion were good or excellent in 26 of our 32 patients. There was no any problem as, pin breakage, skin irritation or loosening of the fixators.

Conclusion: P Frame is a very simple and effective external fixator in hand. It could be construct with available materials. And its indication could expand easily.

## **A-0698** PERIPHERAL NERVE INJURY IN MODERN WARFARE

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Aim: To determine the features of peripheral nerve injuries in modern warfare and the optimal algorithm for their treatment.

Methods: We performed a retrospective analysis of peripheral nerve gunshot lesions in 180 patients treated in our department. Based on our own experience and data from the literature, the optimal conditions and terms for peripheral nerve reconstruction were determined.

Results: Radial nerve injury at the shoulder level was often accompanied by a humerus fracture, and median and ulnar nerve lesions at the forearm level prevailed. As a rule, blast injuries were accompanied by larger primary nerve defects and massive damage to surrounding tissues. Median nerve injury at the shoulder level, in many cases, was accompanied by the brachial artery lesion.

Discussion: The optimal period for peripheral nerve reconstruction after a gunshot injury is determined to be from 3 weeks to 3 months from the moment of injury. Before starting the reconstruction of peripheral nerves, the following conditions must be fulfilled: 1) Eradication of infection; 2) Closure of the tissue defect with full-layer flaps (abdominal or groin flap, perforator or island flaps); 3) Achievement of final bone stability. The greatest number of complications from the nerve side was observed when tissue defects were closed with split-thickness skin grafts.

Conclusion: Limb injuries in modern warfare often accompany peripheral nerve injury and massive damage to surrounding tissues. Since the optimum time for the recovery of peripheral nerves is a relatively small window, and the conditions are assumed for the closure of tissue defects and osteosynthesis - early, active surgical management of such patients is recommended, with minimizing the time between reconstructions.

## **A-0699** NON-OPERATIVE MANAGEMENT OF 5TH METACARPAL NECK FRACTURES: A SYSTEMATIC REVIEW AND META-ANALYSIS

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**Introduction:** Metacarpal fractures account for 10% of all skeletal fractures (1) and 5th metacarpal neck fractures contributes up to 20% of all hand fractures (2). There is a lack of consensus in the current non-operative management methods. Whilst ulnar gutter was once deemed an adequate measure for conservative management, it is burdensome and leads to stiffness. Other methods include buddy strapping, splinting and elastic bandage, allowing for early mobilisation, but has a risk of worsening unstable fractures.

**Aim:** To assess and compare outcomes of non-operative management methods: immobilisation and early mobilisation in terms of 1. Functional outcomes, assessing the range of movement, time to return to work and power grip. 2. Patient-reported outcomes, assessing the pain and validated outcome-tools. 3. Radiological outcomes, comparing the fracture angles at follow-up.

**Methods:** A systematic literature review was performed using a standardised published methodology and custom database search strategy, in accordance with PRISMA. A fixed-effect meta-analysis of the combined complications was conducted.

**Results:** 13 Randomised control trials were identified, with a total of 554 participants who underwent non-operative management of 5th metacarpal neck fractures, with a mean age of 30.5 and 85% males. Initial fracture angulation ranged from 25-60°. 316 patients were managed with buddy strapping or elastic bandage allowing for early mobilisation, whilst 238 patients were immobilised in plaster cast. Our analysis demonstrated an improved pain score and earlier return to work in the cohort who had early mobilisation compared to those immobilised for 4 weeks, with an improved patient satisfaction consequently. Range of movement were better in the former cohort as well at early follow-up, however no significant discrepancy was noted at 3 months follow-up between the 2 groups with hand therapy input.

**Conclusion:** Our findings support the early mobilisation of neck of 5th metacarpal fractures, with acceptable angulation as it has been shown to improve functional outcomes faster without compromising the healing and positioning of the fracture. It obviates the need for cumbersome casts, saving on resources and time.

## **A-0701** A RARE CASE OF NDDH: NEUTROPHILIC DERMATOSIS OF THE DORSAL HANDS

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### **Introduction**

Neutrophilic Dermatoses (ND) encompass a heterogenous group of conditions characterised by non-infectious infiltration of mature neutrophils in the skin. Sweet Syndrome is the prototypic ND diagnosis predominantly affecting middle aged women. Neutrophilic Dermatitis of the Dorsal Hands (NDDH) is an uncommon, localised variant, with fewer than 150 cases described. Here we report a rare case of NDDH secondary to a toxin mediated insult to the finger, and a review of similar case presentations.

### **Case Presentation**

Our patient is a 65-year-old woman with a two-week history of haemorrhagic blistering and infection to her left middle

finger following a suspected insect bite. She underwent initial debridement and treatment with IV clindamycin but developed a necrotic eschar with granulation tissue over the dorsum of the digit, and was referred to our specialist hands unit. Following formal debridement of necrotic skin from the entire dorsum of the digit and biopsies of the proximal violaceous granulation, she subsequently underwent reconstruction with Biodegradable Temporising Matrix (a dermal substitute) to cover the exposed extensor mechanism.

This unfortunately got infected and had to be removed. As initial biopsies were suspicious of invasive squamous cell carcinoma (SCC) not in keeping with the clinical picture, further biopsies were taken and a dermatology opinion sought. New excoriated papular lesions were seen on the face and neck and a working diagnosis of Sweet Syndrome (SS) was made secondary to a bullous reaction to insect bite.

The repeat biopsy demonstrated an ulcerated lesion with features of secondary vasculitis, subcorneal collections of neutrophils with perivascular and follicular lymphocytic infiltration; These findings further supported a toxin mediated neutrophilic dermatitis diagnosis.

She was discussed in the skin cancer MDT and it was agreed that an SCC could be ruled out. She was subsequently managed in the dressings clinic with repeated dressings and minor debridement. Following this her inflammatory rash has subsided and her wound completely healed with conservative measures with minimal loss of function.

#### Discussion

Clinically presentation for NDDH is varied, including painful erythematous and violaceous papules, plaques and haemorrhagic bullae, usually on the dorsum of the hands. Histopathology shows dense dermal infiltrates of neutrophils with underlying dermal oedema, and secondary vasculitis from intense neutrophilic infiltration. 27% are associated with a neoplastic history, though other inflammatory disorders including inflammatory bowel disease are also implicated.

There have been a multitude of unusual triggers for NDDH, including social cocaine use, thalidomide and chemical fertiliser exposure. Interestingly our initial biopsy demonstrated dysplastic dermal changes reminiscent of SCC, and this has been previously reported in the literature as pseudocarcinomatous Sweet Syndrome, clinically and histologically mimicking SCC. Punch biopsies revealed epidermal hyperplasia initially interpreted as SCC, though on re-evaluation by our dermatopathologist neutrophilic dermal infiltrates were seen.

#### Conclusion

NDDH remains a rare and elusive differential for inflammatory pathologies of the hand, but one that should be considered in unusual presentations of focal necrosis following trauma. Biopsies are key in establishing early diagnosis in these unusual presentations so that patients can be treated appropriately in a multidisciplinary setting.

## **A-0702** AN EXTREMELY RARE CAUSE OF ULNAR NERVE AND ARTERY COMPRESSION IN GUYON'S CANAL: A CASE STUDY AND LITERATURE REVIEW

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#### Introduction:

Compressive aetiology in Guyon's canal can be intrinsic or extrinsic and include tumours, repetitive trauma, fractures, aneurysms, and aberrant anatomy to name a few. Compression by a ganglion cyst in Guyon's canal and the piso-hamate hiatus is exceedingly rare in the literature. Patients present with varying degrees of numbness, paraesthesia and/or

intrinsic weakness depending on the duration, size, and location of the lesion. With deep motor branch involvement, signs of intrinsic wasting and clawing manifest after a few months leading to a devastating loss of function if untreated in a timely fashion. Despite the close proximity of the ulnar nerve to the ulnar artery, to the author's knowledge, there have been no reports describing symptomatic compression of the ulnar artery by ganglia. We report a rare case of simultaneous compression of both the ulnar artery and nerve at Guyon's canal and a review of the literature.

#### Materials and Methods:

A 38-year-old female patient presented with a 1-year history of worsening numbness, paraesthesia, and hand weakness. Physical examination revealed ring and little finger clawing with wasting of the ulnar intrinsic muscles, a strong Tinell's at Guyon's canal and a positive Froment's sign. Apart from the sensory symptoms in the ulnar nerve distribution, she interestingly complained of Raynaud's like ischaemic symptoms including cold intolerance and intermittent colour changes in the little finger. Neurophysiology revealed a severe axonal lesion of the ulnar nerve at the wrist and an ultrasound scan demonstrated a 2x2cm pisotriquetral ganglion compressing the ulnar neurovascular bundle.

#### Results:

The patient underwent an ulnar nerve decompression at Guyon's canal and excision of the ganglion which was found to be compressing the ulnar artery as well as the sensory and deep motor components of the ulnar nerve which appeared flat at the junctions of zone I and II. Intraoperative photographs were taken. Post operatively the patient reported improvement in both neurological and vascular symptoms.

#### Conclusion:

Simultaneous ulnar nerve and artery compression in Guyon's canal by a ganglion cyst is a rare and previously undocumented condition. Rapid onset of weakness and intrinsic wasting atypical of common compressive pathology should prompt clinicians to ensure timely investigations and treatment to avoid potentially devastating sequelae to a very reversible condition.

## **A-0703** REVIEW OF DEFORMITY FOLLOWING DISTAL RADIUS FRACTURE MALUNION – THE CORRECTION NEEDED TO RESTORE ANATOMY IN PATIENT SPECIFIC OSTEOTOMIES

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#### Introduction

Patients with malunion following distal radius fractures may need osteotomy to improve pain and function. To achieve this, restoring anatomy is essential. This study reviews the degree of deformity in terms of shortening, volar tilt, radial inclination, and rotation that occurs in malunion of distal radius fracture. In our experience, correcting rotation using radiographs, surgical estimation and freehand technique can be challenging and may lead to suboptimal results. By analysing the deformity in three dimensions (3D) using computer tomography (CT) scans, we can better predict the pitfalls in performing distal radius corrective osteotomies. Moreover, having a greater appreciation of visualising and analysing the displacement produced by fractures in 3D, as surgeons we can be more mindful of fixing distal radius fractures acutely.

#### Methods

Patient specific osteotomies using 3D planning and patient specific guides and implants can be performed to achieve correction and restore anatomy. This involves performing CT scans of both forearms and using the non-injured limb to

model the correction required to restore anatomical alignment for the injured limb.

We looked at data of our patients who have undergone Individual Patient Solution fixation. (To date 16 patients at our hospital have had this procedure and more data is to follow). All patients had malunion of distal radius fractures. We compared the injured and the non-injured sides, and reviewed the parameters of volar tilt, radial inclination, rotation in all planes sagittal, coronal, and axial (x, y, and z) as well as the difference in radial height and ulna variance.

#### Results

(10 patients have been analysed for this abstract, further data is to follow). The difference between the injured and non-injured side is shown below:

- Median difference in radial inclination is 2.6 degrees, range -2.2 to 6.2 degrees
- Median difference in volar tilt is 0.97 degrees, range -8.8 to 7.8
- Median difference in radial height is -1.2mm, range -2.8 to -0.6
- Median difference in ulna variance is 1.15mm, range -2.2 to 2.5 (all but two patients in the study had a more positive ulna variance compared to the non-affected side)
- Median difference in rotation in x (sagittal) plane is 0.05 degrees, range -14.8 to 10.2
- Median difference in rotation in y (coronal) plane is 3.7 degrees, range 1.8 to 7.2
- Median difference in rotation in z (axial) plane is 3.7 degrees, range -2.3 to 8.8

#### Discussion

As predicted, the data shows that radial height is lost for all patients and that most had a more positive ulna variance compared to the non-injured side. However, what has also become apparent is that there are differences in rotation. This difference occurs in sagittal, coronal, and axial planes. The largest range of these differences in rotation occurs in axial plane. This can be difficult to visualise when performing osteotomies without 3D planning. However, surgeons must also be aware of this problem when fixing distal radius fractures acutely.

### **A-0704** TOTAL WRIST REPLACEMENT ON MANUAL LABOR ACTIVE PATIENTS: 4 YEAR FOLLOW-UP Sergi Barrera-Ochoa, Tryno Muñoz-Perdomo, Sergi Alabau Rodriguez, Osman Benavides, Xavier Mir-Bullo *Hand and Microsurgery Unit, ICATME, Hospital Universitari Quiron-Dexeus, Barcelona, Spain*

The recent innovations and evolution of the design in wrist arthroplasty continue to evolve into new models with remarkable improvements on stability and preserved equal or even greater range of motion than preoperative in most of the cases, the Motec<sup>®</sup> cementless modular metal -on- CoCrMo on carbon fiber reinforced PEEK ball-and-socket wrist arthroplasty is an implant with promising short- to midterm results. The objective of contemporary wrist prostheses is replacing wrist arthrodesis in the majority of patients with severe radiocarpal osteoarthritis, including high demand cases. Contraindications are soft tissue or bone stock defects, wrist imbalance and infection.

**Purpose:** The purpose of this study is to assess the preliminary results involve Motec<sup>®</sup> total wrist prostheses implanted in 13 active manual labor patients evaluating the clinical and radiological outcomes of a cementless modular metal -on- CoCrMo on carbon fiber reinforced PEEK ball-and-socket wrist arthroplasty performed by a single surgeon using the Motec<sup>®</sup> total wrist prostheses between 2018 and 2022.

**Methods:** thirteen (13 male) patients with secondary osteoarthritis of the wrist and manual labor work related received an uncemented ball-and-socket total wrist arthroplasty (Motec Wrist). Pre- and post-operative pain on a visual analogue score, pre and post-operative Disabilities of the Arm Shoulder and Hand (DASH), functional parameters measured with

Mayo Wrist score, patient-rated wrist evaluation score, range of motion and grip strengths, and radiographic analysis were collected on 4 years of follow-up. Standardized radiographs were taken to assess osteolysis, loosening, and subsidence. Results: The thirteen patients were followed for a mean of 4 years. One wrist was reoperated owing to distal component loosening and one develop Complex regional pain syndrome. Improved QuickDASH score and visual analog scale pain score both at rest and during activity were found at the last follow-up, as well as increased AROM (20° vs 110°) and grip strength (14 kg vs 26 kg). The radiological follow-up demonstrated no loosening.

Conclusions: An uncemented total wrist arthroplasty can provide long-lasting unrestricted hand function in manual labor active patients.

## **A-0705** DESIGN OF A HOME-MADE WRIST ARTHROSCOPY SIMULATOR

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### Introduction:

Arthroscopy became an essential diagnostic and therapeutic tool in the management of wrist pathologies. Mastering this technique requires a long learning curve. Currently there is no simulator available for the training and the education of young surgeons.

### Objective:

The aim of this study is to create a low cost wrist arthroscopy simulator.

### Materiel and Methods:

In order to facilitate the affordability of this simulator, we choose to print the wrist in 3 dimensions in order to obtain a realistic model of the bone, joint, and ligament elements.

The material used tries to get closer to the reality in the operating room with the visualization, the position, the aesthetic aspect and the texture of the anatomical elements of the wrist.

We perform a 3-dimensional segmentation from scanned sections of a healthy wrist.

A rigid PLA material is used for the bones and resin for the soft parts.

### Results:

Spaces are artificially created between the carpal bones and the main intercarpal ligaments are reproduced.

The skin surface is reproduced from the CT scan, we create a space in our area of interest and we thicken the skin in the fragile areas especially on the dorsal side of the hand.

We also attach importance to the extensor tendons of the fingers and wrists, which provide an augmented aesthetic reality and are also practical for our approaches.

After the evaluation of the different cameras, we select an otoscope camera because of the video quality, low cost, and ease of use.

We create a support to hold our artificial wrist vertically that can be attached to most work surfaces with height adjustment to make the training more ergonomic.

The total cost of the materials used in the design of this simulator is approximately 50€.

### Conclusion:

The quality and the low cost of this wrist arthroscopy simulator tend to encourage educational teams to use it in the training of young surgeons.

**A-0706 RECONSTRUCTION OF SOFT TISSUE DEFECTS OF THE HAND AND FINGERS USING VENOUS FREE FLAPS**  
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**Introduction:** For reconstruction of larger soft tissue defects in the fingers and hand, the reconstructive surgeon has a relatively wide range of options available, including microsurgical transfer of free flaps, enabling early mobilization and rehabilitation of the injured hand. To cover the defects, flaps should be chosen based on the size, color, texture and length of the vascular pedicle. The flap used to cover the defect should also correspond in tissue volume and, if necessary, in the content of the components to restore the function of the hand. Venous free flaps meet all these reconstructive requirements very well.

**Materials and Methods:** At our department, venous free flaps are potential choice for the reconstruction of larger defects with exposure of the bone, joints and tendons or loss of extensor tendons. We present our experience with the use of 36 venous free flaps in 35 patients (27 men, 8 women) for larger soft tissue defects operated within the years 1993 to 2022 at the Department of Plastic and Aesthetic Surgery, St. Anne's University Hospital, Brno. In all cases, venous flaps were harvested from the forearm either as skin flaps or as multicomponent tissue flaps with a thin skin component. The anastomosis of the venous flaps was performed as veno-venous or arterio-venous.

**Results:** During the monitored period, 30 arterialized venous flaps type III and 6 veno-venous flaps type II according to Chen's classification were performed. Of the entire patient group (n=36), one arterio-venous flap completely necrotized (n=1), three flaps healed after partial necrosis (n=3), and all other flaps healed completely without necrosis (n=32).

**Conclusion:** Venous free flaps, harvesting technique and their use can be considered as the established method of choice suitable for the reconstruction of soft tissue defects of hand and fingers.

**A-0707 SUCCESSFUL REPLANTATION IN AN 74 YEARS OLD PATIENT AFTER A CRUSH INJURY WITH PROLONGED WARM ISCHEMIA TIME**

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**Introduction .** Traumatic hand amputation can represent a devastating injury for patients of all ages in terms of functionality and quality of life. Relative contraindications and indications of microsurgical replantation of the extremities evolved vastly in the last decades.

**Material and methods.** Although old age, crush injury and prolonged warm ischemia time are a relative contraindication in upper extremity replantation , we present a successful outcome of a 74 years old patient, retired teacher, with a crush injury amputation metacarpal amputation of 4 fingers and thumb radial collateral digital nerve injury, with a warm ischemia time over 14 hours. The Mangled Extremity Severity Score was 12 predicting a low likelihood of the extremity viability. Under axillary block and sedation, a single team performed osteosynthesis with k-wires, flexor and extensor tendon repair and vascular anastomosis. The index finger was discharged owing to a large bone defect of the proximal phalanx. All the other fingers were viable , with patent anastomosis at the end of the surgery.

Results. Despite some wound healing problems of the volar surface, the third to fifth finger were viable, warm, with good capillary refill, with an O<sub>2</sub> saturation over 95%. The patient was discharged on 14th postoperative day and started physical therapy after 4 weeks. At 7 months follow-up, the patient showed very good passive and relatively fair active range of motion at MCPJ and PIPJ. A static 2PD was between 8-11 mm. The quick DASH score was 34.1% and with a grade II-III Chen criteria for functional result after upper extremity replantation

Conclusion. Despite some relative contraindications, a successful replantation with good patient cooperation and an intensive rehabilitation program, a very good outcome can be achieved even in elderly patients.

## **A-0708** DENERVATION OF THE PROXIMAL INTERPHALANGEAL JOINT

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### Introduction

With an increasing incidence of osteoarthritis worldwide, we constantly seek to improve patients' quality of life. Denervation of the proximal interphalangeal joint (PIPJ) is a simple and effective procedure to relieve pain associated with small joint osteoarthritis. This procedure is performed under local anaesthetic using two mid lateral incisions.

### Aim

We sought to investigate whether denervation of the proximal interphalangeal joint had an impact upon pain scores for patients presenting with small joint osteoarthritis.

### Methods

We prospectively reviewed all patients undergoing PIPJ denervation for osteoarthritis over a 10 year period in our institution.

Cases of post traumatic and inflammatory arthritis were excluded. Preoperative and postoperative pain scores were recorded using a numerical rating scale (0-10). Statistical improvement was investigated using a chi-squared test and patients were followed up for a period of 5 years.

### Results

Mean age was 74.5 years (67 - 84). Median preoperative pain scores were 8.1 (range = 7 to 9) on a numerical rating scale (0-10) and post operative this improved to 0.75 (range = 0 to 2). Using a chi squared test this revealed a statistically significant improvement in pain scores following this procedure ( $p < 0.001$ ).

Follow up ranged from 18 months to 5 years (mean 4.2 years). Patient satisfaction scored at 9.2/10 and no patients in the group requested further treatment. There was no statistically significant improvement in range of motion following denervation. The majority of patients noted an improvement in symptomatic pain at a median of 10 days post procedure (range = 7 to 14 days). No patients requested further surgical procedures at follow up of 5 years.

### Conclusion

This surgical technique for denervation, using two mid lateral incisions provides excellent and reliable pain relief for patients with osteoarthritis of the PIPJ with a rapid and statistically significant decrease in subjective reported pain.

Keywords: osteoarthritis, small joint arthritis, PIPJ, proximal interphalangeal arthritis, denervation, pain relief

## **A-0709** TWO-STAGE RECONSTRUCTION USING THE ALLOGRAFT-PROSTHETIC COMPOSITE TECHNIQUE IN A CASE OF ELBOW PROSTHETIC LOOSENING WITH LARGE BONE DEFECT

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**Introduction:** Originally the use of total elbow prostheses was limited to rheumatoid arthritis or advanced tuberculous arthropathy cases. The improvement of the results in these patients has spread the indications to post-traumatic and primary osteoarthritis, nonunion cases, and acute fractures where synthesis is impossible.

Besides the improvement in the results obtained with last-generation implants, the rate of complications of elbow prosthesis is by far much superior to those presented in other arthroplasties (shoulder, hip, knee). It is actually up to 80% in some studies.

The objective is to present a case of a two-stage prosthetic replacement due to an early prosthetic loosening with a large bone defect to be reconstructed using the allograft-prosthetic composite (APC) technique.

**Material and methods:** A 75-year-old woman with a history of multiple surgeries on her right elbow after a terrible triad in 2016. She presented aseptic loosening of the total prosthesis implanted in 2017 with a significant loss of bone stock in both the distal humerus and proximal ulna.

We performed a 2-stage prosthetic replacement. APC technique was used for the second surgery, using olecranon allograft with its triceps tendon inserted to reconstruct the distal ulna defect and the extensor apparatus. Proximally, an augmentation was performed with two struts at the level of the distal humerus.

**Results:** The results of intraoperative cultures, sonication of the material, and the pathological anatomy were negative, so antibiotic treatment was withdrawn after two weeks. After six months of surgery, the patient presents good clinical and radiological evolution. The mobility balance is acceptable with an extension lack of 10 degrees, flexion of 90, pronation of 30, and supination of 30.

**Conclusions:** Elbow arthroplasty is an evolving technique that still presents a high rate of complications and secondary surgeries. Aseptic loosening is the most frequent reason for prosthetic elbow revision (38% of cases), followed by infection (19%) and periprosthetic fracture (12%).

Severe bone defects due to these complications are difficult to handle as available prosthetic material does not provide an efficient solution for restoring these defects.

The APC technique it is an option to consider in these cases. However, it is a complex surgical technique associated with a high rate of complications.

The diagnosis of infection must be ruled out before performing any surgery, as it is the second most frequent cause of prosthetic revision.

## **A-0710** ATTITUDES OF TRAINEES TO INVOLVEMENT IN HAND SURGERY IN LOW RESOURCE SETTINGS: A NATIONAL SURVEY

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### Background

Sustainable working partnerships between low- and middle-income countries (LMICs) and high-income countries are mutually beneficial for both parties and their patients. In addition to knowledge exchange LMICs can share skills in resourcefulness, and decision-making processes required in the context of healthcare rationing.

### Aims

- To explore UK trainees' attitudes and opinions on hand surgery in low-resource settings
- To identify barriers to involvement in global outreach work

### Methods

A cross-sectional study of trainee hand surgeons was conducted using online survey software (Typeform, ©Typeform, Barcelona). Questions were designed using consensus opinion, with multiple iterations of review to ensure clarity and content validity. Participants' demographics, practice settings, views and experiences of overseas work in hand surgery were collected. The survey was distributed by email, over a 6-month period with reminders sent at 2 and 3 months. Analysis was primarily descriptive. Free text responses were coded into common themes and compared with the quantitative data.

### Results

A total of 101 participants completed the survey. The majority of respondents had not undertaken any medical work in LMICs since medical school, 60% reported that there was no recognised pathway in their training for involvement in global surgery. The most frequently reported barriers were time and family commitments, and lack of information, funding and recognised pathways for undertaking global work. Logistical concerns were the most frequently cited barriers by senior respondents and impact on training and level of experience, the most often cited by junior trainees.

### Conclusion

Our survey demonstrates a strong interest in volunteering in low-resource settings by UK trainees. It highlights commonly perceived barriers to involvement in overseas work, supporting the need for resources, information and engagement from policymakers to facilitate global outreach work by surgeons in training.

## **A-0711** FOUR-CORNER FUSION WITH DORSAL CIRCULAR LOCKING PLATE: FUNCTIONAL AND RADIOLOGICAL OUTCOMES

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The main indication to perform a four-corner fusion is symptomatic radiocarpal arthrosis. Dorsal impingement is a possible complication. It's relation with an eventual deficit in wrist extension is speculated, but has not been established. We designed the present study based on that assumption. *Methodos*: A retrospective study including all patients submitted to four corner fusion with a dorsal circular locking plate between 2017 and 2021 in an university hospital. Demographic data

was collected namely cause of arthritis and its classification, profession and return to work time. Functional evaluation was done according to Visual Analogue Scale (VAS), Quick DASH and range of motion assessment. To determine the possibility of dorsal impingement, in lateral x-ray, the distance between a line passing through the dorsal cortical of the radius until the plate's most prominent dorsal point was measure.

Results: 16 patients was included. 87,5% male and 12,5% female. Median age was 54 years. Mean follow-up time 18 months. Regarding profession, 23,5% worked in construction, 17,6% were truck drivers, 17,6% were carpenters and 17,6% were retired. Average "away from work" time was 6 months and of these, 2 never returned. No correlation found between early return to work and qDASH ( $r=0,386$ ). Regarding cause of arthritis, 50% were scaphoid lunate advance collapse and the other 50% scaphoid nonunion advanced collapse. According to Watson's classification, 17,6% had grade II and 82,4% had grade III. Regarding mobility, 11,8% had a rigid wrist, 17,6% had reasonable range of motion, 41,% very satisfied and 1 patient had a second surgery done: wrist arthrodesis. No relation was found between rehabilitation and qDASH ( $p=0,711$ ). Relatively to pain (VAS), average preoperative pain was 8 vs 1 postoperative. The average qDASH score obtained was, 9,10 with an interquartile range of 3,40-18,20. 3 patients were reintervened: 1 revised to wrist arthrodesis, 1 progression of ulnocubital arthrosis and 1 removed the plate due to impingement. Regarding radiographic outcomes, although no statistical correlation was found ( $p=0,057$ ), 83,3% of the patients with a wrist extension inferior to 15°, had a distance from the plate to the anterior line of the radius inferior to 3 mm. Wrist arthrodesis was obtained in 88,23% of the patients. Discussion: According to our results, there was an improvement of pain up to 90% and functional results were good according to qDASH score. Rate of complications was low and majority the patients remained satisfied at 1-year follow-up, which is line with most recent literature. Concerning the main question, it seems that the more prominent the implant, the greater the possibility of impingement and therefore mobility deficit, leading to the need of implant removal (case of one patient that had a distance of 0.2 mm). A more distal position of the implant, and an augmentation in reaming may contribute to obtain a distance superior to 3mm and avoid this complication.

Conclusion: Four-corner arthrodesis seems to be a good option for pain relief and satisfactory range of motion. Our data suggest that the more prominent the plate is, the greater the impingement being lesser wrist extension possible.

## **A-0712** THE INTERNAL JOINT STABILIZER OF THE ELBOW: A REVIEW OF THE CLINICAL AND BIOMECHANICAL EVIDENCE

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### Introduction

The goal of surgical management for unstable elbow injury is restoration of joint concentricity and stability. Following internal fixation, instability may persist. Additionally, there may be concern for the durability of the repair construct. Historically these scenarios were treated with options such as ulnohumeral pinning or hinged external fixation. Recently, there is increased momentum for internal joint stabilization that allows postoperative mobilization. Our objective was to systematically review the literature to aggregate the clinical and biomechanical evidence for the internal joint stabilizer (IJS) of the elbow.

### Methods

A systematic review was performed in keeping with the PRISMA guidelines. Articles were organized according to study type and device type. These groups were the following: retrospective case series on the IJS, case reports on the IJS,

retrospective case series of intraoperatively constructed internal joint stabilization, and biomechanical reports on the IJS.

## Results

There were 7 retrospective case series on the IJS totaling 130 cases at a mean term of follow up of 12.1 months. Across 6 articles, the mean Disabilities of the Arm, Shoulder, and Hand score was 24.2. All 7 articles reported the complication of implant failure with a pooled rate of 4%. Recurrent instability was reported by 6 articles with a pooled rate of 4%. Four of the 6 articles reported a 0% rate of recurrent instability.

## Discussion

A temporary internal device was developed to stabilize the acutely unstable elbow which allows early motion. The aggregate literature describes satisfactory clinical outcomes and biomechanical efficacy for the IJS. Additionally, case reports have contributed to expanding the knowledge of case application, device position, and surgical approach for the IJS.

## **A-0717** CORRESPONDENCE BETWEEN NERVE ULTRASOUND AND MICROSURGICAL RESULT IN THE TREATMENT OF PERIPHERAL NERVE INJURY

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### INTRODUCTION

At our Institute we have selected patients suffering from traumatic lesions of the peripheral nerves that have been subjected in the diagnostic phase to Nerve Ultrasound by the same operator with high-power linear probe ( 15 MHz) associating the neurophysiological study . Patients were then subjected to microsurgical treatment . In particular, the exact correspondence to the ultrasound data was sought. Patients were then followed to the FU at 1-3-6 months with the intention of evaluating the instrumental clinical correspondence.

### Materials and Methods

From January 2018 to June 2022 we have selected 25 patients with traumatic lesions of peripheral nerves, In particular 10 patients with injury of the median nerve to the wrist , 3 patients with lesions of the palmar branches of the median after division , 1 patient with ulnar nerve injury to the elbow ,3 patients with ulnar nerve injury to the forearm, 4 patients with radial nerve injury to the humerus , 2 patients with NIP injury 2 patients with sensory branch injury to the radial . The patients were subjected by the same operator to ultrasound study with 15 Mhz linear probe and neurophysiological study . During the operation, the incidence of the lesion on the ultrasound data was observed microsurgically. It was all epineural neurorraphy. At the age of 1-3-6 months the ultrasound and neurophysiological study was repeated in order to evaluate the bonta' of the suture , eventual fascicular retraction gap , presence of neuromas , Behavior of surrounding structures with any developments of scarring and fibrosis potential factors depressing the neural recovery.

### Results

In all cases we could evaluate a close correspondence between ultrasound data and microsurgery highlighting the high sensitivity' and specificity' of the procedure .

The F.U. showed good tightness of the epineural suture with excellent treatment of nerve heads ; only in 2 cases was the presence of a non-significant neuroma detected.

The clinical and neurophysiological recovery were evaluated independently and then reassessed in the light of the ultrasound data.

We could see in 18 cases a retraction of the files with a minimum interfascicular gap that could cause possible neuromas .

## Conclusion

Nerve ultrasound with high-power linear probes was highly sensitive and specific. It allows a control of the suture, of the behavior of the fascicles and of the presence of factors hindering the nervous recovery.

In particular, in many cases it has been right in the decision to treat or not already treated patients in non-microsurgical environments.

## **A-0718** TOTAL WRIST REPLACEMENT IN ARTHRITIC AND POST TRAUMATIC CHANGES: A MULTICENTRIC STUDY

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**BACKGROUND:** Recent innovations in wrist arthroplasty implants have led to remarkable improvements in terms of results with improved stability and preservation of bone stock. The Motec cementless wrist arthroplasty is an implant with promising intermediate results. Total wrist arthroplasty is an option for active patients, who wish to retain their wrist function.

**METHODS:** Retrospective case note review of patient demographics, pre and postoperative Disabilities of the Arm Shoulder and Hand (DASH), MAYO scores, range of movement and grip strength, complications and follow-up duration.

**RESULTS:** 16 implants on 16 patients over 5 years, mean age 59; 6 females and 10 male. Indications were RA arthritis, SNAC, SLAC, post traumatic osteoarthritis. The patients showed large improvements of MAYO and DASH scores post-operatively, alongside increased in range of movement. There was just 2 case of implant loosening which were revised with a longer screw. One implant were converted to Motec fusion due to pain.

**CONCLUSION:** We achieved significant improvements in pain relief, performance, and satisfaction both in rheumatic and non-rheumatic patients, confirmed by our scoring system.

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## **A-0720** TIMING AND COMPLICATIONS OF UPPER EXTREMITY SURGERY FOR MULTIPLE TRAUMA PATIENTS

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Upper extremity injuries have less effect on general conditions than trunk or lower extremity trauma. Therefore, the timing of surgical treatment tends to be delayed. However, inappropriate diagnosis and delayed surgical interventions lead to functional impairment.

From April 2019 to August 2022, we retrospectively investigated the waiting time of definitive surgery for upper extremity trauma in multiple trauma patients, who admitted our emergency and critical care center, including comorbid injuries, short-term outcomes, and complications.

Thirty-three patients required surgery, including 30 fractures, 3 amputations, 5 nerve injuries, and 3 vascular injuries. There were 26 males, 7 females. Mean age was 43 years (7-88), mean ISS score was 16 (4-45), mean waiting time for surgery was 80 hours (1-298). As combined injuries, there were 7 head injuries, 12 thoracoabdominal trauma and 11 vertebra or pelvis fractures. The average follow-up period was 6.7 months, and none of the patients experienced short-term limitations

in activities of daily living after surgery. Complications included radial nerve palsy in 1 case and deep infection in 1 case. Upper extremity injuries were delayed in intervention because treatment for trunk injuries was prioritized. However, those with high urgency were operated appropriately, and there were few functional disorders.

### **A-0723** THE EXPERIENCE OF PATIENTS RECEIVING HAND INJURY CARE SERVICES IN GAUTENG

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**Background:** Understanding patients' experience of sustaining a hand injury and accessing care for hand trauma is essential to building interventions that are effective and services that are patient-centered.

**Objective:** To describe the journey of hand-injured patients through the healthcare system using the tool of journey mapping to enable an in-depth understanding of patients' experience of accessing hand-injury care services in South Africa, including occupational therapy intervention.

**Methods:** A qualitative descriptive design was used. Data collection was undertaken at one private and one public healthcare facility in the Gauteng Province as it was anticipated that the experiences of care within the two sectors would differ. Twelve adult patients who had sustained traumatic hand injuries were recruited. All patients had received hand surgery and occupational therapy and had been receiving services for their hand injury for at least 6 months. For triangulation purposes, data collection made use of three techniques: a review of patients' clinical notes, a patient journey mapping exercise, and in-depth interviews. Reflexive thematic analysis (RTA) was undertaken to construct a qualitative account of participants' experiences from the time of injury across various touchpoints within the healthcare system. Rigour was pursued through the use of a reflexive journal kept by the principal investigator, data source triangulation, member checking, and dense description within reporting.

**Results:** Themes captured participants' experience of accessing both surgical and rehabilitation services. An illustrated account (combined journey map), that captures participants' experiences across each of the service touchpoints, highlighted the similarities and variations in experience and is presented and discussed. Patient journeys and experiences varied depending on factors such as the type of services that they were able to access, travel costs to access services, the number of times they were expected to access services, and their view of the benefit of the services rendered. The journey mapping tool revealed that most patients also experienced significant psychosocial changes after a hand injury.

**Conclusion:** The use of patient journey mapping is recommended as a tool for investigating hand-injury care experiences in other contexts. The results of this study are timely as South Africa's healthcare system transitions to National Health Insurance and more integrated service delivery. It is recommended that the implementation of results be generated collaboratively with stakeholders to maximize impact. The study was conducted in the wealthiest province (Gauteng) of South Africa which has some of the most efficient health services in the country. It is thus recommended that similar studies be conducted in the other eight South African provinces to generate in-depth accounts of patients' experiences that can be used to improve and strengthen the patient's voice in hand-injury service delivery and development across South Africa

## **A-0724** HOW TO MANAGE CLINO-SYNDACTYLY WITH METACARPAL APLASIA: A CASE REPORT

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### Introduction:

Syndactyly is the most common congenital malformation of the hand, leading to the fusion of the digits, frequently affecting the ring and middle fingers. The incidence is one out of 2500 children and it is predominantly occurring in boys and Caucasians. Loss of hand functions can lead to a serious deterioration in the quality of life, thus reconstruction is of utmost importance.

### Objectives:

Presentation of the surgical correction's results regarding an atypical case of syndactyly with clinodactyly and metacarpal aplasia.

### Case report:

A girl born in June of 2019 was diagnosed with congenital malformation of the right hand at birth - affecting the right middle and ring fingers, respectively. After X-ray imaging, the fusion of the third and fourth phalanges to a common metacarpal was identified, forming a unique diagnosis of clino-syndactyly with metacarpal aplasia. Surgical intervention was advocated for, which included an osteotomy, correction of synchondrosis at the phalangeal base, and the plastic reconstruction of the part responsible for the clinodactyly. Follow-up of the child is still ongoing, mid-term results suggest enhanced functionality and aesthetics of the affected hand while no complications have been detected.

### Conclusions:

Firstly, we wanted to show that even after age one in a complicated case, syndactyly could be corrected. The patient was aged 3 at the time of the surgery, with two other malformations affecting the right hand. Regardless, the surgery was successful and even though one metacarpal was amiss, we managed to correct the curvature of the fingers while salvaging vital arteries. During control examinations, improvement in the grip of the hand and the fingers' range of motion has been observed.

## **A-0725** CLINICAL EXPERIENCES AND SURGICAL TECHNIQUES OF THE DORSAL ULNAR ARTERY PERFORATOR FREE FLAP IN RECONSTRUCTION OF MEDIUM SIZED DEFECTS OF THE DIGITS

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### Purpose

We share our clinical experiences of utilising the dorsal ulnar artery perforator free flap in reconstruction of medium sized defects of the digits.

### Methods

From 2014 to 2022, we retrospectively reviewed 5 cases – these patients sustained critical defects of the digit(s), either due to trauma or infection, and underwent resurfacing of such defects with a ipsilateral dorsoulnar artery perforator-based free flap. The sizes of the defects ranged from 2.5-3.5cm (width) and 3.5-7cm (length). The main outcomes measured

included active range of movement, 2-point discrimination, patient's satisfaction and time to return to work.

#### Results and techniques

The patients were followed up for an average of 5 months. There were no cases of partial or complete flap failure, and no cases required re-exploration of anastomoses. One of the flaps had a superficial wound infection that resolved with oral antibiotics. All donor sites healed well, although one case had persistent point sensitivity. The average 2-point discrimination was 4-7mm.

Utilising this flap for medium sized, more proximally located defects of the digit gave us the advantage of designing a more proximal anastomosis point, where the recipient (digital) vessel's calibre is larger. In addition, because of the location of the defect, the venous anastomosis was performed to a subcutaneous vein of the digit or hand (recipient). We believe this increases the survivability of the flap due to the larger vessel diameter.

#### Conclusion

The dorsoulnar artery perforator-based free flap is reliable and effective in repairing medium sized digital defects with favourable functional and aesthetic outcomes, minimal donor site morbidity and avoids surgery on the adjacent digits.

### **A-0726** ANATOMY OF THE CARPAL TUNNEL IN REGARD TO A PERCUTANEOUS TUNNEL RELEASE

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A compression of the median nerve inside the carpal tunnel is a well known painful condition. Besides conservative treatment, surgery can lead to a relieve of symptoms and pain by transecting this ligament. The surgery can be conducted via an open incision, endoscopically or with ultrasound guidance. Surgery can injure important anatomical structures due to their close anatomy.

We conducted a study on body donors evaluating the anatomy and anatomical variations of different neural and arterial structures around the carpal tunnel that can be in danger for injury. Since a hook knife is inserted usually at the distal ulnar end of the carpal tunnel, to conduct an endoscopical or ultrasound guided release, the distances of the anatomical structures at danger to the distal ulnar end of the carpal tunnel were measured. These structures include the median nerve, the recurrent branch of the median nerve, the palmar cutaneus branch of the median nerve, the separation of the long finger-ring finger common nerve, the Berrettini branch, the Riche-Cannieu anastomosis, the superficial palmar arterial arch, the ulnar artery and nerve and the palmar superficial innervations of the ulnar nerve. Additionally, ultrasound images were acquired from humans visualizing these structures.

### **A-0727** COMPARISON OF ELECTROMYOGRAPHIC ACTIVITY OF TRICEPS BRACHII DURING THREE DIFFERENT STRENGTHENING EXERCISE

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Purpose: Triceps brachii is an important player especially in holding, pushing or pulling something even our own body weight. Strengthening of this muscle can be done with isolated or combined elbow extension movements. To understand

the best method to activate the each of the muscle head, it is aimed to measure the electrical activity of M.Triceps Brachii during three common strengthening exercises used in gyms. Methods: The study included university students at the age range of 18-25 years with normal body mass index and without any neurological or musculoskeletal problems. Participants were excluded if they had hypermobility, pain in upper extremity, instability, abnormal elbow carrying angle. All participants were informed about the study and consent form was signed by all participants. Triceps Pulldown, Triceps Low Push Down and Cable overhead triceps extension exercises were selected for electromyographic (EMG) measurements. For skin preparation, shaving was performed if necessary. The skin under the electrodes was cleaned by a skin preparation gel (NuPrep, Do Weaver and Co, USA) until the electrical impedance of the skin was less than 5 K $\Omega$  by using an impedance meter (Noraxon USA, INC, impedance meter). Before measurement process, the movement patterns and body postures of three different exercises were shown to the participants and a hands-on learning repetition was performed. The electrodes were placed on the long and the medial head of triceps brachii. The placements were done according to Surface ElectroMyoGraphy for the Non-Invasive Assessment of Muscles (SENIAM) criteria. Silver/silver chloride, pre-gelled surface EMG electrodes (Ambu Blue Sensor, Denmark) and Portable 8 channel TeleEMG (BTS, Milan, Italy) were used to record EMG signals during exercises. First, the participants completed three isometric maximum voluntary contraction (MVICs) test in prone position where the shoulder is in 90° abduction. Then, EMG was recorded in 3 exercises. To avoid the potential effect of fatigue, the order of the tests was randomized. In each test participants were told to do the exercise 3 times, hold the maximum force for 5 seconds. Rest for 2 minutes were allowed between exercises. To regulate the rythm of the start and end points of the exercise, 50 bpm metronome was used. The avarage of maximum voluntary peak contraction was recorded from each head during each exercise. The difference between tests was analyzed with Wicoxon and student t test. Results: Eleven students (7 male, 4 female) at the mean age of 21.72 $\pm$ 1.42 years completed the study. The EMG signals of long and lateral head of triceps was significantly less in three exercises than MVICs ( $p < 0.05$ ). The activation of the muscle did not differ significantly between exercises ( $p > 0.05$ ), however long head was mostly activated during Cable overhead triceps extension and the lateral head activation was higher during Triceps Low Push Down. Discussion: For triceps strengthening, three exercises may have a similar effect. As activation of the muscle was greater during maximum isometric test, clinicans should be careful while designing isometric exercises.

## **A-0729** APPLYING THE WALANT TECHNIQUE TO SURGICAL TREATMENT OF DISTAL RADIUS FRACTURES

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The Wide-Awake Local Anesthesia No Tourniquet (WALANT) method is a recent anesthesia option for surgery of the upper limbs based on the injection of an anesthetic solution containing adrenaline at the surgical site, hence circumventing tourniquet use. In a prospective study, we compared the functional outcomes using this anesthesia technique with those of the regional anesthesia (RA) technique for the surgical care of distal radius fractures (DRF). From November 2019 to June 2020, a non-randomized, single-center study was conducted with a cohort of 41 patients suffering from a DRF and who received volar plate fixation at a university hospital center. Twenty-one patients had WALANT surgery and 20 had RA with installation of a tourniquet. Over a period of 7 months, the clinical and radiological outcomes as well as the QuickDASH functional score were evaluated. Recovery of wrist function, return to work and analgesic withdrawal for the WALANT group occurred earlier than for the RA group. No noticeable differences were found regarding surgery

duration or radiographic results. Using WALANT, functional wrist recovery occurs earlier than with RA. In our study, earlier analgesic stoppage, a quicker return to work and resumption of activity were observed with WALANT. As such, it should become part of the therapeutic arsenal for surgical treatment of DRF.

**A-0736** NEW SURGICAL TECHNIQUE FOR DISTAL INTERPHALANGEAL JOINT IN TRIPHALANGEAL FINGER'S OSTEOARTHRITIS WITH A NOVEL INTERPOSITION PLASTY. CADAVERIC PRELIMINARY STUDY

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**Introduction:** Distal interphalangeal joint (DIP) is the most commonly affected hand joint from osteoarthritis. Arthrodesis is widely performed to treat pain but resting mobility. The purpose of this study is to analyze the digital extensor anatomy and to design a new interposition plasty with sagittal bandelets, providing length measures and stability of it.

**Methods:** Complete cadaveric hands and forearms fixed with thiel, without any previous surgery nor pathology were used. Exposition of the extensor apparatus of triphalangeal fingers was made to the nail bed. Exposure of subchondral bone, the design of the plasty with sagittal bandelets and the dissection of collateral ligaments were protocolized. Passing the plasty through the collateral ligament was performed using specific tools. A longitudinal incision of 3 millimeters without affecting instability was made. The plasty was stabilized with a dorsal surgical suture one over another in the same dorsal point. Resistance was measured with cycles of flexo-extension.

**Results:** Sixteen complete hands were dissected with a total of 64 fingers. No anatomy variants were seen. The average size of the plasty was 23 millimeters of length and 0.54 millimeters of wide. In every finger, half of sagittal bandelets were intact after the procedure. In six cases, length was insufficient to be sutured in the same point, so an individual suture in central bandelet was performed. Rupture of the plasty only happened in one case with 24 cycles of flexoextension.

**Conclusion:** Our DIP plasty is a novel procedure which seems to be factible in DIP degenerative osteoarthritis giving mobility and avoiding arthrodesis fixation as the first surgical solution. Clinical study will give further information.

**A-0738** SUPERCHARGED END-TO-SIDE ANTERIOR INTEROSSEOUS TO ULNAR MOTOR NERVE: FINDING A SAFE ZONE FOR A MINIMALIZED PROCEDURE. CADAVERIC PRELIMINARY STUDY

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**Introduction:** Functional recovery after an ulnar injury is determined by time to end plate motor reinnervation. The anterior interosseus nerve (NIOA) is the donor nerve of choice for ulnar serious injuries with an end-to-side transfer. Many cases require an extended dissection to comfortably perform the procedure. The purposes of this study were to study the neural topography of the ulnar and anterior interosseus nerves and, perform the complete surgery to establish a safe interval were the graft reaches the ulnar nerve avoiding a large surgical exposition.

**Methods:** Complete cadaveric hands and forearms fixed with thiel, without any previous surgery nor pathology were protocolize dissected as shown in the pictures. Complete dissection of the ulnar nerve, fascicles, and branches to the hand, as well as anterior interosseous nerve to the pronator quadratus was performed. Double measurements were made

by different independent observers.

**Results:** Sixteen complete specimens were dissected. Only one accessory NIOA branch was described from proximal forearm as an anatomic variant. The average length of forearms was of 245 millimeters (mm) (SD 13.85). Superficial branch of ulnar nerve was found at 74 mm (SD 10.6) of the pisiform. The last branch of the NIOA for the flexor digitorum profundus was at 48 mm (SD 5) of the pisiform, being possible to dissected 10 mm (SD 2.3) inside the pronator quadratus. The complete NIOA's graft measured 61 mm (SD 9.8). We result with a safe zone from 72mm (SD 21) of epitrochlea and 61mm (SD 13.3) of pisiform.

**Conclusion:** Supercharged end-to-side anterior interosseous to ulnar motor nerve injuries is a reproducible technique and there is a safe zone where we can find the graft and perform the nerve transfer with no tension. The NIOA graft could be used as a free graft in nerve defects of 61mm.

### **A-0739** 3D PRINTED, PATIENT-SPECIFIC SCAPHOID PROSTHESIS AS A TREATMENT OPTION FOR NON-RECONSTRUCTABLE SCAPHOID NONUNIONS

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**Introduction:** Scaphoid fractures are among the most common fractures of the upper extremity and have a high nonunion rate (15.5%). The goal of non-union treatment is reconstruction of the scaphoid bone but due to its complex anatomy and poor healing capacity, reconstruction is not always possible nor successful. Current treatment options for non-reconstructable nonunions are limited to so-called 'salvage procedures'. Although satisfactory results in literature, these procedures all compromise wrist motion and function. Historic attempts to develop a functional scaphoid implant have not been successful. The introduction of 3D printing technology offers the possibility to design a scaphoid implant that can precisely restore anatomy and joint congruency. In this study we present a case-series 3D printed, patient-specific titanium scaphoid implants as a treatment option for non-reconstructable pseudoarthritic scaphoid nonunions, often combined with avascular necrosis.

**Methods:** This retrospective study assessed the functional and radiographic outcomes of 10 patients treated for a non-reconstructable scaphoid nonunion and avascular necrosis with a 3D printed, patient-specific titanium prosthesis. VAS score, range of motion (ROM), grip strength, patient-rated wrist evaluation (PRWE) score and standard PA and lateral radiographs were assessed pre- and postoperatively.

**Results:** The average follow-up was 34 months with a minimum follow-up of one year. The mean VAS score improved from 6,28 preoperatively to 1,23 postoperatively. The mean wrist flexion/extension measured preoperatively was 44,4 / 35,56 degrees versus 37,6 / 37,5 degrees postoperatively. Grip strength did not change significantly postoperatively. PRWE scores decreased significantly from 76 preoperatively to 22 postoperatively. One prosthesis was removed 5 months post-operatively due to instability. All other scaphoids showed satisfactory alignment on X-rays without any further degenerative changes.

**Conclusion:** Early follow-up results show a satisfactory outcome following this procedure. The majority of patients are pain-free and have a significantly improved wrist function. We believe this procedure can be an alternative to salvage procedures, or at least delay the need to perform them.

## **A-0740** SEVERE MADELUNG DEFORMITY – CORRECTION WITH DOUBLE OSTEOTOMY BASED ON 3D PLANNING

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For correction of Madelung deformity, we normally use an open wedge osteotomy to lift up the ulnar part of the radius and to rotate it dorsally using a straight palmar plate for fixation. In case of severe deformities with additional significant bending of the shaft of the radius one single distal osteotomy is not sufficient as the forearm remains in his curved position. For that reason, we perform an additional osteotomy at the shaft of the radius. Freehand technique for this complex procedure is difficult and leads to our experiences not always to perfect correction and standard implants do not always fit to the malformed radius. Therefore, we switched to the 3D planning technique based on CT data.

As usually the opposite site is also involved, we used as reference a radius from a database with regard of gender, age and height. By mirroring the involved wrist and forearm to the reference on the computer the level of the osteotomies and the whole correction till the bone looked so far as possible like a normal one is simulated. Drill and cutting guides together with the implants were calculated and finally printed with special 3D printing techniques.

Nine patients were treated in that way and if the distance of the osteotomies was far enough, we used two separate guides and implants otherwise one long plate and one guide.

All procedures led exactly to the desired correction and all osteotomies united on postop X-ray control between 2 and 4 months. Pain on VAS scale was significantly reduced from 6-7 to 1-2 and the patients were especially happy of the normal appearance of their wrist and forearm after the correction and all of them would undergo the operation again. Corrective osteotomy of severe Madelung deformities with double osteotomy based on 3D planning using patient specific implants represents a significant improvement and leads to reliable results.

## **A-0741** COMPARISON OF REVERSE HOMODIGITAL FLAP FOR THUMB RECONSTRUCTION: DORSORADIAL VERSUS DORSOULNAR

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### Introduction

The reverse homodigital flap remains a useful alternative for covering thumb defects. However, the description of difference between dorsoradial and dorsoulnar homodigital reverse island flap is not clear. To compare the results of reverse dorsoradial flaps and reverse dorsoulnar flap in the thumb reconstruction.

### Materials and methods

From July 2010 to December 2020, 56 patients were treated with the reverse homodigital flap for thumb reconstruction. The patients were divided as Group A (dorsoradial) and Group B (dorsoulnar). Flap survival, flap size, location of defect, the range of motion (ROM) of the joints, and final aesthetic outcomes were evaluated.

### Results

Respectively in the Group A (22 cases) and Group B (34 cases), 21–33 flaps survived uneventfully, whereas 1–1 flaps experienced venous congestion with no or partial flap loss. No significant difference was identified between the two groups for the incidence of venous congestion, aesthetic satisfaction and ROM of the injured thumbs. The flap size of the patients in Group A was significantly larger comparing with that in Group B.

## Conclusions

Homodigital dorsoradial and dorsoulnar reverse island flap may be promising alternatives for thumb reconstruction. Dorsoradial flap is associated with more favorable outcomes in terms of flap size.

### **A-0742** METAL SUCTION TIP FOR PERCUTANEOUS FLEXOR SHEATH WASHOUT: A POINT OF TECHNIQUE

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#### Aims

Flexor sheath tenosynovitis is a common plastic surgery emergency<sup>1</sup>. A variety of medical devices have previously been described for irrigation of the flexor sheath including cannulae and paediatric feeding tubes<sup>2-7</sup>. These, however, have limitations associated with their ease of use mainly due to their non-rigid structure and composition with kinking of tubing being a commonly encountered problem<sup>7</sup>. We, therefore, sought to find a more useful device to perform flexor sheath washout that overcomes this problem while avoiding risk of injury to surrounding structures

#### Point of technique

We suggest the use of a single-use metal suction tip (Medioplast, Sweden) (1.4 x 70 mm, 17G) that can be connected to a standard syringe to undertake irrigation of the flexor sheath. This instrument is primarily used in ear, nose and throat (ENT) procedures. It has a blunt end at the end of a single lumen metallic tube. The other end is curved and has standard plastic tubing that is able to connect to standard syringes (either luer lock or roundhub).

#### Conclusion

We have found the metal suction-tip to be a useful alternative to performing closed, percutaneous flexor sheath washout. This device has many advantages including: rigid structure that is not prone to kinking and allows for greater ease of insertion into the sheath; its blunt tip allowing for safe use in the hand; and its curved proximal end which facilitates straightforward connection of syringes to undertake washout in a time-efficient manner.

### **A-0743** OEDEMA'S TREATMENT IN COMPLEX POST SURGICAL PATIENTS: GOLD STANDARD TREATMENT VS. NEUROMUSCULAR TAPE COMBINED WITH LYMPHATIC BANDAGE: WHICH ONE IS BETTER?

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Background: Oedema is a part of the normal inflammatory response that arises following trauma or surgery. The underlying physio-pathological processes are diverse. Still, in our paper extracellular oedema that develops following surgery will be specifically considered.

One of the main goal of hand therapists is to reduce the swelling as efficiently and quickly as possible, helping the reabsorption of fluids in the intracellular spaces. Persistent swelling can have harmful effects on the range of motion (ROM), soft tissues mobility, scar tissues, until it affects functionally, strength and aesthetics of the whole hand.

Objective: The goal is to evaluate which treatment would be effectiveness in reducing the risks of secondary complications, in facilitating the recovery of functionality and in the rapid reintegration of the affected arm in the Daily Living Activities (ADL).

**Materials and methods:** The randomized controlled study (RCT) includes more than 15 patients with complex trauma (mostly wrist trauma), surgically treated. In the experimental group (EG) patients are treated with Kinesio Taping® application combined with compressive lymphatic bandage, while in the control group (CG) we used the gold standard treatment. Surgically treated patients with major trauma were included and evaluated through three data sheet administrated on the day of surgery (T0), on the third day (T3) and on the tenth day (T10). Data collected concerning oedema evaluation consisted in: 1) the measurements of the diameter in centimetres, 2) the pitting oedema and 3) Stemmer's sign: for evaluation of the range of movement, instead, 1) the goniometric measurements and the 2) Kapandji's score were used. Subjective pain and disability data were collected through the VAS and DASH respectively.

**Results:** the study is still ongoing and all the collected data will be statistically analysed and compared at the end of the trial (December 2022). However, the data collected until now demonstrate that the group using Kinesio Taping® combined with specific lymphatics techniques has more benefits in the immediate postoperative to prevent secondary injuries and to restart sooner the basic Daily Life's Activities compared to the gold standard treatment used in the control group.

**Conclusion:** As the study is still in progress, we cannot reach a definitive conclusion yet, however the statistical trend suggests that the experimental group has more benefit in immediate post surgery, in particular at T3 in reducing oedema and pain and in sooner restart of ADL in comparison to the control group.

#### **A-0744 OSSEOINTEGRATED THUMB PROTHESIS**

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Loss of the Thumb leads to a severe impairment in hand function. Therefore exist many different surgical methods for thumb reconstruction with- or without microsurgical intervention.

Although the results of thumb reconstruction are very good, some patients do not want further surgery but a prosthetic replacement. The anchorage of conventional prostheses in partial thumb amputations and also complete amputations is difficult and usually leads to a limitation of the hand function.

In these cases, osseointegration is a good measure to provide the patient with a powerful countergrasp. Maximum patient comfort and a very long daily use time should be emphasized here.

The 7 patients treated with osseointegration so far have given a very positive response. The prosthesis is worn for over 7 hours a day, and no infections have been recorded. The average grip strength of the osseointegrated thumb is 13.5 kg. The different cases are discussed and the decisive steps in the surgical technique are highlighted.

#### **A-0745 A SYSTEMATIC REVIEW INTO THE USE OF PATIENT-SPECIFIC TECHNOLOGY FOR CORRECTIVE OSTEOTOMIES OF DISTAL RADIAL MALUNIONS**

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##### **Introduction**

Malunions of the distal radius are the most common complication of distal radius fractures, with resultant deformity

that can be debilitating to patients. One surgical management option is that of a corrective osteotomy, and advances in software now allow precise, three-dimensional assessment of rotational deformities. Such technology has also allowed the production of patient-specific instrumentation to accurately recreate a patient's own anatomy.

The aim of this systematic review was to appraise the literature surrounding corrective osteotomies of malunited extra-articular distal radius fractures, specifically comparing traditional methods of fixation with patient-specific implants.

#### Methods

This review was performed according to the PRISMA guidelines. The review was registered with the International Prospective Register of Systematic Reviews (PROSPERO) database Registration: CRD42021235855).

A literature search was conducted using search engines CINAHL, EMBASE, EMCARE, Medline and PubMed. Inclusion criteria included full-text articles, available in English, of studies including post-traumatic, extra-articular fracture patterns of the distal radius in patients aged 16 years and over. Exclusion criteria included children, intra-articular fractures, fractures of the proximal forearm, contra-lateral deformity, congenital anomalies, inflammatory arthropathy, and cadaveric studies. Primary outcome measures included range of motion, patient satisfaction and union, with secondary outcome measures of grip strength, radiological parameters, and complications. Statistical analysis was performed, with our findings demonstrated in forest plots.

#### Results

In total, 8 papers were included in this literature review. The level of evidence included one randomised control trial, one case-control and six case-series. A total of 141 participants were recruited across 22 hospitals.

All eight papers measured post-operative wrist motion, with respect to flexion, extension, pronation and supination. Two papers failed to report the pre-operative measurements for comparison. Out of the remaining six papers, all reported improvements in flexion, extension, pronation and supination following corrective osteotomy. Patient symptomatic scores were mostly reported as degree of pain on the Visual Analogue Scale (VAS), along with patient satisfaction scores. All papers reported an improvement in patient pain following surgery. For the 116 patients with data provided, 115 (99%) went on to achieve full radiological union. This was achieved at an average of 13 weeks across five studies.

#### Discussion

Our literature review has demonstrated that there is a lack of high-quality research directly investigating the impact of patient-specific implants and instrumentation. Single institution case series have demonstrated enhanced outcomes with their use, with improvements in range of motion, grip strength and pain. Improvements in radiological parameters were also seen and were found to have statistical significance.

We could find only one RCT that directly compared these methods with more traditional fixation techniques. This paper was limited by small sample size and insufficient power, differing post-operative rehabilitation programmes, and inconsistent use of intra-operative autograft.

#### Conclusion

Although early evidence suggests patient-specific instrumentation to be beneficial for clinical and functional outcomes, it is unclear from the research available as to the significance of these improvements. This literature review highlights a need for high-quality research papers, directly comparing three-dimensional planning techniques and patient-specific instrumentation/implants, with more traditional imaging and fixation methods.

**A-0746** DOES THE ANGLE BETWEEN THE FRACTURE LINE AND THE DORSAL BLOCK PIN AFFECT THE QUALITY OF REDUCTION IN BONY Mallet INJURIES TREATED WITH EXTENSION BLOCK PIN TECHNIQUE?

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**Purpose**

We aimed to investigate the hypothesis that, in bony mallet injury, the angle between the fracture line and the dorsal block pin might have an impact on reduction quality.

**Material and Methods**

Thirty one patients (10 females, 21 males, mean age of 29 years) who underwent extension block pin for bony mallet injury were included. In postoperative phalanx lateral radiographs, the angle between the fracture line and the dorsal block pin were measured by 3 researchers. The mean of measurements was recorded as the final value. The quality of reduction was classified according to the sum of the gaps in the joint and dorsal surfaces. A total gap of less than 1 mm was noted as satisfactory while greater than or equal to 1 mm as unsatisfactory reduction.

**Results**

Interobserver correlations for all measurements were statistically significant ( $p < 0.001$ ). In terms of reduction quality, 12 patients were in the satisfactory and 19 patients in the unsatisfactory groups. The means of the angle between the fracture line and dorsal block pin was  $10.84^\circ$  in satisfactorily reduced group and  $18.67^\circ$  in unsatisfactorily reduced group ( $p = 0.251$ ).

**Conclusion**

Perpendicularly applied compressive force to the fracture line is accepted to be effective in terms of reduction quality. Application of this concept in bony mallet means that the fracture line and the block pin should be adjusted as parallel as possible. In this study, which included a limited number of patients, we could not obtain evidence to support this hypothesis.

**A-0747** DISTAL BICEPS TENDON RUPTURE: TWELVE-YEAR EXPERIENCE USING SUTURE ANCHORS THROUGH A SINGLE ANTERIOR APPROACH

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**Background:**

Distal biceps tendon rupture is an uncommon injury involving the dominant arm in middle-age male population. With this retrospective cohort study, we reported the clinical outcomes of patients treated with tendon reinsertion using anchors through a single anterior approach.

**Methods:**

102 patients with distal biceps tendon rupture were treated between 2010 and 2022 and they were evaluated at follow-up considering the recovery of ROM in flexion-extension and pronosupination and examined with DASH, MAYO and OXFORD score.

**Results:**

The ROM recovery shows fine results, with an average of flexion-extension of  $135^\circ$ - $5^\circ$  and pronosupination  $90^\circ$ - $85^\circ$ . The average DASH score was 1.3; the MAYO elbow score was 98.87 and the OXFORD elbow score 47.8. There were reported four complications: one case of partial re rupture, two cases of superficial infection, one case of anchor avulsion from

bone. We had no cases of nerve palsy, radio-ulnar synostosis, or heterotopic ossification.

Conclusion:

The clinical outcomes obtained by anatomical reinsertion of distal biceps tendon in its anatomical site by means of suture anchors are satisfactory and the single anterior approach can minimize the risk of nerve injury and heterotopic ossifications.

## **A-0748** DIAGNOSIS AND TREATMENT OF DISTAL TENDON INJURY OF THE BRACHIAL TRICEPS MUSCLE: OUR EXPERIENCE

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Introduction:

Rupture of the distal tendon of the brachial triceps muscle is a rare injury with an incidence of 0.78% of all tendon injuries affecting the upper limb. The lesion in most cases is localized at the level of the olecranon insertion. Rarely it is localized at the level of the myotendinous junction or the muscle belly. Male patients are most affected especially at a young age; risk factors are represented by therapies with corticosteroids or local infiltration of cortisone which lead to tendon degeneration. Clinically, the patient shows elbow extension deficit, however frequently not complete, with a very variable grade of pain. Standard radiology can help by highlighting bone fragments detached from the olecranon area ("flake" sign). Ultrasound and MRI are used for the diagnosis.

From January 2015 to May 2022 we surgically treated 14 patients using different surgical methods: transosseous reinsertion, reinsertion with anchors, direct suture for partial lesion.

Materials and methods:

We performed 14 re-insertion surgeries of the distal portion of the brachial triceps. In all cases they were male patients (20-60 years old). In 9 cases they were body builder patients and the lesion manifested itself in 6 cases with extension versus resistance mechanism (bench press), in 3 cases as a spontaneous lesion. In the remaining 5 cases following a fall on the hand posed for defense.

The radiographic images in most cases showed parceled bone detachment of the olecranon. In some cases, ultrasound was performed to confirm the clinical suspicion of complete injury.

The patients were all immobilized in a plaster cast and underwent surgery about a week after the traumatic event.

The surgery consisted of bone reinsertion of the tendon with two methods: transosseous reinsertion (Krakow method), reinsertion using anchors. In one case the tendon appeared partially damaged and therefore a direct suture was performed.

Results:

Patients were initiated for physiotherapy approximately 3 weeks after removal of the plaster cast. They all recovered elbow rom and extension strength by returning to work and sports activities prior to the injury in about 10 weeks.

Conclusion:

Rupture of the distal tendon of the brachial triceps muscle is a rare injury. Primary repair gave better results than secondary repair therefore, when identified, the lesion must be treated surgically to allow for a more rapid return to usual daily activities and sports.

## **A-0749** CASE REPORT: ALTERNATIVE WAY OF TREATMENT 5TH METACARPAL NECK FRACTURE USING ANTEROGRADE AND RETROGRADE LOCKING WIRES

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Metacarpal fractures account for 40% of all hand fractures and 1/4 of these are represented by the 5 metacarpal neck fractures. There are several ways of treating this type of fracture in the literature and the gold standard is fixation with K-wires. We identify a valid treatment technique using an antegrade and a retrograde wire in order to have a four-point fixation, adding stability with a system to lock the wires together. This allow a good outcome even without any physiotherapy due to the possibility of immediate mobilization from day 1 post op.

## **A-0754** TRAPEZIUS ELBOW FLEXOLASTY: A NOVEL TECHNIQUE TO RESTORE SHOULDER AND ELBOW FUNCTION IN LATE PREGANGLIONIC PAN-PLEXUS INJURIES

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### Introduction

Pre-ganglionic Pan plexus injuries involve avulsion of C5-T1 roots. There are few options even for early presenting cases. Options are negligible for the patients who present late 3-4 years after injury.

The objective of this study is to share our experience of single muscle tendon transfer to achieve abduction at shoulder and flexion at elbow for flail upper limb in late pan plexus injuries.

### Methods

We managed 47 cases of pre-ganglionic pan plexus injuries during last 5 years. Mean duration of presentation was 3.5 years after injury. All patients were having flail limb with zero power of all muscles of upper limb including latissimus dorsi and pectoralis major. Mean age of the patients was 32 years including 5 females. Minimum age was 14 years. We lifted 2 heads (Upper and middle) of trapezius muscle from its site of insertion and transferred to the Biceps tendon with the help of intervening Tensor Fascia Lata graft. An improvised splint was applied to keep the shoulder and elbow at 90 degree for 04-6 weeks. Assisted movements followed by active physiotherapy was started at 06 weeks. Maximum range of movements was achieved within 6-9 months. 38 (81%) patients showed improvement. Among them 09 patients showed very good, 15 good, 09 fair and 06 patients showed poor results. 08 patients didn't show any improvement. On average, 57 degree of abduction at shoulder and 67.6 degree of flexion at elbow was achieved with mean <\_ M3 power by 12 months. Additional procedures were performed at wrist and fingers as per patient's need.

### Conclusion

Trapezius transfer with the help of Tensor Fascia Lata graft to the Biceps tendon is a useful option to achieve reasonable movements at shoulder and elbow in patients presented with late pan-plexus injuries with flail upper extremity.

## **A-0755** ARE BIOPHYSICAL AGENTS EFFECTIVE IN THE TREATMENT OF CARPAL TUNNEL SYNDROME? AN OVERVIEW OF SYSTEMATIC REVIEWS

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### Objective

To summarize and synthesize the evidence evaluating the effectiveness of biophysical agents compared to other treatments, for the management of carpal tunnel syndrome (CTS).

### Methods

This is an overview of systematic reviews (SRs). We registered the protocol for this overview with PROSPERO (CRD42022319002). We searched several online databases and obtained SRs relating to managing CTS using biophysical agents up to November 2021. Two independent researchers screened the titles, abstracts, and full texts, then appraised the quality of the SRs using the AMSTAR-2 tool.

### Results

We found 16 SRs addressing 12 different biophysical agents. The quality of the SRs was mainly critically low (n = 14) or low (n = 2). The most frequently assessed biophysical agents were low-level laser therapy (LLLT, n = 11), ultrasound (n = 5), extracorporeal shockwave therapy (ESWT, n = 4)), and short- and microwave diathermy (SWD, MWD, n = 3). The evidence was inconclusive for the effectiveness of LLLT and favorable for the short-term efficacy of non-thermal ultrasound in improving symptom severity, function, pain, global rating of improvement, satisfaction with treatment, and other electrophysiological measures compared to manual therapy or placebo. Evidence was inconclusive for ESWT, and favorable for the short-term effectiveness of SWD/MWD on pain and hand function. Evidence regarding the long-term effectiveness of either of these agents was scarce. Other biophysical agents had fewer and more conflicting results.

### Conclusion

The findings of the SRs mainly were based on low-quality primary studies, with an unclear or high risk of bias, small sample sizes, and short follow-ups. Therefore, no recommendations can be made for the long-term effectiveness of any biophysical agents. SWD/ MWD, non-thermal ultrasound, superficial heat, and phonophoresis can be used for the short-term relief of CTS symptoms. High-quality evidence is needed to support evidence-based recommendations on the use of biophysical agents in the management of CTS.

## **A-0756** EFFECT OF DISTAL RADIOULNAR JOINT CONFIGURATION ON THE CLINICAL OUTCOME AND DEVELOPMENT OF OSTEOARTHRITIS OF THE DISTAL RADIOULNAR JOINT AFTER ULNAR SHORTENING OSTEOTOMY

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**Purpose:** To evaluate the postoperative outcome and the development of osteoarthritis of the distal radioulnar joint (DRUJ) after ulnar shortening osteotomy depending on the orientation of the DRUJ in regards to the Tolat-classification.

**Methods:** A total of 80 Patients with primary or posttraumatic ulnar impaction syndrome were divided into 3 groups depending on the configuration of the DRUJ in regards to the Tolat-Classification. Those cases were than assessed

postoperatively after ulnar shortening osteotomy.

Considered factors were range of motion (ROM), grip strength, postoperative pain using the visual analog scale (VAS) and clinical outcome of the hand judged by the quick disabilities of the arm, shoulder and hand score (quickDASH). Additionally those patients were evaluated for clinical and radiological signs for the development of postoperative osteoarthritis of the DRUJ.

Results:

A total of 80 wrists were evaluated after a mean follow-up time of 40 month. The mean active ROM resembled 97% of the unaffected, opposite side. Patients reported a good reduction of pain to VAS 1 (during rest) and VAS 2 (during stress). The average postoperative quickDASH was 14, showing a good condition of the hand. There were no significant differences of postoperative outcomes between the three subgroups. In 5% percent of the cases, there were radiological signs for the development of an osteoarthritis of the DRUJ. There were no significant differences in between the three subgroups.

Conclusion:

Ulnar shortening osteotomy is a good option to treat patients with an ulnar impaction syndrome. The morphology of the DRUJ does not affect the postoperative outcome in regards of ROM, pain and function nor does a certain DRUJ morphology favor the development of postoperative osteoarthritis of the DRUJ.

## **A-0757** THE USE OF ACELLULAR COLLAGEN IMPLANT FOR TRAPEZIO-TETACARPAL OSTEOARTHRITIS. PRELIMINARY RESULTS

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### INTRODUCTION AND GOALS

Rhizoarthrosis is a disabling disease of the hand that causes pain, stiffness and weakness, resulting in impaired function and strength of the hand.

Non-surgical treatment mostly consists of activity modifications, NSAID intake, splinting and corticosteroid injections. After the failure of conservative treatment, various surgical options exist.

ChondroFiller Liquid® is a resorbable filler based on type I collagen and a neutralizing solution, used to form a protective layer around the cartilage defect while stimulating the growth of chondrocytes and the consequent regeneration of the cartilage, indicated for the repair of lesions cartilage with a maximum surface area of 3 square centimeters.

Our study was aimed at the use of ChondroFiller Liquid® on two populations of 20 patients (groups A and B) divided according to the Eaton-Littler classification (group A stage 1-2; group B stage 3-4). The objectives of the study were: evaluation of any adverse events; assessment of painful symptoms; possible improvement of the grip strength evaluated with Jamar test and pinch test; possible improvement of the DASH score; evaluation of any modification of the cartilage component analyzed with serial MRI studies.

### MATERIALS AND METHODS

40 patients were enrolled for the study, divided into two severity groups according to the Eaton-Littler classification. The patients were assessed on an outpatient basis and recruited according to the inclusion criteria (time 0) with x-ray and, only for group A, also with MRI. All patients were clinically evaluated with the Jamar test, Pinch test, NRS (Numeric Rate Scale) and DASH score. Subsequently, a single infiltration of ChondroFiller Liquid® under fluoroscopic guidance in a sterile

environment was performed (time 1). A clinical re-evaluation was performed 30 days after infiltration (time 2) with the administration of DASH score and NRS. At 6 months all the patients were re-evaluated with Jamar test, Pinch test, NRS, DASH score and only the patients of group A underwent further MRI.

## RESULTS

The preliminary results of the study show that there was an improvement in pain symptoms, associated with an increase in force in the pincer and grip movements evaluated with clinical tests. MRI imaging evaluation showed a change in the joint profile in patients subjected to infiltration with ChondroFiller Liquid®, with reduction of bone edema and periarticular effusion.

## CONCLUSIONS

ChondroFiller Liquid® has proven to be a valid alternative to the surgical approach, at least to slow down the progression of painful symptoms and functional limitation. The clinical improvement would justify an infiltrative approach by anticipating the possible subsequent surgical approach.

## **A-0758** IS THERE ANY TECHNICAL DETAILS THAT MAY AFFECT THE OUTCOMES OF PEDIATRIC BOTH BONE FOREARM DIAPHYSEAL FRACTURES TREATED WITH ELASTIC STABLE INTRAMEDULLARY NAIL?

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### Purpose

The aim of this study is to assess the radiological and functional results of pediatric both bone forearm diaphyseal fractures treated with elastic stable intramedullary nails (ESIN) and identify the factors affecting the results.

### Material and Methods

Thirty-six (33 male, 3 female, mean age: 11.6 years) patients were included. The mean follow-up was 41.5 (18-96) months. Demographic characteristics and the details of surgical techniques were analyzed retrospectively. In addition to standard radiographic evaluations, the ratio of nail diameter to medullary canal diameter (ND/MCD) and maximal distance of radial bowing were measured.

### Results

According to Price and Flynn criteria; 28 patients (77.8%) had excellent and 8 (22.2%) had good results. Nonunion or delayed union was not observed in any patients. There was no significant difference between titanium (24 patients) and stainless steel (12 patients) nails according to functional and radiological results ( $p>0.05$ ). It was observed that the prebending maneuver (performed in 19, and not performed in 17 patients) did not affect the functional and radiological results ( $p>0.05$ ). Loss of reduction was observed in 4 patients with ND/MCD ratio of  $<40\%$ . It was observed that maximal distance of radial bowing was improved in all patients.

### Conclusion

Regardless of nail type and prebending, ESIN is reasonable method for both bone forearm diaphyseal fractures with excellent radial bow remodeling. The ND/MCD ratio recommended by us is 50%.

## **A-0759** RECONSTRUCTION OF PAINFUL NEUROMA OF SUPERFICIAL BRANCH OF RADIAL NERVE AFTER FIRST DORSAL COMPARTMENT RELEASE: PRESENTATION OF TWO CASES

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**Background:** First dorsal compartment release (DeQuervain's tenosynovitis) release is a commonly performed procedure by the generalist orthopaedic surgeon, as well as the hand surgeon. Due to its proximity to the surgical approach, the superficial branch of the radial nerve is at risk in this procedure. Standard procedure involves identification and protection of the superficial branch of the radial nerve prior to identification of the first extensor compartment and its release. Nevertheless, complications such as bleeding, postoperative swelling and injury to the radial nerve can occur.

**Materials and Methods:** We present two cases of middle-aged women who suffered debilitating neuropathic pain at the surgical site after first dorsal compartment release, later diagnosed as neuromas of the superficial branch of the radial nerve.

**Results:** In both cases, neuromas were surgically excised and reconstructed using a sural nerve autograft. Postoperatively, both patients showed nearly complete resolution of pain and partial recovery in dorsal hand and finger sensation.

**Conclusions:** Iatrogenic lesions of sensitive nerves can be a devastating consequence of surgical release of the first dorsal compartment. Failure to protect neural structures during approach can derive in neuroma formation and postoperative pain. The author exposes two cases of this complication and an option for reconstruction using nerve grafts with excellent functional results.

## **A-0760** VALIDATION THE QUICK-DASH-BR QUESTIONNAIRE FOR WORKERS WITH WORK-RELATED MUSCULOSKELETAL PAIN AND DISCOMFORT COMPLAINTS OF THE UPPER LIMB

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**Background:** Complaints of work-related musculoskeletal pain and discomfort may be related to several individual / personal, physical, biomechanical, or psychosocial/organizational risk factors and preventive actions are necessary. When an individual experiences pain or discomfort in the upper limbs, their performance in the tasks of daily living, work performance, and leisure activities are negatively affected. Therefore, assessing the impact of injuries and diseases on the patient's function and perception of his or her health status is essential for decision-making, follow-up of evolution, and determining the patient's prognosis. In addition to the objective instruments of clinical measurement, self-report questionnaires have been increasingly used to measure the patient's perception of the impact of the injury. QuickDASH is a specific, self-administered questionnaire that assesses the level of disability in patients with various upper limb disorders. It is widely used in clinical practice and research worldwide although it is few applied for workers with upper limb complaints.

**Objective:** The present study aimed to validate the Brazilian Version of Quick-DASH (QD-Br) in patients with work-related musculoskeletal upper limb disorders with the hypotheses of moderate correlation of QD-Br with fatigue, ergonomic, and function questionnaires.

**Methods:** Were included workers with pain and musculoskeletal discomfort in the upper limbs and cervical region perceived

from a university hospital without a clinical diagnosis. The study was part of the randomized clinical trial registered on Clinicaltrial.gov NCT 04047056. The discomfort, fatigue, work capacity, pain, and dysfunction were evaluated by: Numeric scale of pain (NSP), grip strength, isokinetic shoulder abduction, upper limb fatigue with Functional Impairment Test-Hand, and Neck/Shoulder/Arm (FIT-HaNSA), Need for recovery Scale (NRS) and Work ability index (WAI), Patient-specific functional scale (PSFS-Br), Neck Disability index-Br (NDI-Br) and Quick Exposure Check (QEC-Br) with hypotheses of moderate correlations with Quick-DASH-Br. SPSS™ calculated Pearson Correlation Coefficient,  $p < 0.05$ , with benchmarks of direction and strength of association by Dancey & Reidy (2020).

Results: 85 volunteers, mean age of 47.6, were 57% male and 43% female. Regarding the construct validity, a strong correlation was observed between the QuickDASH-Br score and NDI-Br ( $r = 0.72$ ), moderate correlation between NSP, grip strength, PSFS-Br, and WAI respectively ( $r = 0.47; -0.42; -0.43; -0.57$ ) and poor correlation with QEC-Br, isokinetic and FIT-HaNSA.

Conclusion: This study suggests that QuickDASH-Br could be used as a valid instrument for upper limb evaluation in a group of workers with upper limb complaints in the Brazilian population. Association of cervical pain with the upper limb was present and could be included in the assessment of workers with upper limb complaints. However, more studies are necessary to assess responsiveness.

#### **A-0762** RELIABILITY AND CONCURRENT VALIDITY OF A NEW BLUETOOTH ENABLED GRIP DYNAMOMETER (SQUEGG) FOR MEASURING GRIP STRENGTH: A CROSS-SECTIONAL STUDY IN ASYMPTOMATIC SUBJECTS: A PILOT STUDY

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Purpose: Assess hand-healthy individuals' grip strength agreement using Squegg and Jamar dynamometers.

Methods: This study of reliability and validity used a repeated measures design to control for individual participants' differences. Participants were randomized into two groups and numbered one to sixty: Right and left grip strength of odd-numbered female and male participants was measured with the Jamar dynamometer first and the Squegg dynamometer second. Even-numbered participants were measured sequentially opposite. The alternate sequence controls for potential fatigue effects. The design is consistent with the Mathiowetz et al. (2000) study, which compared the Jamar and Rolyan dynamometers.

Participants: Participants were recruited from the community and were tested at Rothman Orthopaedic Institute locations. Sample size included 44 females from 22 to 80 years of age with a mean age of 40.6 and 16 males from 23 to 67 years of age with a mean age of 44.6 years. Exclusion factors included any prior hand fracture, osteoarthritis, neuropathy, or diabetes. Instruments: Jamar® hydraulic hand dynamometer (J. A. Preston Corporation, Clifton, NJ) and Squegg hand dynamometer (Plantation, FL) were used for measuring participants' grip strength. The Jamar was set at the second handle position from the inside for all testing. The Squegg was used held in the hand with the fingers in the finger indentations.

Procedures: Participants were positioned with shoulder in adduction, elbow in 90 flexion, forearm in neutral rotation and wrist in 0-30 degrees extension. Subjects did not rest their arm on a surface during testing. Each time, verbal reinforcement was, 'Harder! ... Harder! ... Relax'. Three successive measurements were taken for the right, then left hands. 15 seconds rest was given between trials. Afterwards, there was a timed 5-minute interval until the right hand was tested again with the second dynamometer, during which the left hand was tested. Measurements were recorded in pounds. Squegg dynamometer grip measurement displayed on the Squegg app on the evaluator's cellphone via Bluetooth. Four Certified

Hand Therapists collected the data. Participation duration was a single 30 minute session collected over 2-4 weeks. Results: The paired data t-test for male and female participants indicate a significant difference between the Jamar and Squegg dynamometers for the right and left hands. The statistical difference between the means of the two dynamometers indicates weak evidence of concurrent validity between the Jamar and Squegg dynamometers. ICC (Inter Class Coefficient) values between the two dynamometers ranged from 0.320 to 0.528, suggesting weak inter-instrument reliability. Conclusion: The Squegg dynamometer does not show acceptable concurrent validity with the Jamar dynamometer. The small p value  $< 0.05$  indicates strong evidence against the null hypothesis. Difference ratio between the two is not consistent across groups or between hands. Therefore, the two devices cannot be used interchangeably to assess grip strength. The Squegg can be used clinically but cannot be compared 1:1 to Jamar measurements. Future studies should address a larger population and equal age and gender distribution. Possible future applications include use in telehealth for grip strength assessment and an exercise tool for home and clinic use by patients with flexor tendon injuries.

### **A-0763** FUNCTIONAL OUTCOME OF NERVE TRANSFERS FOR MIXED HIGH MEDIAN AND ULNAR NERVE INJURIES

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Introduction: Mixed median and ulnar nerve injuries at high level result in great disability in the limb. Primary repair of a high ulnar and median nerve injury results in a uniformly poor outcome because of great distance between the site of injury and the innervated muscles. Nerve transfers are one of many options available to surgeons caring for these patients when they present early because this is a much better approach than the traditional primary neuroorrhaphy only as this converts proximal to distal repair. Here, Great limitation is the unavailability of donor nerves. Branches from the radial nerve are the only option for these transfers.

Objective of this presentation is to share our experience of nerve transfers for mixed high median and ulnar nerve injuries in terms of functional outcome.

Material and methods: Prospective study of 4.5 years conducted from January 2017 to July 2021 with total number of 24 patients with mixed high median and ulnar nerve injuries. Mixed high median and ulnar nerve injuries were managed with transfer of supinator branch to FDS, branch to ECRB to AIN and branch to BR to ulnar motor.

Results: This resulted in timely return of function to the ulnar and median innervated extrinsic and intrinsic muscles of the hand that were documented further by electromyography. Sensations were also improved measured by fine touch, pain and 2 points discrimination tests.

Conclusion: Distal nerve transfers from the branches of radial nerve for the treatment of mixed high ulnar and median nerve injuries allow for a shorter reinnervation period and improve recovery resulting early returning of function of the hand.

## **A-0765** DETERMINING THE VALUE OF HAND SURGERY: A META-ANALYSIS OF HEALTH UTILITIES FOR HAND AND WRIST CONDITIONS

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### INTRODUCTION

Health state utility values (HSUVs) describe the desirability of a health state. HSUVs are calculated by asking people (including the public, patients and professionals) about their preferences for health states in different types of experiments. HSUVs are scaled from 0 (equivalent to death) to 1 (equivalent to full health). HSUVs provide the quality component of Quality-Adjusted Life Years (QALYs) and are thus essential for health economic analyses. HSUVs can vary between populations and by derivation method, meaning a range of HSUV can exist for a single health state. Using appropriate HSUVs is essential when studying cost-effectiveness in processes like NICE's Technology Appraisal. The aim of this systematic review was to determine how utilities have been measured, assess the quality of estimates and collate utility values for common hand and wrist conditions.

### METHODS

A PRISMA-compliant PROSPERO-registered systematic review was conducted. EMBASE, MEDLINE, CINAHL and CENTRAL were searched up to December 2020, using strategies comprising index and free text terms. All studies that measured the value of hand and wrist health states in adult patients were eligible for inclusion. This included primary utility derivation studies, decision models, discrete choice experiments and clinical studies which used PBMs as outcome measures. Abstract screening and data extraction was performed in duplicate. Pooled utility estimates were determined across conditions and intervention status using random effects models.

### RESULTS

Collectively, 56 studies reporting 341 HSUVs across 20 hand and wrist conditions were identified. HSUVs were estimated using a range of direct and indirect methods methods. The commonest measure used to estimate HSUV was the EQ-5D. Health states were valued by a range of respondents including patients, the public, healthcare professionals, and medical students. Utility derivation methods and respondent group affected the magnitude of HSUVs for similar health states. HSUVs

### DISCUSSION

HSUVs for similar health states demonstrate marked variation. Use of current HSUVs for health economic analyses of interventions for hand and wrist conditions may lead to under or over-estimation of intervention effect. In this presentation, we will present pooled utility estimates for common hand and wrist conditions stratified by condition and intervention status. We will outline steps which may lead to more accurate utility estimates in hand surgery through wider use of multi-attribute utility measures and hand-specific preference-based measures.

**A-0766** THE EFFECT OF A CORRECTIVE OSTEOTOMY ON PATIENT-REPORTED FUNCTION, PAIN AND AESTHETICS, IN PATIENTS WITH A SYMPTOMATIC DISTAL RADIUS MALUNION

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**Objective**

Malunion of the distal radius is a common complication after treatment of a distal radius fracture and can result in symptoms of function loss, pain and aesthetic loss. Patients with a symptomatic distal radius malunion may benefit from a corrective osteotomy. Most studies which focus on corrective osteotomies are mainly interested in the improvement of radiographic parameters or objective functional outcome measurements. However, these outcomes are poorly associated with the improvement of the ability to use the wrist in daily life and with patient satisfaction. Therefore, this study aims to evaluate the symptom-specific therapeutic value of a corrective osteotomy on patient-reported function, pain and aesthetics in a large patient population.

**Methods**

A retrospective cohort study with prospectively collected data was performed. We included adult patients with symptomatic distal radius malunion. All patients underwent a corrective osteotomy. Patients filled in the patient-rated hand wrist evaluation (PRWHE) and the VAS pain before and one year after surgery. We divided patients into subgroups based on their symptoms before surgery: function loss (PRWHE function score  $\geq 20$ ), pain (PRWHE pain score  $\geq 20$  and/or VAS pain  $\geq 40$ ), and aesthetical loss (PRWHE aesthetics score  $\geq 4$ ).

**Results**

A total of 163 patients were included for analysis. Most patients (62%) had a combination of symptoms at baseline: function loss, pain and aesthetic loss. The other patients had one or two of these symptoms. Patients with function loss and pain showed significant improvements in the PRWHE function and the VAS pain score. Patients with pain and aesthetical loss had significant improvements in the PRWHE function, the PRWHE pain, the VAS pain, and the PRWHE aesthetics score. Patients with aesthetical loss and function loss had significant improvements in the PRWHE function, the VAS pain, and the PRWHE aesthetics score. Patients presenting with all three symptoms showed significant improvements in all symptoms. A total of 82 patients (50%) had no/low symptoms one year after surgery.

**Conclusion**

Corrective osteotomy in patients with a symptomatic distal radius malunion leads to improvement in function, pain and aesthetics 12 months after surgery. Improvements in patient-reported outcome measures can be differentiated by individual baseline symptoms and in some cases extended to the improvement of more aspects of the wrist.

**A-0768** MODIFIED HEMIREESECTION INTERPOSITION ARTHROPLASTY FOR DISTAL RADIOULNAR JOINT OSTEOARTHRITIS

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**Hypothesis**

Hemiresection interposition arthroplasty (HIA), which can preserve TFCC and DRUJ function, is one of surgical options

for DRUJ osteoarthritis. We hypothesized that modified HIA combined with TFCC repair (reconstruction) can obtain good functional and radiological results for DRUJ osteoarthritis.

#### Methods

Twenty-one wrists in 20 patients (9 males and 11 females, averaged age was 62 years) with DRUJ osteoarthritis were treated. Patients with rheumatoid arthritis were excluded. Preoperative ulnar variance value averaged 1.8 mm (ranged from -3 mm to +9 mm). The average length of follow-up period was 2 years and 10 months (ranged from 5 months to 12 years). The current modified procedure included extensor retinaculum as well as dorsal DRUJ capsule for interposition, and TFCC repair or reconstruction were conducted. Functional outcomes were evaluated by visual analogue scale (VAS) for wrist pain, disabilities of the arm, shoulder, and hand (DASH), patient-rated wrist evaluation (PRWE), range of wrist and forearm motion (palmar-volar flexion and pronation-supination), and grip strength (% of the contralateral value). X ray parameters (width of the ulnar head, DRUJ gap) were assessed. A p value of less than 0.05 was considered to indicate a statistically significant difference.

#### Results

The postoperative grip strength and range of wrist and forearm motion improved significantly ( $p < 0.05$ ), and VAS for pain and PRWE improved larger than minimum clinical important difference (MCID of VAS 9.9 mm, PRWE 24 points). Functional outcomes of patients with or without positive ulnar variance ( $>3\text{mm}$ ) showed comparable results. The width of ulnar head at the final follow-up was decreased significantly when comparing to the immediate post-surgery value. The DRUJ gap distance maintained sufficiently in averaged value of 5.3 mm (ranged from 2.1 mm to 14.8 mm) at the final follow-up.

#### Conclusion

The current modified HIA procedure combined with TFCC repair or reconstruction provide feasible short-term functional outcomes for treatment of patients with DRUJ osteoarthritis regardless of preoperative ulnar variance. The radiological assessment of DRUJ morphology resulted in tapering of resected ulnar head but maintenance of DRUJ gap distance after the surgery.

## **A-0769** THE USE OF MASQUELET TECHNIQUE TO TREAT A SEPTIC ARTHRITIS OF A THUMB'S METACARPOPHALANGEAL JOINT: CASE REPORT

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#### Introduction

Septic arthritis of the hand is a serious disease that often results in dysfunction of the joint or even the need to perform amputation of the finger. These small articulations are the second most frequent target for the pathogens, after the knee. The index and middle are the most prevalent fingers involved in this process. The majority of cases are caused by penetrating trauma, animal bites, etc. *Staphylococcus Aureus* is the most prevalent microorganism involved in these pathologies. In case of destruction of the cartilage and osteomyelitis, bone resection and arthrodesis are the most useful treatment in order to improve the pain and eliminate the infection.

#### Material and method

We present a case report of a 41 years old man affected by a septic arthritis of the metacarpophalangeal joint of the thumb after a surgical procedure caused by traumatic events. This infection destroyed de cartilage and the surrounding bone quickly. In this scenario, the surgical debridement and antibiotic treatment was insufficient, so we used the Masquelet technique. A generous wound debridement and affected bone removing was performed in a first surgery, an external

bone fixation system was used and a gentamicin cement filling the defect. Iliac crest bone graft replaced this cement in a second surgery, and an arthrodesis of the joint was performed. These two surgeries were separated by 10 weeks of antibiotic therapy.

#### Results

The infection was solved and the complete arthrodesis occurred 6 months after the surgery. Patient have no pain and he can use his hand for the daily living activities. The pinch strength is almost normal and he only complains to perform fine activities.

#### Discussion and conclusions

The gold standard treatment for small hand joint infection is the debridement and antibiotic therapy, but in some advanced cases, that's not a good option.

Several studies have demonstrated the effectiveness of the Masquelet technique in the treatment of bone defects caused by trauma or infection. However, only few studies have reported the use of this technique for septic arthritis in small joints of the hand, and its effectiveness in treating septic arthritis in metacarpophalangeal joints remains unclear. Facing a large articular destruction caused by a septic process, this two-steps technique could be a good option to preserve the finger and solve the infection.

### **A-0771** INVESTIGATION OF THE RELATIONSHIP BETWEEN ANXIETY AND DEPRESSION LEVELS, PAIN PERCEPTION, PERCEIVED VALIDATION AND CRITICISM IN PAIN IN PATIENTS WITH CHRONIC SHOULDER PAIN

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**Objective:** Shoulder pain is the third most common musculoskeletal problem presenting to physicians or physiotherapists in primary care settings and tends to be chronic. Psychological factors seem to play a role in explaining why musculoskeletal pain becomes chronic after tissue damage has healed in patients with chronic shoulder pain. The aim of this study; to investigate the relationship between anxiety and depression levels, pain perception and perceived validation and criticism in pain in patients with chronic shoulder pain.

**Methods:** A total of 111 patients, 88 (79.3%) women and 23 (20.7%) male, there is pain in the shoulder for at least 6 months were included in our study. The majority of diagnoses had rotator cuff injury (n=42, 37.8%), while the remaining patients had adhesive capsulitis (n=24, 21.6%), subacromial impingement syndrome (n=21, 18.9%), pain after soft tissue injuries (n=15, 13.5%) and pain after scapula, clavicle and proximal humerus fractures (n=9, 8.1%). Using Hospital Anxiety and Depression Scale (HADS), the risk of anxiety and depression was evaluated. Using the Centrality of Pain Scale (COPS), it was evaluated how central, or dominating, in their lives patients with chronic pain perceive pain to be. Perceived validation and criticism by others when in pain were assessed using the Perceived Validation and Criticism Questionnaire in Pain Questionnaire (PVCQP). Correlation between questionnaires was evaluated using the Spearman Correlation test. Statistical significance level was accepted as  $p < 0.05$ .

**Results:** The average age of the patients included in our study was  $54.68 \pm 10.37$  years. The average duration of chronic shoulder pain was  $28,12 \pm 23,32$  months. The average working time was  $14.25 \pm 11.97$  years. Strongly positive correlation was found between Anxiety subscale of HADS and COPS ( $r=0.610$ ,  $p < 0.001$ ), and moderately positive correlation was found between Depression subscale of HADS and COPS ( $r=0.566$ ,  $p < 0.001$ ). Weakly negative correlation was found between Anxiety subscale of HADS and validation subscale of PVCQP ( $r=-0.231$ ,  $p < 0.001$ ), and weakly positive correlation

was found between Anxiety subscale of HADS and criticism subscale of PVCPCQ ( $r=0.372$ ,  $p<0.001$ ). While there was no statistically significant relationship between Depression subscale of HADS and validation subscale of PVCPCQ ( $p>0.05$ ) and weakly positive correlation was found between Depression subscale of HADS and criticism subscale of PVCPCQ ( $r=0.289$ ,  $p<0.001$ ). Weakly negative correlation was found between COPS and validation subscale of PVCPCQ ( $r=-0.340$ ,  $p<0.001$ ), and moderately positive correlation was found between COPS and criticism subscale of PVCPCQ ( $r=0.404$ ,  $p<0.001$ ).  
Conclusions: Our results show that there is a relationship between anxiety and depression levels, pain perception and perceived validation and criticism in pain in patients with chronic shoulder pain. Chronic shoulder pain is a complex syndrome and recovery rates are poor. Therefore, the relationship of these parameters should be considered in reducing the severity of pain and improving physical and psychological symptoms in patients with shoulder pain.

### **A-0772** SUBUNGUAL SQUAMOUS CELL CARCINOMA OF THE THUMB: CASE REPORT AND REVIEW OF LITERATURE

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Subungual squamous cell carcinoma are rare tumors that arises from the digits, most commonly the thumb and great toe. These tumors are frequently diagnosed late due to them presenting as chronic wounds or wart infections. They are low grade tumors which rarely have nodal involvement, and their treatment options include surgical resection +- amputation, and radiotherapy for patients who cannot tolerate surgery. We present a case which underwent tumor excision and immediate reconstruction of the digit.

### **A-0773** EFFICIENCY OF TELEPHONE CONSULTATIONS FOR INITIAL ASSESSMENT IN A HAND THERAPY CLINIC

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Objective: A hand therapy outpatient clinic introduced telemedicine during pandemic to avoid cross-infection risk and to reduce patient waiting lists. Telephone consultations (TC) were offered for the initial assessment and potential follow-ups of routine cases. This study aims to provide insides on the efficiency of TC from a therapist's perspective for using telephone consultation in a routine hand therapy caseload.

Methods: This is a retrospective study based on the initial assessments that were offered through TC. The caseload was based on referrals from the general practitioner for routine hand therapy assessment. Consultations were carried out by a single senior therapist during a period of 22 months. The study addresses the number of offered appointments, in contrast with the need for a physical follow up. It also analyses the diagnosis range and the outcome of each case (did not attend, discharged, referred to different specialty).

Results: A total of 176 initial TCs were made. The efficiency of the intervention was estimated by classifying the consultations as successful TC only, requiring a physical visit, or no successful telephone contact. 40.9% of the patients had a successful TC only treatment. Furthermore, we divided them into 2 groups dependent on the outcome of the overall treatment: resolved and unresolved. 78.4% of all cases were resolved. The results support the conclusions of earlier studies that much of the work of a clinic can be managed on the telephone but that many patients (almost 50%) need to be seen in person. The waiting time to speak to a therapist is greatly reduced by the introduction of telephone consultations.

Conclusions: From the clinicians' perspective, TC is adequate in appropriate patients as the primary mode of consultation for routine caseload in a hand therapy clinic. Telephone consulting could work well for patients with straightforward problems or those needing routine follow-up. In conclusion, a well-structured framework based on telemedicine and in-person can ensure safety of healthcare and can be effective for a busy clinic. Future research should be done on a larger scale, and an analysis of cost-effectiveness ratio should be done. Telemedicine is a feasible option in a hand therapy department and an interesting resource to preserve post-pandemic.

Keywords: Hand therapy; COVID; telemedicine; telephone consultation.

## **A-0774** THE CLINICAL APPLICATION OF FREE ANTEGRADE VENOUS FLAP FOR DIGIT LARGE DEFECTS REPAIR

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**Purpose** To investigate the clinical effect of repairing the large digit tissue defects using a free antergrade venous flap that elevated between the wrist and elbow regions.

**Methods** 18 patients with 23 finger were identified as having large digital tissue defects between March 2016 and October 2021, which were repaired using a free flap. All flaps were arterialized flow-through flaps with the venous anastomosis as the outflow. The average age of the patients, including 15 male and 3 female, was 34 years (range, 22-55 years). The defect involved the finger dorsal in 11 patients and the volar in 7 patients. The mean wound size was 7 cm<sup>2</sup> (range, 2.0×1.5 to 5.5×2.0 cm<sup>2</sup>). The patients were followed-up for a mean period of 10 months (range, 6-15 months). The survival and the complications of the flap were evaluated. The color match of the flaps are evaluated at 6 months postoperatively by assigning a score.

**Results** The mean area of the flap was 8 cm<sup>2</sup> (range, 2.5×2.0 to 6.0×3.5 cm<sup>2</sup>). A vascular crisis due to a venospasm occurred within 48 hours in 3 flaps, but ultimately, all the flaps survived completely excepting four had only partial marginal necrosis with ultimately healing by no-operation. All the patients returned to their previous work after 10-12 weeks. No pain or significant scar contracture was reported in either the recipient or donor site. The flap showed complete viability with little postoperative atrophy in all 18 patients. The mean color match score for the flaps was 3.7, and it decreased as the flaps were raised further from the wrist region.

**Conclusions** The free antegrade venous flap harvesting from the wrist or forearm region can be used for repair the large tissue soft tissue defects of the digit, resulting in acceptable wound coverage.

## **A-0775** UNSTABLE FOREARM LESIONS. CLASSIFICATION SYSTEM AND CLINICAL RESULTS IN A PROSPECTIVE SINGLE-CENTER CONSECUTIVE SERIES

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### Introduction

The forearm joint is based on the integrity of Proximal, Middle, and Distal Radio Ulnar Joint (PRUJ, MRUJ, DRUJ). Unstable Forearm Lesions (UFL) include a wide range of traumatic patterns in which two or three forearm lockers have been damaged. They may cause transversal and longitudinal instability, respectively when two and three lockers are involved.

Historical types of UFL include Galeazzi, Monteggia and Essex-Lopresti lesions. Other uncommon and rare traumatic patterns have been reported in the literature and recently classified in a comprehensive classification system developed by our study group.

The aim of our study was the evaluation of clinical results in a consecutive series of UFL surgically treated in our Tertiary Referral Trauma Center in a three-year period of time.

#### Methods

From June 2018 to June 2021, we treated 21 patients with 24 UFL (3 bilateral cases).

Three patients were lost to follow-up, 1 was excluded from the study because he was involved in a severe polytrauma with residual neurological impairment, and 1 patient died.

The clinical evaluation was performed with Mayo Wrist Score (MWS), Mayo Elbow Performance Score (MEPS), Disability of the Arm Shoulder Hand (DASH). A new specific forearm score, the Forearm Italian Performance Score (FIPS) was also used. Surgical treatment was performed according to the concept that in case of two and three lockers injuries, respectively at least one or two lockers must be repaired in order to avoid residual transversal and longitudinal forearm instability.

#### Results

At the time of follow-up 16 patients (17 cases) were available for the study.

There were 9 men and 7 women, with a mean age of 36.6 years (range 17-66 years). The

Time of follow-up ranged from 12 to 36 months.

We observed 6 Monteggia (including 1 open fractures), 5 Galeazzi, 3 radius and ulna fractures with DRUJ disruption, 1 open ulna fracture with DRUJ disruption, 1 Essex-Lopresti and 1 Leung crisscross injuries.

The functional results observed in our series were reported in mean, median, and range.

MWS: mean 86.2, median 90.0, range 55-100;

MEPS: mean 89.1, median 100, range 45-100;

FIPS mean 69.7 median 70, range;

DASH mean 16.2, median 14, range 1-44;

The results were good to excellent in 13/17 patients (>75 points) for MWS, in 13/17 patients (>80 points) for MEPS, and in 8/17 patients (>75 points) for FIPS score.

#### Conclusions

Surgical treatment of UFL lead to positive results when forearm injuries are correctly evaluated and operated according to the three lockers concepts. Most patients were satisfied according to subjective results and residual disability.

We observed a partial disagreement of evaluation between the scores used. In our opinion it can be explained because the elements considered in the evaluation, and the score attributed to the different parameters may vary according to the type of score.

## **A-0776** REVIEW OF SEVEN YEARS RESULTS WHEN TREATING IV STAGE OF DUPUYTREN'S DISEASE WITH NEEDLE FASCIOTOMY

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**Purpose:**The purpose of this study is to report results, reduction of contracture, complications and recurrence after seven years. A common protocol for review was made. Dupuytren's disease (DD) previous surgery, age 40-78, affected family,

bilateral DD, degree of contracture. Percutaneous needle fasciotomy (PNF) is a minimally invasive technique used to manage IV stage of Dupuytren's contracture.

**Methods:** We selected 189 fingers with DD stage IV according to Tubiana's classification. The contracted Dupuytren's tissue is divided longitudinally along multiple points so that the finger can stretch out straight again. The procedure is performed with a needle through the skin and the sharp, small bevel of the needle is used to cut the Dupuytren's tissue beneath the skin. We also administer a corticosteroid injection to the treatment area at the time of the procedure. Stretching, exercises and extension splinting during the recovery phase are important to gain maximum benefit from the procedure. The patients were evaluated preoperatively and per-operatively at one, eight, twenty-four weeks, after one, two, three, four, five, six, seven years. 167 patients with 189 fingers were operated. Median age was 59 (40-78) with 159 men and 8 women.

**Results:** Finger most seriously affected was little. MCP joint was affected in 189 fingers and PIP was affected at the same time as MCP in 62 cases. Side effects like edema was present in 14 cases. Local puncture pain was variable and disappeared after two days. Skin rupture occurred in two cases. Complete healing was evident after seven days. Treatment of MCP in cases of both joints. MCP and PIP affected usually obtained complete MCP elongation and PIP complete elongation. One week after surgery patients were allowed to return to full work activities. No cases of flexor tendons lesions, hematomas or infections were registered. No scar formation, no palpable cord occurred.

**Conclusions:** Needle fasciotomy is a good method for treatment of IV stage DD. Patients feel very comfortable as minimal side effects and can avoid the operating theater. Needle fasciotomy does not involve incisions to the skin of the hand, so there is less tissue damage, less pain, less swelling, less down time quicker healing, less expensive and less time-consuming. PNF is a good alternative in cases with IV stage of DD because of these preliminary good results and low morbidity.

## **A-0778** EVALUATION OF DONOR-SITE MORBIDITY AFTER RADIAL FOREARM FLAP ELEVATION: COMPARISON BETWEEN TWO DIFFERENT COVERAGE STRATEGIES

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**Introduction:** Radial artery forearm free-flap (RAFFF) is one of the most frequently used free tissue transfers. The study aims to evaluate the surgical and functional outcomes of donor site reconstruction in a consecutive series of patients who have undergone RAFFF.

**Materials and Methods:** A retrospective analysis of patients undergone RAFFF from 2016 to 2022 was performed. Data were extrapolated from medical and operating records. All enrolled patients met the study inclusion criteria. The followings were considered as outcome measures: duration of the procedure, hospital stay, size of the donor-site defect and postoperative complication rate (<90 days, according to Clavien Dindo classification). Functional outcomes were evaluated through validated tools and questionnaires: Vancouver scar scale, POSAS scale, Scar Pinch Test, and aROM. Patient-reported outcomes were inquired using a 3 items ad-hoc created questionnaire. Moreover, a sub-analysis was carried out according to the reconstructive technique applied to the donor-site defect. In Group A a full-thickness skin graft (FTSG) while in Group B a single-layer dermal matrix with split-thickness skin (STSG) graft was applied.

**Results:** 34 patients were included in the study. Group A included 18 (53%) patients, whereas 16 (47%) patients were assigned to the group B. Mean follow-up was 24 months (IQR 11-40). Mean age was 33 years (IQR 27-46). Preoperatively, no significant differences among the groups were recorded. The median donor-site defect was 302 cc (IQR 306-323,

p=0.21). No intraoperative complications were detected. Overall, early postoperative complications were described in 23.5% of cases. According to Clavien-Dindo classification, we recorded Grade 1 in 14.7%, Grade 2 in 5.8%, and Grade 3a and Grade 3b in a single case (2.9%) respectively. Mean graft take was 91%. A complete graft take was detected in 58.9% of the patients. Considering the two groups separately, a significant advantage for group B (93.8%) was recorded when compared to group A (27.8%) (p= 0.0001). Furthermore, in Group B a significantly shorter operative time (310min vs 447min p= 0.0001) and a reduced median hospital stay (8 days vs 10 days p= 0.001) were recorded compared to Group A. From a functional point of view, in both groups the results were satisfactory, overall 80% were satisfied with the appearance of the arm, and 92% with the post-surgery functionality and the possibility of resuming the previous work activity. Considering the two groups separately, Group B reached a significantly higher satisfaction rate in terms of arm appearance compared to group A (94% vs 66% p = 0.048).

The small sample size, short follow-up, the absence of randomization, and the single-center nature of the study are the most important limitations

Conclusions: FTSG or single layer dermal matrix with STSG for donor-site reconstruction after RAFFF provides satisfactory surgical, functional, and aesthetic outcomes. The single-layer dermal matrix combined with a STSG showed better surgical and functional results when compared to FTSG alone.

## **A-0782** CORRECTIVE OSTEOTOMIES OF THE UPPER LIMB

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### Introduction and Aim:

Malunions of fractures of the upper limb can cause deformity, pain, restriction of range of motion, reduction of strength and at later stages development of joint osteoarthritis. The indications to treatment are young and symptomatic patients but also older patients with an active life. The classical method of measurement of bone and joint axis of the different upper limb bones on XRays are very useful, but also comparative XRays, as well as CT scan which is mandatory in order to understand the tridimensional malunion. Custom made plate and engineer assisted osteotomy guide systems can be useful in selected cases in complex malunions. Aim of the study is evaluate the results of the treatment of several malunions of the upper limb at different levels

### Materials and Methods

From 2018 to 2022 we have treated 24 malunions of the upper limb: 6 humerus, 7 radius, 1 forearm, 5 ulna, 2 metacarpals, 3 phalanges. Mean age 38 (11- 70 yo), 6 females and 18 males. Patients were reviewed with a mean follow up of 18 months (5 – 60months) with Mayo wrist or elbow score, DASH, PRWE, VAS scores, XRays check. Closing wedge osteotomy was used for distal humerus and and open wedge for the rest of the patients, in two cases bone graft was used. The majority of patients were treated with plate and screw fixation, one kid was treated with K wire and external fixation was used in phalanges correction. In one case of forearm complex malunion engineer assisted guide system was used.

Results: all patients obtained an excellent score with the Mayo wrist score or Mayo Elbow score with an excellent recovery of function at Follow-up. All malunion united. One case of distal radius had a loss of radiographic correction at FU and one elbow had a residual stiffness of 20° in extension (already present in the pre-op). Mean DASH was 7.8, mean PRWE was 6.6, VAS 0,5.

Discussion and conclusions: corrective osteotomies are safe operations that allow optimal correction of post-traumatic

upper limb deformities in order to improve function and prevent osteo-arthritis. The preoperative planning is essential with Xrays and CTscans. Custom made systems are useful in selected cases. Modern internal fixation systems allow an optimal correction and stabilization of the fragments. Osteotomies are indicated in young patients with malunions of the upper limb bones but also in older symptomatic, active and independent patients.

### **A-0783** AUTOLOGOUS CHONDROCYTE TRANSPLANTATION IN THE TREATMENT OF THUMB CMC JOINT OSTEO-ARTHRITIS: FROM A TWO-STAGE TO A ONE-STAGE TECHNIQUE

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**Introduction:** Degenerative thumb carpometacarpal (CMC) joint osteoarthritis is a common disease in women. Several treatments are advocated but none is able to restore a normal joint. The aim of this study was to evaluate the outcome of patients treated with autologous chondrocyte transplantation at the thumb CMC joint at early stages.

**Materials and methods:** a prospective study on 10 cases of thumb CMC osteoarthritis in 8 patients was done. The thumbs were stage Eaton II (2 cases) and III (8 cases) and were treated by CMC arthroplasty with the implant of autologous chondrocytes by an open or arthroscopic technique. Two patients were treated bilaterally. Mean preoperative pinch strength was 3.7 Kg pain on VAS was 8, DASH was 55. All patients had limited abduction and flexion of the thumb. Ethics committee approval was obtained for this study. Fragments of 3–4 mm of cartilage were harvested from the wrist or elbow joint. Cartilage cells were sent to the laboratory to be grown on a collagenous biphasic matrix (MACI/Novocart1) and then implanted in the thumb CMC joint (two stage). The technique evolved in a one stage technique with a collagen scaffold added with bone marrow derived cells. All patients were females aged 42–67 years (mean 52 years). The dominant hand was treated in 6 cases. Partial trapezium resection and dorsoradial ligament reconstruction was added to stabilize the CMC joint in most cases. Patients were seen in person at 1, 3, and 6, months, 1 year, 2 years, and 5 years after the initial surgery. Nine cases were then reviewed at a mean follow up 8 years (range 4.4–11 years); pain on VAS, Mayo, DASH and PRWE scores were evaluated at follow-up.

**Results:** One patient was lost to follow-up after 2 years. Of nine hands, seven had an excellent result according to Mayo score, one had a good result. One thumb CMC joint was still painful and was reoperated and converted to arthroplasty after 4.4 years. All patients regained full range of motion. Mean pinch strength increased to  $6.25 \pm 1.3$  Kg, mean DASH score was  $7.3 \pm 6.7$ ; pain on VAS was  $1.0 \pm 1.5$ ; these data were statistically significant compared to preoperative values ( $p < 0.01$ ). Grip strength also increased in all cases, but this was not statistically significant. PRWE was  $7.7 \pm 6.4$ . No complications occurred postoperatively.

**Discussion:** The results obtained are encouraging since the implanted cartilage has lasted a mean of 8 years and up to 11 years. Biological tissue engineering techniques are developing and could be a new solution to restore normal cartilage in young patients to postpone more aggressive surgical procedures to an older age. In cases of CMC joint instability, a ligament stabilization procedure was added to avoid subsequent damage to the implanted neocartilage. A longer follow-up and a greater number of cases are necessary to definitively establish the usefulness of this procedure, which has the advantage of being completely biological. The costs have been greatly reduced with the one stage technique.

**A-0784** ISOLATED LUNATE FRACTURE NONUNION: A CASE REPORT OF CHRONIC WRIST PAIN IN A 37-YEAR-OLD MALE  
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**Introduction:**

Lunate fractures are considered rare to get fractured accounting for 0.5-1% of all carpal fractures. Usually they are accompanied with other wrist injuries rather than isolated. Usually patients will present late to seek medical advice and they will be complaining of limitation on in wrist motion and chronic pain. As a sequel if left untreated patient may develop avascular necrosis of the lunate.

**Case presentation:**

We report a case of 37-year-old male with no prior medical history complaining of right wrist pain, painful grip and limited range of motion for 2 years. Further imaging was ordered which included Magnetic resonance imaging (MRI) and showed signs of prior partial displaced lunate fracture with signs of nonunion and signs of partial injury of scapholunate ligament and injury to the triangular fibrocartilage complex (TFCC). Patient underwent wrist arthroscopic TFCC repair, SL repair and open reduction internal fixation with 2 headless screws. Follow up after 6 months of post-operative management showed good bony union with no signs of avascular necrosis of the lunate bone.

**Conclusion:**

Lunate fractures are rare fracture to be isolated, so high suspicious of index should be there whenever there is history of fall over the wrist with normal plain radiographs. Early intervention with open reduction internal fixation for displaced lunate fractures in order to prevented further complications such as avascular necrosis of the lunate.

**A-0785** MEDIAL FEMORAL CONDYLE FREE FLAP IN THE TREATMENT OF NON UNIONS AND BONE NECROSIS OF UPPER LIMB: AN EXPERIENCE OF 28 CASES

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**Introduction**

Since a few years, after Prof Masquelet's description in 1989 of the anatomy of the medial femoral condyle region and its possible uses, the medial knee area has become one of the most frequently used sites by hand and upper limb surgeons to augment biological bone healing.

Vascularized bone grafts taken from the medial femoral condyle can be of three types: pure corticoperiosteals, corticoperiosteals with cancellous bone, and osteochondral corticoperiosteals, with a portion of cartilage

Those corticoperiosteal can be taken to wrap are used in the treatment of pseudoarthrosis of the long bones or to replace parts of the metacarpals or phalanges; those with spongy tissue especially for pseudoarthrosis of the scaphoid where massive bone grafts are needed in young patients; and osteochondral ones that are indicated in the reconstruction of bone defects of the proximal pole of the scaphoid and semilunar for postrumatic pathology or avascular necrosis.

**Materials and Methods.**

We report the results of 28 cases of CFM use in the upper limb. 17 cases for long bones, 3 cases for scaphoid pseudoarthrosis,

and 8 cases for osteochondral grafting from 2014 to 2021.

Specifically, 8 cases for radius, 6 for ulna, 2 for the humerus, and 1 for metacarpal; 3 for scaphoid pseudoarthrosis, 5 for scaphoid proximal pole necrosis or pseudoarthrosis, and 3 for Kienböck's disease.

The results are reported with an average follow-up of 12 months ( $\pm 4$  months); through functional assessment and Quick Dash and radiographic evaluation at 2 and 6 months and VAS. As for the wrist also through the Mayo Wrist score.

#### Results

We had only one complication regarding the retrieval site. A medial condyle fracture, compounded in an extremely overweight patient (corticoperiosteal harvest with free spongiosa graft (healed with 3 months of unloading in the lower limb). Regarding pseudoarthroses of the long bones, we had consolidation in all treated cases in 3 months on average ( $SD \pm 1$ ). Only in 7 cases, a new synthesis had to be performed.

Regarding osteochondral grafts, we have had no failures at the moment with an average healing time of 3 months ( $SD \pm 1$ ). We have had only one failure in a scaphoid treated for the middle portion in a multi operated patient and a salvage operation was necessary.

#### Conclusions

Indications for use of the internal portion of the femoral condyle are expanding over time given the minimally invasive nature and comforting results. The various techniques and methods of graft fixation are described in the report with the degree of satisfaction of patients treated. With regard to osteochondral grafting, the indications are very "restricted" to cases of young patients where the salvage of the carpal bones allows for no need for salvage surgeries; in contrast, corticoperiosteal grafts are very technically complex

## **A-0786** THE EVOLUTION OF THE INSETTING AND OSTEOSYNTHESIS OF FREE FIBULA FLAPS FOR THE TREATMENT OF FOREARM BONE DEFECTS IN 52 CONSECUTIVE CASES

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#### Introduction

Free vascularized fibula graft has been used with great success for the reconstruction of large forearm bone defects to pseudoarthrosis, posttraumatic loss of substances, infections, and oncologic resections. Over the years we have used the vascularized free fibula graft with loss of substance of the radius and ulna for an average loss of substance of 6.5 cm ( $SD \pm 1.8$ ). The purpose of this paper is to analyze the evolution of the methods of synthesis and inseting that have evolved over the years with greater precision and stability. The use of piezoelectric cuts and long plates with possibly, for more complex cases, 3D models have changed the way these surgeries are performed, giving increasingly satisfactory results with shorter surgery times and shorter healing.

#### Materials and Methods.

We report the results of 52 cases of vascularized fibulae in the forearm from 2005 to 2022. Types of synthesis and also flap inseting methods are analyzed. Syntheses for fibulo-scafo-lunate fusion and for very proximal segments of the ulna are described. Radiologic healing times result with Quick Dash, and complications of the withdrawal site and reconstructions are reported. Forty-six reconstructions were performed for trauma and infections while only 6 were for reconstructions of post oncologic resections. A terminolateral suture of the peroneal artery was performed in 80% of cases, and a skin paddle was used in 8% of cases.

## Results

The average consolidation time was 4 months (SD +/- 2). The synthesis changed from very unstable and precarious in the early cases in the 2000s (K-wires, free screws) to a double plate synthesis until 2010. From here on, the search for a single plate synthesis or synthesis with dedicated plates allowed more anatomic reconstructions with less consolidation time. We had 2 cases of long hallux flexor retraction and one paralysis of the extensor long hallux. 4 cases of non-healing of the graft (1 proximal case in the proximal ¼ of the ulna in a girl with Rheumatoid Arthritis and three cases of pseudoarthrosis of the proximal portion of the graft (1 reoperated).

## Conclusions

The evolution of vascular fibula synthesis and inseting in radius and ulna loss of substance has resulted in improved clinical outcomes over time. The evolution of plates and materials have certainly aided this evolution. The report describes the evolution of synthesis leading in 90 percent of cases to a long plate reconstruction that solidarizes the bone graft. Distal synthesis of fibulo-scafo-lunate grafts can be of two types, with long plate or with a dedicated plate, notes of technique are given.

## **A-0787** COMPARISON OF A RETROSPECTIVE STUDY OF MECHANICAL FAILURE OF THE UNIVERSAL 2 TWA AND A COMPUTER MODEL

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**Objective:** The implantation of the Universal 2 model under certain angles will have as a result bone overload, which can lead to bone weakening, loosening of the components and mechanical failure.

The aim of this study is to identify the unsuitable angles of implantation of the components through revision of previous cases and comparing them to computer model, thus bringing us closer to optimization of the implantation.

**Methods:** We used the results of a retrospective review of case notes of 72 Universal-2 total wrist arthroplasty procedures performed from 2008 to 2015 at our institute and we compared them to the results of a computer model that was created in cooperation with CTU (Czech technical university in Prague) biomechanics department. There were evaluated postoperative radiographs for radiolucent lines around radial and metacarpal components and screws, subsidence and signs of migration. CT scans were used for the creation of the computer model.

**Results:** Implants failure occurred in 12 out of 72 wrists. The most frequent reason of the mechanical failure was an increased volar angulation of the metacarpal component which led to bone overload and loosening. Signs of loosening on the radiographic exam were in 45 out of 72, 10 had angular migration of more than 10%, in 18 cases there was radiolucent line of more than 2mm.

**Revision surgical procedure** in twelve patients (16,6%): in seven cases, a carpal component revision procedure and in five cases, total implant failures requiring either conversion to a wrist joint fusion.

**Conclusion:** We concluded that the most treacherous part of the implantation is the embedding of the metacarpal component, prone to volar tilt, which is the main reason for the loosening of the component. The clinical data are in agreement with the results we have from the computer model. With meticulous surgical technique while keeping in mind the ideal implantation parameters and avoiding the unsuitable angles we can accomplish a longer survival rate of the implants.

## **A-0788** MEASUREMENT AND DEFINITION OF SCAPHOID FLEXION DEFORMITY

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The height/length (H/L) ratio based on computer tomography (CT) has been reported as a reliable measurement for scaphoid flexion deformity. However, there is no consensus how to define and where to set the cutoff value for a deformity. Some studies have defined flexion deformity as H/L ratio of 0.6, based on measurements of injured scaphoids.

In a retrospective assessment of 63 patients operated for scaphoid nonunion, we compared CTs of the operated scaphoid with the uninjured side and found that a deformity definition of H/L ratio  $>0.6$  resulted in a substantial proportion of “false positive” flexion deformities.

Based on our data we suggest that if there is no uninjured scaphoid to compare the H/L ratio with, the estimated cutoff for a flexion deformity is a H/L ratio of 0.75.

## **A-0789** ISOLATED LUNO-CAPITATE OSTEOARTHRITIS: OUR EXPERIENCE AND LITERATURE REVIEW. CASES REPORT WITH PI2 SPACER IMPLANT

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Osteoarthritis of the luno-capitate joint is a rare pathology whose treatment is like that proposed for the necrosis of the proximal pole of the capitate. A small number of cases are described in the literature, often with post-traumatic etiology. The arthritic evolution of the wrist in complex ligament injuries has long been known. However, in addition to SLAC, numerous authors have described forms of segmental arthrosis in the radial styloid–scaphoid joint, scaphocapitate joint and, finally, the lunocapitate joints. These patterns are often misdiagnosed and not correctly treated.

The authors report the cases of two patients suffering from luno-capitate arthrosis treated by resection of the head of the capitate and positioning of a Pi2 spacer with subsequent pain relief and good recovery of the wrist functionality in both cases.

The treatment, surgical access, implantation method, prosthesis used, and the operating surgeon were the same in both cases. Both cases were followed with the same rehabilitation protocol according to the guidelines of our structure. Both cases were followed up according to our standard follow-up. In both cases the patients reported a clear clinical and functional benefit, associated with a radiographic finding of correct prosthetic implantation maintained over time. In conclusion, on the base of our experience, although limited but confirmed by data present in the literature, we can affirm that the use of Pi2 prostheses for the treatment of luno-capitate osteoarthritis is a valid option, with good functional and satisfactory radiographic results.

## **A-0790** CORRECTIVE OSTEOTOMY IN A PATIENT WITH CONGENITAL ABSENCE OF PRONATION BASED ON THREE-DIMENSIONAL STATISTICAL SHAPE MODELLING

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### Objective

An eighteen-year-old girl with no history of trauma presented with negative pronation ( $-20^\circ$ ) of her left forearm and limited pronation ( $50^\circ$ ) of her right forearm. Supination was normal. The patient could not remember ever having a normal rotation. Radiographs showed increased bowing of both the radius and the ulna. Intensive physical therapy and pronation braces did not result in increased pronation. Three-dimensional (3D) techniques are increasingly used to plan and execute corrective osteotomies. Normally, the contralateral side is used as a model. Since in this case both forearms were affected, this was not possible and we, therefore, compared a 3D model of the patient's forearms with a statistical shape model (SSM). The left arm with the largest limitation deviated the most from the model. Our aim was to investigate the possibility of performing a corrective osteotomy based on a SSM in a patient who had never been able to pronate and achieve functional improvement with this technique.

### Methods

We made 3D models of the radius and ulna of the patient's left forearm using a CT scan. The SSM of the radius and ulna was based on CT scans of 18 healthy young people. Using the Mimics Innovation Suite software, the correction needed to mimic the SSM as closely as possible was planned in 3D. We developed patient-specific drilling and cutting guides for intraoperative use. After the correction, a new CT scan was made. Measurements of pain and function were taken both pre-operatively and six months post-operatively.

### Results

The post-operative CT scan showed that the correction of the radius and ulna were almost entirely according to the 3D planning of the corrective osteotomy. This resulted in much improved pronation of  $45^\circ$  ( $65^\circ$  improvement) six months after surgery, which can still improve through the rehabilitation program that the patient is following. She is already much better able to perform her daily activities and is very satisfied with the result of the surgery. In addition, the patient is pain-free and radiographs show complete consolidation of the osteotomies.

### Conclusions

This case demonstrates that restoration of the normal alignment of both the radius and ulna in a patient with congenital absence of pronation can result in a large functional improvement. We believe that using a SSM of peers to plan and perform a corrective osteotomy offers opportunities for patients with congenital abnormalities or bilateral trauma.

## **A-0791** 3D PRINTING AND PRACTICAL APPLICATIONS IN HAND SURGERY

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### INTRODUCTION

Three-dimensional (3D) printing, also known as Additive Manufacturing (AM), is a manufacturing technology which enables the production of three-dimensional models of a computer-designed template or data from medical imaging

technologies by specially designed printers; current fields of application are the training of young hand surgeons, patient education, preoperative planning and fabrication of customized rehabilitation devices, customized surgical guiding tools, implants, and prostheses In hand surgery the use of 3D-printed models has mainly been focused on preoperative planning in patients with distal radius intra articular fractures or scaphoid pathologies, post traumatic malunion, elbow or wrist septic disease, loss of substance or bone necrosis 3D printed guides are an important tool to execute osteotomy in case of malunion, to realize customized plates or prosthesis.

#### OUR EXPERIENCE

In our department in the last 3 years 11 patients benefited of 3D technology; in one case we planned a cement antibiotic spacer for a septic elbow loss of substance; in three cases we substituted the lunate bone affected by a Kienbock disease 2b Bain Begg, we implanted a custom made titanium nitride coated prosthesis projected using a 3D reconstructed lunate bone of the healthy wrist; in one case we had to replace a phalanx affected by a giant cells tumor with a 3D custom made titanium nitride coated implant, before it was substituted with a cadaver bone graft then reabsorbed; in another case we had to replace the index finger PIP joint of a hard worker with a custom made constrained prosthesis because of the post traumatic important deformity, loss of substance and instability, in 2 cases a 3D technology was used for radius osteotomy and in 2 cases for reconstruction of vascularized bone graft for the scaphoid and lunate; in the last case a reconstruction with 3D preop plan was used for a difficult free fibula flap for the proximal ulna in a rheumatoid patient. This technology enabled us to better study the reconstructions of affected bones and joints, obtaining more precise and faster reconstructions. All cases are presented with clinical and radiographic results.

#### DISCUSSION

We think 3D printing technology is a precious tool to plan difficult surgery, to project prosthesis custom made in case of necrotic bone, important loss of substance or un-reparable joint surface when standard prosthesis on the market are not a possible solution, this technology is important even to plan section guide in case of malunion and dedicated hardware to reconstruct the anatomy. Sometimes are used for prosthetic replacement (3 lunate and two phalanx) and in other cases 3D printing was important for cutting guides or preoperative reconstructions.

We believe that in the near future 3D printing technology can add a significant value to hand surgery.

### **A-0792** SENSORY PROCESSING IN CHILDREN WITH CONGENITAL UPPER LIMB ANOMALIES

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**Background:** Children begin to discover their environment and they learn to realize information from their environment with their senses. While the central nervous system interprets information from environment, the seven senses (tactile, vestibular, proprioception, olfactory, visual, auditory, gustatory) interoperate. Failure in upper limb can occur at different levels and forms of congenital upper limb anomalies (CULA). Deficiency of upper limb can cause receiving less sensory input from upper limb. For this reason, children with CULA can not process information properly and they can not respond appropriately. The objective of the study is to investigate sensory processing in children with CULA.

**Methods:** In all, 35 children with CULA of the age group 7 months-10 years were included in the study. We excluded parent and children who did not speak Turkish, and children with CULA accompanied by neurological (cerebral palsy, etc.) involvement. Sensory processing was assessing on The Toddler Sensory Profile-2 (TSP-2) in children of the age group 7-35 months, the The Sensory Profile Caregiver Questionnaire (SPCQ) in children of the age group 3-10 years.

The TSP-2/SPCQ is a questionnaire that is developed by Dunn. The TSP-2/SPCQ score interpret in term of the impact of child's

life, activities of daily life and school activities. The TSP-2 is a 54-item and scored in a 5-point Likert scale. The SPCQ is a 125-item questionnaire and scored in a 5-point Likert scale as well. The TSP-2/The SPCQ classified the children as having “less than others (definite difference and probable difference)”, “typical performance” and “more than others (definite difference and probable difference)”. Written and verbal informed consent was obtained from the parents of the children. Results: Of the 35 children with CULA, 17 completed The TSP-2 and 18 completed The SPCQ. Also among the children with CULA, there were 30 malformation, 2 deformation and 3 syndromes. According to TSP-2 quadrant systems results, 5 toddlers had definite difference performance, 3 toddlers had probable difference performance in seeking; 4 toddlers had definite difference performance, 1 toddlers had probable difference performance in avoiding; 3 toddlers had definite difference performance, 2 toddlers had probable difference performance in sensitivity; 1 toddlers had definite difference performance, 5 toddlers had probable difference performance in registration.

According to the SPCQ quadrant systems results, 4 children had definite difference performance, 7 children had probable difference performance in seeking; 3 children had definite difference performance, 4 children had probable difference performance in avoiding; 5 children had definite difference performance, 3 children had probable difference performance in sensitivity; 3 children had definite difference performance, 4 children had probable difference performance in registration. Conclusion: It was determined that children with CULA may have sensory processing problems especially as seeking part of quadrant system. The sensory processing difficulties can be lead behavioral problems such as aggressive, hyperactive, risky or fatigue easily, slowly behaviors on a child. Sensory processing problems can be an important clue about different behaviors and developmental delays in children with CULA.

## **A-0793** ASCENSION PROXIMAL INTERPHALANGEAL JOINT PROSTHESIS: 16 YEARS OF EXPERIENCE

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Smaller joints, such as the proximal interphalangeal (PIP) fingers, may be affected by degenerative phenomena secondary to systemic diseases such as rheumatoid arthritis and systemic lupus erythematosus, primary osteoarthritis or secondary osteoarthritis following joint fractures.

Despite the continuous progress in the evolution of the treatment of these pathologies, there is currently no cure capable of resolving or stopping the clinical course and the surgical solution is aimed at resolving the pain and joint stiffness of FH. The Ascension prosthesis for FH has a design that allows minimal cortical-spongiosa resection while preserving a good structural density (bone-stock) sufficient to validly support the implant, does not require the execution of an excessively wide access route, and respects the capsular-ligamentous structures so as to maintain primary intrinsic stability.

The authors describe the technique and surgical experience developed over 16 years. 46 patients were re-evaluated in a total of 51 implants. Of these 30 were men and 16 women, the average age was 45 years. The toes treated were the 4th (21 prostheses), 2nd (17 prostheses), 3rd (10 prostheses) and 5th (3 prostheses), with the left side predominating over the right. All enrolled patients were re-evaluated for range of motion, global grip strength (Jamar), digital grip strength (pinch-test, three jaw-test, tip-to-tip-test), functional recovery in ADLs and work activities, pain satisfaction and improvement (Michigan test), and joint stability; all patients underwent standard radiographic examination.

Pain was absent in 44 patients (94%), in 30 patients (66%) there was an improvement in strength and in 28 patients (60%) there was an improvement in joint motion compared to the preoperative clinical picture, in all controlled patients there was stability of the treated joint, in no case was there an infection, in only one case was there a dislocation of the

prosthesis, in no case was there an implant fracture and in no case was there osteolysis on the final control X-ray. On 5 patients, a second tenoarthrolysis operation had to be performed for joint stiffness, with good results in only three cases; In conclusion, prosthesising the base of the second phalanx would be recommended in cases where this articular surface is significantly altered on a post-traumatic basis.

Finally, we believe that this treatment can be preferred to the surgical alternative of arthrodesis, which definitively prevents any movement of the affected joint by markedly limiting digital function.

**A-0796** A RARE CASE OF PARESTHESIAS OF THE HAND: AN INTRAMUSCULAR LIPOMA OF THE BICEPS BRANCHII  
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Deep soft tissue lipomas are less common than superficial ones occurring in the subcutaneous tissue. They are benign and can be either intermuscular or intramuscular, representing 0,3 and 1,8 % of fatty tumors respectively. Intramuscular can be further classified in 83% of cases as infiltrative and in 17% as well-circumscribed. Most intramuscular lipomas are nontender and within a single muscle, and rarely have been described as responsible for compressive neuropathies, especially in the forearm. We present a rare case of a giant intramuscular lipoma of the biceps brachii muscle with a parosteal component and compressive neurologic symptoms of the median and cubital territory. A 61-year-old female was referred to our hospital with an indolent mass in the upper left arm. She had no local symptoms related to the mass but complained of everyday paresthesias in the hand in the past months. An arm radiograph (X-ray), an ultrasound (US), a computed tomography (CT), and electromyography (EMG) were obtained, but magnetic resonance imaging (MRI) was not due to the patient medical background. A voluminous lipomatous mass deep in the biceps brachii muscle was diagnosed. It was well-defined, with no calcifications or other atypical characteristics or signs of sarcomatous degeneration. It measured 11,3 x 3,8 x 6,6 cm (latero-medial x anterior-posterior x length) and contacted the humeral diaphysis, but no osseous erosion was observed. The neurovascular bundle was deviated by the tumor. Light compression of the mass worsened the hand paresthesias in the cubital and median territory. The EMG was described as normal. Complete marginal excision of the tumor was performed through an extended anterolateral approach. The tumor was found subfascial in the middle of the biceps brachii muscle and posteriorly it had a parosteal component that was excised. The tumor was well-circumscribed, and it was easily detachable from the neurovascular bundle. Postoperatively, histopathologic examination confirmed the diagnosis of lipoma and the healthy surgical margin of the tumor. During the follow up the paresthesias improved. The patient had no complaints referred to the arm. Regarding the management of these tumors, an X-ray and an MRI are mandatory. Unfortunately, it was not possible to obtain it. The tumor was bigger than 5 cm and caused neurologic complaints due to the mass effect, so conservative treatment did not seem an option. The treatment of well-circumscribed lipomas is marginal excision, as it was performed in this case, with wide excision needed in infiltrative types. Only rarely do deep lipomas recur, and usually are related to incomplete excision or an initial malignant tumor not identified. The most important differential diagnosis of deep lipomas without ossification is the liposarcoma well differentiated, which can only be confirmed by the histologic study. In English literature, there are only 5 intramuscular lipomas in the biceps brachii muscle, and neurologic deficits were not referred to. To our knowledge, this is the only case of a giant intramuscular lipoma responsible for hand paresthesias.

## **A-0798** OUTCOME OF SIMPLE IN SITU DECOMPRESSION FOR IDIOPATHIC CUBITAL TUNNEL SYNDROME USING MINIMAL INCISION UNDER WIDE AWAKE LOCATE ANESTHESIA WITHOUT TOURNIQUET

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**Purpose** The WALANT and minimal invasive technique have many advantages for hand surgery. The purpose of this study is to evaluate the outcome of in situ decompression for idiopathic cubital tunnel syndrome with minimal skin incision under WALANT.

**Methods** Patients who underwent in situ decompression for idiopathic cubital tunnel syndrome using minimal skin incision technique under WALANT in a day surgery unit were selected. A total of 62 procedures were performed in this cohort of 58 consecutive patients. The mean age of the patients was 51.3 (range: 23-76) years and average follow up period was 20.3 months (range: 12-69 months). The severity of ulnar neuropathy was classified according to the McGowan classification: there were 14 in grade I, 42 in grade II and 6 in grade III. The pain and the bleeding during the operation were evaluated. Postoperative outcome measurements consisted of the patient satisfaction, subjective improvement, complications and re-operation rate.

**Results** All the patients got the ideal anesthetic effect (VAS range: 0-2) with no needing other anesthesia methods during the operation. There was no obvious bleeding during the operation without adding temporary tourniquet. The mean time of the operation was 15 minutes (range: 10-21 minutes) for every procedure. 56 patients stated that they would choose to have the operation performed under same procedure again, but two would have favored a general anaesthetic. fifty patients were included in the final analysis. The technique was highly satisfactorily esthetic for all. 42% (21 of 50) patients reported complete resolution of their preoperative symptoms. 58 (29 of 50) reported significant improvement immediately following surgery and some continuing improvement thereafter. One patient required re-operation due to his symptoms returned. There was one case of hematoma as a postoperative complication with drainage treatment no needing re-operation.

**Conclusions** Minimal skin incision to perform in situ decompression of the ulnar nerve at the cubital tunnel under WALANT is a simple, safe and effective method. This procedure is comparably effective alternative which involves less surgical trauma, morbidity and minimal complications with good surgical outcomes, and is well tolerated by the majority of patients.

## **A-0799** EFFECT OF SHORTER NERVE GRAFT AND SELECTIVE MOTOR RECIPIENT NERVE ON NERVE TRANSFER SURGERY FOR RESTORATION OF ELBOW FLEXION IN TRAUMATIC BRACHIAL PLEXUS PALSY

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**Background:** Spinal accessory nerve is commonly used as a donor nerve for re-innervation of elbow flexors in brachial plexus injury (BPI) reconstruction. There is no comparative study of postoperative outcomes between spinal accessory nerve transfer to musculocutaneous nerve (MCN group) and spinal accessory nerve directly transfer to nerve to biceps (NTB group).

**Objective:** This study aimed to compare postoperative time to recovery of elbow flexors between two different nerve transfer techniques.

**Methods:** Between 1999 -2017, 748 operatively treated pan-plexus BPI patients were retrospectively reviewed. A total of 233 patients (162 patients in MCN group and 71 patients in NTB group) were included. Elbow flexion motor power was evaluated monthly by using Medical Research Council (MRC) grading system for 24 months postoperative follow-up period. Survival analysis and Cox regression were used to compared time to recovery (MRC grade > 3) between two groups. **Results:** Two hundred and thirty-three patients underwent nerve transfer surgery for restoration of elbow flexion. There were 162 patients in MCN group and 71 patients in NTB group. The NTB group had 81.7% success rate, while the MCN group had 74.1% success rate at 24 months after the surgery. The NTB group had significant faster median time to recovery (19 months) compared to MCN group (21 months). Cox regression analysis showed that NTB group with combination of proximal dissection technique of the recipient nerve is the only significant factor affecting time to recovery (HR 2.33, 95% CI 1.46-3.72; p-value <0.001).

**Conclusions:** Spinal accessory nerve transfer to the selective motor nerve to biceps in combination with proximal dissection technique for shorter nerve graft is the preferable nerve transfer option for restoration of elbow flexion in traumatic pan-plexus palsy.

### **A-0801 TREATMENT OF ACUTE PERILUNATE DISLOCATIONS AND AND PERILUNATE FRACTURE-DISLOCATIONS: ORIF VERSUS PROXIMAL ROW CARPECTOMY**

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**Background:** perilunate dislocations and perilunate fracture-dislocations are caused by high-energy trauma. These injuries constitute less than 10% of all wrist injuries; nevertheless, they can cause long-term complications and significant disability, especially if combined with delayed diagnosis. Current guidelines call for reduction in urgency, monitoring of median nerve neuropathy, followed by rapid stabilization with repair of injured structures. However, short-term and long-term complications such as wrist stiffness, reduced grip strength, and post-traumatic arthrosis often develop even with optimal treatment. Our research aimed to evaluate whether proximal row carpectomy, in some types of injury, could become the first choice treatment to achieve rapid mobilization, improved functional recovery, reduced complications and reduced reoperation rate.

**Design:** Retrospective study from a one-university based institution.

**Methods:** From January 2011 to November 2021, 92 patients had perilunate dislocation or perilunate fracture-luxation surgery at our Center. 40 patients were lost to follow-up and 16 were excluded because they did not satisfy the inclusion criteria.

Thirty-six patients (34 males and two female) were evaluated. The mean time between injury and surgery was six days. The patients underwent reduction, surgical stabilization, ligament repair (28 patients) and in most complex cases proximal row carpectomy was performed (8 patients). All included patients were evaluated with The QuickDASH Outcome Measure and Mayo Wrist Score; residual grip strength, complication rate, re-interventions and return to work were also assessed. **Results:** The study's average follow-up period was 74 months (minimum 16, maximum 137) . Comparison of the range of motion, Visual Analogue Scale and clinical tests showed no statistically significant data between the two groups of patients. However, the comparison of immobilisation time, complications, re-interventions and return to work were statistically significant.

**Conclusion:** Treatment with open reduction and stabilization remains the first choice for most of these lesions, however,

proximal row carpectomy can be performed in acute complex cases with good results.

Keywords: perilunate dislocations, perilunate fracture-dislocations, wrist dislocation

### **A-0803** 3D PRINTED REPLICA OF HAND AND WRIST FRACTURES FOR SURGICAL PLANNING AND PATIENT CONSENT: A 5 YEARS MULTI-CENTRIC EXPERIENCE

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CT scanning with 3D reconstructed images are currently used to study articular fractures in orthopedic and trauma surgery. A 3D-Printer creates solid objects, starting from a 3D Computer representation.

We report from 5 year of multicenter experience in 3D printing of articular fractures.

During the study period, 200 patients (distal radius fractures, radial head, scaphoid and phalanx) underwent 3D printing. The realistic personalized medical models were used by surgeons to appreciate the dislocation of fragments and the yielding of the articular surface. In addition, models were showed to patient as part of the acquisition of the informed consent before surgery creating and improvement in quality of treatment

3D printing of articular fractures are innovative procedures that achieve a preoperative tangible, highly useful evaluation of the fractures to plan intervention and educate patients.

### **A-0804** PISOTRIQUETRAL ARTHRITIS. AN ATYPICAL DIAGNOSIS IN A PATIENT WITH ULNAR WRIST PAIN

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#### INTRODUCTION

Degenerative arthritis of the pisotriquetral joint is an uncommon condition that we must consider during the differential diagnosis of ulnar wrist pain as well as pathology of the FCU and ECU, TFCC tear, DRUJ instability and ligament injuries.

#### MATERIALS AND METHOD

A 40-years-old right-handed man, manual worker, complained of persistent and increasing pain in the left wrist for 8 weeks. On examination, there was no external deformity or swelling. There was pain over the ulnocarpal joint that worsened by opposed active flexion and ulnar deviation of the wrist. Besides, crepitus and pain were produced by external pressure on the pisiform.

No DRUJ instability noted. Motion of the wrist was preserved.

Routine X-Ray exams showed degenerative changes at the pisotriquetral joint. CT scans and MRI evidenced Palmer IB TFCC injury as well as signs of and old fracture of the pisiform with complete bone healing and heavy pisotriquetral arthritis. The patient received rehabilitation therapy for 3 months in combination with NSAIDs and 2 corticosteroid injections. Because of the lack of improvement with non-operative therapeutic measures, the pisiform was excised through a volar approach.

#### RESULTS

Postoperatively, the wrist was immobilized in plaster for 4 weeks before starting rehabilitation.

The patient had complete relief of symptoms and full range of motion 8 weeks after the surgery.

#### CONCLUSION

Excision of the pisiform would seem to be the treatment of choice when patient's symptoms fail to respond to nonoperative measures.

Some different surgical techniques have been described to treat this pathology, including excision by open or arthroscopic approach, pyrocarbon interposition arthroplasty and arthrodesis.

The choice of the most appropriate surgical technique will depend on patient's characteristics and associated pathologies in the hand and wrist (other degenerative processes, instabilities, TFCC injuries..) as well as the surgeon's preference and experience.

Excision of the pisiform has been reported in the literature to provide a complete relief of pain with no loss of wrist motion or strength.

### **A-0805** BONE VIABILITY IN VASCULARIZED INTERPHALANGEAL UNICONDYLAR TRANSFER WORTH THE EFFORTS? A 5-YEAR FOLLOW-UP

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**Introduction:** a previous report described the use of a free vascularized unicondylar transfer to salvage proximal interphalangeal (PIP) joints with loss of one large condyle compared to not vascularized partial toe joint osteochondral autografts as unique alternatives when open reduction and internal fixation is not feasible.

We describe the radiological and clinical follow-up at 5-year follow-up

**Methods:** at 5-year follow-up performed by an independent hand therapist, the active and passive proximal interphalangeal (PIP) and distal interphalangeal (DIP) range of motion were measured with a goniometer, and the pinch and grip strength was tested through a Jamar Hand dynamometer.

A radiological evaluation was undertaken in postero-anterior (PA) and lateral view to check graft alignment, joint congruity and bone healing.

A hand surgeon board-certified for musculoskeletal ultrasounds, performed an ultrasound (US) examination by using a real-time scanner (My Lab Sigma; Esaote, Genoa, Italy) with a high-definition 18-MHz linear array transducer to check vascular patency at the site of digital arterial anastomosis.

**Results:** at 5-year follow-up, a pain-free active PIP joint range of motion (ROM) of 10–90° and DIP ROM of 10–50° were obtained, with a grip and pinch strength of 36 lbs and 5 lbs respectively. No donor site complications were found.

Post-op radiographs revealed good graft alignment with no signs of malunion or bone resorption.

US evaluation revealed a normal vascular patency.

**Discussion:** after 5 years we confirm that this procedure is feasible and represents an ideal alternative surgical therapy in adults with > 5 mm bone loss and asking for a functional interphalangeal joint.

**Conclusions:** this report confirms the vascularized toe unicondylar bone grafting as an alternative tool in the management of significant PIP injuries at a mid-term follow-up.

## **A-0806** VOLAR LOCKING PLATE VS CAST IMMOBILIZATION FOR DISTAL RADIUS FRACTURES: A SYSTEMATIC REVIEW AND META-ANALYSIS

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**Introduction:** The aim of our study was a systematic review and meta-analysis to evaluate whether volar locking plate (VLP) fixation leads to better clinical and radiological outcomes than those of closed reduction and cast immobilization for the treatment of distal radius fractures.

**Methods:** A comprehensive literature search was performed in the PubMed, Web of Science, and Cochrane databases up to January 2022. Inclusion criteria: RCT studies comparing the outcomes of VLP fixation with cast immobilisation for the treatment of DRFs. Investigated parameters were Patient-rated Wrist evaluation questionnaire, Disabilities of the Arm, Shoulder and Hand Score (DASH), range of motion (ROM), grip strength, quality of life (QoL), radiological outcome and complication and reoperation rate, both at short- and mid-/long term follow-up

Assessment of risk of bias and quality of evidence was performed with Downs and Black's "Checklist for Measuring Quality". Results: A total of 12 RCTs (1368 patients) were included. No difference was found for ROM, grip strength, QoL, and reoperation, while the DASH at 3 months was statistically better in the VLP group ( $P < 0.05$ ). No clinical differences were confirmed at longer follow-up. From a radiological perspective, only radial inclination ( $4^\circ$ ) and ulnar variance (mean difference 1.1 mm) at  $>3$  months reached statistical significance in favor of the VLP group (both  $P < 0.05$ ). Fewer complications were found in the VLP group ( $P < 0.05$ ), but they didn't result in different reintervention rates.

**Discussion:** The main finding of this systematic review and meta-analysis is that the surgical approach leads to a faster functional recovery, better fracture alignment, better clinical and fewer complications, although no overall clinical differences were found between ORIF and cast in the long term.

**Conclusions:** our findings suggest operative treatment for people with higher functional demand requiring a faster recovery while they support the benefit of a more conservative approach in less demanding patients.

## **A-0807** SCAPHOID NON UNION IN A 11 Y OLD CHILD

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Scaphoid fractures in children are uncommon. Scaphoid nonunion is usually the result of delayed presentation or missed diagnosis.

A 11 y old girl came to hospital after 3 months from a motocross injury with pain. Imaging was performed and a scaphoid non union was found. CT Sagittal showed tendency to volar collapse, so surgical treatment was indicated. Open reduction, toilette, bone autograft from distal radius and screw fixation was performed.

After 60 days x rays showed good healing and return to motocross was allowed.

We recommend to perform good investigation in caso of hand injury in children.

## **A-0808** DUAL MOBILITY PROSTHESIS IN TREATMENT OF TRAPEZIOMETACARPAL OSTEOARTHRITIS: A PROSPECTIVE STUDY OF 97 PATIENTS

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The Touch® prosthesis is a dual mobility total implant used to treat carpometacarpal thumb osteoarthritis. This prospective study reports outcomes and the global assessment of 97 implanted prostheses with a mean follow-up of 2.2 years (range, 1.7-2.8 years).

There were 91 patients enrolled (17 male and 74 female), with an average age of 68.1 years (range, 58-79 years) and 65 dominant and 32 non-dominant operated hands. Patients were totally satisfied with surgery in 91 cases (93.8%), and the mean VAS scale decreased from 7.2 to 0.7. The mean DASH score improved from 49.8 to 13.2, and the mean Kapandji score from 7.9 to 9.6. Strength tests showed that the average Hand grip increased from 19.3 to 31.5 kg, the Key pinch from 3.8 to 6.6 kg and the Tip pinch from 1.8 to 4.2 kg. All the tests showed a statistically significant improvement ( $p < 0.05$ ) compared to the preoperative values.

There was no dislocation, postoperative fracture, implant loosening or infection. De Quervain's disease occurred in 4 cases (4.1%) and transient dorsal thumb paresthesia in 6 patients (6.2%). In only one case did an intraoperative fracture of the trapezium occur, and surgical conversion to suspension arthroplasty was necessary.

In conclusion, this study shows our preliminary results with dual mobility Touch® prosthesis, which allows rapid recovery of strength, range of motion and function, with no incidence of early prosthetic dislocations. In any case, the prosthesis avoids trapeziectomy, which can still be performed in case of implant failure.

## **A-0810** THE EFFECT OF MOTOR IMAGERY ON UPPER EXTREMITY DYNAMIC BALANCE IN HEALTHY INDIVIDUALS

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**Purpose:** Upper extremity dynamic balance which includes mobility and stability is the most desired achievement for good recovery or performance. In this study, it was aimed to examine the effect of motor imagery on upper extremity dynamic balance in healthy individuals. **Methods:** The study included fifty participants between the age range of 18-45 years, without any neurological, psychological, ortopedic, sensory problems. Demographics including age, sex, hand dominance was questioned. Upper extremity length was measured from the C7 spinous process to the distal tip of the right middle finger in centimeters. Upper Quarter Y balance (UQYBT) test was used to evaluate the dynamic balance of the upper extremity. This test provides an information about both mobility and stability of the upper extremity. The test is administered while the patient is in a elbow extended plank position. The person was asked to maintain the position of one hand in a standardized location while reaching with the other hand in the medial, inferolateral, and superolateral directions as far as possible. The standart angle between inferolateral and mediolateral line is 90 degrees, where the angles between these both lines with the medial line is 135 degrees. The maximum reach distances were measured in centimeters and were divided by the subject's upper limb length to normalize each reach distance. The test was done and the avarage of three masurements were recorded by one of the researchers. The participants were randomly divided into two group. Study group got motor imagery training for 15 minutes with eyes closed. Control group had rest for 15 minutes. The training was given by an another researcher who was blind to the assessments. UQYB test was repeated for

both groups. Wilcoxon test was used to analyze the difference between two measurements and Mann Whitney U test was used to compare the results between groups. Results: The average age of the participants was  $28.50 \pm 9.08$  years; 54.2 % of the participants were female in total. Age and gender distribution did not differ between groups ( $p > 0.05$ ). Results: A statistically significant difference was found after motor imagery training in medial ( $p = 0.029$ ), inferolateral ( $p = 0.002$ ) and superolateral ( $p = 0.019$ ) directions of UQBYT test. There was not any statistically difference between two measurements in control group ( $p > 0.05$ ). Discussion: A short time motor imagery instructions had an effect on the dynamic performance of the upper extremity. The long time effect of the training can be investigated. Motor imagery can be used to increase performance in individuals who need good motor performance. The research was done in healthy individuals however we think motor imagery can also be used within rehabilitation program to increase mobility/stability in injured individuals.

## **A-0811** SURGICAL FASCIECTOMY VERSUS COLLAGENASE INJECTION IN RECURRENT DUPUYTREN CONTRACTURE: RANDOMIZED CONTROLLED TRIAL

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**Aim:** To compare surgical fasciectomy and collagenase injection in the treatment of recurrent Dupuytren contracture.

**Methods:** We conducted a single-center randomized controlled trial between 2018 and 2022. The inclusion criteria were recurrent contracture in one or more of the three ulnar fingers after previous treatment with either fasciectomy or collagenase injection, passive extension deficit  $\geq 30$  degrees in the metacarpophalangeal (MCP) or proximal interphalangeal (PIP) joint, and a palpable cord causing the recurrent contracture. Primary outcome was total active extension deficit (TAED) in the treated fingers (MCP + PIP) at 3 months. Randomization was done with computer-generated randomization sequence and sealed envelopes. The pretrial estimated sample size was 25 patients per group. The fasciectomy procedures were performed by two surgeons and the collagenase injections by one (different) surgeon. Baseline and follow-up examinations and measurements were performed by two hand therapists independently of the treating surgeons.

A total of 61 patients were randomized, of whom 1 patient randomized to fasciectomy chose not to have any treatment and 1 patient randomized to fasciectomy withdrew consent 6 weeks after surgery. Thus, 59 randomized patients (28 in the fasciectomy and 31 in the collagenase group, 3 women in each group) received the assigned treatment and completed the 3-month follow-up. Of 74 treated fingers, the fasciectomy group comprised 33 fingers (7 recurrence after previous fasciectomy) and the collagenase group comprised 41 fingers (10 recurrence after previous fasciectomy). Mean patient age in the fasciectomy group was 71.5 (SD 9) and in the collagenase group 71.3 (SD 7) years.

**Results:** At 3 months after treatment TAED in the treated fingers improved significantly (by approximately 50 degrees) in both groups with no statistically significant difference between the two groups. Adverse events in the fasciectomy group included digital nerve injury (1 finger), and in the collagenase group skin rupture (5 fingers).

**Conclusions:** In patients with recurrence of Dupuytren contracture in fingers previously treated with surgical fasciectomy or collagenase injection, randomized to either fasciectomy or collagenase injection, the short-term (3 months) improvement in active extension deficit in the treated fingers was similar.

## **A-0814** DISTAL HUMERUS NON UNION IN THE ELDERLY

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**Background**  
Nonunion is a challenging surgical problem of distal humerus fractures especially after failed ORIF and has a reported incidence of up to 25%. Factors that contribute to failures are a poor initial fixation, extensive comminution and osteopenia. Along with these other contributing factors are smoking, poor soft tissue envelope, metabolic diseases and poor compliance with rehabilitation protocols. The elderly population is a unique subgroup where osteoporosis may lead to suboptimal results after these complex fractures.

**Material**  
Sixteen patients with an average age of 74.3 years were included in this retrospective study. All the patients except one were female and the average time between the original operation and the index procedure was 14.6 months. Common characteristics of each nonunion were an extensive periarticular fibrosis, low synovial nonunion and osteopenic bone. Two patients had additional surgical procedures between the original and the reconstructive one. One patient had a septic nonunion and there were four patients with nerve problems. Three with symptoms of ulnar neuritis and one with complete radial nerve palsy. Pain, instability and severe functional limitation were noted in each individual. Loose or broken hardware was present in all cases. Common steps in the reconstructive procedure included a posterior approach, ulnar nerve management, olecranon osteotomy, complete capsulectomy, removal of the old hardware, debridement of the synovial nonunion, provisional stabilization with K-wires, bone graft and final stabilization of the construct utilizing a distal humerus anatomic plating system. In one patient bone shortening was necessary to achieve a good apposition and alignment.

**Results**  
The average follow-up was 16 months and all these patients were followed personally. All the nonunions healed at an average time of 5 months. All the patients with ulnar neuritis regained ulnar nerve function. Tendon transfers for the radial nerve palsy patient were performed eight months post reconstruction. The average arc of elbow motion was 100°. A focal area of avascular necrosis in the capitellum was observed in one patient. DASH score and Mayo Elbow Performance Index will be analyzed at the presentation. (For the purpose of this presentation all these patients will be contacted by phone, to get an updated functional result).

**Conclusion**  
Current standard principles for ORIF of acute fractures should also be utilized for non-unions. Distal humeral nonunions remain a challenging problem and are most often a result of poor initial fixation. Most nonunions can be addressed by stable internal fixation with modern surgical implants, capsular contracture release, bone grafting and management of the ulnar nerve.

## **A-0815** NEGLECTED ELBOW DISLOCATIONS -SUBLUXATIONS

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### **Background**

The treatment of chronic elbow dislocation is a challenging problem. The results are accompanied by frequent stiffness, recurrent instability, and/or dysfunction. Postoperative complications have led some surgeons to recommend against surgical procedures for older patients and patients who are more than 3 months out from initial injury.

### **Aim**

To present our approach to this problem, to highlight the range of complications and to propose treatment options accordingly.

## Material

Twelve patients with an average age of 52yrs with a neglected elbow dislocation included in the study. Five patients suffered from pure elbow dislocation without any obvious bony injury and seven with an unreduced elbow subluxation after an open reduction and fixation of a complex fracture dislocation. The mean time from the injury to the index operation was 7.4 months. The “pure dislocation group” underwent an open reduction of the joint, management of the ulnar nerve and stabilization with an external fixator. The ‘subluxation group’ underwent a revision procedure with or without the use of external fixators.

Results. The mean follow up was 23 months. The ‘pure dislocation’ group got better functional results than the other group, as this confirmed with the DASH and Mayo Elbow performance score. Furthermore, better ROM was observed in the first group. Further details as well as complications will be presented. There were no cases of recurrent instability.

## Conclusion

This series of open reduction of chronic elbow dislocation-subluxation, demonstrates that this approach can result in reasonable outcomes, no recurrent dislocations, provided that articular anatomy will be restored. External fixators are of great value

## **A-0816** INCIDENCE AND RISK FACTORS FOR ASEPTIC LOOSENING IN REVISION TOTAL ELBOW ARTHROPLASTY

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Background: Revision total elbow arthroplasty is a challenging surgery due to poor bone stock. Our hypothesis was that performing strut bone grafts could prevent loosening when the bone stock was poor.

Methods: We retrospectively analyzed patients who underwent revision total elbow arthroplasty at our hospital between 2005 and 2020. We excluded from the study if the bone loss was too severe and required allograft prosthetic composite reconstruction, if the implant was not replaced, or if the follow-up was < 2 years. We defined bone loss as follows: 1) the overall diaphysis thickness was < 50% compared to the contralateral side or 2) the diaphysis was locally thinner than the surrounding area by < 50% in the radiograph. Implant stability and aseptic loosening were analyzed on the last radiograph.

Bone loss, strut bone graft, and demographics were compared between the group with and without aseptic loosening.

Results: A total of 15 patients were analyzed during the study period. There were 7 males, and the average age was 65 (range, 39 – 79) years. The average follow-up period was 52 (range, 24-158) months. Bone loss was observed in 11 patients, and strut bone grafts was performed in 5 of them. At the last follow-up, 3 patients had aseptic loosening, and 2 of them had severe symptoms and underwent re-revision surgery. All three patients with loosening showed bone loss on the radiograph before surgery. Two patients who underwent re-revision surgery did not undergo strut bone grafts. One patient who had loosening with mild symptoms underwent strut bone grafts. The demographics of 3 patients with loosening were as follows: male (n=1), mean age was 67, worker (n=1), dominant arm involvement (n=0), and prior revision surgery due to aseptic loosening (n=3).

Conclusion: Bone loss could increase the risk of aseptic loosening in revision total elbow arthroplasty. Performing strut bone grafts could make a better results.

## **A-0817** NORA'S LESIÓN IN A 77 YEARS-OLD PATIENT. AN ATYPICAL DIAGNOSIS

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### INTRODUCTION

The aim of this study is to report a bizarre parosteal osteochondromatous proliferation (BPOP) or Nora's lesion and a therapeutical management revision.

### MATERIAL AND METHODS

77 years-old female patient evaluated in hand and wrist unit presenting pain and swelling in her right hand's 4th finger for 1 month along with periungual pus discharging in the last 2 days. X-ray did not show pathological findings, MRI was requested to complete the case study.

### RESULTS

MRI showed osseous proliferation/exostoses in the 4th finger distal phalanx's cubital aspect suggesting bizarre parosteal osteochondromatous proliferation (BPOP) or Nora's lesion, confirmed after excision and anatomopathological study.

### CONCLUSIONS

Bizarre parosteal osteochondromatous proliferation (BPOP) or Nora's lesion is a rare bone pathology affecting small bones of hand and feet, although isolated cases in long bones and skull have been reported. This condition was described by Nora et al. in 1983, existing around 200 cases reported in literature.

Diagnosis is made through radiological suspicion confirmed with anatomopathological study after excision. Differential diagnosis with malignant pathology is mandatory, such as parosteal osteosarcoma and chondrosarcoma and also with benign pathology such as osteochondroma or ossificant myositis. Radiological diagnosis is highly complex as the periosteal location can be similar to parosteal osteosarcoma and cartilaginous matrix can be similar to osteochondroma

Etiology is widely discussed in bibliography, some authors defend the neoplastic origin due to chromosome alterations in cytogenetic study while others defend its origin as a reactive periostitis.

Treatment is based on "en-bloc" excision including the lesion's pseudocapsule, periosteal tissue and underlying cortical bone in case of presenting any abnormality in order to prevent local recurrence risk ( 29%-51% documented in largest case series available in literature)

Despite histological atypia, no malignization or metastasis have been described.

## **A-0818** CHRONIC DISTAL BICEPS TENDON RUPTURES

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Background: Delayed presentation of distal biceps tendon rupture can make primary repair difficult, in which case reconstruction using a tendon graft is an option.

### Aim of the study

To present an operative approach to this pathology using tendon graft, as well as to focus on difficulties encountered in the management of such lesions.

### Material

Thirteen patients with an average age of 37 yrs suffered from chronic distal biceps rupture treated at our institution,

in a seven year period. The palmaris longus tendon was used to reconstruct the distal biceps in all of our patients. In 11 patients a two-incision procedure was utilized in order to manage the biceps remnant as well as to prepare the bed for the tendon anchorage. A palmaris longus tendon was harvested from the ipsilateral limb, interweaved to the retracted distal biceps, at the tendon muscle junction. The other end was fixed to the bicipital tuberosity using an anchor and a pull out technique separately, in order to get a wider foot print as well as one technique to act as a backup should the other fails.

#### Results

The mean follow up was 19 months for twelve patients. The other one was lost from follow up 10 months postoperatively. Elbow ROM, supination strength and flexion strength were compared with those of the contralateral side. Although elbow ROM was equal to ROM of the contralateral elbow the strength measurements were less in the operatively treated group. DASH score and Mayo elbow performance index were recorded as well as complications of the procedures.

#### Conclusion.

Technically speaking we believe that is a difficult procedure and the results are not optimal, regarding the strength measurements. Despite the fact that most patients consider the result as satisfactory, we believe that the feeling of the regained bulkiness of the arm is the main reason for this opinion. May be more sophisticated surgical techniques or more detailed physio programme can give better objective results

### **A-0819** NERVE TRANSFER FOR TRAUMATIC BRACHIAL PLEXUS INJURIES AFTER 18 MONTHS

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**Background:** Traumatic brachial plexus injuries are the most challenging and complex conditions to be managed by the peripheral nerve surgeon. Late presentation after 18 months has frightened nerve surgeons in the last decades. The nerve recovery advances 1 mm daily after a nerve transfer or repair. However, medical data shows that the motor endplates disappear after 18-24 months. Thus, operative management is usually performed within six months, allowing reinnervation. And the distance between the injury site and the muscle target is considered.

**Case Report:** A 22-year-old male with a traumatic brachial plexus injury in March 2015 due to a motorcycle accident. He attended our Microsurgery team in September 2016 (18 months after the trauma). Clinical examination showed upper trunk and middle trunk injuries, and electromyography presented a motor unit that kept the biceps' motor endplates. Oberlin's procedure (Flexor carpi ulnaris branch to the biceps) achieved good elbow flexion.

**Conclusion:** Nerve transfer can be performed in patients after 18 months if the electroneuromyography examination shows at least one motor unit for the biceps.

the electroneuromyography examination shows at least one motor unit.

**Keywords:** Brachial Plexus; Peripheral nerve injuries; Nerve transfer

## **A-0820** UNSTABLE ELBOW DISLOCATION TREATED WITH LIGAMENOUS RECONSTRUCTION AND HINGED EXTERNAL FIXATOR – CLINICAL REPORT

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**Introduction:** The elbow is the second most common large joint to dislocate. This dislocation can be termed simple if it involves injury to only capsular and ligamentous structures, or complex, if it is associated with fractures of the surrounding bony structures. The most common mechanism leading to elbow dislocations is falling onto an outstretched hand, and a posterolateral dislocation is the most common pattern of dislocation. The initial management of this lesion consists of attempting closed reduction, after which elbow stability is assessed and the patient is immobilized with a posterior long arm splint. Surgical management might be required if the dislocation is unable to be reduced, if there are associated unstable fractures or damaged collateral ligaments that need to be repaired.

**Presenting problem:** The authors present the case of a 58-year-old woman who presented to the emergency room after a high-speed motorcycle accident. The radiological examination revealed a posterolateral elbow dislocation, a fracture-dislocation of the left ankle, a lateral malleolar fracture of the right ankle and stable fractures of the first and second lumbar vertebrae. The elbow and ankle injuries were submitted to closed reduction and temporary splint immobilization. There were no signs of neurovascular compromise of the limbs pre- or post-immobilization. The CT scan of the elbow post-reduction revealed no bone lesions.

**Clinical management:** The patient was submitted to surgery with osteosynthesis of both ankles. The lumbar vertebrae fractures were treated conservatively. Regarding the elbow, due to inability to maintain reduction of the articulation (which presented with medial subluxation), surgery was performed with open reduction of the dislocation, reconstruction of the lateral ulnar collateral ligament using the ipsilateral palmaris longus tendon followed by temporary external fixation with a modular hinged system which was initially locked in 90° of flexion. Reduction of the joint was confirmed with intraoperative fluoroscopy. At this time, the patient presented with ipsilateral wrist stiffness due to prolonged splint immobilization. Two weeks later, the external fixator was unlocked, allowing flexion and extension of the elbow. The external fixator was removed 6 weeks post-operatively and articular congruity was confirmed under fluoroscopy. There were no complications related to the use of the external fixator. Physical therapy was initiated to improve range of motion of the wrist and elbow, as well as muscle strength. Six weeks after the removal of the external fixator, the patient presented an elbow active range of motion of 10-130°.

**Discussion:** Residual instability after an elbow dislocation is a serious condition and its treatment poses a challenge. Ligamentous repair in an unstable elbow may not be sufficient to stabilize the joint in a way that immediate active movement is tolerated. On the other hand, cast immobilization isn't ideal as previous studies have shown that mobilization is essential during healing of ligaments as the functional load on the collagen fibers prevents contracture and stiffness of the joint. Thus, a hinged external fixator is an alternative as it provides enough stability to initiate early mobilization, allowing flexion and extension while protecting against valgus and varus stress.

## **A-0821** FUNCTIONAL OUTCOMES AFTER SAUVÉ-KAPANDJI DISTAL RADIOULNAR JOINT ARTHRODESIS

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### INTRODUCTION

The aim of this study is to analyse functional outcomes and complications after distal radio-ulnar joint (DRUJ) through Sauvé-Kapandji procedure.

### MATERIAL AND METHODS

Consecutive case series retrospective analysis of 24 patients treated in our centre between 2018 and 2020 performing Sauvé-Kapandji DRUJ arthrodesis using a single canulated full thread screw.

Demographic variables, underlying pathological conditions, pre and post intervention functional scale (Quick-DASH), pain scale (VAS), range of motion, radiological measures, patients satisfaction and complications after the procedure were registered.

Statistic analysis was performed using IBM SPSS Statistics 2022

### RESULTS

Patient series consisted on 15 females (62.5%) and 9 males (37.5%). Most prevalent ethiology was post-traumatic (n=15) followed by degenerative (n=7) and rheumatoid arthritis (n=2). Quick-DASH functional scale showed statistically significant improvement ( $p<0.05$ ) 1 year after surgical intervention, as well as patient's pain and wrist supination range. Complication rate (n=6) consisted on 4 proximal stump instabilities and 2 painful scars. No malunion or infection was reported. Patients' general satisfaction was moderate/high.

### CONCLUSIONS

Sauvé-Kapandji procedure is a valid surgical tool for DRUJ dysfunction with results of this study demonstrating excellent pain relief, improved postoperative grip strength, supination improvement, high rate of successful arthrodesis, low rate of major complications and moderate to high patients satisfaction.

## **A-0822** TRAPEZIOMETACARPAL ARTHROPLASTY AS TREATMENT FOR RHIZARTHROSIS – REVISION OF 15 PATIENTS WITH A MINIMUM 12-MONTH FOLLOW-UP

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**Introduction:** Osteoarthritis of the trapeziometacarpal joint, or rhizarthrosis, is a common and often debilitating pathology, that causes pain, mobility limitation and decrease of strength. The initial treatment of this pathology is conservative, including splinting, physical therapy, analgesics or local injections. After failure of the conservative treatment, there are multiple surgical techniques that can be used to treat this pathology, such as trapeziectomy, arthrodesis or arthroplasty, for example. The goal of this study was to evaluate the clinical outcome of a group of patients submitted to trapeziometacarpal total joint arthroplasty for treatment of rhizarthrosis.

**Methods:** A retrospective study was conducted, evaluating 15 trapeziometacarpal arthroplasties in 13 patients. A dual mobility, uncemented trapeziometacarpal prosthesis was used in every patient, and every surgery was performed in the same hospital. The clinical outcome in terms of function and pain was evaluated using pre- and post-operative QuickDASH score. The muscle strength of the operated hand was compared to the pre-operative strength. A radiological examination

was also performed, pre-operatively for staging of the rhizarthrosis and post-operatively to access the implants position and possible complications such as osteolysis. The mean follow-up period was 21.9 months.

Results: The mean age of the evaluated patients was 60.7 years, ranging from 51 to 73 years old. Most (93.3%) were female. Globally, there was a clinical improvement in terms of function and pain, according to the results of the QuickDASH score, with a mean pre-operative score of 52.8 and post-operative of 17.1. There was no statistically significant correlation between this score's improvement and the patient's age at the time of surgery. There was a global increase in the operated hand's strength compared to pre-operatively. The arthroplasty revision rate was 6.7% (1 case), due to mechanical failure of the prosthesis, with the consequent need for a trapeziectomy and suspensoplasty with Mini TightRope. There were no complications on the remaining cases.

Discussion: The result of this study reveals a positively significant impact of the dual mobility, uncemented, trapeziometacarpal arthroplasty for the treatment of rhizarthrosis, with improvement of pain, function and strength of the operated hand, and a consequent improvement of the patient's quality of life. Further studies are necessary to evaluate the long-term outcomes, as well as to compare this technique to other surgical procedures for the treatment of rhizarthrosis.

## **A-0823** RADIAL HEAD ARTHROPLASTY USING "WIDE AWAKE LOCAL ANAESTHESIA NO TOURNIQUET" TECHNIQUE – CLINICAL REPORT AND LITERATURE REVIEW

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Introduction: Radial head fractures are among the most common fractures around the elbow. Radial head arthroplasty is one of the surgical treatment options after complex radial head fractures. This surgery is usually done under general anaesthesia. However, there is a recent anaesthetic technique - wide awake local anaesthesia no tourniquet (WALANT) - that has proven useful in different surgical settings, such as in distal radius or olecranon fractures. It allows a good haemostatic control without the use of a tourniquet and allows the patient to actively collaborate during the surgical procedure. Furthermore, there are no side effects or complications caused by the general anaesthesia and there's an earlier patient discharge.

Presenting problem: The authors present the case of a seventy-six-year-old woman who presented to the emergency department after a fall from standing height with direct trauma to the left elbow. The radiological examination revealed a complete intra-articular comminuted fracture of the radial head (Mason III).

Clinical management: The patient was submitted to surgery with radial head arthroplasty, using WALANT. The surgery was successfully completed without pain. There were no intra or immediate post-operative complications and the patient was discharged on the same day. Six weeks after surgery, the patient presented with an active elbow range of motion of 20-130°, complete pronation and supination and was very pleased with the functional outcome, with no limitations on her activities of daily living.

Discussion: The use of WALANT has been expanded beyond the hand and wrist surgery. It is a safe and simple option for patients at high risk of general anaesthesia, allowing similar surgical outcomes without the intraoperative and postoperative complications of general anaesthesia and permitting an earlier hospital discharge. Furthermore, it allows the patient to actively collaborate during the surgery, providing the surgeons the opportunity to evaluate active mobility and stability, permitting final corrections before closing the incision.

**A-0824** COMBINED ARTHROSCOPIC WAFER RESECTION AND TRIANGULAR FIBRO-CARTILAGE COMPLEX DEBRIDEMENT VERSUS ULNAR SHORTENING DIAPHYSEAL OSTEOTOMY IN MANAGEMENT OF ULNAR IMPACTION SYNDROME

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**Background:** We aimed primarily to compare the clinical and functional outcomes of arthroscopic wafer resection (AWP) with TFCC debridement versus ulnar shortening diaphyseal osteotomy (USO) in the management of ulnar impaction syndrome (UIS).

**Methods:** The study was conducted as a randomized clinical trial including 23 patients with UIS whose ulna variance was < 4 mm. Patients were randomly allocated to either the AWP group (11 patients) who underwent arthroscopic wafer resection and TFCC debridement or the USO group (12 patients) who underwent diaphyseal ulnar shortening osteotomy. Patients were followed up for at least 12 months. The primary outcome measure was the Modified Mayo Wrist Score (MMWS). The Disabilities of the Arm, Shoulder, and Hand (DASH) score, the mean operative time, postoperative complications, and patient satisfaction were our secondary outcomes.

**Results:** Radiological correction of variance was achieved in all patients. The mean operative time was significantly shorter in the AWP group. The postoperative MMWR and DASH scores were greater in the AWP group than in the USO group. Fewer complications occurred in the AWP group (1 of 11 patients) compared with the USO group (3 of 12 patients).

**Conclusions:** Arthroscopic wafer procedure with TFCC debridement is a reliable and safe method for the management of ulnar impaction syndrome with a positive variance of less than 4 mm with better clinical and functional results than diaphyseal ulnar shortening osteotomy.

Type of study/level of evidence: Therapeutic type II

**A-0825** OBERLIN'S PROCEDURE FOR TRAUMATIC BRACHIAL PLEXUS: DELAY TO MANAGEMENT AND ELECTROMYOGRAPHY PREDICT THE OUTCOMES?

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**Background:** Loss of elbow flexion after traumatic brachial plexus injuries are widespread in the daily scenario. Public health systems in underdeveloped countries could delay management. We present the results of Oberlin procedures in patients after eight months of injury.

**Methods:** 16 male patients underwent Oberlin's procedure (Flexor carpi ulnaris branch to the biceps). The mean age was 30 years (18 to 55 years old), and the mean time to surgery was 13.7 months (8 to 22). All patients presented no spontaneous recovery with at least one motor unit in the electromyography. All patients showed C5, and only ten had C7 injuries. Oberlin's procedure achieved an excellent biceps recovery in a mean time of 61 minutes (40 to 88 minutes). Medical Research Council grade was 4.5 (8 patients presented Grade IV and 8 Presented Grade V) at the end of the follow-up mean of 61.1 months (40 to 80 months).

**Results:** There were no statistical differences for age ( $P=0.328$ ), follow-up ( $p=0.629$ ) or total surgery time ( $p=0.501$ ). The electromyography motor unit presented statistical differences in the postoperative outcomes ( $p=0,021$ ). The delay to the surgery for patients within less than 18 months achieved grade V muscle function of the biceps at the end of the follow-up ( $p=0,023$ ). However, Oberlin's procedure presented good outcomes in the patients presented.

Conclusion: Oberlin's procedure is safe for biceps recovery in traumatic brachial plexus injuries.

Keywords: Brachial Plexus; Peripheral nerve injuries; Nerve transfer

## **A-0826** PULL-OUT SUTURE TECHNIQUE FOR FLEXOR TENDON REPAIR IN ZONE I AND II: IS STILL AN OPTION?

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**Background:** The topic of surgical technique and rehabilitation protocols for flexor tendon injuries has long been debated throughout history and in recent years. It is commonly believed that the three main factors that contribute to achieving good results are: a surgical procedure appropriate to the type of injury, an efficient postoperative rehabilitation, and finally, the cooperation and commitment from the patient. For these reasons, several suturing techniques and rehabilitation schemes have been developed over time, however, the turning point came with the introduction of early postoperative mobilization. The fact that some techniques require a strict physiotherapy protocol or proper splinting could represent a problem especially for smaller centers. Furthermore, it may also happen that some patients do not pursue this type of rehabilitation. In 1973 Mantero together with his colleagues, described a modification of Bunnell's pull-out technique for the repair of flexor digitorum profundus lesion (FDP) that allows patients to begin active mobilization right after surgery. Differently from the other techniques, a splint is not mandatory, but it is useful for maintaining wrist, MF and IF in neutral position for preventing rigidity. Patients are instructed to carry out simple exercises several times a day, therefore, the physiotherapist only needs to see the patient periodically to track progress. As a result, even the most reluctant patients in attending physiotherapy appointments will be able to achieve a proper recovery. The purpose of this research is to demonstrate that this technique allows functional recovery with low comorbidities. Furthermore, since it has a simple execution and does not require sophisticated instruments, it could be advantageous for smaller centers that cannot afford to have the patient followed by a specialist during the whole recovery period or for less compliant patient. **Methods:** We treated 58 flexor tendons lesion of zone 1, zone 2a or 2b of the fingertip with a pull-out technique and early active motion (EAM) between January 2018 until March of 2022. Evaluation of the functional outcomes were made with Total Active Motion score (TAM), JAMAR FORCE score, DASH scale and the Visual Analogue Scale for pain (VAS). Follow up was at least 4 months.

**Results:** The mean of the TAM score was 208 ( $55 \pm SD$ ), the JAMAR score mean was 21.5 ( $3.6 \pm SD$ ), the DASH scale 26.3 ( $4.4 \pm SD$ ) and the VAS 3.4 ( $2.9 \pm SD$ ). Strickland scores were mostly excellent (49%) and good (30%), only 5% was poor. 26 patients had associated lesions; therefore, statistic signification was not seen between scores in patients with associated lesions versus non-associated: JAMAR 16 ( $21.1$  vs  $21.8$   $p=0.5$ ), DASH ( $26.4$  vs  $26.1$   $p=0.9$ ), VAS ( $4.6$  vs  $2.54$   $p=0.9$ ), TAM ( $201$  vs  $214$   $p=0.2$ ). None of the patients had any complication in long-term follow up.

**Conclusion:** The pull-out technique for lesion of zone 1, zone 2a or 2b of the fingertip in conjunction with an early active mobilization permit an excellent functional recovery with low comorbidities.

**A-0827** WHICH FACTORS ARE INDEPENDENTLY ASSOCIATED WITH FULFILLING INFORMATION NEEDS IN PATIENTS TREATED FOR HAND OR WRIST CONDITIONS? A PROSPECTIVE COHORT STUDY

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**Objective:** Information provision that meets patients' personal information needs is important in patient-centered care. Meeting patients' information needs yields better outcomes and satisfaction with treatment results. It is unclear which factors explain information need fulfillment in hand and wrist patients. If patients who are more likely to have unmet information needs at three months can be identified before treatment, it may be possible to modify the content and the way the information is provided.

We investigated the independent association of baseline sociodemographics, category of information the patient needed, mental health and expectations, treatment type, and patient-reported outcome measures with the extent to which the most important information need has been fulfilled at three months. Second, we investigated the association with the patient's experience with information provision.

**Methods:** This was a prospective cohort study on a generic sample of patients with hand or wrist conditions treated at Xpert Clinics, The Netherlands. We used a primary sample for the fulfillment of information need, measured at three months with the question: "To what extent have your information needs been met?" (range: 0-10). Before the first consultation, the patient chooses the most important information need category (i.e., diagnosis, advice, perspective, treatment). We used a separate sample for the patients' experience with information provision. For both questions, we used hierarchical linear regression models.

**Results:** We included 1,171 patients in the primary sample and 750 in the second sample. Sixty-six percent rated an eight or higher on the fulfillment of their information need. The final model on the information needs fulfillment explained 14.8% of the variance. Mental health and expectations had the strongest association, with 13.6% explained variance. Higher treatment credibility (standardized beta coefficient and 95% confidence interval B[95%CI]) (0.20 [0.12; 0.28]), higher treatment expectations (0.11 [0.03; 0.19]), psychological distress symptoms (0.28 [0.05; 0.51]) and higher quality of life (0.10 [0.04; 0.17]) were associated with higher fulfillment of information needs. No education (-0.90 [-1.67; -0.13]), higher professional education (-0.33 [-0.64; -0.03]), information need category on advice (-0.25 [-0.40; -0.09]), and perspective (-0.18 [-0.35; -0.01]) were associated with less information needs fulfillment.

The final model on experience with information provision explained 19.0% of the variance. Mental health and expectations explained almost all of the variance, with 18.7%. Treatment of dominant side (0.15 [0.01; 0.28]), light physical work (0.24 [0.01; 0.46]), higher treatment credibility (0.35 [0.26; 0.45]), and psychological distress symptoms (0.36 [0.08; 0.64]) were associated with more positive experience with information provision, whereas scientific education was negatively associated (-0.50 [-0.93; -0.06]).

**Conclusions:** The extent of information needs fulfillment, and the experience with information provision is mainly associated with mental health and expectations. Our findings can be used directly in daily practice by 1) improving patients' pretreatment expectations and treatment credibility, e.g., by being positive (though realistic) about the outcomes and

treatment; 2) adjusting information provision to the level of education; 3) tailoring the content of the information to the patient's specific need, especially when patients have a need for advice or on their perspective.

### **A-0828** ACCESSORY NERVE AND INTERPOSITION SURAL GRAFT TO BICEPS

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**Background:** Loss of elbow flexion after complete traumatic brachial plexus injuries is challenging. There are few alternatives to achieve biceps function when we don't have intercostal nerves or phrenic nerves as suitable options. The accessory nerve and interposition sural graft for the biceps is an alternative ideal for this condition.  
**Methods:** 11 male patients underwent an Accessory-Sural graft to Biceps procedure to achieve elbow flexion. The mean age was 20.4 years (18 to 25 years old), and the mean time to surgery was nine months (8 to 12). All patients presented no spontaneous recovery and a total brachial plexus injury, with the accessory nerve being the only donor nerve available. The procedure took 104 minutes (88 to 123). The Medical Research Council grade was IV (ten patients presented Grade IV and two Presented Grade III) at the end of the follow-up mean of 32.1 months (18 to 108 months).  
**Results:** There were no statistical differences for age ( $P=0.131$ ), total surgery time ( $p=0.670$ ), and electromyography findings ( $p=0.980$ ). The follow-up time presented a statistical difference, where patients less than 39 months presented grave III biceps function at the end of the follow-up ( $p=0.012$ ). However, the procedure presented good outcomes in the patients that became satisfied.  
**Conclusion:** Accessory-Sural Graft interposition to Biceps nerve transfer is safe for biceps recovery in traumatic brachial plexus injuries.  
**Keywords:** Brachial Plexus; Peripheral nerve injuries; Nerve transferrn

### **A-0829** "ON TOP PLASTY" AS CONGENITAL PREXIAL POLYDACTILIA TREATMENT; A CASE REPORT

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#### INTRODUCTION

Preaxial polydactilia is one of the most frequent congenital malformations. Incidence is variable geographically. Wassel-Flatt classification is widely used to classify and orientate therapeutical management. On Top Plasty surgical technique is an available resource for some cases.

#### MATERIAL AND METHODS

9 years-old female patient diagnosed of bilateral preaxial congenital polydactilia, presenting thumb duplicity type VI Wassel-Flat. On physical examination a more hypoplastic radial thumb is observed, with preserved extensor capacity and no active flexion and an ulnar thumb able to pinch grip and dominant function.

#### RESULTS

Racket shape approach is performed to excise the most radial thumb preserving partially its metacarpal bone. The ulnar thumb is fixed to the metacarpal remanent using intramedullary K-wires, the radial joint facet is excised and extensor brevis tendon transposition to F1 is performed. Correct stability, alignment rotation is checked. After 6 months postoperatively good functional and esthetical outcome is reported.

#### CONCLUSIONS

Due to complex anatomic alterations of this congenital malformation, given not clear predominance fingers or complete

functionality, “On Top Plasty” technique is useful to preserve and combine most functional hypoplastic fingers structures, giving stability, correcting size and obtaining better esthetical outcomes. It is recommended to perform surgery during the firsts years of life to favour a correct bone development, better function and less surgical complexity. It is mandatory to individualize the treatment in every case and adapt resection and reconstruction to the patient’s characteristics and needs.

### **A-0830** FLEXOR CARPI RADIALIS TO POSTERIOR INTEROSSEOUS NERVE TRANSFER

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**Background:** Loss of wrist and finger extension after traumatic brachial plexus injuries are common in the nerve injury scenario. We present the outcomes of Median Nerve Flexor Carpi Radialis (FCR) branches to Posterior Interosseous Nerve (PIN) procedures in patients with traumatic brachial plexus injuries.

**Methods:** 12 patients (nine males and three females) underwent FCR to PIN procedures to achieve wrist and finger extension. The mean age was 26.4 years (18 to 31 years old), and the mean time to surgery was 10.8 months (9 to 14). All patients showed C5 to C7 injuries with no spontaneous recovery. The procedures took 72 minutes (65 to 81 minutes). Medical Research Council grade was IV at the end of the follow-up mean of 53.3 months (20 to 83 months).

**Results:** There were no statistical differences for age ( $P=0.153$ ), follow-up ( $p=0.619$ ), total surgery time ( $p=0.140$ ) or delay to the surgery ( $p=0.912$ ). The patients presented a good wrist, finger, and thumb extension recovery. Four patients presented Grade V and eight presented Grade IV for muscle function.

**Conclusion:** FCR to PIN procedure is safe for wrist, finger, and thumb extension recovery in traumatic brachial plexus injuries.

**Keywords:** Brachial Plexus; Peripheral nerve injuries; Nerve transfer

### **A-0831** PERILUNATE INJURIES OF THE WRIST

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**Introduction:** The fracture dislocations of carpal bones are rare wrist injuries but unfortunately their diagnosis can be incorrect and missed in up to 25% of the cases. Their management has changed in the years, passing from a conservative closed treatment to an open reparative and reconstructive treatment. A correct diagnosis is necessary in order to reduce the fracture and correctly stage treatment.

**Methods:** Between 2006 and 2020, we have treated 67 patients (61 males and 6 females, range 17-65yrs, average 38,0yrs) with perilunate dislocations and fracture dislocations of the carpal bones. In all cases the mechanism of injury has been a hyper-extended wrist impacting the ground. Diagnosis of lunate dislocation was early and correct in 56 cases, late in 11 cases (12, 14, 15, 19, 21, 23, 27, 38, 45, 49, 50 days after trauma). Scaphoid fracture (34 cases) was always correctly diagnosed at the time of presentation. Lunate dislocation was open in 5 cases. We performed reparative and reconstructive surgery in all cases except 2 (proximal row carpectomy). We applied temporary Kirschner (K) wires for intercarpal and radiocarpal stabilization in cases without scaphoid fracture (33 cases). In the 34 cases with associated

fracture of scaphoid we applied temporary K wires for intercarpal and radiocarpal stabilization in 26 cases and the fracture of the scaphoid was fixed with a screw in all cases. We performed an open dorsal approach in 41 cases, open volar approach in 8 cases, combined open approach (volar and dorsal) in 10 cases, percutaneous technique (scaphoid fixation with screw and carpal stabilization with K.wires) in 8 cases. We repaired the scapho-lunate ligament in 35 cases, the luno-triquetrum ligament in 13 cases. We removed K. wires on average 53 days after surgery (min 40-max 62).

Results : we evaluated results in 56/67 patients (mean follow-up of 18 months, min 3-max 32) and

used an algorithm including radiographic measurements, Mayo Wrist Score, Jamar test and Dreiser test.

Results were optimal in 37 patients, good in 21, fair in 9. Only in 6 patients we have not observed the same level of activity they exercised before the trauma. Complications: superficial K wires infection (6 cases), stiffness (8 cases), local osteoporosis without clear CRPS (3 cases), post-traumatic arthritis (16 cases but with few symptoms) , scaphoid nonunion with avascular necrosis of the proximal fragment (1 case).

Conclusions:A correct as well as timely diagnosis is necessary to provide early and appropriate treatment.

### **A-0832** CAN WE “JUST” REPAIR CHRONIC LIGAMENT INJURIES OF THE THUMB?. LONG-TERM OUTCOMES OF PRIMARY REPAIR OF CHRONIC THUMB ULNAR AND RADIAL COLLATERAL LIGAMENT INJURIES

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The porpouse of our study is to assess the feasibility of delayed primary repair of the collateral ligaments of the thumb (radial and ulnar colateral ligaments) instead of ligamentous reconstruction in chronic injuries.

Patients with at least 6 years of evolution were reviewed in consultation. Radiographs were obtained and functional and pain scales were made. Return to work and sports activities was evaluated and also satisfaction rating. 47 (4 RCL & 43 UCL) of the 52 patients operated on before 2017 could be evaluated (90%). The mean follow-up was 7.5 years (10-6 years). All patients except 3 were able to return to work and/or sports that they perform prior to injury. Postoperative joint function, as well as range of motion and laxity, were comparable to the contralateral side (except for the 3 referred patients who presented with residual pain and instability). These 3 patients underwent reoperation, performing ligament reconstruction of the UCL. Mean duration from injury to surgery was 21 months (range: 8 weeks– 96 months). Total range of motion MCP 61°, total range of motion IP 89°, opposition pinch 91% apposition pinch 89%, VAS 0.8, Quick DASH 6,7, Normal function 93%. Complication rate was very low: 3 reintervention (pain & instability), 2 superficial infection, 6 numbness (5 transient), 15 patients had some degree osteoarthritis in xray (without clinical impact). All the patients (47) reported they were satisfied or very satisfied with the surgery.

In conclusión, repair of chronic ligamentous injuries of the thumb metacarpophalangeal joint appears to be a reasonable alternative to ligament reconstruction, resulting in long-lasting, durable results while avoiding the morbidity associated with more aggressive techniques.

## **A-0833** REHABILITATION OF ZONE ONE EXTENSOR TENDON REPAIRS

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### Introduction

Current evidence suggests immobilising the distal interphalangeal joint (DIPJ) in neutral for six weeks using a dorsal blocking splint. Following a period of immobilisation, the splinting is reduced and the functional and activity demand of the digit is increased. Anecdotally, outcomes from this approach did not consistently yield satisfactory results often leading to an excessively stiff DIPJ and in some cases acquired swan neck deformities. We therefore undertook an audit to explore if there was a more effective approach to managing the rehabilitation of Zone I extensor tendons.

We hypothesised that scar adhesions to the repaired tendon was the primary differentiation between the repaired tendon population and injuries that were managed conservatively (ie: closed injuries). With this in mind and with the prevalent concept of early active movement for tendon rehabilitation stimulating intrinsic tendon healing and lessening the effects of scarring on the tendon glide, a guideline that promoted early movement of the DIPJ and earlier and more rigorous application of scar management was developed.

In the absence of information describing the perpendicular forces the DIPJ places on the extensor tendon as the DIPJ flexes, and to minimise the risk of rupture to the repaired extensor tendon, a small arc of movement (10 degrees) was decided upon.

The proposed guideline

At initial contact (within one week) post operation:

- Fabrication of a dorsal blocking splint – protecting the DIPJ only. Secured with Velcro.
- Fabrication of an exercise splint that allowed 10 flexion at the DIPJ.
- Starting scar massage as soon as the wound was amenable.

At week six post operation, the splint was reduced to night time and protection with unrestricted active movement at the DIPJ. Functional load was graded in line with the treating therapists' usual approach to closed injuries so was not prescriptive and relied on clinical judgement.

The audit was lodged with the Saint George's Hospital Clinical Audit team and the guidelines proposed and discussed in a plastic surgery clinical governance meeting in January 2020.

### Results

Patient data was collected from surgeries completed between August 2020 to August 2021.

Patients were allocated to either the limited early active movement (EAM) guideline group or to the standard immobilisation group.

Data was collected from ten cases in the EAM group and fifteen cases in the immobilisation group.

Miller criteria for assessing extensor tendon function was applied at the end of treatment to each case as well as number of sessions attended – both for extensor lag and arc of movement.

Outcomes of the groups were similar in terms of outcome and number of appointments attended.

### Discussion

Acknowledging the group numbers were small, extrapolation of information to larger population is limited. As there was no meaningful difference in the outcomes and number of appointments offered, there is no compelling reason to adopt the new and potentially more complicated guidelines. However, a question for further study was proposed by a surgical colleague: Do we need to repair simple open mallets?

## **A-0834** RADIAL POLYDACTYLY: CLINIC AND RADIOGRAPHIC EVALUATION IN A MULTICENTER STUDY

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### Background

Radial polydactyly is a common congenital deformity of the hand usually treated surgically within the first 2 years of age. Despite a mean low reoperation rate, the overall outcomes are not always complete satisfactory. In this multicentric study clinical and radiological outcomes in patients from two different hospitals were evaluated.

### Methods

This study was conducted between the Hand Surgery Unit of Poznań (Poland) and the Hand Surgery Unit of Verona (Italy). 41 patients were recruited (24 in Poznań and 17 in Verona), from an overall of 130 patients operated in both the units between 2021 and 2011.

Among these patients, 30 were male and 11 female, the mean age at the moment of surgery was 2,08 years (SD 2,39), mean age at the moment of the visit was 5,74 years (SD 3,49) and 5 patients underwent bilateral surgery, with a total of 46 thumbs examined.

We classified bifid thumbs, based on preoperative radiographies, according to the Rotterdam Classification.

Main complications that led to a secondary procedure on the operated thumbs were evaluated.

An examination of the operation reports was assessed, considering the use of k wire, corrective osteotomy, ligament reconstruction and plasty of part of the joint when involved.

The patients underwent a clinical evaluation using the JSSH (Japanese Society for Surgery of the Hand) score and strength assessment with a pinch gauge.

Plain radiograms were taken, length and width of the articular surfaces distal and proximal to the duplication were measured and compared to the healthy one. Patients with bilateral duplicated thumb were excluded from this measure due to the impossibility of an appropriate case-control comparison.

### Results

According to the JSSH score, we reported 5 poor, 9 fair, 22 good, 10 excellent results.

5 patients had already undergone a second operation when tested and 3 patients were advised for a second procedure during the visits, for an overall 17% of reoperation rate. All of them had a JSSH score <15 and IP or MP joint instability was the main reason for reintervention.

Pinch strength tests, radiological findings and surgical techniques didn't seem to be related with the JSSH score results. Triphalangism, triplication of thumb and type III bifid thumb showed a poorer JSSH scores.

### Conclusion

The bifid thumb is a complex pathology, causes of reintervention are more connected with the natural evolution of the primitive deformity than with a specific surgical technique applied, nevertheless, due to the main role of instability as a cause of reoperation, special care must be taken in operative assessment and reinforcement of collateral ligaments.

A treatment tailored on the type of the thumb is crucial, with caution with triphalangism and type III. During a postoperative evaluation has to be considered that the functional outcome often is not linked with differences of strength and radiological measures.

## **A-0835** WAFER OSTEOTOMY THROUGH DISTAL RADIOULNAR PORTALS

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### Introduction

Ulnocarpal impaction syndrome is one of the most common causes of ulnar pain. With the aim of decompressing the ulnar region in variances not greater than 4mm, the “Wafer” osteotomy of the distal ulna was developed. The open technique allowed the removal of 2 to 4mm of the ulnar head, despite the risk of injuring the triangular fibrocartilage. With the development of arthroscopy, it is possible to reproduce the arthroscopic Wafer technique, also allowing the assessment and treatment of associated injuries and resection of the distal ulna through the triangular fibrocartilage complex (TFCC) injury. With the publication of the distal radioulnar portals and their use in the arthroscopic wafer, the possibility of preserving more fibrocartilage and achieving uniform resection without performing pronosupination maneuvers was developed.

### Objective

Description of the technical advantages, analysis of the functional results and repercussion of the arthroscopic findings.

### Material and method

Retrospective longitudinal study of patients who underwent wafer osteotomy through distal radioulnar portals. The differential aspects of the arthroscopic technique as well as the functional results of the operated patients are described. The study variables were: sociodemographic data, pre- and postoperative radiological study (Tolat classification, ulnar variance measurement), functional result according to the Mayo Wrist Score and pain according to the Visual Analogue Scale. The result is stratified according to the degree of involvement of the triangular fibrocartilage and lunate osteochondral lesions.

### Results

21 patients were included, with a mean age of 56 years and a mean follow-up period of 8 months. Mean preoperative ulnar variance was +2.4mm with Tolat I morphology in 57%, Tolat II in 32%, and Tolat III in 11% of cases. An improvement in the Mayo Wrist Score was observed, going from an average of 76 to 91 points. The postoperative radiological study showed a neutral ulnar variance except in one case. Regarding the Visual Analogue Scale, an improvement from 5.4 to 1.7 was observed at the end of the follow-up period. The mean physical rehabilitation time was 11 weeks. No differences were found in the results related to fibrocartilage or osteochondral lesions, however, the best scores were observed in the cases of intact fibrocartilage.

### Conclusions

The preservation of the fibrocartilage and the restoration of the neutral variance using this technique have shown a correct functional result regardless of the arthroscopic findings.

The use of the distal radioulnar portals allows to respect the fibrocartilage and facilitates the technique by creating a direct and perpendicular access to the distal ulna.

## **A-0838** POSTOPERATIVE INFECTION RATE IN LOW-ENERGY OPEN WRIST FRACTURES IN PATIENTS OLDER THAN 65 YEARS

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### Introduction

Wrist fractures commonly occur in elderly patients and are characterized by being the most frequent of the upper limb.

Despite it is a very frequent pathology whose management in closed fractures is well characterized, there are only a few studies that evaluate the results in open fractures.

The aim of this research is to evaluate the rate of infection associated with open fractures of the distal radius and/or ulna due to low-energy trauma in patients older than 65 years treated with a locked palmar plate.

#### Methods

We studied a retrospective cohort between 2005 and 2022. We included all those patients older than 65 years, with open wrist fracture due to low-energy trauma, initially treated in our institution by reduction and rigid osteosynthesis (radius-locked plate), with at least 6 months of follow-up. We excluded all patients under 65 years of age, with high-energy trauma, initially treated in another hospital, with conservative treatment or fixation with another implant different than a locked volar plate.

Demographic data, AO classification, Gustilo-Anderson classification, antibiotic prophylaxis per shift, time in days until surgery, surgical treatment performed, and postoperative infectious complications as a result variable were collected from the clinical history. A descriptive statistical analysis of the data was performed.

#### Results

Of 45 patients with open fractures in the period studied, 35 met the inclusion criteria. The incidence of open fractures was 1.9% (95% CI 1.33 - 2.6%).

94.3% were female. The mean age was 76.91 years ( $SD\pm 7.72$ ). The mean follow-up was 83 months ( $SD\pm 52.79$ ).

The fractures were distributed according to the affected bone (21.2% radius and 78.8% associated radius and ulna), classified according to severity based on the AO classification (55.6% type A and 44.4% type C) and according to the degree of exposure by Gustilo-Anderson (74.3% grade I and 25.7% grade II).

96.2% of the patients received intravenous antibiotic prophylaxis upon admission to on-call care. 71.4% presented a surgical toilette the same day of the consultation by guard. The median time between the day of the fracture and reduction and osteosynthesis was 8.17 days ( $SD\pm 6.35$ ).

In our series, there was only one case of superficial infection, a 76-year-old female patient with a Gustillo grade I fracture who developed cellulitis on the third postoperative day and resolved with oral antibiotic treatment. This represented an incidence of infection of 2.85% (95% CI 0.07 - 14.91%). We did not obtain cases of deep infection, nor the need to remove the implant. The incidence rate of postoperative infection in open fractures was 0.43 cases of infection/100 open fractures-year (95% CI 0.06 - 3.03).

#### Conclusion

Due to the low rate of infection in our series, we believe that Gustilo I and II fractures could be treated by surgical toilette + rigid internal fixation in acute care, because it would not be associated with risk of reoperations or implant-associated infection.

## **A-0839** MULTISTRUCTURAL VOLAR WRIST AND FOREARM INJURY: DEFINITION & TREATMENT ALGORITHM

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#### Introduction

The multistructural volar wrist and forearm traumatic lesions (spaghetti wrist) constitute frequent traumatic injuries of the upper limb, which require demanding hand surgery techniques and specific post operational observation and restoration. This type of injury is interweaved with serious functional defects. There is no consensus on the exact definition of these

injuries. The purpose of the current study is to define the multistructural volar wrist and forearm injuries, the assessment of their extent and the study of the epidemiology and treatment.

#### Materials and methods

From 2018 to 2022, 179 patients (161 men, 18 women), aged 11 to 91 years old (mean age: 42,6 years) presented injury of zones V to VIII of the volar wrist and forearm, underwent surgery. All patients received regional anaesthesia with axillary nerve block. We define as multistructural volar wrist and forearm traumatic lesion, the injury of at least two different structures of the volar wrist soft tissues: artery, nerve, tendon. The restoration of the structures follows the sequence of tendons, arteries, and nerves in accordance with the surgical techniques of hand surgery. Sutures nylon 5-0, 4-0 & 3-0 were used for the repair of the tendons. Arteries and nerves were repaired with microsurgical technique and sutures nylon 8-0, 9-0 & 10-0. Post-operatively, dorsal plaster with finger flexion and mild volar wrist flexion was implemented to all the patients for 30 days. Every patient started passive mobilisation of the fingers with instructions for passive flexion exercises.

#### Results

Regarding the number of the injured structures, we report 6,44 per patient, 1-3 tendons (42,5% per patient), 1 nerve (73,1%) and 1 artery (53,2%). In most of the cases the flexor digitorum superficialis of the ring finger is injured (10,9%), whereas concerning the neurovascular trauma, ulnar nerve (52%) and the median nerve (50,8%) ulnar artery (46,9%) are mostly injured. In the majority of injuries, 1132 patients (98,2%), all structures were repaired "end to end", in 10 cases (0,9%) nerve or artery grafts were used, 2 patients (0,2%) required tendon transfer techniques and 9 patients (0,8%) presented non-repairable injuries.

In the 3-month follow-up every patient report satisfactory range of motion with mild rigidity. In 6 months, every patient with nerve injury shows progress. Patients with median nerve injury had better outcome than those with ulnar nerve injury or multiple neural structures.

#### Conclusion

Multistructural volar wrist and forearm traumatic lacerations concern mainly labourers with injury of 1 to 3 tendons, 1 nerve and 1 artery. Post operative examination of the patient according to the algorithm of the treatment and the patient's compliance to the post-operative instructions are crucial for the result. Every patient should be informed to anticipate the slow evolution of the nerve healing.

## **A-0840** NERVE TUMORS OF PAEDIATRIC HAND: TREATMENT PROTOCOL

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#### Introduction

Nerve tumors of the upper limb and particularly of the hand present rare incidence and they are usually misdiagnosed. Specifically, due to its asymptomatic appearance, a nerve tumor is underestimated and characterized as ganglion. The vast majority of nerve tumors of the pediatric upper limb is schwannomas or neuroma as part of the Neurofibromatosis type I (NF 1) syndrome, which, without the appropriate treatment, cause neurological sensory and motor deficiency. Moreover, in rare cases, a nerve tumor may transform to a malignant mass, despite its initial benign characteristics. The purpose of the current study is to register these rare cases, examine the diagnostic path, the treatment and post operative management.

## Materials and Methods

From 2018 to 2022, 3 children (2 girls, 1 boy), 4, 6 and 10 years old (average: 6,6 years) were treated for nerve tumours of the upper limb. A palpable mass of the left upper limb was present in all 3 cases (100%), with a diameter between 3 to 7cm (average: 4,2 cm). The mass was located in the middle forearm in two cases and in one case it occupied the hand and the wrist. The mass originated from the median nerve in two cases and in the other case from both the median and ulnar nerve. During clinical examination, every child presented mild symptoms, a relatively painless mass, mild paresthesia of the median and ulnar nerve (Weber test average: 9), a feeling of “heavy hand” during fatigue, positive Durkan and Phalen tests, without severe loss of grip’s strength. The pre-operative management consisted of radiographs of the upper limb, MRI and ultrasonography of the tumour. All children underwent general anaesthesia. The surgeries were conducted using microsurgical techniques, microsurgical tools and magnification surgical glasses (surgical loupes). The resection of the tumor was wide, with delicate preservation of the nerves structure. In all 3 cases the carpal tunnel was released and the excised mass was sent for biopsy.

## Results

Three month post-operatively, every child showed improvement of the paresthesia, according to the Weber two point discrimination test and amelioration of the feeling of limb heaviness. Muscular strength was not affected and in all cases an improved cosmetic result was reported, due to the reduction of the turgidity. The anatomic pathology report showed two cases of neuroinoma and one case of schwannoma.

## Conclusion

Mapping the tumour, based on the clinical assessment and the imaging evaluation, is crucial for choosing the appropriate surgical technique for the wide resection of the mass. Respect for the nerve integrity and use of the microsurgical techniques ensure the optimal post-operative outcome. The diagnosis, as a combination of the intra-operative observation of the surgeon and the result of the anatomic pathology report, determine the prognosis and additional treatment (chemotherapy, radiotherapy) if needed. The proper post operative examination and assessment of the child are critical in order to ensure the punctual detection of a recurrence or a transformation to a malignant nerve tumor neurosarcoma.

**A-0842** EXPOSED KIRSCHNER WIRES IN HAND FRACTURE FIXATION: A MAJOR TRAUMA CENTRE 18-MONTH REVIEW  
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## Introduction

Hand fractures are common and represent 20% of all forms of fracture. Placement of percutaneous Kirschner wires (K-wires) is the most commonly used modality of surgical hand fracture fixation, followed by open reduction and internal fixation (ORIF). K-wires are recognized as a cost-effective and safe method of hand fractures fixation. K-wires are typically removed after a period of 4-6 weeks, with an associated protocol for ensuring optimal early mobilisation. There is a recognised risk of infection at the pin site ranging from 4-33%, and in rare cases this can lead to osteomyelitis. Evidence suggests iodine-soaked dressings, skin releases at pinsites or burying k-wires can possibly reduce infection rates.

We share our experience as a tertiary plastic surgery unit and a Major Trauma Centre. Our unit manages over 3000 hand fractures annually. Our departmental practice is exposed K-wires unless contraindicated, with a single IV antibiotic dose on induction.

We report on our findings from a retrospective study of 191 patients with hand fractures requiring K-wire fixation.

#### Methods

We identified eligible patients within our trauma database. Follow-up data was collected via Trust and GP electronic patient records. 191 patients underwent K-wire fixation over an 18-month period (March 2021 – Sept 2022) and a total of 263 K-wires were inserted. BSSH guidelines on closed hand fractures were used as a gold standard for service evaluation.

#### Key results

Majority of patients requiring K-wire fixation of hand fractures were male (75.0%), peaks between 30–49 years of age. 79.0% were closed injuries. Metacarpal fractures were the most common site needing K-wire fixation (45.1%), followed by proximal phalangeal fractures (24.7%). 43.5% of the fixations were on the little finger. 97% of K-wires inserted were exposed not buried. Most (56.7%) of the fractures were fixed with 2 K-wires. The mean number of days that the K-wires were in situ was 32.2 days. K-wires were removed in outpatient clinics by registrars or consultants.

The overall post-operative K-wire infection rate was 6.3%. The majority being pin-site infections that were successfully treated with one short course of oral antibiotics. One case required a washout under local anaesthetic, and only one case developed osteomyelitis requiring amputation. There were no statistically significant correlation in K-wire infection rates with open injuries, smoking status and medical comorbidities, including diabetes.

The overall average time from injury to fixation was 5.7 days, which is compliant with the 7 days as recommended in BSSH guidelines.

#### Conclusion

Our findings confirm exposed k-wires is safe and cost-effective practice. This is consistent across patient groups with open injuries or medical comorbidities, which are often presumed to have an increased risk of infection. A single IV antibiotic dose and careful post-operative follow-up is effective in protecting our patients against k-wire infections.

## **A-0843** WRIST INJURY AND DISORDERS IN THE MILITARY

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**Aim:** To analyze the structure of injuries, treatment results, and develop the treatment principles of wrist injuries based on their characteristics in the military.

**Materials and methods:** we revised 30 cases of wrist disorders and injuries in the military. 19 of them - acute gunshot or blast injury and its consequences. 15 of them combined with tendons injury, 11 nerves, arteries injuries, skin cicatrice transformations, and hand ischemia (4), traumatic finger amputations (3). Wrist injury was an element of polytrauma in 13 patients. First aid in frontline institutions for these patients includes cast, K-wires, external fixators, debridement, and VAC. 11 patients have typical exacerbations of the chronic wrist disorders (SLAC - 2, SNAC - 5, Kienbock's Disease - 2, Rhizarthrosis - 2).

**Results and discussion:** Patients with primary K-wires fixations through the injured joint and skin defects were closed late - developed complicated arthritis, which made it impossible to treat all elements of the injury in the first 5-7 months. We have seen 3 deep infections, all with polytrauma and K-wires fixation. In patients treated with extra-articular fixation and early wound closure, we observed the absence of deep infection. After the skin had healed, we faced the main dilemma: What is first? Bone support or functionally important structures? For defects of the bone tissue of the wrist, which grossly violate the structure, length, and axis - bone reconstruction is a priority (mainly - resection-stabilizing surgery). Then

reconstruction of tendons and nerves. In less complicated wrist bone lesions, - nerve and tendon structures should be treated first. In the case of war wounds, damage patterns, wrist kinematics, and biomechanics are non-typically for ordinary “peaceful” fractures and dislocations. They do not fit into the typical perilunate or axial displacements of the wrist. As a rule, there are significant wrist structural defects - the absence of bone mass and articular surfaces. However, it is often possible to find a kinematic pattern from the preserved structures and perform an intervention that preserves the useful amplitude in the wrist joint (proximal row carpectomy, partial arthrodesis, trapezectomy). Manifesting of disorders or wrist injuries in the military is typical for these conditions in civilians. However, the way of treatment significantly depends on the patient’s chosen pathway. Motivated soldiers refuse interventions with long rehabilitation (partial arthrodesis, osteosynthesis with bone plastic) in favor of operations with a quick but partial effect, preferring such interventions as denervation of wrist joint, the radial styloidectomy, proximal row carpectomy, which quickly return them to their duty. Conclusions: Wrist war injuries almost always combine with vessels, nerves, and tendons defects. In the case of a polystructural injury, the best sequence is stabilization, closure of the defect, restoration of gross bone defects, and tendon-nerve reconstruction in combination with hand therapy is a priority. Exacerbations of chronic diseases in the military are treated according to general principles, but the military’s motivation to return to the army is considered.

#### **A-0845** DESCRIPTION OF UNUSUAL OSTEOCHONDRAL LAMINAR FRAGMENT PATTERNS IN DISTAL RADIUS FRACTURES

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#### Background

Distal radius fracture (DRF) is one of the most common fractures and, frequently, surgical treatment is mandatory in the presence of an intra-articular fracture. However, there are some unusual intra-articular fracture patterns, were it remains challenging to properly recognize and anatomically reconstruct the articular surface. The objective of the present study is to describe an intra-articular fracture pattern of the distal radius characterized by the presence of osteochondral laminar fragments, which could potentially require a different treatment to standard stabilization. We aim to answer the following questions: (1) What are the radiological characteristics of intra-articular DRFs with osteochondral laminar fragments (OCLF), (2) What is the prevalence of DRFs with OCLF relative to all intra-articular surgical DRFs, (3) What are the differences in epidemiological characteristics of patients with OCLF in relation to all patients with intra-articular DRFs, (4) What is the prevalence of intra-articular DRFs with OCLF in patients belonging to a closed community.

#### Patients and methods

We reviewed radiological and tomographic records of all adult patients operated on distal radius fractures at our institution. We analyzed tomographic characteristics; prevalence of osteochondral laminar fragments relative to all intra-articular surgical distal radius fractures and compared clinical and demographic characteristics of patients with osteochondral laminar fragments in relation to all patients with intra-articular fractures.

#### Results

Two main groups according to the fracture pattern were described: group I, volar rim impacted OCLF (vOCLF); and group II, central impacted OCLF (cOCLF). Prevalence of OCLF relative to surgical intra-articular DRFs: 42/989 (4.2%); group I: 23/989 (2.32%); group II: 19/989 (1.92%). Characteristics of patients with OCLF compared to all patients with intra-articular DRFs: Significant differences were found in the five variables evaluated (age, less than 65 years, female, high energy fracture,

and associated fractures). The global prevalence of DRFs with OCLF in patients affiliated with the medical care insurance system of our institution was 2 per 10,000 individuals (95% CI 1.4 to 2.9).

#### Discussion

Global prevalence of these fragments relative to surgical intra-articular fractures was very low. However, despite being epidemiologically rare, it is important to identify these specific fracture patterns because their treatment can be challenging.

Level of evidence: IV (Observational/Descriptive); Cross sectional study.

### **A-0846** CORRECTIVE OSTEOTOMIES OF THE DISTAL RADIUS BY OSTEOTOMIC GUIDES WITH 3D TECHNOLOGY

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**Introduction:** The treatment of acquired or congenital deformities of the distal radius may not be easy to manage. In the case of fracture outcomes as well as for congenital deformities (Madelung) it is often necessary to manage not only the radio-carpal joint but also the ulno-carpal and distal radial-ulnar joints to recreate the correct anatomical relationships. Among the various aids that we can use there are 3D reconstructions with the creation of osteotomic guides to program in advance the angles and sites of osteotomy starting from a pre-operative CT scan.

**Materials and Methods:** This work reports our experience in the treatment of distal radius malunions in fracture outcomes and congenital deformities such as Madelung with corrective osteotomies performed by 3D computer-assisted reconstruction.

Almost always an autologous bone graft corresponding to the patient's bone defect was used and internal fixation was performed using plates and screws. We compared the postoperative radiographic parameters of the operated side of the patient with their healthy side and analyzed the final clinical results.

**Results:** All patients achieved bone consolidation on X-ray at final follow-up. Mean differences in volar tilt, radial tilt and ulnar variance between the operated and contralateral sides were significant. In all cases we have achieved a significant improvement in wrist functionality with good objective and subjective results. Almost all patients returned to their normal daily activities.

**Conclusions:** with the clinical and radiographic results obtained, it is concluded that the corrective 3D osteotomy assisted by osteotomic guides and test wedges for definitive bone grafts has obtained good functional results and that it can be used for all cases in which the correct axes and normal articular relationships of the wrist must be restored.

### **A-0847** WHICH IS THE IDEAL TREATMENT OF SCAPHOLUNATE LESIONS? OUR OUTCOMES FROM DORSAL CAPSULODESIS TO TENODESIS

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**Introduction:** The ideal treatment for scapholunate (SL) instability has not yet been established. This study examined the results of various procedures for the primary treatment for chronic SL dissociation from dorsal capsulodesis to flexor carpi radialis tenodesis.

**Materials and Methods:** We report a retrospective cohort of 25 cases of chronic scapholunate instability. A retrospective analysis was conducted that examined dorsal capsulodesis and tenodesis procedures performed for chronic SL instability between 2011 and 2021. Of the 25 patients, 4 had a RASL procedure, 16 dorsal capsulodesis procedure and 5 had a tenodesis procedure. Results were reviewed clinically and radiographically.

**Results:** We excluded the 4 patients treated with RASL procedure. Postoperative wrist motion decreased in both groups after surgery. Postoperative grip strength remained unchanged in both groups. There was no statistical difference in the overall wrist motion, grip strength, or wrist scores between the capsulodesis and tenodesis groups.

A significant deterioration in SL angle and SL gap, but not correlated to function, was seen at final follow-up. In two cases of capsulodesis and one case of tenodesis we had a complete failure treated with PRC. The other patients achieved a significant improvement in wrist functionality with good objective and subjective results. Almost all patients returned to their normal daily activities.

**Conclusions:** Arthroscopy permits a direct evaluation of the scapholunate injury and the status of the articular surfaces. Dorsal capsulodesis and tenodesis provided improvement in symptoms for patients with chronic SL instability. Both procedures appear to provide similar results in the treatment of this difficult problem.

Despite radiological deterioration of SLA and development of degeneration in most cases, capsulodesis and tenodesis can give satisfactory wrist function in some patients, but with not without failures or complications.

## **A-0848** THE FOREARM DISTAL LOCKER: HOW TO TREAT INSTABILITY IN FRACTURE-DISLOCATIONS OF THE FOREARM

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**Introduction:** distal radioulnar joint lesions are not rare and are usually associated with distal radius fractures, ulnar styloid fractures, Galeazzi or Essex\_Lopresti fractures-dislocations.

Galeazzi's lesions are the fracture of the distal third of the diaphysis of the radius with concomitant dislocation of the distal radioulnar joint (DRUJ), which account for about 7% of forearm fractures in adults.

The gold standard of treatment is open reduction and internal fixation to anatomically restore the radial arch and avoid any functional deficit. This fracture is known to be unstable and delayed or inadequate treatment can cause complications and disabling functional limitations.

The radius and ulna are held together by the interosseous membrane (IOM) which is composed of 3 lockers: proximal, distal and central which is the strongest component.

The distal locker – the RUD – has in the TFCC the main stabilizer along with the dorsal and volar radioulnar ligaments.

We report our experience in the reconstruction of the distal locker and, therefore, TFCC in Galeazzi's lesions after reducing and performing radius osteosynthesis.

**Materials and Methods:** there are different classifications for the Galeazzi lesion: according to the dorsal or volar dislocation of the distal radius (Walsh), according to the distance from the DRUJ (Rettig and Raskin) or even according to the position of the fracture of the distal radius (Beneyto).

The diagnosis is performed with standard X-ray (possible contralateral X-ray) of the elbow, forearm and wrist with the addition of CT, while the usefulness of wrist MRI is still debated.

If treated conservatively in adults, most patients with Galeazzi's fracture will have unsatisfactory results.

It is necessary, in fact, to proceed with bone synthesis with the volar and Henry approach which is classically used to access the fractures of the middle and distal third of the radius while if the DRUJ is unstable it is necessary to perform

(more often after arthroscopic control) the foveal reinsertion of the TFCC.

In this work we have included patients treated in the last 5 years with bone synthesis of radius and subsequent evaluation of DRUJ stability with consequent reinsertion of TFCC describing the various reconstructive possibilities of TFCC itself with or without DRUJ pinning.

Results: the radiographic and clinical results of our patients treated with bone synthesis of radius and subsequent stabilization of DRUJ were evaluated with an assessment of subjective satisfaction and return to work activity prior to trauma.

Conclusions: Galeazzi fractures are rare and highly unstable; they must be treated as soon as possible to limit their complications. In adults, the gold standard of treatment is open reduction and internal fixation; if DRUJ is unstable, TFCC reconstruction should then be carried out and not limited to stabilization with temporary percutaneous pinning.

### **A-0849** 'SUZUKI FRAME' EXTERNAL FIXATION OF ARTICULAR PHALANGEAL FRACTURES

Andrea Ghezzi, Emanuele Pamelin, Elena Francioni, Valentina Susca, Romeo Raimondo Ribolzi, Giorgio Eugenio Pajardi

Treatment of complex phalangeal fractures may be challenging, especially for comminuted intraarticular fractures. Surgical synthesis of small articular fragments is not always possible with standard techniques (K wires, screws) and clinical outcomes are often not satisfying. In some cases, the only way to achieve a good reduction is ligamentotaxis: 'Suzuki frame' external fixators, built with K wires, apply a distraction to the fractured bone and allow a stable synthesis and an early mobilization of the finger. The aim of this study is to evaluate clinical outcomes of complex phalangeal fractures treated with 'Suzuki frame' external fixators.

This study includes patients diagnosed with articular P1 or P2 fractures, treated with 'Suzuki frame' external fixator between January 2020 and October 2022 in our hospital. Patients were evaluated using DASH and PRWE clinical scores and total finger active range of motion (TAM).

14 patients were included in our study. Mean follow up was 12 months. Average total active motion at follow up was 210 degrees, with an average DASH score of 11.7 and PRWE score 12.

Our technique represents an excellent alternative to standard surgical treatments for comminuted intraarticular phalangeal fractures. 'Suzuki frame' external fixation is a cheap, quick and easy to perform technique to achieve a good reduction of complex phalangeal fractures. Mid term clinical outcomes are good.

### **A-0850** US PERIPHERAL NERVE EVALUATION: UTILITY AND PREDICTABILITY

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Introduction: Evaluation of peripheral nerve lesions has classically been based on clinical and electrophysiologic criteria. Nowadays, ultra sound (US) imagines are more and more frequent used for morphologic assessment of nerve injury sites and concomitant lesions. We would present our experience.

Methods: Since September 2021 in our University Hospital a multidisciplinary outpatient service has been started. Hand surgeons and neurologists work together to evaluate all kind of peripheral nerve lesions. 37 patients underwent clinical

evaluation, neurophysiological examination and US study. We discussed neuromas, peripheral nerve's tumours, peripheral nerve's reconstruction outcomes, OBP palsy outcome, CRPS, complex peripheral nerve's injuries, brachial plexus injury, traumatic and iatrogenic peripheral nerve lesions, peculiar compression lesions.

Results: US imagines allowed to have a definitive diagnosis in all patients, and to help surgeon in decision-making and surgical options. 31 patients underwent surgery and the intra-operative aspect confirmed the US study. In 12 patients the US imagines changed the initial diagnosis, and so the treatment.

Conclusions: We believe that collaboration in a multidisciplinary outpatient service is a value added. US imagines are useful and predictable. We advise it in all complex or unusual cases.

## **A-0851** FLEXOR TENDON REPAIR AND REINSERTION 3 MONTHS OVER TRAUMA: PUSH BEYOND THE LIMIT

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### Introduction

In the literature, direct repair of the flexor tendons in zones 1 and 2 and reinsertion of type 1 Jersey finger is limited to 6 weeks after the trauma. Recently, cases with repair occurring within 3 months of trauma have been reported. Here we report the functional results obtained in 4 cases in which deep flexor repair and reinsertion was performed beyond 3 months after the trauma.

### Materials and methods

The results obtained by performing a late tendon repair and reinsertion were retrospectively analyzed. Patients whose lesions were repaired more than 3 months after trauma in zone 1 or 2 of the long fingers or thumb in the period from early 2020 to late 2021 were included in the study. Patients were treated via exploration of the lesion, direct M-Tang + epitendineous suture or pull out reinsertion was performed. Fractional lengthening, flexor tendon tenolysis and Z plasty were performed to achieve direct suture without excessive IP flexion. Patients were immobilized with intrinsic dorsal plus splint. Rehabilitation was undertaken between the seventh and twentieth postoperative day. Evaluation of TAM was measured at last follow up.

### Results

Four patients matching the inclusion criteria were identified. The lesion was located in zone 2 of the little finger and zone 1 in the thumb; one patient was affected by Jersey finger type 1 of the middle finger. The time elapsed between the trauma and the surgical treatment was 5.5 months. Mean follow up time was 6 months. Mean TAM was 193°. Extension lag of 10° and 20° at PIP and DIP was registered.

### Discussion

In this case series direct suture was possible in all patients, helped by ancillary procedures required to increase tendon length and avoid excessive tendon traction and IPj flexion. Another fundamental aspect to perform this procedure is the integrity of pulley system. So that an experienced surgeon should be in charge of these kind of patients. It is important to perform such a suture that bears immediate rehabilitation program. Patients should be informed prior to surgery about therapeutic alternatives if direct suturing is not possible: tendon graft, arthrodesis of the distal interphalangeal joint or tenodesis.

### Conclusions

The repair by direct suturing of the flexor tendons in zones 2 and 1 and reinsertion of Jersey finger type 1 is possible even

after 3 months from trauma. Fundamental is the presence of complete passive range of motion of the affected finger. During surgery the surgeon must confirm the integrity of pulley system. The execution of accessory gestures such as fractional elongation of the tendon, tenolysis or Z plasty are required. The suture must be at least 6 strands and must allow for early active mobilization. The patient must be informed about the possibility to perform different treatments in the event that the repair by primary intention must not be possible.

## **A-0852** COMPARISON OF ORTHOSIS SATISFACTION OF HAND-INJURED PATIENTS USING STATIC ORTHOSIS, DYNAMIC ORTHOSIS OR RELATIVE MOTION ORTHOSIS

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### Objective:

Orthoses can be designed to relieve pain, immobilize a body part, protect the injury site, prevent, or correct deformity, and promote body healing. Patients' satisfaction with the orthoses may be affected by the factors such as orthotic material, aesthetics, weight and size of the orthosis. The aim is to assess the hand-injured patients' satisfaction with static, dynamic and relative motion orthoses with the orthotics and prosthetics users survey (OPUS).

### Methods:

We included 85 patients with a mean age of  $35.3 \pm 13.3$ . Inclusion criteria were; being 18-65 years old, having hand injuries and using an orthosis for hand injury for at least 4 weeks. All patients included in the study actively used one of the static orthoses, dynamic orthoses or relative motion orthoses. In this study, a demographic information form and OPUS satisfaction module were applied to the patients. OPUS consists of 4 main modules. These modules are; the quality of life index, upper extremity functionality, lower extremity functionality and the user satisfaction scale. The scoring and maximum score of each module are different and the scores in all modules are calculated with a Likert scale. A higher score indicates a better outcome for all measures. The score of the Satisfaction module is in the range of 0-105. The satisfaction module consists of 2 parts. The first section, consisting of 11 questions, measures device satisfaction, while the second section, consisting of 10 questions, measures satisfaction with the service provided. In our study the mean satisfaction scores were compared by dividing 85 patients into 3 different groups (dynamic orthosis, static orthosis, relative motion orthosis). Data was presented with the mean and standard deviation.

### Results:

Relative motion orthosis was used in patients with boutonniere deformity, extensor tendon injuries and phalanx fractures. Static orthoses were used in patients with Distal Radius fractures, Ulna fractures, metacarpal fractures, crush injuries, extensor pollicis longus tendon injuries and nerve injuries. Dynamic orthoses were used to fix a deformity such as an extensor lag in chronic flexor and extensor tendon injuries or claw hand after peripheral nerve injuries. The mean orthosis satisfaction score of all patients was 87, the mean satisfaction score of 30 patients with relative motion orthoses was  $89.9 \pm 10.9$ , the mean score of 40 patients with static orthoses was  $85 \pm 9.2$ , and the mean score of 15 patients with dynamic orthoses was  $86.9 \pm 10.3$ .

### Conclusion:

In general, all patients included in the study had high orthotic satisfaction. We observed that while patients with relative motion orthoses had higher satisfaction, patients with static orthoses had relatively lower satisfaction scores. We think that the reason for this is that static orthoses which our patients use were more rigid and more difficult to use if

comparing relative motion orthoses. Orthotic intervention should be individualized considering the individual's unique physical and psychosocial needs.

## **A-0853** RISK OF VOLAR LOCKING PLATE REMOVAL FOLLOWING DISTAL RADIUS FRACTURES. TIME TO EVENT ANALYSIS

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### Background

The incidence of volar locking plate (VLP) removal following distal radius fracture (DRF) surgery is highly variable. Published studies only report the incidence of hardware removal at the end of follow-up, without considering the time elapsed and the variability throughout the postoperative years.

The primary aim of this study is to determine the risk of VLP removal after DRF surgery over the postoperative years. The secondary goal is to examine the relationship between the Soong index and hardware removal.

### Methods

We retrospectively reviewed 300 patients (313 wrists) over seven years. Patients older than 18 years old with DRF who underwent VLP fixation were included. Those treated with another implant, history of infection or revision surgeries were excluded. The hardware removal and primary reason of it were recorded. Demographic information, VLP brand, and dominant side were collected. Fractures were classified radiographically according to AO, the postoperative palmar inclination was measured, and hardware prominence was categorized according to Soong classification. Patients were divided into two groups according to the removal or not of the plate for comparative analysis.

Statistical analysis: Kaplan-Meier and actuarial survival methods were used for the incidence of implant removal. Univariate and multivariate logistic regression were performed to assess the relationship between removal extraction and Soong classification.  $P < 0.05$  was considered to be statistically significant.

### Results

The overall incidence of hardware removal was 11.2% (35 cases) at 15 years of follow-up.

During the first postoperative year, the removal incidence was 6.2% (95% CI 3.7–9.5%), decreasing to 1.7% (95% CI 0.57–4%) and 1.4% (95% CI 0.4–3.7%) for the second and third postoperative years. After that period, the removal incidence remains below 1% until the end of the follow-up.

The causes of removal were: 12 (34.3%) tenosynovitis, 9 (25.7%) implant associated pain, 6 (17.1%) screw protrusion, 4 (11.4%) carpal tunnel syndrome symptoms, 2 (5.7%) due to foreign body sensation, and 2 (5.7%) by patient request.

According to the Soong index, 65 (21%) were grade 0, 148 (47.9%) grade 1, and 88 (31.1%) grade 2.

Univariate analysis showed no statistically significant differences between groups. Logistic regression showed an odds ratio of 2.05 (95% CI 0.6–6.5,  $p = 0.213$ ) and 2.37 (95% CI 0.7–7.8,  $p = 0.156$ ) for Soong 1 and 2 compared to grade 0.

### Conclusion

VLP removal after DRF is more common in the first year after surgery and remains significant until the third year. Given that the most common reasons for VLP removal were tendon pathology and pain, we believe that regular monitoring and patient education are critical during this period of time to avoid potential complications.

## **A-0854** SECONDARY RECONSTRUCTION AFTER NEXOBRID TREATMENT IN HAND BURNS

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Debridement using Nexobrid has established itself as a potential standard of care in the treatment of deep second-degree burns. Due to the readily available analgesia in the hand area through the placement of plexus catheters, isolated hand burns in particular are often a reason for enzymatic debridement. In 2018 - 2022, 11 patients were treated again surgically in our clinic after completing treatment with Nexobrid. In all cases, new debridements were necessary and all patients received a secondary split skin transplantation.

In addition to the correct selection of hand burns suitable for enzymatic debridement, the recognition of the need for skin grafting during the course of treatment is crucial. Inadequate debridement may need to be supplemented surgically or repeated enzymatically. If wound healing disorders occur in the course of skin grafting after debridement with Nexobrid, prompt operative correction is crucial for regaining hand function. The present case series is used to clarify the guidelines for treatment and to illustrate the complications with regard to their underlying errors in indication or execution.

## **A-0856** TARGETED MUSCLE REINNERVATION AND CENTRO-CENTRAL SUTURE IN TREATMENT AND PREVENTION OF PAINFUL NEUROMAS OF THE HAND: CLINICAL APPLICATION AND DECISION-MAKING

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### Introduction:

The treatment and prevention of painful neuroma of the digital nerves is complex and, at present, there are no safe techniques that allow therapeutic success. The literature shows that the best way to prevent recurrence is to secure a distal target for the nerve stump. Targeted muscle reinnervation (TMR) has recently been shown to be a very effective treatment for neuromas of large nerve segments, but little is known about its application in the hand. Here we summarize the most recent scientific evidence relating to the treatment of painful post-amputation neuromas and our experience in the use of TMR in the hand and central center suture (CCU) for the prevention of recurrence of amputated neuromas.

### Methods:

We conducted a review of the literature on the use of TMR and CCU in the treatment of hand neuromas on the main scientific search engines. Patients treated for painful neuromas of the hand and patients who required digital or ray amputation were included. Patients affected by painful neuromas were evaluated with block tests and high-resolution ultrasound examination. CCU was performed in digital amputation and neuromas at the level of P2 or the palm. TMR was performed in painful neuromas of the palm or in case of ray amputation. Patients were evaluated postoperatively by NRS and DASH.

### Results:

Of the 15 works obtained from the selected research, 4 articles were analyzed. Of these, 2 describe the feasibility of TMR at the level of the hand, while another 2 report results from a series of cases treated with the method in question. Five patients were included: one fifth ray amputation, one P2 acute amputation and three patients affected by painful neuromas at P1 and P2. CCU was performed at P2 level and in one case at the MP joint; TMR was performed on lumbricalis motor branch in ray amputation and neuromas at P1 and MP joint. Mean follow up time was 12 months. In patients affected by painful neuroma NRS decreased (from 7 to 2), one neuroma relapsed in CCU. No neuromas arose in patients treated in acute and in ray amputation.

## Conclusions:

In our small series, pain improved in all patients. One neuroma relapsed after CCU in a patient affected by pain for a long-lasting period before surgical procedure. No neuromas appeared in patients treated immediately. We believe that TMR should be used when neuromas are inside the palm or at the P1. On the other hand, when the neuroma is located more distally, the CCU seems to be the most adequate technique, so as to minimize nerve dissection. In these cases, TMR can be considered in the case of multiple relapses. The same approach should be used in ray amputation in which TMR could be performed easily. Otherwise in finger amputation CCU could be the most indicated technique.

## **A-0857** TREATMENT OF PROXIMAL MIDDLE PHALANGEAL FRACTURES USING A DYNAMIC EXTERNAL FIXATOR DEVICE: COMPARISON WITH OPEN REDUCTION AND INTERNAL FIXATION TECHNIQUE

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### Introduction

Phalangeal fractures are the second most common upper extremity fractures and represent 10% of all whole skeletal fractures. The goal of treatment for these fractures is to achieve bony healing and preserve motor function. Immobilization and splinting in proximal middle phalangeal fractures is often sufficient to achieve adequate bone healing but often results in poor functional outcomes. Surgical procedures are indicated for unstable fracture patterns and those involving the articular surface. Open reduction and internal fixation (ORIF) are technically demanding in these fracture patterns and are likely to result in stiffness, reduced range of motion and poor functional outcomes.

### Materials and Methods

In this study, we present the results of 29 patients referred to our trauma center with complex fractures of the middle phalanx from January 2014 to May 2022. 13 patients were treated using a ORIF technique with screws or plates and screws depending on the fracture pattern. In contrast, 16 patients were treated with a dynamic external fixator that provides distraction through the proximal interphalangeal joint while maintaining the alignment of the fracture fragments by ligamentotaxis. Patients treated with this external fixation device are encouraged to actively and passively move the interphalangeal joint with the goal of reducing the risk of stiffness and promoting better outcomes. QuickDASH was administered to all the patients, ROM was recorded using the Total Active Flexion (TAF) Scale, and grip strength was assessed using a dynamometer comparing the results with the contralateral limb.

### Results

At an average follow-up of 24 months in both groups (minimum follow-up 2 months), all patients achieved a satisfactory subjective clinical outcome according to the results obtained by QuickDASH score. The mean grip test value, measured as a percentage comparison with the contralateral limb, was similar in the 2 groups showing no significant differences. Similarly, the TAF scale also revealed no differences in the 2 groups. The operative times in the second group of patients were significantly lower ( $p < 0.0001$ ).

### Conclusions

Larger case histories will be useful to show the superiority of one technique over the other. Immediate mobilization following surgery may ensure a lower risk of stiffness and scar adhesion formation. The use of a dynamic external fixator can meet this need: it is a simple, reproducible, and well-tolerated technique. Its use is also recommended in comminuted fractures that would otherwise be managed with a conservative treatment due to the inability to obtain a stable fixation even with an open approach. Classical ORIF surgery still has a role in cases where closed reduction is not achievable.

## **A-0858** INDOCHINESE SPITTING COBRA ENVENOMATION: A NOVEL USE FOR BIODEGRADABLE TEMPORISING MATRIX IN A RARE CASE OF UPPER LIMB SOFT TISSUE LOSS

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### Background:

Snake bite injuries are relatively uncommon in the United Kingdom. There are only three species of snakes found in the wild across the nation, and only one of them, the adder (*Vipera berus*), is known to be venomous. Increasing popularity of exotic snake species as household pets introduces new challenges to the National Healthcare System in view of the acute sequelae of bites and the subsequent care of the resultant wounds.

Among such household snakes is the Indochinese Spitting Cobra (*Naja siamensis*), whose peculiar appearance and dangerous disposition may attract some snake owners. Its potent venom has both neuro- and cytotoxic properties and can lead to severe injuries and death. Fast spreading poison can lead to extensive soft tissue necrosis, warranting aggressive debridement and posing reconstructive challenges.

Novosorb Biodegradable Temporising Matrix (BTM)<sup>®</sup> is a dermal substitute gaining traction as a novel strategy in staged complex wound reconstruction. Where donor sites are compromised or limited there is growing literature describing its utility in the plastic surgeons' armoury.

### Case:

We present the management of the first documented case of Indochinese Spitting Cobra envenomation in the United Kingdom. An 18-year-old female patient was bitten by her pet Indochinese Spitting Cobra and experienced extensive skin and fat necrosis of the affected upper limb and subsequent fasciocutaneous tissue loss of 7%TBSA after surgical debridement. Advice was taken from the National Poisons Information Service and augmented with experiences in literature. Two doses of anti-venom were administered within 12 hours of injury.

The patient experienced respiratory depression and was managed for several weeks in ICU for sedation and mechanical ventilation. The resultant defect included exposed median nerve and long flexor tendons of the wrist. Satisfactory soft tissue coverage was achieved in two stages using BTM and split thickness skin grafting. At 3 months the patient demonstrates stable, pain-free scarring with superior contouring, 'skin-pinch' and tendon glide relative to skin grafting in isolation.

### Discussion:

The literature pertaining to the acute management and outcomes of patients affected by exotic snake envenomation is limited, confined to a handful of case reports and series in Australasia.

The initial care of such patients is multi-disciplinary, inclusive of intensivists, surgeons, clinical toxicology, clinical psychology and early hand therapy to maintain passively supple joints for optimal reconstruction and rehabilitation. The role for anti-venom is limited only to counteracting neurotoxicity and early aggressive surgical debridement may have a role in limiting the extent of soft tissue damage.

Whilst the role for dermal substitutes on the reconstructive ladder is well recognised, the proffered benefits of BTM over its counterparts has offered great promise for an appropriate cohort of patients. Furthermore, where local or distant tissue flaps might prove bulky with poor-contour definition and in some instances substantial donor morbidity, BTM may address some of these frequently encountered issues. We have identified a novel and effective role for this technology going forward.

## **A-0859** WRIST HEMIARTHROPLASTY FOR COMPLEX INTRAARTICULAR DISTAL RADIUS FRACTURE IN A PATIENT WITH MANIFEST OSTEOPOROSIS

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Distal radius fracture (DRF) is one of the most common fractures of the elderly. The higher the degree of joint surface destruction, and the more adverse factors are involved, the more challenging proper treatment becomes. In this regard, osteoporosis as underlying systemic disease, chondropathy or degeneration of adjacent wrist bones as well as in compliance significantly impair the success of the chosen primary therapy. Wrist hemiarthroplasty has already been reported as primary or secondary procedure for DRFs.

In this case report, we present a patient with a severely comminuted DRF including posttraumatic degeneration of the lunate as well as manifest osteoporosis (lumbar and femoral T-score of -2.9 and -2.7). 3 months after initial surgery including osteosynthesis with 2 Kirschner-wires and an external fixation, wrist hemiarthroplasty using the ReMotion radius component in combination with proximal row carpectomy was performed as secondary surgery. Follow-up examinations after 1.5 and 6.5 years showed a substantial reduction of pain levels, improvement of Disability of the Arm, Shoulder and Hand Scores as well as range of motion data, while we could detect no complications or radiographic changes. Thus, this procedure proved to be a viable treatment option in this case of complex distal radius fracture.

## **A-0862** LIPARTHROPLASTY FOR THUMB CARPOMETACARPAL JOINT OSTEOARTHRITIS: A CASE SERIES WITH MEDIAN 5 YEARS OF FOLLOW-UP

Matthias Holzbauer<sup>1,2</sup>, Manfred Schmidt<sup>2,3</sup>, Julian Alexander Mihalic<sup>1,2</sup>, Dominik Duscher<sup>4</sup>, Tobias Gotterbarm<sup>1,2</sup>, Stefan Mathias Froschauer<sup>2,5</sup>

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Liparthroplasty, i.e. autologous lipoaspirated fat transplantation, is recently discussed as promising bridging therapy after failed conservative treatment options to postpone arthroplasty surgery of the thumb carpometacarpal joint as long as possible.

The current study investigates the sustainability of this method in 7 stage II, and 24 stage III osteoarthritis patients (27 female and 4 male cases). Data were evaluated preoperatively, 6 months, 2 years postoperatively as well as at a final follow-up assessment after median 5.1 (interquartile range: 1.4) years.

We found a significant reduction of postoperative Disabilities of the Arm, Shoulder and Hand (DASH) Scores and pain levels at all follow-up examinations compared to the data prior liparthroplasty. Moreover, we even detected a reduction in both parameters within the postoperative course so that the DASH Scores of our final investigation were significantly lower than the values after 6 months. Furthermore, 12 of our 31 cases demanded a surgical conversion after a mean period of  $1.6 \pm 1.0$  years due to recurrence of symptoms: these patients presented with significantly worse functional scores, pain levels and range of motion data compared to patients attending our final follow-up appointment. A binary regression analysis found smokers to have significantly higher odds (11 times) for therapy failure leading to surgical conversion. 17

of 19 patients in our final assessment stated to be pleased with the result of liparthroplasty.

Due to favourable mid-term outcomes of 61% of the 31 initially treated patients, we recommend liparthroplasty as reliable bridging therapy for preserving joint's integrity as long as possible, especially in non-smoking patients.

### **A-0863** HAS THE PANDEMIC CHANGED OUR TREATMENT STRATEGIES? CASE REPORT OF A DELAYED TREATMENT OF 4TH AND 5TH PIPJ FRACTURE DISLOCATION DUE TO COVID INFECTION

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Due to the pandemic situation, patients who have access to AeE for fracture and subsequently tested positive for covid swabs, not having the necessary resources in hospital to treat them with lack of ppi, were sent home to await negativization before undergoing surgery. We know how variable and long the negative time was in the initial phase of the pandemic and how much a delay can negatively affect the clinical outcome for intrarticular fracture. We present a case report of a patient who suffered a fracture – dislocation of the 4th and 5th PIPJ who was treated after 3 weeks with a percutaneous technique. We used a suzuki frame to treat the 5th PIPJ and an extension block wire to treat the 4th PIPJ after percutaneous calloclasia. The patient was followed carefully and accurately in the postoperative period and had a complete recovery of the range of motion without pain despite the not perfect radiographic result. If we had treated the patient immediately we would have used orif for both fractures to obtain a better radiological result with probably a worse clinical outcome, but due to the long period of immobility pre op we opted for early mobilization to reduce surgical dissection and comorbidity.

### **A-0864** PERIPROSTHETIC RADIOLUCENCY IN TOTAL WRIST ARTHROPLASTY: A RADIOGRAPHIC STUDY

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The poorly understood process of periprosthetic radiolucency is observed in nearly all types of arthroplasty surgery, also in total wrist arthroplasty. The crucial question is which changes indicate implant loosening requiring revision surgery and which cases can be considered as plain radiographic changes.

Thus, this retrospective study investigates radiographs of 50 total wrist arthroplasty (ReMotion prosthesis) patients with a mean age of 58.1 (SD 11.1) years. Available dorsopalmar radiographs were clustered in immediate postoperative, one-year, two-year, three-year, five-year, and max. (>six)-year postoperative groups. The area of periprosthetic radiolucency (area of reduced bone density), periprosthetic radiolucent lines in 4 zones, and the position of the prosthesis according to 5 methods were assessed by two independent examiners. Moreover, Disabilities of Arm, Shoulder, and Hand Scores, pain levels and range of motion data had to be available at the longest follow-up time, where a radiograph was taken. The periprosthetic radiolucency was assessed using a heat-maps, i.e. a false-colour image technique, in each follow-up group. Statistic evaluation included interrater reliability testing to detect methods, which assess the position of the prosthesis most accurate. Moreover, radiographic outcomes were correlated with functional parameters.

The present study shows that periprosthetic radiolucency is a progressive phenomenon beginning at bone adjacent to the joint line and might be explained by stress shielding. Implant-MCIII angle, Implant-CMCIII distance, and Implant-Tip radial diameter revealed the best reliability values for assessing the prosthesis position. Moreover, we could find a significant correlation between reduced Implant-CMCIII distance and higher postoperative pain levels and patient dissatisfaction. Thus, we recommend considering revision surgery of total wrist arthroplasty in symptomatic patients presenting with continuous pain and swelling as well as radiographic sign of carpal implant subsidence.

## **A-0865** ANTEROMEDIAL RELEASE FOR POSTTRAUMATIC FLEXION-PRONATION CONTRACTURE OF THE WRIST: A CASE REPORT

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Wrist stiffness is a common and potentially debilitating complication following trauma. Lack of supination appears to be the most disabling form.

Patients presenting with a soft tissue flexion-pronation contracture may have an injury of the ulnar side of the wrist involving: capsular contraction of the distal radioulnar joint, contracture of the flexor carpi ulnaris, contracture of the volar ulnar carpal ligaments and the pronator quadratus muscle. This injury may develop subsequent contracture of the ulnocarpal and midcarpal joints and contracture of the volar capsule of the distal radio ulnar joint (DRUJ). Its evaluation requires a thorough clinical examination and adequate radiographic investigation. A surgical option to manage this condition is the release of injured structures using an anteromedial approach to the wrist.

We report the case of a 39-year-old woman presenting supination loss of her left wrist. She suffered a proximal third radius fracture of her left wrist as a child treated conservatively with a cast. After a recent wrist sprain, increased pain started associated with ulnar nerve paresthesias. Physical examination found tenderness over her distal radioulnar joint and severely impaired wrist function, with supination limited to 90 degrees. There was no evidence of motor nerve abnormality. Plain radiographs showed dislocation of the distal radioulnar joint and static volar intercalated segment instability. Magnetic resonance imaging showed inveterate volar dislocation of the left ulna, acute extensor carpi ulnaris tenosynovitis, and rupture of the DRUJ capsule, radioulnar ligaments, and triangular fibrocartilage complex.

Having failed nonoperative management, anteromedial release was performed. Quadratus pronator was found interposed and contracted and was released from its ulna insertion. Flexor carpi ulnaris was lengthened, and the midcarpal joint was released. Anterior dislocation of the ulna was observed with chondral lesion and radial sigmoid notch dysplasia. After distal radioulnar release, DRUJ was unstable. Due to this reason, chondral injury and inveterate joint dislocation, matched ulna resection arthroplasty was finally performed.

Surgery was performed without complications. After two years of follow-up, the patient has regained her previous functional status managing to achieve supination of -20 degrees, almost symmetrical compared with the contralateral side, complete resolution of pain and resume of daily life activities.

Flexion-pronation deformity is caused by injury of volar ulnar side of the wrist. Careful exam must be performed and subsequently release achieved.

This anteromedial approach is described for patients failing nonoperative management. It is a safe and predictable technique to access the volar ulnar corner of the wrist, reducing subsequent damage to the surrounding soft tissue, and minimizing further contractures and scarring.

**A-0866** A BLAUTH IIIB HYPOPLASTIC THUMB RECONSTRUCTED BY USING A NON-VASCULARIZED PROXIMAL INTERPHALANGEAL JOINT FROM THE TOE AS A NEW ALTERNATIVE TO POLLICIZATION - DESCRIPTION OF THE TECHNIQUE AND OWN EXPERIENCES

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**Introduction**

Thumb hypoplasia or aplasia is a significant functional and cosmetic problem for the developing hand in children. The gold standard in the treatment of Blauth IIIB type is the amputation of the thumb and the pollicization of the index finger. Despite the good functional and clinical results, more and more parents do not consent to the operation, mainly for cosmetic reasons - the four-finger hand. Alternatively, there are operations to increase stability and restore the first carpometacarpal joint of the thumb, such as reconstruction using the metatarsophalangeal joint, phalanges, or parts of the metatarsal bone.

**Material and Method**

We want to present an alternative technique used in our Department of Hand Surgery for over 20 years, consisting of stabilizing a hypoplastic thumb with a non-vascularized proximal interphalangeal joint from the toe to reconstruct the first carpometacarpal joint in kids' hands. More than 20 children were operated on with the technique mentioned above. This type of surgery is described in the literature, but there are no reports of its use in this type of defect.

**Results**

After the operation, the results show an improvement in the stability of the hypoplastic thumb, which improves the grip and active use of the hand in everyday functioning. The grip pattern using or not using the hypoplastic thumb depends on the age at which the operation was performed.

Removal of the proximal interphalangeal joint from the toe does not affect the gait quality, and the cosmetic defect is acceptable to patients and parents.

**Conclusion**

The transfer of the non-vascularized proximal interphalangeal joint from the toe to the Blauth IIIB hypoplastic thumb seems to be an acceptable alternative to index pollicization for patients whose parents do not accept thumb amputation and four-finger hand.

**A-0867** WHY DO WE BECAME TO USE A MEDIAL CONDYLE FEMORAL FLAP FOR SCAPHOID BONE DEFECTS REPLACING LESS FREQUENT

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**Objetives:** For many years, vascularized medial condyle femoral flap has been one of the most useful types of treatment for scaphoid pseudoarthrosis. The purpose of the study was to determine the amount of femur donor site damage in comparison to the required size for the scaphoid defect replacement.

**Materials and Methods:** There were 17 patients (15 men and 2 women) who operated on with a diagnosis of scaphoid nonunion and pseudoarthrosis. Other characteristics included the height, weight, and body mass index of patients. A vascularized medial femoral condyle flap has been used to replace the defect after resection of the area of pseudoarthrosis.

After preparing the recipient zone and determining the defect size the flap was elevated according to the standard procedure. Length, width, and height of the bone flap were measured after the vessel's separation. The final fit of the flap was performed to the size of the recipient zone before implantation.

Results: The average height of patients is 180 cm for men and 174 cm for women. Weight 77.4 kg for men and 62 kg for women. The BMI is 23.86 for men and 20 for women. The average size of the obtained flap was 2.66 cm<sup>3</sup> for men and 2.5 cm<sup>3</sup> for women. There was a positive correlation obtained between the size of the flap taken and the patient's body mass index (correlation coefficient 0.329211). There is a similar situation with weight: the bigger it is, the larger the flap elevated (correlation coefficient 0.200587). The size of the flap inverse ratio height of the patient height (-0.11612). Using the results of previous anthropometric measurements of the scaphoid bone, the average volume of the scaphoid in the population was calculated. It is 2186 cm<sup>3</sup> for men and 1355 cm<sup>3</sup> for women. Finally, the volume of flap received during the operation was compared to the scaphoid bone size in a population. On average, the volume of the flap outsizes the volume of the entire scaphoid bone by 21-46%.

Conclusions: About half of the bone that we get from the femur is not used for defect replacement. Medial femoral condyle flap application is important for scaphoid reconstruction in case of the scaphoid pseudoarthrosis and aseptic necrosis of its proximal pole. We need to take into account that the size of the donor site defect may be several times higher than the amount of bone we need to cover the defect, and the amount of loss depends on the patient's constitution as well. In some cases, arthroscopic revision and scaphoid bone grafting from the iliac crest can be a selection method.

## **A-0868** SURGICAL CORRECTION OF WARTENBERG'S SIGN: A CASE REPORT

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Wartenberg's sign, or permanent abduction of the little finger, is most commonly caused by ulnar nerve palsies. Several surgical techniques to correct this sign are reported in the literature, with majority using extensor digiti minimi (EDM). We propose a case of Wartenberg's sign, treated by a transfer of extensor digitorum communis to the little finger (EDC V), a variation on a technique described by Voche et al. After six-week follow-up, result was good with no recurrence of any deformities and a normal active extension.

The rationale behind the method of surgical correction is two-fold: it ensures active extension of the little finger is not compromised by sparing the EDM, and the multiple slips of EDC tendon makes it a versatile option. This method is dependent on patient anatomy and presence of single EDC tendon to the little finger or a single common EDC tendon distributed to the ring and small finger. In addition, this technique should only be considered in cases with no claw deformity. Considering the lack of robust data on which tendinous transfer is most advantageous in correction of this deformity, an anatomical study comparing surgical techniques is warranted and will be the subject of an ongoing project by named authors of this paper.

## **A-0869** GLOMUS TUMOUR OF FINGER TIP- ANALYSIS OF RECURRENCE AND NAIL DEFORMITIES

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### Materials and Methods:

Retrospective review was performed of 26 patients diagnosed as having glomus tumor in the thumb or fingertips over a 10-year period. The data collected included demographics, presenting symptoms, duration, previous treatment history, physical examination, treatment, and recurrence. The data were presented by means of descriptive statistics.

### Results:

The mean duration of symptoms before presentation was 2.6 years (range 2 to 6 years). The mean age at presentation was 44 years (range 16 to 62 years), and female to male ratio was 2.1:1. sixteen patients had left-hand involvement; thumb 2, index finger 3, middle finger 7, ring finger 10, and little finger 4. Clinical and radiological assessments were made preoperatively. At presentation, 10 cases had nail changes, whereas 16 had no obvious nail changes – out of these, 4 had pulp involvement. The lesion involved the subungual region in 21 cases. 15 patients had Glomus tumour under the germinal matrix; 10 had nail deformities at presentation. All patients who had Glomus tumour under germinal matrix developed nail deformities after surgery. None of the patients with sterile matrix Glomus tumour had nail deformity at presentation and they did not develop nail deformity after surgery. The mean size of the lesion was 2.8 mm (range 2 to 10 mm). All patients were found to have histopathologically proven glomus tumors.

### Conclusion:

Early diagnosis of glomus tumors is important to avoid lengthy treatment delays, chronic pain and disuse syndromes. Glomus tumours removal under the germinal matrix is associated with nail deformities post operatively. Glomus tumours under the sterile matrix are less likely to develop nail deformities

## **A-0871** SURGICAL TREATMENT OF KIENBÖCK'S DISEASE USING AN INTERCARPAL ARTERY REVASCULARISATION TECHNIQUE: OUR EXPERIENCE

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The pathophysiology of Kienböck's disease is still unclear today. The currently most supported hypothesis sees a concomitance of intrinsic or extrinsic factors that intervene on a predisposing substrate making the disease manifest. The aim of surgical treatment is to preserve the biomechanics and function of the wrist and to revascularise the necrotic half-moon. Our study aims to evaluate the short- to medium-term clinical and instrumental outcomes of a new revascularisation technique used in the treatment of 9 cases of Kienböck's disease stage 2, 3A and 3B according to Lichtman's classification. By means of a retrospective analysis, we analysed 9 patients (6 females and 3 males) who underwent treatment for Kienböck's disease using a revascularisation technique that has never before been proposed by any author, involving the grafting of a vascular pedicle taken from the dorsal intercarpal artery. Of these patients, 2 who also underwent radius osteotomy were excluded from the study, which therefore involved 7 patients (5 females and 2 males) aged between 17 and 38 years (mean age 27.14 years). The patients were evaluated 6 - 30 months after surgery by clinical examination (Mayo Wrist score, dynamometric examination and joint ROM measurement) and instrumental examination (x-ray in 2

projections and MRI).

In the short to medium term, all patients reported a reduction or resolution of pain symptoms with a change in the mean value of the NRS scale from 6.75 pre-operatively to 1 at the final check-up. We also recorded a 17.51% increase in joint ROM values and an increase in mean grip strength from 18.5 kg to 27.2 kg. The clinical improvement is associated with a relative stability of radiographic parameters such as the Carpal Height Ratio (mean preoperative values 0.475 - mean postoperative values 0.49).

The technique of revascularisation of the semilunar bone by means of a dorsal intercarpal artery represents a valid alternative to preserve the semilunar bone even in advanced stages 3A and 3B of Kienböck's disease

## **A-0872** TURKISH TEST-RETEST RELIABILITY OF THE UPPER EXTREMITY MODULE OF THE OPUS (ORTHOSIS PROSTHESIS USER SURVEY)

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### Objective:

User satisfaction is important in terms of the efficiency of treatment in cases using orthoses. In the literature, there is the OPUS (orthotic prosthesis user questionnaire), which is frequently used in international publications, in which orthosis wearer satisfaction and extremity functionality are measured together. Although there is currently a validity and reliability study for the Turkish OPUS lower extremity module, there is no study for Turkish upper extremity validity yet. Our aim is to research the Test-retest validity for the upper extremity module of the OPUS (orthotic prosthesis wearer questionnaire).

### Methods:

We included 34 patients with a mean age of  $34.5 \pm 14.3$ . Inclusion criteria were; being 18-65 years old, having hand injuries and using an orthosis for hand injury for at least 4 weeks. In this study, a demographic information form and OPUS satisfaction module and OPUS Upper extremity module were applied to the patients. OPUS consists of 4 main modules. These modules are; the quality of life index, upper extremity functionality, lower extremity functionality and the user satisfaction scale. The scoring and maximum score of each module are different and the scores in all modules are calculated with a Likert scale. A higher score indicates a better outcome for all measures. In the upper extremity functionality module, there are 28 questions and the score range of this module is between 0-112. Retests were performed 7 days after the first tests. The scores of 34 patients included in the study were calculated with ICC (Interclass Correlation coefficient).

### Results:

As a result of the statistical analysis, the ICC value of the upper extremity module was 0.85. While the average of the first test was  $69 \pm 20.6$ , the average of the retest results was  $69.73 \pm 21.8$ . With these results, OPUS revealed an excellent result in upper extremity test-retest reliability above the acceptable range.

### Conclusion:

Since there is no upper extremity functionality scale in Turkish, it is important to research the reliability of OPUS. In general, it is expected that the application of OPUS in Turkey will increase with the proof of upper extremity reliability as a result of the patients participating in the study.

## **A-0873** A NEW METHOD OF DETECTING TISSUE ISCHEMIA – THE ISCALERT STUDY

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**Introduction:** One of the main causes of death is ischemia. Examples are myocardial infarction, stroke, vascular disease and shock conditions. An early diagnosis of ischemia is necessary to improve our current treatment options and survival of ischemic tissue. The Biosensor Research Group (led by Professor Tor Inge Tønnessen) at Rikshospitalet, Oslo University Hospital has for years worked with methods for early detection of ischemia. They have designed a sensor, called IscAlert™, which detects ischemia by continuously measuring the tissue pCO<sub>2</sub> directly and in real-time. The sensor is 0.8 mm in diameter with a surface of Polymethylpentene, which only permits passage of gases. The core consists of a temperature sensor and surface electrodes, surrounded by a less than one microliter of deionized water. By applying very low electrical AC current through the liquid, an increased presence of CO<sub>2</sub> and carbonic acid will dissociate into protons and bicarbonate and thereby increase electrical conductance.

**Material and methods:** Porcine studies including more than 200 pigs have proven the sensors' efficacy in detecting ischemia in brain, heart, liver, pancreas, intestine, kidney, skeletal muscle and subcutaneous tissue. We have performed the first human study, a prospective, open, single centre clinical investigation designed to examine the feasibility and safety of the IscAlert™ device. We included 50 patients scheduled for elective extremity surgery with planned use of perioperative tourniquet >30 minutes. Exclusion criteria was infection at planned insertion site of the sensor. Three sensors (two intramuscular, one subcutaneous) were placed in the intervention arm/leg, and two sensors (one intramuscular, one subcutaneous) in the control arm/leg. The sensor was introduced by split-needle technique under sterile conditions. The sensors in the control extremity were removed before end of anesthesia, while approximately 50% of the patients kept the sensors in the operated extremity up to 72 hours to investigate whether the sensor continued to show stabile measurements. The patients were followed throughout the hospital stay, and a telephone consultation was performed 7 and 30 days after discharge from hospital.

**Results:** 50 patients (32 males) >18 years of age (mean age 53.5 years) were included, five were excluded after inclusion, four at the surgeon's discretion (planned surgery was changed or cancelled), one withdrew consent between inclusion and surgery. According to our power analysis we had defined 2 kPa as a clinically significant rise in pCO<sub>2</sub>. Records of pCO<sub>2</sub> three minutes before release of tourniquet showed statistically significant difference of 3.9 kPa in mean pCO<sub>2</sub> levels between the extremities with a p value <0.0001. No pain, inflammation or bleeding more than 3 ml from insertion site were recorded, neither during surgery nor in the follow up period. The patients throughout the study period noted no pain from the sensor (NRS 0). 5 adverse events were noted, none related to the study device.

**Conclusion:** IscAlert™ is a safe and reliable monitor of ischemia with continuous and real-time measurements. Further studies are planned on replanted fingers and flaps to hopefully aid in diagnosing early ischemia and help improving survival of microsurgically reconstructed tissue.

## **A-0874** COMPARING POSTERIOR INTEROSSEOUS NERVE STRAIN IN LATERAL SURGICAL APPROACH TO RADIAL HEAD: A CADAVERIC STUDY

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**Background:** The posterior interosseous nerve (PIN) is known to be at risk during the exposure of the proximal radius. This study aimed to quantify the PIN strain during the Kaplan and Kocher approach for internal fixation radial head and neck fractures.

**Methods:** Nine fresh-frozen upper extremity specimens were dissected with Kaplan (n=3) and Kocher (n=6) approaches, and the PIN was exposed at the anterior elbow with a separate incision. A strain gauge (microminiature M-DVRT) with sensors was placed on the PIN at its origin from the radial nerve and proximal to the proximal edge of supinator muscle. PIN displacement was measured using LORD MicroStrain LVDTs device (Williston, VT). The PIN length (distance between two sensors) was measured using a vernier caliper. The PIN strain (%) was calculated by dividing the excursion of the PIN by the PIN length. The strains were compared between Kaplan and Kocher approach in neutral, supination, and pronation at 90° elbow flexion.

**Results:** The average PIN length from its origin to the proximal edge of supinator muscle was 9.9 mm (range, 7.9- 12.2 mm). The median PIN strain in neutral, supination, and pronation during the Kaplan approach was 2.2%, 1.9%, and 2.1%, respectively. The PIN strain was less than 0.1% during the Kocher approach in all forearm positions. Using a Mann-Whitney U test, the difference in strain between these two approaches was statistically significant (P-value 0.02).

**Conclusions:** The PIN strain increased significantly during the Kaplan approach for exposure of internal fixation of radial head and neck. Therefore, caution on a traction injury to the PIN should be made when using this approach.

## **A-0875** THE VALUE OF QICKDASH SCORE IN TENDON INJURIES

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Sometimes it is necessary to evaluate the functional result of the patients we treated. One of the easiest ways to get measurable values about it is the QuickDASH questionnaire. The questions are easily understandable, even the elderly and low demand patients can answer them. Nowadays the real value of the Quick DASH score is often debated in hand injuries.

**Aim:**

We wanted to prove that the QuickDASH score gives reliable information about the results of the treatment in case of tendon injuries of the hand.

**Method:**

We ran a retrospective study on all patients with tendon injuries treated in our unit between 1 January 2021 and 28 February 2022. The overall satisfaction of the patients and the pain in the injured fingers was registered in a Visual Analogue Scale of 1-10. Patients were asked to fill the Quick DASH questionnaire as well.

**Results:**

160 patients were registered with tendon injuries in the examined period. 72 of them has filled out our questionnaire. Patients with absent data were excluded from the study.

The Quick DASH score and the satisfaction scores of the patients correlated well. The correlation coefficient was -0,71, that

means a high negative correlation. Comparing pain and QuickDASH, or pain and satisfaction the correlation coefficient was under 0,5, there is no correlation between them.

Conclusion:

The QuickDASH score in tendon injuries of the hand is a reliable tool to estimate the real value the surgeon could give to the patient. Even though a part of the questions are about shoulder or elbow function, it can be used after tendon injuries as well.

## **A-0876** NON-OPERATIVE TREATMENT IN SELECTED TERRIBLE TRIAD INJURIES

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### Introduction

The majority of terrible triad elbow injuries (ulnohumeral dislocation, radial head and coronoid fracture) are managed surgically, while non-operative treatment is usually reserved for a selected group of patients who meet certain criteria. Unfortunately, to this day, results with this approach have been limited by very small studies.

### Material-Methods

This retrospective study included 14 patients with terrible triad elbow injuries treated non-operatively between 2016 and 2021. All patients were non-athletes over 40 years of age, with concentric and stable joint reduction and able to pronate and supinate their forearm without mechanical block.

All patients underwent closed reduction in the emergency department and CT scan to further characterise radial head and coronoid fracture. Immobilisation of the elbow was applied for no less of 4 weeks after weekly clinical and radiographic assessment. Ten patients were available for follow-up of at least 12 months (mean follow-up 26 months, range 11-32 months).

Outcome measures included patients' physical examination and recorded elbow range of motion, radiographic evaluation and certified functional outcome score (DASH score).

### Results

No instability was detected in any of the patients examined. Two patients demonstrated mild arthritic signs on the latest radiograph without further complaints. At latest follow-up mean ROM was 130° flexion and 18° extension with a mean DASH score of 8. Complications included one patient with elbow joint stiffness who underwent surgical release and one with heterotopic ossification who underwent surgical debridement.

### Conclusions

Non-operative treatment in selected Terrible Triad Injuries of the elbow seems to be a valid option for patients that meet certain criteria. Stability and functional range of motion can be restored. However, conservative management requires good communication with patients and close clinical and radiographic follow-up in order to monitor for any delayed elbow subluxation or fracture displacement.

## **A-0877** CRPS IN TIMES OF COVID-19

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### Background

Complex Regional Pain Syndrome (CRPS) is a well-known complication after trauma of the extremities. The incidence in Middle European Countries is known to be 20-26/100 000 per year. The cause of CRPS is yet unknown, but known to be multifactorial. The most important causing factors are the posttraumatic inflammation and sympathetic dysregulation. Furthermore, psychological and psychosocial risk factors have an impact on the development CRPS.

### Aim of study

During the first 2 years in the Covid-pandemic, it seemed that the number of patients presenting in the Department of Orthopedics and Traumatology at the University Hospital in Innsbruck with CRPS had risen.

The purpose of this study was to reveal an assumed higher incidence of CRPS during the Covid-pandemic.

### Methods and Materials

We compared the patients presenting with CRPS in the two years pre-Covid and the first two years in the Covid-pandemic presenting in the Department of Orthopedics and Traumatology at the University Hospital Innsbruck. The medical reports of all patients presenting in those 4 years have been screened for the keywords CRPS and Mb. Sudeck and the positive cases have been analyzed.

### Results

Overall, there was no significant difference in the two groups. Also comparing the CRPS cases following a distal radius fracture showed no difference. After splitting up the two Covid-years in smaller periods, defined by the governmental restrictions like lockdown and reopening, we found a significant increase in first periods of the Covid-pandemic, especially during the first lockdown.

### Conclusion

The first period of the Covid-pandemic had an impact on the development of CRPS. The reasons for the increased incidence could be as multifactorial as the disease itself, including the stressful situation of a pandemic and the following restrictions and the reduced capacity of occupational therapy.

## **A-0878** INTRAOPERATIVE ULTRASOUND GUIDED NERVE RESECTION: WHAT TO EXPECT

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The identification of intraneural scar tissue is a challenge for every surgeon who is treating delayed nerve injuries. For nerve reconstruction it has been proposed that normal or near-normal histological architecture of proximal stumps is a necessary condition to obtain clinically useful results and consequently much effort has been focused on researching methods to optimize nerve stump quality. Actually, nerve section of proximal nerve stump is performed just with grossly evaluation (until bleeding is seen). Previous studies demonstrated that this kind of resection underestimates the extension of fibrous tissue into the proximal stump and the following nerve reconstruction could be limited and unsuccessful due to scar invasion. To ameliorate this procedure, intraoperative ultrasound study of nerve stumps has been proposed thanks

to the increased ability of sonography to recognize nerve microstructure.

#### Materials and methods

Patients affected by in continuity neuromas and painful neuromas of the upper and lower extremity were included. After macroscopical nerve resection, intraoperative ultrasound was used to investigate the quality of both stumps and recut was done according to ultrasound appearance. Then nerve gaps were reconstructed by cable grafts as required. In one case, after neuroma resection, the nerve stump was embedded into the tibia (common peroneal nerve neuroma). The difference between macroscopical and ultrasound guided cut was registered and histological sections of stumps were obtained.

#### Results

In this paper six neuromas in continuity and one terminal painful neuroma of different peripheral nerves both in upper and lower extremity were excised and reconstruct by means interposition cable grafts. The mean nerve gap after macroscopical resection was 5,1 cm (between 2 and 8 cm). The gap increased to 5.7cm after intraoperative ultrasound evaluation (between 2 and 9 cm). The nerve stump after neuroma resection wasn't recutted, but ultrasound confirmed the absence of intraneural scar. In three patients over five the ultrasound induced to resect 1 cm more. In one patient the use of ultrasound study induced the operators to carry out an external neurolysis due to the evidence in ultrasound of continuity of deep fascicles.

The intra-operatory findings were compared to histological appearance, revealing a qualitative correlation between ultrasound and microscopy.

#### Conclusions

In the presented case series, a protocol of intraoperative sonographic study is reported. This tool seems to be feasible and helpful in nerve reconstruction. In all cases greater nerve resection was induced by ultrasound appearance of nerve stumps, reducing the amount of intraneural scar. In presence of a terminal painful neuroma this technique could be useful to ensure the absence of scar between fascicles. The ultrasound analysis was conducted by an experienced nerve radiologist during surgical procedure and, for surgeons, an accurate ultrasound analysis could be difficult without a specific and intense training. These findings are supported by qualitative histological analysis that showed differences between macroscopical and ultrasound guided cut. Further studies are required to correlate quantitatively sonohistology to histological findings, increasing the accuracy of nerve resection before reconstruction.

### **A-0879** THE USE OF MASQUELET TECHNIQUE FOR THE TREATMENT OF UPPER EXTREMITY NONUNION

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#### INTRODUCTION

Forearm fractures still remain a challenge for the surgeon, despite the evolution of different type of fixation (1). The radius and ulna constitute a functional unit whose integrity guarantees the correct function of the forearm, elbow and wrist (2). Surgical treatment must therefore provide for the restoration of normal anatomy and joint relationships between the structures involved. Among the possible complications in the treatment of forearm fractures is nonunion, from 2 to 10% (3). In the literature, different treatment strategies have been proposed for the restoration of the bone defect: autologous graft with removal from the iliac crest, use of the RIA, allograft, bone transport, Masquelet technique or use of the vascularized fibula. (4)

The purpose of this retrospective work is to report our experience with the use of the Masquelet technique, applying it

in the presence of nonunion with loss of substance and with suspected or overt septic state.

#### METHODS

From January 2020 to June 2022 we treated 4 patients with upper extremity nonunion: 2 cases of ulna nonunion, 1 case of radius nonunion, 1 case of first metacarpal nonunion and a complex case of ulna nonunion associated with radius malunion. The patients underwent 2 surgery according to the Masquelet technique. At the first stage it was removed fixation devise previous positioned and cement was applied to induce the formation of the biological chamber. Between 6 and 10 weeks a second stage was performed in which the cement was removed after having opened the biological chamber, performed the bone graft harvested from the iliac crest and performed reduction and definitive osteosynthesis with a 3.5 mm LCP plate mm locked with screws.

The mean follow up was about one year.

#### RESULT

The Masquelet technique is a relatively simple technique introduced by Masquelet in 1986 with numerous advantages: it is applicable in septic or aseptic conditions, following a trauma or a neoplastic lesion and does not require a microsurgical team (4). It is applicable in any bone area with a bone gap even greater than 10cm.

In all cases we had healing of the nonunion with complete recovery of the forearm functionality. There were no complications.

#### COCNLUSION

The use of the Masquelet technique must be considered a valid alternative in the treatment of forearm nonunion that can also be used for significant loss of substance or in the presence of infection, restoring the physiological bone conformation in an anatomical and biological way, however leaving chance for the possibility of intervening subsequently with other techniques.

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### **A-0880** PRELIMINARY RESULT OF AN ULTRASOUND COMPARATIVE STUDY VERSUS RADIOGRAPHIC CRITERIA OF THE SOONG CLASSIFICATION

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#### INTRODUCTION

Distal radius fractures account for approximately 17% of all fractures and the treatment of choice is plate-and-screw osteosynthesis and reduction (1). The most common complications of this treatment are tendinopathies and tendon

ruptures affecting mainly the long flexor of the thumb, the incidence of which varies in the literature from 0.8% to 12% (2-3). The main triggering cause of these complications is the position of the plate beyond the so-called watershed line of the distal radius. Soong et al made a radiological classification to assess this prominence (4). Grade 2 of this classification is associated with the highest risk of tendon rupture (5-6).

The purpose of this retrospective work is to analyze a sample of patients with the aim of evaluating a correlation between radiographic parameters (Soong's classification) and ultrasound signs for the diagnosis of tendon impingement and the consequent indication for the removal of the fixation device.

#### METHODS

At the San Martino Polyclinic Hospital we retrospectively assessed 88 patients with fracture of the distal epiphysis of the radius who was treated with volar plate from December 2019 to November 2020. These patients underwent radiographic and ultrasound evaluations after 6 months from surgery to identify plate / tendon conflicts, the distance between the plate and the tendon, and the thickness of the pronator muscl. The mean follow-up was 18 months.

#### RESULT

The investigations showed that there is no correlation between the radiographic and ultrasound criteria. In fact, ultrasound tendon impingement did not correspond to Soong 2 radiographic grade. In all cases, there was an accurate reconstruction of the pronator muscl, which can be evaluated through ultrasound examination. There were no obvious signs of early plate removal.

#### CONCLUSION

This comparative study between radiographic and ultrasound criteria showed that, in our series, there is no ultrasound correlation between the thickness of the plate and the risk of onset of tendinitis or short-term tendon ruptures. Tendon injuries can also occur 10 years after surgery, however in the patients studied there was no indication for early removal of the fixation device.

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## **A-0881** VOLAR PLATE RETENSIONING AFTER TRAPEZIECTOMY AND LIGAMENT RECONSTRUCTION TENDON INTERPOSITION IN BASAL THUMB ARTHRITIS WITH HYPEREXTENSION METACARPOPHALANGEAL INSTABILITY

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**Introduction** Hyperextension instability of the metacarpophalangeal (MCP) joint of the thumb leads to malfunction and bad outcomes of basal thumb arthritis surgical treatment. Loss of metacarpal height after trapeziectomy and ligament reconstruction tendon interposition (LRTI) can make MCP instability worse. Various techniques have been used to adjust this hyperextension depending on its severity. The purpose of this study is to determine the long-term outcomes using of a volar capsular flap fixed with suture-anchor to the neck of first metacarpal bone to restore normal extension in grade 3 instability during basal thumb arthritis surgery.

**Material and methods** Our case series included 19 thumb of 16 patients affected by basal thumb arthritis and MCP hyperextension which were treated at once by trapeziectomy and (LRTI) and volar capsular retensioning with a mean follow-up of 52 months (min 6 - Max 96). Patients were assessed measuring pain (VAS), ranges of motion, MCF hyperextension, Jamar and Pinch Test and using questionnaires about disabilities (DASH score) and personal satisfaction. X-ray views were done at follow-up to control scaphoid-metacarpal height. MCP arthritis was a contra-indication for this technique. **Results** The mean VAS was 8,0 preoperatively and 0,5 at follow-up. MCF extension passed from -70 to -5. The mean grip strength switched between 2,5 before surgery to 4,0 after surgery. The mean DASH was 38,4 preoperatively and 10,2 postoperatively. 14 of 16 patients were very satisfied with the results and were able to return to the precedent activities better than before. Radiographic controls revealed reduction of scaphoid-metacarpal height from 20 to 50% at follow-up. Although some studies assert that this technique leading to long-term failure, we reported only 2 cases of partial collapse (MCF extension -30 and -40, respectively, 4 years after surgery).

**Conclusion** Volar plate retensioning is a satisfactory treatment to improve stability of metacarpophalangeal joint preserving motion in alternative to arthrodesis. Doing at the same time trapeziectomy and LRTI and volar plate retensioning is a safe and attractive technique to treat basal thumb arthritis associated to Z deformity improving functional and subjective outcomes.

## **A-0882** MID-TERM RESULTS WITH DOUBLE-MOBILITY TOTAL THUMB ARTHROPLASTY

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**Introduction:** Osteoarthritis of basal thumb is a common condition seen in hand clinics which increases with age and is seen predominantly in postmenopausal women. The present retrospective study shows mid-term outcomes in patients with thumb carpometacarpal osteoarthritis treated with dual mobility prosthesis TOUCH® (Kerimedical, Route des Acacias, Les Acacias, Switzerland).

**Material and methods:** We enrolled 75 patients (78 thumbs) treated at our centre for primary basal thumb osteoarthritis with dual mobility prosthesis TOUCH® between December 2018 and June 2022. Inclusion criteria were Eaton/Littler stage 3 osteoarthritis, no previous surgery, no concomitant rheumatic arthritis and no history of trauma.

We assessed patient demographics, pain (VAS), grip strength of the thumb using pinch dynamometer, range of motion using Kapandji and DASH score. Radiographs were taken pre operative, immediate post operative and at 1, 3, 6, 12 and

24 months after surgery. All occurring complications were recorded.

Results: Average follow-up period was 21 months (1,5 – 45 months). The mean VAS was 8,36 preoperatively and 0,9 postoperatively. The mean preoperative Kapandji opposition score was 7,7; postoperative the score was 9,2. The mean grip strength switched between 2,7 before surgery to 5,8 after surgery. The mean DASH was 47,9 preoperatively and 10,5 postoperatively.

The overall complication rate was 2,6% (2 cases): one cup collapse and one aseptic cup loosening. No cases of infection or dislocation were reported.

Conclusion: Total joint arthroplasty with a dual mobility prosthesis TOUCH® appears to be a satisfactory solution in our series, giving the patients the opportunity to return quickly to work or manual hobby. Therefore, randomized studies with long-term follow-up are needed to verify sustainability of these prostheses.

### **A-0883** 12 PATIENTS TREATED BILATERALLY WITH DUAL MOBILITY PROSTHESIS AND TRAPEZIECTOMY WITH SUSPENSION ARTHROPLASTY FOR TRAPEZIOMETACARPAL OSTEOARTHRITIS: A MULTICENTRE STUDY WITH 2-YEAR FOLLOW-UP

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This study analyses and compares the outcomes and global evaluations at a 2-years follow-up of 12 patients with bilateral trapeziometacarpal osteoarthritis, treated on one hand with trapeziectomy and Altissimi tendon suspension arthroplasty, and on the contralateral hand with the implantation of the Touch® dual mobility prosthesis.

The patients, operated at the Sant'Andrea University Hospital of Rome or the San Francesco Clinic of Verona, were 2 males and 10 females with an average age of 61.5 years (range, 47 - 83 years). The operated hands were 24: 7 dominant and 5 non-dominant with the prosthesis and 5 dominant and 7 non-dominant with the suspension arthroplasty.

In the hands treated with trapeziectomy and suspension arthroplasty, the mean VAS scale improved from 7.6 to 1.8, the mean DASH from 52.0 to 10.4, the mean Kapandji from 7.6 to 9.3, and the mean Pinch test from 2.1 to 2.7 Kg. In the hands treated with Touch® prosthesis, the mean VAS scale reduced from 8.7 to 0.3, the mean DASH from 48.9 to 4.3, and the mean Kapandji increased from 7.3 to 9.5, and the mean Pinch test from 2.2 to 3.8 Kg. Both techniques demonstrated significant improvement ( $p < 0.05$ ) over preoperative assessments in almost all tests, except for the Pinch test of the patients treated with arthroplasty. The comparison between the two techniques demonstrated better ( $p < 0.05$ ) recovery of mean DASH and Pinch test in the hands treated with the prosthesis.

In conclusion, the dual mobility prosthesis demonstrated faster pain relief, the gain of function and range of motion, and better recovery of strength and function than tendon suspension arthroplasty with trapeziectomy. In addition, the prosthesis spares the trapezius, reserving trapeziectomy in case of implant failure.

## **A-0884** OUTCOMES OF MASON II-III RADIAL HEAD FRACTURES TREATMENT WITH OR WITHOUT ELBOW DISLOCATION

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**Purpose:** The purpose of this study was to evaluate the results of patients treated for a type Mason II-III radial head with and without dislocation and instability

1- Mason type II-III radial head fracture with elbow dislocation by open reduction with internal fixation or arthroplasty, collateral ligament repair and early mobilization

2- Mason type II-III radial head fracture without elbow dislocation by open reduction with internal fixation or resection of radial head.

An additional purpose was to investigate whether there is any effect of elbow dislocation on the severity and functional outcome.

**Methods:** We treated nineteen radial head fractures. Fifteen patients were treated with open reduction with internal fixation using screws for comminuted fracture of the radial head. Ten fractures were Mason type II-III with elbow dislocation. One patient was treated with resection of radial head. Three patients were treated with arthroplasty. After surgery for all patients we used AMARE protocol of physiotherapy (Active Movement Against Resistance). The follow-up time goes from 1 to 71 months. Patients were reviewed for functional ability with MEPS (Mayo Elbow Pain Score), physical examination, and radiographic assessment.

**Results:** At the last follow-up the mean flexion-extension arc of the elbow was 124° and the mean forearm rotation was 135°. The mean MEPS was 95 points (range, 85-100 points), with 16 excellent results and three good results. Two patients had heterotopic ossification, one patient had a superficial infection, and one patient had ulnar nerve neuropathy.

**Conclusions:** Selected Mason II and III radial head fractures and fracture dislocations could be stabilized successfully with internal fixation. Meticulous surgical technique, combined with rigid internal fixation, can allow early motion of the forearm and elbow with and without elbow dislocation and ligamentous injury. We believe there is still a role for prosthetic replacement in comminuted Mason III radial head fractures that cannot reliably be treated with open reduction and internal fixation. In rare cases, when there aren't ligament lesion it is possible the resection of radial head. We couldn't appreciate any significant difference in the outcomes of Mason II-III radial head fractures treatment with or without elbow dislocation.

## **A-0885** THERAPEUTICAL APPROACH IN RADIAL PALSY POST CLOSED HUMERAL FRACTURES

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### **Background**

The radial nerve palsy is the most common associated injury in a humeral fracture, being either primary, occurring at the time of the fracture or secondary, occurring after manipulation of the fracture, the incidence rising up to 20%. The onset consists of the inability to execute dorsiflexion and numbness on the radial nerve trajectory. Most surgeons recommend observation, leaving the exploration for 8 weeks to six months postoperatively.

## Methods

Our clinic has treated 37 secondary radial nerve palsies associated with humeral shaft fractures in which we chose early exploration at 10-12 weeks in the absence of clinical or electromyographic signs of recovery. We found that 3 of the radial nerves were trapped under the plate, 18 in the callus and the rest were severely contused, the range of trauma ranging from neuropraxia to neurotmesis.

## Results

We managed to liberate or reconstruct the nerves in all 37 cases and start recovery using physiotherapy and dietary supplement intake. Even though the rehabilitation is a long journey, patients regained up to 90% of motor function and almost full sensitivity.

## Conclusions

Radial nerve palsy is relatively frequent in humerus trauma; nevertheless by highlighting the radial nerve during osteosynthesis, one can prevent further damage and unnecessary follow-up surgeries.

## **A-0886** EPIDEMIOLOGY OF HAND AND WRIST INJURIES IN THE WORKPLACE. A REVIEW OF SURGICALLY TREATED PATIENTS AT A SINGLE CENTER

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## Introduction

Injuries to the hand and wrist at work account for over 20% of all workplace injuries, with considerable effects on activity restriction and prolonged time off work. This study investigates the epidemiology of the hand and wrist injuries in patients with trauma during work activity.

## Material and Methods

A retrospective analysis that included all patients with a hand or wrist injury surgically treated at a single institution was conducted. All surgeries were performed by the senior author.

Inclusion criteria were patients surgically treated between January 2017 and July 2022, with a hand or wrist injury that occurred during work activity. Age, gender, date of trauma, type of injury and complications were included in the database. A descriptive statistical analysis was performed using SPSS. Association between qualitative and quantitative variables was determined using t-Student test.

## Results

In this study 951 patients with hand and wrist injuries were included. Most were males (70%) and the commonest age group was 41-50 years. Of the 951 patients treated, 922 (97%) were surgically treated due to an acute or sub-acute hand or wrist injury, while 36 patients (7.42%) due to chronic conditions.

The most common injuries were bone fractures (n=567, 59.6%) mainly distal radius fracture (n= 258) and phalanx fracture (n=134). Metacarpal fracture, scaphoid fracture and ulnar fracture were also present. Ligament and tendon (extensor and flexor) injuries were also seen (n= 172, 18,1%), followed by soft tissue injuries including infection, amputation, foreign bodies and complex wounds (n=93 9,8%), and peripheral nerve injuries (n=83, 8,7%). Association between gender and diagnosis, and between age and diagnosis was statistically significant (p < 0.05).

Patients surgically treated due to chronic conditions presented carpal instability and cysts (n=36, 3,8%).

Seven complications were reported, which included four pseudarthrosis/ nonunion, one infection after ORIF and two ligament reconstruction failure.

#### Conclusion

Hand and wrist lesions represent a substantial number of cases surgically managed in the context of workplace injuries, especially hand and wrist fractures. Health and safety regulations measures should be taken in order to protect workers and reduce occupational accidents.

### **A-0887** SINGLE-ACCESS ENDOBUTTON TECHNIQUE VS DOUBLE-ACCESS TRANSOSSEOUS TECHNIQUE IN THE TREATMENT OF DISTAL BICEPS TENDON RUPTURES

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**Introduction:** distal biceps tendon rupture is a relatively rare lesion. Although conservative treatment is an acceptable option in low-demanding people, young and active patients may benefit from an early surgical reinsertion. Many surgical techniques have been described, but in Current Literature there are emerging evidences about the superiority, clinical and biomechanical, of the single-access endo-button technique over the traditional double-access transosseous technique (Morrey). Comparing the two approaches, the results observed in our Study seem to confirm this trend.

**Materials and Methods:** between 2003 and 2021, 61 patients underwent surgical reinsertion of the distal biceps tendon. 21 patients (Group A) were treated with double-access transosseous technique; 40 patients (Group B) with single-access and endobutton (ZipLoop ToggleLoc, Biomet Zimmer). Chronic lesions were excluded from the Study. Mean follow-up was 52 months. All subjects were clinically (ROM, grip strength recovery, DASH score) and radiographically evaluated.

**Results:** In Group A mean ROM was 6-132° in F/E and 89-0-87° in P/S; grip strength recovery in flexion and supination was respectively 96 and 88% vs contralateral. Average DASH score was 11. Mean surgical time was 100 minutes and rehabilitation time 15 weeks. The main complications were 2 cases of heterotopic ossifications, 1 asymptomatic fracture of the proximal radius and a temporary palsy of the radial nerve. In Group B mean ROM was 5-138° in F/E and 87-0-85° in P/S; grip strength recovery in flexion and supination was respectively 97 and 92% vs contralateral.

Average DASH score was 8. Mean surgical time was 45 minutes and rehabilitation time 10 weeks. The main complication was one temporary palsy of the radial nerve  
**Conclusions:** analyzing the results of our Study, there are no statistically significant clinical differences between double-access transosseous and single access endobutton techniques. The latter, however, appeared to be significantly faster, reliable (low complications rate) and with a shorter recovery time (the higher biomechanical stability allowed an earlier rehabilitation). These outcomes seem to confirm those found in Literature. The surgical approach remains a personal surgeon's choice but, in young and high-demanding patients, we believe it is mandatory to choose the one that allows the fastest return to work and sport activity.

## **A-0888** SALVAGE OF ADVANCED CARPAL COLLAPSE: PROXIMAL ROW CARPECTOMY WITH PYROCARBON RESURFACING OF THE CAPITATE VERSUS FOUR-CORNER ARTHRODESIS

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**Objective:** Four-corner fusion and scaphoidectomy (4CF) is probably the gold standard procedure for the treatment of advanced stages of carpal collapse, when the lunate facet of the radius is still intact. However, in the past decade, the Resurfacing Capitate Pyrocarbon Implant (RCPI) associated to first row carpectomy (FRC) proved his efficacy in such arthritic wrists. We retrospectively compared our case series of RCPI associated with FRC vs 4CF, for the treatment of SLAC-SNAC stage III wrists.

**Methods:** Among all patients who underwent surgery for SLAC-SNAC stage III wrist OA in our Hand Surgery Department, between July 2007 and July 2019, 63 patients, with similar population characteristics and disease etiology, were retrospectively selected. All cases had a minimum follow-up of 2 years. 35 patients underwent FRC + RCPI implant (Group A); 28 patients underwent 4CF with dorsal plate (Group B). The follow-up was 56 months (min.24, max.106) for Group A and 49 months for Group B (min.26 max.68). All patients were clinically (pain, range of motion and grip strength) and radiographically evaluated. PRWE Score, DASH Score were assessed. Similarly, return to previous working and sport activities was investigated.

**Results:** in Group A patients showed consistent pain relief, while preserving wrist mobility and grip strength, with a satisfactory recovery allowing previous working activities. Mean operative-time was 76 minutes. The average DASH score was 19,5 and the average PRWE score was 28,2. No implant mobilization or capitate fracture was detected during the follow-up. One patient presented volar carpal dislocation one week after surgery and underwent immediate open reduction and stabilization. No acceleration of distal radial OA was observed.

In Group B similar results were observed as for pain relief, mobility and strength. Mean operative-time was 97 minutes. The average DASH score was 22,7 and the average PRWE score was 27,56. In 2 cases, non-union of the arthrodesis was observed and the patients underwent revision with total wrist fusion.

No statistically significant difference was underlined by statistical analysis among Group A and B for all the measured outcomes and scores, except for a better radial inclination ( $p < 0,05$ ) in Group B. Consistently, DASH and PRWE scores were not found to be statistically different. Grip strength, that has always been the major criticism to FRC, has been slightly lower in Group A but without any statistical difference. Operative time was significantly lower in Group A, while patients' age was significantly higher (54 vs 43 years).

**Conclusions:** according to these outcomes, for treatment of advanced stages of OA (SNAC/SLAC stage III), RCPI associated to FRC proved to be a reliable alternative to 4CF and scaphoidectomy, the most widely spread technique, even in younger patients. The lack of grip strength that has historically been attributed to FRC seemed to be not significant. On the contrary, the surgical time appears to be lower and there are no risks of non-union.

## **A-0889** RESULTS OF ELBOW TERRIBLE TRIAD MANAGEMENT WITH AN ACTIVE MOVEMENT AGAINST RESISTENCE PROTOCOL OF PHYSIOTHERAPY

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**Background:** Terrible triad of the elbow can be a challenging injury to treat, with a history of well-known complications. The purpose of this study is to report the outcomes of our surgical protocol for the repair of terrible triad of the elbow injuries. We established in 2019 a postoperative protocol done by an Active Movement Against Resistance (AMARe) protocol with a termoplastic cast Dynacast® Prelude for 21 days and immediate mobilization against resistance (first week from 80 to 100° (20° degree of movement), second week (40° of movement), third week 60° (from 60° to 120°) – pronosupination differs by the radial head synthesis. (Ref 1) )

**Methods:** We retrospectively reviewed terrible triad of the elbow injuries treated at our hospital by using the mostly used surgical technique. Surgical procedure includes fixation or replacement of the radial head and repair of the ruptured lateral collateral ligament (LCL) through a lateral approach. Simultaneous fixation of the coronoid process and repair of the common flexor muscle and medial collateral ligament (MCL) injury were performed through an anteromedial incision. Mayo Elbow Performance Score (MEPS) was determined for each patient at the final clinic visit. We addressed all patient to the AMARE protocol for the first three weeks.

**Results:** There were 10 patients (10 elbows) included in the analysis, and the follow-up period goes from 5 to 71 months. At the last follow-up the mean flexion-extension arc of the elbow was 126° and the mean forearm rotation was 139°. The mean MEPS was 95 points (range, 85-100 points), with 8 excellent results and two good results. Concentric stability was restored in all cases. Two patients had heterotopic ossification, one patient had a superficial infection, and one patient had ulnar nerve neuropathy.

**Conclusion:** Our surgical and post-surgical strategy with AMARE for terrible triad of the elbow has the advantage of providing both bony and soft-tissue stability simultaneously, thereby allowing active early motion as well as functional recovery of the elbow. The immediate active movement against resistance give to the patient the possibility to maintain proprioception avoiding stiffness and muscle atrophy after surgery. The rehabilitation period is in that way shorter and results seems to be faster than with immobilization.

1) AMARe protocol of immediate mobilization against resistance after simple elbow dislocation. A randomized cotrolled study on 44 patients –

Anna Maria Nucci, Pierluigi Tos, Sandra Pfanner, Massimo Ceruso, Andrea Poggetti  
*Giornale Italiano di Ortopedia e Traumatologia 2019;45:150-154; doi: 10.32050/0390-0134-138*

## **A-0890** CASE REPORT: INDEX DIGITAL ISCHEMIA IN A COVID-19 POSITIVE PATIENT

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### Introduction

COVID-19 is an infectious disease which initially appeared in Wuhan in 2019 and is caused by SARS-CoV-2. Immediately expanded worldwide with a broad range of symptoms and complications. One of the complications of this virus is its

induction of coagulopathy disease (including thrombosis and ischemia) which is not completely understood. There are many theories, one of them is that the virus enters into the cell and induces endothelial dysfunction, contributing to vascular damage and production of procoagulant factors.

We presented a case of a 19 year-old man who developed index digital ischemia associated with Covid-19 disease.

#### Case Presentation

A 19-year-old male patient with a history of minor thalassemia consulted for pain without improvement despite analgesic treatment and cyanosis at the distal phalanx of the right index finger.

The patient denies trauma and refers history of diagnosis of covid-19 infection 4 days prior to the consultation. Clinically, he was afebrile, without respiratory symptoms and reported generalized body pain as the only positive symptom.

Physical examination at the level of the distal phalanx of the right index finger shows cyanotic coloration, with delayed capillary refill, decreased local temperature and preserved radial and ulnar pulse.

Laboratory findings revealed negative lupus anticoagulant, normal C3-C4, normal protein C and S.

It was decided to perform Doppler ultrasound which showed absence of arterial flow in the distal phalanx associated with a poorly defined hypoechoic area of approximately 3 x 1 x 6 mm, with dermal-epidermal thickening.

An MRI also was performed observing bone edema of the distal phalanx corresponding to an avascular process.

Conservative treatment with Acetylsalicylic Acid and cilostazol was decided.

The patient was re-evaluated 3 weeks later and a small dry necrotic lesion was observed at the level of the distal phalanx of the index finger which seems to have re-epithelialization below the necrotic area.

#### Discussion

There is a wide spectrum of clinical manifestations of limb injury caused by the systemic inflammation and hypercoagulable state. The clinical findings related to limb ischemia include acral cyanosis, bruising, blood blisters, and dry gangrene.

Numerous theories have been proposed regarding ischemia in COVID-19, which include hypoxia-induced microvascular damage and endothelial shedding, and cytokine/inflammation-mediated damage. It seems to be Endothelial inflammation and dysfunction the primary cause of injury. All these factors contribute to the risk of thrombosis and ischemic events.

Treatment strategies and outcomes of the affected extremity varied widely across the reported cases, ranging from observation with resolution to open thrombectomy with recurrence and/or amputation.

#### Conclusion

Coagulopathies, especially those of the hand, are a marker of severe illness and merit close monitoring and early hand service consultation for appropriate intervention.

As we observed, COVID-19 patients can present with various clinical manifestations, and also can develop limb or digital ischemia without any significant respiratory symptoms.

It is important to be aware of acro-ischaemic lesions, as they could be associated with systemic involvement, prognostic factors or have therapeutic implications needs to be elucidated.

## **A-0891** ARTHROSCOPIC INTERPOSITION ARTHROPLASTY USING DERMAL ALLOGRAFT

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**Objective:** To evaluate the results of arthroscopic interposition arthroplasty (AIA) using acellular dermal matrix allograft in patients with severe chondral defects of the distal radius secondary to scapholunate advanced collapse (SLAC) and distal radius fractures.

**Method:** Five patients (4 SLAC III and 1 distal radius sequelae) were treated, with a mean age of 38.2 (28-52) years old. The mean time of symptoms before surgery was 8.2 (3-18) months. All patients were treated with an AIA of the distal radius (4 scaphoid and 1 lunate fossae) surface using a acellular dermal matrix allograft. The size and shape of the graft was determined based on the CT images and it was fixed with 3 anchors. All steps were performed through dorsal and volar radiocarpal portals. The wrist was immobilized for 2 weeks, followed by a progressive rehabilitation protocol. Preoperative and postoperative clinical and radiological parameters were evaluated. The mean prospective follow-up was 19 (8-48) months.

**Results:** The range of flexo-extension was 124° before surgery and 118° in the post-operative period. Pain (EVA 0-10) decreased from 6.8 (3-7) to 1.9 (0-8). The mean Disabilities of the Arm, Shoulder, and Hand (DASH) score was 66 preoperatively and 21 at final follow-up. No increase of carpal collapse or osteoarthritis changes was observed. No patient required a new surgery.

**Conclusion:** The treatment of severe chondral defects of the radius with arthroscopic assisted interposition arthroplasty using acellular dermal matrix allograft presents good clinical and radiological results and can be a useful alternative for stages II-III SLAC and sever chondral defects due to distal radius fractures.

## **A-0892** DORSAL CLOSING OSTEOTOMY OF THE FIRST METACARPAL BONE (WILSON - OSTEOTOMY) FOR TREATING PAINFUL INSTABILITY OF THE CMC I JOINT - LONG TERM RESULTS AFTER AN AVERAGE OF 10 YEARS

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### **Problem**

Pain in the CMC I joint may be related merely to instability of this joint without any radiological signa of arthrosis. If conservative management fails, operative stabilization may be necessary. As an alternative to ligamentoplasty a dorsal closing osteotomy may be performed by which the important dorsal ligaments are indirectly tightened and simultaneously the load of the joint is redirected. Having encountered difficulties with the results of ligamentoplasty I started performing dorsal closing Osteotomy for treatment of these rare cases of painful instability

How are the functional results after a longer follow up?

### **Methods**

A telephone survey of the patients operated between 2007 and 2015 by dorsal closing osteotomy of the first metacarpal with dorsal plating has been performed asking for the result regarding pain as rated on a NRS at rest, at motion and at loading, satisfaction with the procedure and overall estimation of the result. Quick DASH and a similar score, referring to the function of the thumb only, the thumb - disability - index (TDX), have been calculated. Inclusion criteria have been completely normal x rays and painful instability on clinical examination, confirmed by increased mobility in extension of the CMC I joint, whilst pushing the first metacarpal in relation to the trapezium in radial direction, becoming stable however in flexion. Patients showing instability in flexion as well have been excluded assuming a more general laxity not being suitable for this operation. Patients suffering from other pathologic conditions of the hand have been excluded.

### **Results**

From 2007 to 2015 10 women and two men have been operated. The average age was 38 years (24 - 52 y.), 10 have been reached by telephone 6 x the dominant, 4 x non - dominant side was affected. Follow-up-time was 118 months in average. 4 x the plate used for osteosynthesis had to be removed because of localized pain. One patient was free of pain

for 7 years until a trapezectomy was done. 9 Patients have been fully satisfied with the procedure one partly. All would have agreed to have the operation again. Pain on the NRS at rest was estimated in average as 0,2, at motion as 0,5 and at load as 1,9. Quick Dash was 8,4 in average, thumb disability index (TDX) was 7. 7 Patients have been completely free of pain also at load and had optimum scores near to zero.

Three patients complained of pain at load. TDX - Score was 29 resp. 10. Hardware removal had not been done and was recommended. Patient post trapezectomy had TDX of 49.

#### Conclusion

The dorsal closing osteotomy of the first metacarpal bone is a reliable way to treat painful instability of the CMC I joint achieving mostly good longterm results. When performing plate osteosynthesis hardware removal in time should be considered.

### **A-0893** ARTHROSCOPIC SCAPHOLUNATE 360° LIGAMENT RECONSTRUCTION WITHOUT TENDON GRAFT

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**Objective:** To evaluate the results of arthroscopy-assisted 360° reconstruction of the scapholunate (SL) ligament with an internal brace (IB).

**Method:** Fifteen patients were treated, with a mean age of 39.9 (22-51) years old. The mean time of symptoms before surgery was 6.9 (1-18) months. According to Geissler classification, 9 patients were type III and 6 type IV. All patients were treated with an arthroscopic double reconstruction of the scapholunate ligament (dorsal and volar) using a IB without tendon graft and biotenedosis screws fixation. Kirschner wires were not used. The wrist was immobilized for 10 days, followed by a progressive rehabilitation protocol. Preoperative and postoperative clinical and radiological parameters were evaluated. The mean prospective follow-up was 12 (8-18) months.

**Results:** The range of flexo-extension was 141.6° before surgery and 127.4° in the post-operative period. Watson test was positive in 93% pre-operative period and only in 8% at the end of FU. Pain (EVA 0-10) decreased from 5.5 (3-7) to 1.9 (0-8). Scapholunate angle decreased from 73,8° (60-90°) to 64° (35-90°), DISI deformity was present in 100% before surgery and 46% at the end of FU. The Scapholunate gap decreased from 3.8 to 2.3 mm. All patients returned to their previous sports activity. One patient required a new surgery to remove the IB due to tendon entrapment.

**Conclusion:** The treatment of scapholunate instability with arthroscopic assisted repair without tendon graft presents good clinical and radiological results with a short period of recovery. Arthroscopic reconstruction with 360° IB can be a useful alternative for chronic SL dissociation.

### **A-0894** LONG-TERM RESULTS OF TREATMENT OF POST-TRAUMATIC SEQUELAE OF THE PROXIMAL INTERPHALANGEAL JOINT WITH HEMIHAMATE OSTEOCHONDRAL GRAFTS

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**Objective:** To evaluate the long-term results of treatment with osteochondral grafts in post-traumatic sequelae of the proximal interphalangeal joint (PIP).

**Method:** 21 patients with post-traumatic PIP sequelae with a mean age of 44.5 (22-70) years, were surgically treated with an ipsilateral hemi-hamate osteochondral graft. The average time from trauma to surgery was 3.2 (1-7) months. All cases were operated using a volar shotgun approach and graft fixation with 1.5 mm screws. No immobilization was performed and he was mobilized early with a progressive rehabilitation protocol. Preoperative and postoperative clinical and radiological parameters were evaluated. The mean follow-up was 45.3 (12-94) months.

**Results:** The most affected finger was the 4th in 47% of the cases. At the end of follow-up, they presented 17° of extension and 82° of flexion, with an active flexion-extension arc of 70.9°. Pain (VAS 0-10) was 1.5. and no signs of absorption of the graft and decrease in the joint interline was observed. All patients returned to their activity prior to the accident. 3 patients required a new surgery: 2 tenoarthrolysis and one reversion to PIP prosthesis.

**Conclusion:** The treatment of post-traumatic sequelae with osteochondral grafting presents good long-term clinical and radiological results.

## **A-0895** BILATERAL ULNAR DEVIATION SUPINATION STRESS TEST TO ASSESS DYNAMIC SCAPHOLUNATE INSTABILITY

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### Introduction

After years of clinical experience in the wrist surgical field, we believe there is still a need for developing dynamic tests for the diagnosis of scapholunate ligament (SL) instabilities in early stages that allow standardizing SL gap reference values. Carefully reviewing the literature and based on evidence-based research findings on wrist biomechanics, we developed a stress radiological test called BUDS (Bilateral Ulnar Deviation Supination) considering the biomechanical effect of the dynamic stabilizer or destabilizer muscles of the SL joint. Our desire is to explain the rationale behind it.

### Material and methods

We designed a bilateral forearm holding device that allows to perform a comparative radiographic assessment of the SL joint gap during the resisted ulnar isometric contraction of the extensor carpi ulnaris (ECU) muscle in full supination based on the already known pronation effect of this muscle to the scaphoid. After testing 70 patients, clinical data of 12 patients was retrospectively collected, testing their symptomatic and asymptomatic contralateral wrists. Wrist arthroscopy was performed in all cases.

### Results

The test was positive in seven patients, with a mean scapholunate joint gap of 4.8 mm. The mean difference in the scapholunate joint gap between both wrists was 2.6 mm in BUDS positive patients and 0.2 mm in BUDS negative ones. A stage III or IV scapholunate ligament rupture (Geissler classification) was confirmed in all BUDS positive patients; by contrast, BUDS negative patients exhibited either no lesion or a Geissler stage I injury.

### Conclusion

“Bilateral Ulnar Deviation Supination” stress test is a new radiologic test based on proven biomechanical effects that is able to accurately assess dynamic SL dysfunctions. The analysis carried out found a correlation between radiographic and arthroscopic findings. We consider relevant to present this data before conducting a prospective and multicentric study to confirm the validity of the test.

## **A-0896** ARE CHILDREN LOSING HAND STRENGTH?: RESULTS OF A SCHOOL SCREENING PROJECT

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**Purpose:** Hand strength is an indicator in many diseases to understand the functioning and disability. The hand use of children is decreasing as technology use is increasing. This study aimed to determine the hand strength of healthy children going to school and difference of strength according to demographics. The main purpose of the study is to understand the evolution difference of strength according to child norms. **Methods:** A total of 376 healthy children (153 elementary, 167 middle, 56 high school) with the age range of 7-18 years participated to the study. Age, sex and hand dominance was recorded. Hypermobility was assessed by Beighton test. Hand strength was measured by a hand held dynamometer. During assessment the children sat on a chair without any arm support where the shoulder was in neutral, elbow is in 90 degrees of flexion and forearm is in neutral. The handle was in 1st position for students going to elementary and middle school and in 2nd position for high school students. They were asked to squeeze the dynamometer as hard as possible for 5 seconds while maintaining the proper position of the dynamometer. The measurement was done for both hands and was repeated 3 times. The average force was recorded in terms of kg/F for both hands. Student t test was used to compare results. **Results:** The average mean of dominant hand measurements were  $12.24 \pm 5.42$  kg/F for elementary,  $19.75 \pm 5.86$  kg/F for middle and  $29.05 \pm 7.30$  kg/F for high school students. The values were similar with norm values ( $p > 0.05$ ). However grip strength of females in elementary school and of males in middle and high school was significantly lower than the norm values ( $p < 0.05$ ). When the grip strength difference between dominant and nondominant hand was analyzed, 43.14% of elementary, 45.51% of middle and 41.07% of high school students had more than 10% strength difference between hands. Hypermobility elementary students had significantly lower hand grip strength ( $p = 0.001$ ). **Discussion:** One of the key things to maintain health is to maintain motor movements and muscle strength. This study pointed out some knowledge to consider for future health. Even though hand strength did not differ in total according to norms, there were some gender specific significant decrease. Hand therapists may consider to screen hand strength and dexterity for future upper extremity health.

## **A-0897** UNSTABLE LESIONS OF THE FOREARM: CLASSIFICATION AND EVALUATIVE SCORE

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**Objective:** Over the last two decades, anatomical and biomechanical knowledge of the forearm has greatly improved, and some traumatic injuries involving this anatomical segment can now be seen from a new perspective.

The term "Unstable Lesions of the Forearm" (ULF) has been used to describe a partial or complete instability of the forearm unit (FU) that might occur as a consequence of a traumatic loss of transverse or longitudinal connection between Radius and Ulna. For such alteration to take place, at least two of the three main osteoligamentous lockers (proximal-middle-distal) must be interrupted, often in association with a Radius and/or Ulnar fracture. The aim of this multicentric study was to analyse different patterns of forearm's lesions, to evaluate the results and the utility of a score specific for the forearm injuries, comparing it with the most useful ones for wrist and elbow.

**Methods:** A multicentric study was made by two high experienced elbow teams and one high experienced wrist team,

after approval of the Hospitals ethical committee. The Authors retrospectively evaluated their surgical records relative to the 2012-2016 period, identifying 586 patients treated for forearm trauma. Among this pool, 62 patients showed classic patterns of ULF (Monteggia, Galeazzi, Essex-Lopresti). In addition, 13 patients showed uncommon patterns of ULF. Because no specific score evaluated forearm lesions, the Authors contributed in 2018 to develop an evaluation scale for ULF outcomes: it was named Forearm Italian Performance Score (FIPS)

The injuries were classified using an alphanumeric system that allowed the inclusion of all types of dislocations and fracture-dislocations of the forearm.

The results of surgical treatment were evaluated with the Mayo Wrist Score, the Elbow performance score and the new Forearm Italian Performance Score (FIPS). The subjective DASH score was also assessed.

Results: Clinical results revealed a correlation between earlier diagnosis-treatment and a better score. The higher mean score was obtained by the patients treated in acute phase (10 days); patients treated between 10 and 90 days obtained an average score; the lower score was linked to those treated after 90 days. The retrospective evaluation of surgical records pushed the Authors to produce a synoptic table as first result. The table originates from the identification of the 4 most common forearm instability patterns and their variants, and from the different scoring obtained by the lesions depending on the timing of treatment

Conclusions: Specific elbow and wrist score alone do not describe with accuracy the real function of the forearm joint after ULF. In this multicentric study, a forearm specific classification scheme and a new functional score (FIPS) demonstrated their utility in the evaluation of a large number of ULF cases.

## **A-0898** TREATMENT OF NEGLECTED ASSOCIATED LESIONS IN A DISTAL RADIUS FRACTURE

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Introduction: Distal radius fractures are one of the most common fractures in orthopedic practice and could be treated either no operative or by a surgical procedure. In association, there are several lesions that must be ruled out, such as scapholunate ligament (SLL) lesion, triangular fibrocartilage complex (TFCC) lesion and distal radioulnar joint (DRUJ) instability. With this work, the authors pretend to demonstrate the relevance of neglected lesions management, specifically a 360° reconstruction for chronic scapholunate (SL) dissociation.

Methods / Case report: Retrospective case report about a 53 year old woman who suffered a distal radius fracture three years ago. After a nonoperative treatment with cast and physical therapy, patient remained with ulnar-sided pain and over the dorsal aspect of the wrist.. A MRI showed a foveal TFCC lesion (EWAS/Atzei 3) and SLL lesions (Garcia Elias type 3) and a DRUJ instability. The patient was proposed for an arthroscopic dorsal capsulodesis (Mathoulin's technique), a Wafer procedure and re-insertion of TFCC in ulnar styloid with transosseous suture. Six months later, the patient maintained pain over the SLL region, with SL gap and dorsal intercalated segment instability (DISI). At this points, the patient underwent a distal radius osteotomy and a SL reconstruction with flexor carpi radialis tendon (360° reconstruction), through a dorsal and volar approach, with scaphoid and lunate tunnels. Physical examination, visual analogue scale (VAS) and Quick-DASH score were evaluated.

Results: After the first surgery, the patient had a daily VAS of 5-6/10. One year after the last surgery, the patient maintained sporadic pain (VAS of 3/10), with a fair wrist motion with limited flexion (15°), extension (40°), radial deviation (20°) and

ulnar deviation (10°). Quick-DASH score was 31,4% meaning a moderate incapacity in daily life activities. CT scan showed consolidation of the radius osteotomy and correction of DISI.

Conclusion: Distal radius fractures are frequently associated with soft tissue lesions that can be misdiagnosed and may lead to serious limitations in daily life activities. With this case, the authors pretend to demonstrate that SLL 360° reconstruction technique is a valid salvage procedure in chronic SL lesions, with acceptable results, especially in pain. The authors also intended to draw attention to the injuries associated with distal radius fractures that often carry a severe burden to active patients.

## **A-0900** PERILUNATE DISLOCATIONS AND FRACTURE-DISLOCATIONS: WHY WE HAVE FAIR AND POOR RESULTS AFTER STANDARD TREATMENT?

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Objective: Complex carpal lesions are rare and involve carpal dislocation with ligament lesions and/or bone fractures. The most frequent injuries are perilunate dislocations, and 65% of these are dorsal trans-scaphoid perilunate fracture-dislocations. The diagnosis can be missed in 25% cases at the time of the injury, while the algorithm of treatment for perilunate fracture-dislocations has improved during the past years.

The purpose of this study was:

- 1) to retrospectively review the outcomes of all cases treated in our Hand Surgery Department in Trauma Centre Hospital in 10 yrs and compare these results with those reported in the Literature;
- 2) to analyze the most frequent complications, determining the main factors associated with the fair and poor outcomes of surgical treatment.

Methods: Between 2011 and 2021, 93 patients were treated for complex carpal lesions. The data collection was performed retrospectively and divided according to Herzberg's classification. 53 patients accepted to be evaluated. Including in the study only the patients treated with surgical reduction, ligament repair and pinning, we analysed the data of 28 patients with a mean follow-up of 70,6 months, using the Mayo Wrist Score (MWS), VAS score and DASH score.

Results: The majority of the patients returned to an acceptable hand function, with objective good results and a subjective satisfaction. The mean final Mayo Wrist Score is 78.4, the mean VAS score is 1,5 and the mean DASH is 15.9, according to the results in literature. 8 (28,5%) patients had a fair/poor MWS with a range of movement less or equal to 100° in 12 (42,8%), a grip strength less than 50% in 6 (21,5%), e 5 (17,8) patients not satisfied. They were treated surgically in a mean 6,2 days after trauma. 2 pzt had intolerance of the screw, 1 patient had a scapholunate instability and underwent proximal row carpectomy, 1 pzt had an ELP rupture. Factors influencing the outcome are: open and associated injury and delay in treatment without a statistical difference.

Conclusions: The main factors influencing the outcomes are the type of lesion with or without carpal bones fractures and the timing of surgery but it is impossible to determine a statistical correlation among too many different factors. An acute non-surgical reduction is mandatory in order to restore the normal anatomical connections as soon as possible, but it is not adequate as a definitive treatment. Treatment should involve an open reduction, internal stabilisation, ligament repair and temporal pinning.

## **A-0901** IMPACT OF COVID-19 ON OPERATIVE TIMING FOR PLASTIC SURGERY HAND TRAUMA IN A PLASTIC SURGERY TERTIARY REFERRAL CENTRE

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### AIM

To evaluate the impact of COVID-19 on operative timings for hand trauma in a plastic surgery tertiary referral centre

### METHODS

Data was collected retrospectively on 80 patients who underwent surgical management of hand trauma in a plastic surgery tertiary referral center in the United Kingdom. Forty patients were in the pre-covid group (Jan-Mar 2019) and 40 in the post-covid group (Jan-Mar 2022).

Data included operative timings for closed hand fractures (19 pre-covid, 17 post-covid), digital nerve injuries (8 pre-covid, 6 post-covid), and tendon injuries (13 pre-covid, 17 post-covid).

Parameters included:

- Operative delay time
- Whether delays were related to covid-19
- Adherence to operative timing requirements as set by the British Society for Surgery of the Hand (BSSH)

### RESULTS

In the post-covid group, the mean number of days between decision to operate and the operation date was longer than in the pre-covid groups for hand fractures (3.9 vs 2.5,  $P=0.0503$ ), nerve injuries (3.8 vs 1.8,  $p=0.3062$ ), tendon injuries (2.2 vs 1.4,  $p=0.016$ ), and overall (3.3 vs 1.9,  $p=0.0024$ ).

In the post-covid group, BSSH operative timing requirements were not met in a higher proportion of patients than the pre-covid group for hand fracture fixations (15% vs 0%,  $p=0.231$ ), nerve repairs (13% vs 0%,  $p=1$ ) tendon repairs (15% vs 0%,  $p=0.1793$ ) and overall (15% vs 0%,  $p=0.0214$ ).

The delay in management was related to covid-19 in all patients whose operative timings did not meet the BSSH requirements.

### CONCLUSION

Covid-19 has significantly impacted operative timing for hand trauma and adherence to BSSH operative timing requirements

### RECOMMENDATIONS

Further studies to evaluate the impact of vaccination-based triaging on recovery of services

## **A-0902** REVISION SURGERY OF THE ARPE TRAPEZIOMETACARPAL ARTHROPLASTY: COMPATIBILITY WITH THE TOUCH PROSTHESIS ALLOWS THE STEM TO BE RETAINED

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### Introduction

When failure of a trapeziometacarpal joint arthroplasty necessitates revision, several surgical options are available. The surgeon must decide whether to preserve the arthroplasty or not. Preserving the arthroplasty is especially advantageous in the first years after initial surgery, since the peri-prosthetic fibrosis does not provide sufficient stability at that time, when

converting to a trapeziectomy. These patients are at risk for collapse and scaphoid-metacarpal impingement. Another advantage is not having to remove the stem of the prosthesis, which can be difficult and cause substantial collateral damage. A common limitation to preservation of an arthroplasty is the fact that arthroplasties run out of production with time and that interchanging various component is simply not possible. In this perspective, we determined the feasibility to successfully salvage the ARPE arthroplasties (Zimmer-Biomet Warsaw, IN, USA) with components of the TOUCH prosthesis (KeriMedical, Les Acacias, Switzerland).

#### Materials and methods

We report three patients with a symptomatic failure of an ARPE trapeziometacarpal arthroplasty, necessitating surgical revision. In vitro testing of the compatibility and measuring of the stability of the neck of the TOUCH prosthesis with the stem of ARPE prosthesis, was satisfactory. The distal part of neck of the TOUCH arthroplasty – which is 4.5mm long and slightly conical – does not allow complete insertion in the ARPE stem, although it can easily sink over three quarters of its length in the stem. Its slightly conical shape allows for firm fixation in the stem. Approval of the ethical board of the hospital to perform this hybrid surgery was granted. All patients were well informed preoperatively and all concurred to this salvage procedure. Pain scores, QuickDASH scores and biometrical analysis were registered pre- and post-operatively. Radiographic control was performed. Follow-up was provided up to 6 months after salvage surgery.

#### Results

Three patients were submitted to the salvage procedure in which the ARPE stem was retained and combined with neck and cup of the TOUCH arthroplasty. The female:male ratio was 2:1. Mean age at surgical revision was 64.6 years old (range 45 – 76). Failure was the consequence of polyethylene wear in two patients (three years and eleven years after initial surgery respectively) and cup loosening in one patient (four years after initial surgery). No peri- or post-operative complications occurred. Pain scores, QuickDASH scores and biometrical analysis significantly improved after a minimum of 6 months of follow-up. Patients satisfaction was high. Radiographic analyses were satisfactory as well.

#### Conclusion

Failure of a primary trapeziometacarpal arthroplasty can necessitate surgical revision. Conversion to trapeziectomy (with or without ligament reconstruction and tendon interposition) is one possibility, although it involves the risk for scaphoid-metacarpal impingement and collateral damage when trying to explant the stem of the arthroplasty. In case of a failing ARPE arthroplasty, we successfully demonstrated the feasibility of preserving its metacarpal stem and combining it with neck, polyethylene, and cup of the TOUCH arthroplasty.

### **A-0903** PROPRIOCEPTIVE DEFICITS IN WRIST MOVEMENTS FOR MILD TO MODERATE CARPAL TUNNEL SYNDROME

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**Background:** The proprioceptive sense plays an important role in neuromuscular control of the wrist. Carpal tunnel syndrome (CTS) has been reported to impair proprioception during grasping and negatively affects fine motor skills required for pinching and grasping. The primary aims of this study is to investigate wrist position sense in patients with CTS and to compare the proprioceptive deficit during wrist movements in mild to moderate CTS. Secondly, we investigated the relationship between proprioceptive deficit and function.

**Methods:** Forty-eight patients (age, 47 (15) years) diagnosed with mild (n=24) or moderate (n=24) CTS on the basis of

electrophysiological examination participated in the study. Patients with a history of trauma/surgery to the hand and wrist, double-crush syndromes, rheumatologic diseases, and patients who required regular use of analgesics were not included in the study. Wrist joint position sense (JPS) was assessed with a goniometric platform which has been found to be reliable method. Measurements were made using target angles during wrist flexion, extension, radial deviation, and ulnar deviation in a single session for the affected and unaffected sides. The absolute value of the difference between the patient's wrist position angle and the target angle was recorded as the "JPS error amount". Measurements were repeated three times and the mean value was calculated. Function was evaluated using Disabilities of Arm, Shoulder and Hand Questionnaire. Wilcoxon signed ranks test was used to compare affected and unaffected sides. Mann-Whitney U test was used to compare mild and moderate CTS. Spearman's correlation test was used to investigate the association between disability and proprioceptive deficit.

Results: Wrist position sense was decreased on the affected side compared to the unaffected side in wrist flexion ( $p < 0.0001$ ), extension ( $p < 0.0001$ ), ulnar deviation ( $p < 0.0001$ ), and radial deviation ( $p = 0.024$ ). The mean difference in proprioceptive deficit was  $3.7^\circ$  ( $1.8^\circ$ ) in extension,  $1.9^\circ$  ( $1.5^\circ$ ) in flexion,  $1.8^\circ$  ( $1.4^\circ$ ) in ulnar deviation and  $1^\circ$  ( $1.7^\circ$ ) in radial deviation. Patients with moderate CTS had more proprioceptive deficits in wrist extension ( $p = 0.001$ ). There was no association between disability and proprioceptive deficit.

Conclusion: The result of this study shows that wrist position sense is impaired in patients with mild to moderate CTS. To prevent incorrect mapping of proprioceptive information and cortical reorganization, incorporating conscious proprioceptive exercises into the early phase of CTS rehabilitation may provide additional benefit to neuromuscular control of the wrist. In addition, positional awareness exercises during wrist extension may be critical in patients with moderate CTS.

## **A-0905** FOREARM RECONSTRUCTION IN SUBSTANCE ABUSE GONE WRONG- CASE REPORT

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### Background

The effects of injectable drugs can be devastating in the hands of the unexperienced who also lack mental clarity. Free flaps, although extremely useful, are usually a last resort in soft tissue coverage due to the complexity of the harvesting and reintegration.

### Case presentation

A 33 year old patient, 5 year drug user, presented himself into our clinic with forearm cellulitis post multiple heroin injections. The course of treatment included sequential debridments, highly conservatively in order to preserve as much coverage as possible; followed by skin grafting with split thickness grafts. Unfortunately, the patient continued injecting and developed graft necrosis that was this time extensively debrided. The remaining defect called for a radial flap, which healed nicely, with no notable complications.

The postoperative results were satisfactory, with a pleasing aesthetic outcome given the state of damage which the patient presented upon arrival.

### Conclusions

Although presenting with severe injectational complications, by meticulously treating them through debridment- aiming

to preserve as much healthy tissue and complex free flap reconstruction, our patient recovered fully, with an acceptable amount of scarring and disability.

## **A-0907 BIODEGRADABLE TEMPORISING MATRIX (BTM), A VIABLE ALTERNATIVE TO FLAPS FOR THE RECONSTRUCTION OF COMPLEX UPPER LIMB DEFECTS: A CASE SERIES**

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### Background

Complex hand infections and injuries resulting in exposed tendon, fascia, joint or bone, pose significant reconstructive challenges, especially in patients that are not ideal candidates for major complex microsurgical reconstruction. NovoSorb™ Biodegradable Temporising Matrix (BTM™) is a synthetic polyurethane dermal substitute that we have utilised in these patients along with secondary skin grafting. BTM™ has been widely reported in burns surgery with excellent outcomes. Its application in complex wounds has only recently been realised. This study to our knowledge represents the first case series evaluating the efficacy of BTM™ in non-burns upper limb reconstruction.

### Methods

A retrospective review of all complex upper limb wounds resurfaced with BTM™, presenting to our tertiary hand centre in a four-year period was performed using electronic clinical records. The 10 patients included had a median age of 67 years (range 18-92yrs). Gender distribution was equal. The median follow-up period was 6 months (range 1.5 - 24 months) and patients were evaluated to assess BTM™ and graft take, aesthetic outcome, return of sensation, pain, range of movement (ROM), and complications. Pre- and post-operatively photographs were obtained where possible as well as patient reported outcome measures (PROMs).

### Results

A total of 10 patients with 10 wounds were included in this case series with aetiologies including infection (6/10), trauma (1/10), oncological resection (1/10), and extravasation injury (2/10). Wounds were temporised when clinically infection free, with BTM™ and secondary skin grafting. Cases has a mixture of one or more exposed structures preventing the use of primary skin grafting including flexor tendons (3/10), extensor tendons (4/10), bone (3/10), joint (1/10), median nerve (1/10) and superficial radial nerve (1/10). The surface area reconstructed ranged from 2cm<sup>2</sup> to 200 cm<sup>2</sup>. The median time between injury and application of BTM™ was 3 weeks (range 0.7 – 104 weeks). Six cases (60%) were successful with BTM™ and graft take with healed wounds at follow-up while four (40%) cases failed, needing alternative procedures. One of the failures was not a failure of the BTM™, but an extension of gangrene and necrosis resulting in digital amputation. All four failures had preceding infection, two were smokers and two were diabetics. Of the six successful cases, two had preceding infection, one had diabetes and four had active malignancy. At follow-up, the successful cases reported excellent range of movement in four out of six cases, with one experiencing globally stiff fingers and one had no documented assessment of ROM. Both cases that had the BTM™ and subsequent skin graft on the median and superficial radial nerves healed well with no neuropathic pain.

### Conclusion

BTM™ demonstrates enormous potential in healing both infected and non-infected wounds with exposed deep structures, even in high-risk patients with poorly controlled diabetes or immunosuppression. Wound breakdown and infection rates were low. In suitable patients, BTM™ may offer a promising alternative to free flaps and a “life-boat” in complex upper limb reconstructions.

## **A-0908** TEARDROP ANGLE: AN IMPORTANT RADIOLOGICAL PREDICTOR OF INSTABILITY IN DISTAL RADIUS FRACTURES

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**Introduction:** teardrop angle (TDA) is one of the most recently described radiological parameters. Some authors propose it as an indicator of articular incongruity of the lunate facet and also relate it to the presence of an intraarticular gap. To date, its usefulness as a predictor of instability in distal radius fractures (DRF) has not been well studied. **Objective:** to evaluate the usefulness of the TDA as a predictor of instability in distal radius fractures. **Method:** cohort study, exposure was defined as the initial radiological parameters of the DRF and as outcome the reduction loss during the follow-up period. **Sample:** patients older than 15 years with DRF. **Inclusion criteria:** patients with DRF diagnosed by an antero-posterior and lateral wrist radiograph. **Exclusion criteria:** those who did not have a post-reduction control radiograph and another one with a follow-up period of at least 7 days, patients with insufficient reduction, surgical intervention prior to the first follow-up radiograph, open physis, previous wrist deformities, radiocarpal dislocation and/or a distal ulna fracture. The variables analyzed were: sex, age, radial height and inclination, ulnar variance, volar tilt, TDA, cortical and metaphyseal comminution, step – off or gap at the articular surface, fracture pattern with shearing feature, ulnar styloid fracture, radiological signs of distal radioulnar joint incongruity and reduction loss during the follow-up period. **Statistical analysis** was performed using mixed logistic regression models using the “R” statistical program. **Results:** 154 patients with distal radius fracture fulfilled the described criteria. The average age was 59 years old and 107 (70%) patients were female. The statistically significant predictors of instability were: ulnar variance (p: 0.003), joint step-off (p: 0.007) and TDA (p: 0.008). The initial TDA average was 46° and after closed reduction was 59°. TDA measurement proved to be better predictor of reduction loss than volar tilt in the lateral radiograph, replacing it as a statistically significant predictor of instability in the multivariate analysis. The decrease in TDA was associated with a dorsal angulation of the articular surface of the radius and/or a posterior displacement of the distal fragment of the fracture, while its increase was related to incongruity of the lunate facet and intra articular gap or step-off. **Conclusion:** TDA is a good radiological predictor of instability in distal radius fractures. Therefore, we suggest that its measurement should be considered within the initial radiological evaluation in all these patients.

**Keywords:** distal radius fractures, teardrop angle, radiographs, diagnostic imaging, wrist, loss of reduction, instability.

## **A-0909** SPARE PARTS SURGERY – CLINICAL APPLICATION

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Mangling limb injuries can lead to severe disability with each patient presenting an unique pattern of injury and tissue loss. Therefore, these are challenging cases for surgeons who aim to restore function and appearance of the hand. A planned strategy with well-defined hand shape and function goals from the moment of presentation is essential.

The need for tissue harvesting for limb reconstruction implies additional morbidity. In this setting an alternative strategy, such as spare part surgery which involves reconstruction using tissue from other parts that cannot be reconstructed and would otherwise be dispensed, is an interesting option.

The authors present a case of a traumatic lesion of the hand that underwent surgical treatment, where the concepts of spare part surgery were applied, with a description of the clinical and imaging findings, treatment performed and postoperative evolution.

A 38-year-old male construction worker, presented to the emergency department with a mangled left hand caused by an electric saw. There was significant loss of substance at the dorsal level of the hand from the 1st to the 3rd ray and an amputation of the 2nd finger. In the X-ray, there is an almost total absence of the 1st metacarpal and a comminuted fracture of the proximal phalanx of the 3rd finger. He also presented a destruction of the extensor apparatus of the 1st to 3rd fingers.

Urgent surgical treatment was performed with debridement of devitalized tissues. Thumb reconstruction was performed with transposition of part of the 2nd metacarpal to the 1st metacarpal region and fixed with K threads and suture cerclage. It was performed subtraction of the 2nd ray, fixation of the fracture of the proximal phalanx with k-wires and arthrodesis of the distal interphalangeal joint in the 3rd finger and reconstruction of the extensor apparatus.

Post-operatively skin necrosis developed in three regions and surgical treatment was performed with debridement and coverage with synthetic skin substitute and subsequent coverage with a partial skin graft.

At 3 months postoperatively, there is consolidation of the base of the transposition of the 2nd metacarpal. Arthrodesis of the thumb metacarpophalangeal and proximal interphalangeal join of the 3rd finger are planned.

In mangling lesions, when anatomic repair is not possible, functional reconstruction should be the goal of treatment.

There are several prerequisites for the application of spare part surgery, it should be noted that the reconstruction must offer a better result than the primary amputation and the spare parts must offer a superior function when used for reconstruction of other parts than when they are reimplanted in their anatomical place.

The thumb reconstruction has the highest priority with the available segments of other fingers possibly reallocated to this segment reconstruction.

In this case, these principles were applied, having defined a precise surgical plan in the initial approach, using the 2nd metatarsal for thumb reconstruction and preservation of the cubital fingers.

Spare part surgery is a useful concept that addresses primary reconstruction while trying to limit donor site morbidity. This should be applied when necessary, being of particular interest in complex injuries of the hand.

## **A-0910** THE USE OF HEAT SENSITIVE NAIL VARNISH FOR TEMPERATURE MONITORING IN DIGITAL MICROSURGICAL PROCEDURES

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### BACKGROUND

Despite the improvement in knowledge and techniques regarding digital microsurgical procedures, surgical failure due to vascular compromise remains a present complication with a great impact on the patient's quality of life.

Early identification of signs of digital vascular compromise during the postoperative hospitalization allows the surgeon to revise the vascular anastomosis with the right timing and decrease the failure rate. Temperature of the revascularized segment, as well as color, capillary refill, and turgor, is one of the predictive signs of vascular compromise.

Our study illustrates the use of heat sensitive nail varnish, as an objective, inexpensive, easily reproducible method that can assess temperature changes and therefore aid in early detection of possible failure.

## METHODS

Our study is based on the experience gained from 2019 to 2022 at the Department of Hand Surgery at San Giuseppe Hospital, while monitoring 19 digits who underwent reimplantation, 13 revascularization and 9 fingers who underwent toe to hand transfer in 36 patients.

These patients were provided with heat sensitive nail varnish in the immediate postoperative period to the replanted/revascularized finger and, for comparison, to adjacent fingers. This nail varnish contains two types of pigments and it changes color in response to the temperature of the finger (yellow when nail temperature is higher than 32°, red below 32°) Health care personnel, the patient himself and relatives were instructed on the functioning of the nail varnish and asked to perform constant monitoring.

Patients were monitored by physician and nurses every 2h for the firsts 3 days and every 4 h until 5-day post operative during hospitalization days. Collected data include age, gender, type of surgical procedure, polish color shift and time of change, time of onset of vascular compromise, failure of the surgery, vascular anastomosis revision. Data collection was done retrospectively by extracting data from each patient's medical record.

## RESULTS

Of 41 digits on whom heat-sensitive nail varnish was applied 15 experienced vascular compromise while 26 did not. 11 fingers did not survive while 4 survived after revision of the venous anastomosis.

In all 26 digits that had no complications the nail varnish remained yellow without any change in color. Among the 15 patients who went into vascular distress, 14 experienced nail varnish color change. The change of nail varnish happened around clinical sign of vascular compromise. In the four fingers who underwent anastomosis revision and which then survived the nail varnish changed color to yellow after microsurgical revision.

## CONCLUSIONS

The application of heat sensitive nail varnish after digital microsurgical procedures is an easily reproducible, inexpensive and objective method of assessing temperature change and for the prediction of poor prognosis.

The color change can be highlighted even by non-expert personnel or the patient himself, this makes the nail polish an easy-to-use adjunct tool for monitoring vascular compromise.

Clinical evaluation and assessment of color, capillary refill and turgor are dependent on the experience and knowledge of the medical staff but remain the main tool available in the detection of vascular compromise.

## **A-0912** WRIST SPANNING PLATES IN COMPLEX DISTAL RADIUS FRACTURES "BOON OR BANE" – EXPERIENCE FROM A MAJOR TRAUMA CENTRE

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### Background

The use of wrist spanning plates (WSP) in the management of distal radius fractures has become increasingly widespread. Though the WSP and external fixators use similar principles, the outcome and complication rates with WSP are encouraging when compared to external fixators. We analysed the functional outcome and the safety profile of the WSP's.

### Methods

We reviewed 16 patients (17 wrists) who had WSP between 2016 and 2022. The mean age of the patients was 54 (18-83) and 62.5% (10) of patients were male. 69% of cases resulted from high energy trauma and 75% had polytrauma. All

fractures were complete articular and multi-fragmentary (AO 23.C2 or 23.C3) and 53% were open. 59% of patients had WSP fixation alone and the remaining had simultaneous WSP and volar plating. All the patients were given an appointment for removal of plates and the functional outcomes were evaluated using PRWE scores.

#### Result

The mean follow-up following application of WSP was 16 months. Mean PRWE scores for patients was 38.2 (0-68). Of the 17 WSP's used for primary fixation 6 were removed prematurely due to complications including metalwork failure, infection or non-union. Nine were removed without an associated complication (mean infix duration 7.8 months). 1 patient died and 1 was lost to follow-up with WSP's in situ (the latter had paranoid schizophrenia). Overall, 41% had complications including metalwork failure (18%), metacarpal fracture (6%), non-union (12%), infection (6%) and tendon rupture (6%).

#### Conclusions

The use of WSP's in our centre has been reserved for the most complex of cases. Caution should be exercised when used in patients with mental health issues as in our series we experienced delays in removal and loss to follow-up. In elderly patients with osteoporosis, additional immobilisation with plaster for six weeks could reduce the risk of non-union and implant failure. The newer generation WSP is less bulky and has less soft tissue and bony complications. WSP has a role in selected group of patients, careful patient selection and patient education is paramount in obtaining good functional outcomes.

### **A-0913** ARTHROSCOPIC MANAGEMENT OF THE DRUJ INSTABILITY

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Distal radioulnar joint (DRUJ) is the main rotation mechanism of the forearm, now a days we consider it as a part of the "wrist" joint. Injuries of the DRUJ can be isolated or associated with the fractures of the distal radius, fractures of the ulna or radius on the different levels or carpal bones. It is often missed in the emergency departments due to it hard clinical and instrumental examination.

There are many stabilizers of the DRUJ including: volar and dorsal ligaments, capsule of the joint, TFCC, ECU and its sheath, Shape of the sigmoid notch (ski slope, s-type, c-type), pronator quadratus and interosseus membrane. But the main two to be restored are interosseus membrane and TFCC. Because of the very high variability of the anatomy of the DRUJ and many patterns of it's biomechanics such methods as MRI and CT are not very specific, we find sonography more useful in acute cases, in old cases arthroscopy is the golden standard. Using these methods, you got to scan contralateral extremity. Arthroscopic procedures showed good results and high variety in treatment acute and old instabilities of the DRUJ and considered to be primary techniques in treatment of the DRUJ injuries according to its mini-invasive, "ligaments saving", and blood supply saving abilities.

## **A-0914** HOW TO AVOID DAMAGE TO DORSAL SENSORY BRANCH OF THE ULNAR NERVE IN SETTING ARTHROSCOPIC ULNAR PORTALS: AN EXPERIMENTAL ANATOMICAL STUDY

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Creation of ulnar portals for wrist arthroscopy exposes to the risk of iatrogenic injury of dorsal sensory branch of ulnar nerve (DSBUN).

Aim of this anatomical study is to describe the anatomy of the DSBUN and its changes in location with different forearm positions, in order to identify the safer position to avoid iatrogenic injury to DSBUN, while performing arthroscopic procedures on the ulnar side of the wrist.

### **METHODS**

From 19 different cadavers (10 male, 9 female; mean age: 75.4 (58-91 years), nineteen fresh arms including elbow were dissected to demonstrate DSBUN anatomy.

The longitudinal axes running through the ulnar styloid (StU), and the Flexor Carpi Ulnaris (FCU) were used as landmarks to locate the path of the DSBUN at specific distances proximal /distal to the tip of the StU.

The forearm was positioned in full supination (S), neutral pronosupination (NPS), and full pronation (Pr).

We used a Cartesian axes system, setting the tip of the StU as the origin. The 6U and DF portals were also reported. Measurements were taken with standardized photographs and analyzed with dedicated software application. All measured distances (mm) were recorded as positive values if palmar to StU and negative if dorsal.

For Statistical Analysis, the Shapiro-Wilks test was used for a non-parametric approach.

Median and interquartile range (IQR) were used to summarize variables. Friedman' test was used to compare each variable in three forearm positions.

Both median courses with 95% Confidence Intervals (95%CI) and individual measurements were considered. The median area in mm<sup>2</sup> between the DSBUN and FCU courses and 95%CI was estimated for each forearm position.

A probability of 5% was used to assess the statistical significance. The software R was used for the statistical analysis.

### **RESULTS**

Using the StU as reference. The distributions of the DSBUN distance at proximal measurements at 2 and 1 cm in NPS were significantly higher than in S ( $p=0.03$  and  $p=0.027$  respectively). The distributions of the distal measurements at 2 and 1 cm in NPS were significantly greater than in Pr ( $p=0.003$  and  $p=0.003$ ). The distribution of the distal 1 cm measurement in Pr was significantly lower than the one in S ( $p=0.027$ ). No significant differences were found at StU level ( $p=0.088$ )

Using the FCU as reference. The distributions of the proximal measurements at 2 and 1 cm in S were significantly higher than in NPS ( $p=0.009$  and  $p=0.009$ ). In addition, the distribution of the proximal measurements at 1 cm was also significantly higher in S than in Pr ( $p=0.012$ ). No significant differences were found at StU level, and at 2 or 1 cm ( $p=0.259$ ,  $p=0.753$ ,  $p=0.071$  respectively)

### **CONCLUSION**

For procedures proximal to the tip of the StU, working in NPS close to the axis along the StU, reduces significantly the risk of iatrogenic damage of DSBUN.

If we work close to the dorsal margin of FCU for proximal procedures, S is significantly safer. In settings 6U and DF portals, forearm Pr should be avoided to prevent DSBUN injury.

## **A-0915** WORKING SMART WITH EXCEL: USING FORMULAE TO EXTRACT AND ANALYSE SURGICAL DATA

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### Introduction:

Auditing clinical practice remains a key pillar of clinical governance. With advances in electronic patient records (EPR) and use of electronic databases to store and code patient data at time of assessment and operation, there have been incredible opportunities created for large scale data extraction, analysis and use in high impact epidemiological studies. The Birmingham Hands Centre have utilised this opportunity by creating their own EPR and audit tool "eHands" for clerking hand trauma and recording operation notes. From this tool it is feasible to create diagnoses for each tendon, nerve, artery and fracture alongside repair performed. Currently coded injuries are stored as a single text string rather than delineated values. This presents a challenge when analysing thousands of patients across six years. Manual data extraction is slow and prone to data errors or incongruent values.

Here we present the use of Excel formulae to automate data extraction from text strings, alongside a case example for extracting and analysing the epidemiology of partial extensor tendon lacerations and management at a single tertiary centre. Our example can be used and adapted by other clinicians and researchers for use with their own EPR systems, and we present our findings to highlight the benefits and power of Microsoft Excel as a database and data analysis tool, with features that clinicians and researchers may be unaware of.

### Methods:

The database was interrogated for procedures in which partial extensor tendon lacerations were recorded, with 763 hands identified. Diagnoses for all injuries of each hand were recorded in a single string value, containing the injured structure, degree of injury, zone of injury and associated finger. Operations for each hand were recorded in a separate string value containing the injured structure, degree and zone of injury, and whether the structure was repaired. Free text entries for the diagnoses, operation note title and operation note contents were also present for each hand.

To extract data on partial injuries, a "MID" formula was used to identify the text "Partial" in the diagnosis and extract information on the injured structure. By utilising nestled "SUBSTITUTE" formulae within the "MID" formulae, we extracted multiple injuries within the same text string. Variations of "MID" were used to identify percentage of tendon divided and zone of injury, "IF(ISNUMBER(SEARCH" to exclude non-extensor tendon injuries, and "INDEX(MATCH" to associate the tendon with an injured finger.

The resulting data on diagnoses and operations were then compared to identify whether partial tendon injuries were repaired, and whether injuries with <50% division were managed with non-repair.

### Results and conclusion

By utilising the functions and equations present within Excel, we were able to extract data on the repair of 827 tendons and analyse the repair of partial tendon injuries in under 10 hours. By improving our current spreadsheet, it is feasible to input the recorded diagnoses and operations from our "eHands" databases, and extract epidemiological data for hand fractures, flexor tendon, extensor tendon, nerve and artery injuries.

## **A-0916** IMPACT OF COVID-19 VACCINATION-BASED TRIAGING ON RECOVERY OF SERVICES FOR PLASTIC SURGERY HAND TRAUMA IN A PLASTIC SURGERY TERTIARY REFERRAL CENTRE

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**Aim:** To evaluate the impact of COVID-19 vaccination-based triaging on recovery of operative services for plastic surgery hand trauma in a plastic surgery tertiary referral centre

**Method:** Data was collected retrospectively on 120 patients who underwent surgical management of hand trauma in a plastic surgery tertiary referral centre in Scotland. Forty patients were in the pre-covid group (Jan-Mar 2019), 40 in the post-covid pre-vaccine group (Jan-Mar 2022), 40 in the post-covid post-vaccine group (Jul-Sep 2022).

Data included operative timings for closed hand fractures (17 pre-covid, 19 post-covid pre-vaccine, 15 post-covid post-vaccine), digital nerve injuries (6 pre-covid, 8 post-covid pre-vaccine, 6 post-covid post-vaccine), and tendon injuries (17 pre-covid, 13 post-covid pre-vaccine, 19 post-covid post-vaccine).

**Outcome measures:**

- Average number of days between decision to operate and the operation date (operative delay)
- Adherence to operative timing requirements as set by the British Society for Surgery of the Hand (BSSH)
- Where operative timing requirements were not met, whether this was related to covid-19

**Results: Operative delay**

In the pre-covid group, operative delay was shorter than both post-covid groups for hand fractures (2.5), nerve injuries (1.8), and tendon injuries (1.4). Overall, the difference was statistically significant compared to the post-covid pre-vaccine group (1.9 vs 3.3,  $p=0.0024$ ) and the pre-covid post-vaccine group (2.7 vs 1.9,  $p=0.0238$ ).

In the post-covid post-vaccine group, operative delay was shorter than in the post-covid pre-vaccine group for hand fractures (3.6 vs 3.9) nerve injuries (3.8 vs 2.5), and tendon injuries (2.1 vs 2.2). Overall, the difference between the 2 groups was not statistically significant (3.3 vs 2.7,  $p=0.2526$ ).

**Adherence to BSSH timing requirements**

In the pre-covid group, BSSH operative timing requirements were met in all patients for all plastic surgery hand trauma groups (100%).

In the post-covid post-vaccine group, BSSH operative timing requirements were met in a higher proportion of patients than in the post-covid pre-vaccine group for hand fracture fixations (93% vs 85%), nerve repairs (100% vs 87%), tendon repairs (89% vs 85%) and overall (89% vs 85%). Overall, BSSH operative timing requirements were met for a lower proportion of patients than in the pre-covid group (89% vs 100%).

**Conclusions:** Vaccination-based triaging has had a positive impact on reducing operative delays and improving adherence to BSSH operative timing requirements. However, plastic surgery hand trauma services have not yet fully recovered from the COVID-19 pandemic and further interventions are required to aid recovery of services to pre-pandemic standards.

**Recommendations:** Further studies to evaluate the usefulness of vaccination-based triaging on recovery of services in other areas of surgery following a global pandemic.

Further interventions to aid ongoing recovery of plastics surgery hand trauma services following the COVID-19 pandemic.

**A-0924** SCAPHOID WAIST NON UNION TREATED WITH DISTAL END RADIUS CORTICO-CANCELLOUS BONE GRAFT AND KIRSCHNER WIRE FIXATION: A PROSPECTIVE STUDY OF 103 CASES

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**BACKGROUND:** An untreated scaphoid non-union leads to carpal collapse which subsequently leads to wrist arthritis. Till date the optimal treatment for scaphoid non-union remains controversial. The objective of this study was to assess the union rate in scaphoid waist fracture non-union treated with non-vascularized cortico-cancellous bone graft harvested from the volar aspect of the distal radius and fixed with Kirschner wire(s).

**METHODS:** This is a prospective study of 103 cases from 2005 to 2022 from a single senior surgeon's private clinic-based practice. The demographic details, mode of injury, time since injury and prior treatment taken were noted. Patients who had a scaphoid nonunion as a part of perilunate dislocation, ipsilateral distal radius fracture and those with persistent non-union after prior surgical intervention were excluded from the study. Non-union was confirmed by plain radiographs utilizing four views. Post-operatively patient's wrists were immobilized for 3 months. Every patient underwent elective Kirschner wire removal at 6 months. We assessed status of bone union, range of motion, functional outcome using Mayo wrist score and complications at 3 months, 6 months and 12 months. The minimum follow-up period was 12 months.

**RESULTS:** There were 103 patients included in the study which comprised of 100 males (97.08%) and 3 females (2.91%). The mean time from injury to index surgery was 94.5 weeks. Union occurred in 101 patients (98.05%) with one patient developing persistent scar site tenderness. Two patients (1.94%) developed a persistent non-union. The mean time to union was 13.5 weeks. Mean Mayo wrist score was  $81 \pm 7.9$  at 4 years follow up.

**CONCLUSION:** From the results of this study we conclude that the author's technique using cortico-cancellous non-vascularized bone graft harvested from the distal radius and fixed with Kirschner wire(s) is a reliable method for the management of scaphoid waist fracture non-union.

**A-0928** CLINICAL PERFORMANCE OF A LOCKED INTRAMEDULLARY WRIST ARTHRODESIS NAIL

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**Introduction:** Wrist arthrodesis (WA) provides symptom relief for patients with painful end stage wrist arthritis. Considerations for choice of fixation include implant prominence on the dorsum of the hand, the ability to maintain a functional hand position despite lack of wrist motion, and the risk of subsequent operation. Prior reports for WA with a locking nail have demonstrated predictable rates of union with variable complications across small sample reports and short terms of follow up. We present clinical and radiographic outcomes across 2 institutions for a locking nail used to treat primary WA.

**Methods:** A chart review from 2010-2022 was performed at two institutions for cases of wrist arthrodesis fixed with the IMPLATE locking nail (Skeletal Dynamics, Miami, FL). Data collected include indication, follow up term, the Patient-Rated Wrist Evaluation (PRWE), a visual analog scale for pain at rest (VASr) and during activities of daily living (VASa) and radiographic assessment of bony union. The criterion for union was bridging trabeculae across the fusion site on posteroanterior and lateral view.

**Results:** Across 38 cases at a mean of 7 months of follow up, radiographic union was achieved in 97.4% of cases which

included 1 case of delayed union. There were 7 cases (18%) of distal screw migration, of which 5 reported minimal pain. There were 2 cases (5%) with radiographic evidence of implant loosening without corresponding clinical symptoms. The mean PRWE was 37 at a mean follow up of 38 months. One implant was removed at 8 months postoperatively in a patient with rheumatoid arthritis. There was no evidence of infection, and the implant was radiographically stable. The patient presented with pain and swelling of undetermined cause, that may be secondary to the underlying condition. Discussion: The current results demonstrate high rates of radiographic union and satisfactory clinical outcomes following wrist arthrodesis with a locking nail. Cases with radiographic evidence of distal screw migration did not display concerning symptoms. The PRWE scores indicate that satisfactory function can be attained when the hand is placed in a functional position despite the absence of wrist motion. The third carpometacarpal joint was not included in the arthrodesis preparation in this series. Further investigation is needed to determine if arthrodesis preparation of the third carpometacarpal joint can mitigate implant loosening due to reduced forces across the fixation construct.

## **A-0929** OUT OF SIGHT OUT OF MIND: A DIAGNOSTIC ALGORITHM FOR MANAGEMENT OF GLOMUS TUMOURS

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### Background

Glomus tumours are benign tumours which most frequently affect the upper extremities, Accounting for approximately 1-5% of all hand tumours, there is a particular predilection for the subungual regions of the digits. The classic triad of presenting symptoms include cold hypersensitivity, point tenderness and paroxysmal pain. The absence of a visible lesion (often disguised by the nail plate) or a lack of a complete triad of symptoms, renders these lesions notoriously difficult to diagnose. Non-hand surgery department visit has been associated with high rates of misdiagnosis. The aim of this study is to analyse the referral pathways and misdiagnosis rates in relation to management of upper limb glomus tumours at our institution and compare this to international metadata.

### Patients & Methods

We conducted a retrospective review of all glomus tumours treated at St Vincent's Hospital Group over a twenty year period. Medical records, radiological imaging and histopathology reports we reviewed to identify patient-, disease- and treatment-related factors relating to patient management. A literature review of published case series of upper limb glomus tumours was performed to assess referral pathways, treating specialties and misdiagnosis rates.

### Results

Twenty three upper limb glomus tumours were treated St. Vincent's Hospital Group between 2000 and 2022. The mean age of diagnosis was 52.56 years (27-63) with a male preponderance 17/23 (74%). The overall rate of misdiagnosis was 70% based upon histological request forms at the time of surgery. 35% (8/23) of the upper limb Glomus tumours were diagnosed correctly prior to surgery with lowest rates associated with hand surgery specialists. Eight published case series in the literature were reviewed. Highest misdiagnosis rates are associated with non-hand surgery specialist opinions.

### Conclusions

Failure to recognise the classic symptomatology often leads to high rates of misdiagnosis, long delays to definitive management causing persistent pain, disability and psychosocial dysfunction for patients. Referral to hand surgeons

(orthopaedic or plastic surgeons) improves diagnostic accuracy. We have devised a simple algorithm to direct patients through a hand surgery referral pathway and recommend the most appropriate adjunct investigations to improve diagnostic accuracy.

### **A-0930** HOW NECK ANGULATION AND STEM ROTATION AFFECT THE METACARPAL'S POSITION IN THE TRAPEZIOMETACARPAL JOINT REPLACEMENT: A 3D ANALYSIS

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The ball-and-socket designed trapeziometacarpal joint replacement obtains good strength, faster and better pain relief, while preserving range of motion, with a ten-year survival of more than 91%. Despite the good functional outcome, this design of thumb base prosthesis cannot fully replicate the kinematics of the original saddle joint, and this could explain why complications, such as luxation and loosening of the cup occur. To reduce the 8,4% complication rate, guidelines for optimal positioning of the prosthetic components are warranted. Some surgical guidelines, including orientation of the distal articular trapezial osteotomy and cup, have been proposed, but these are based on retrospective clinical studies. Pilot data shows that the center of rotation of the ball and center of rotation of the socket don't match if the current guidelines are followed. To date, limited 3D analytic data has been published on this subject.

This study analyses the three-dimensional (3D) anatomy of the trapeziometacarpal (TMC) joint to correlate with that of the ball-and-socket designed trapeziometacarpal joint. It evaluates how the neck angulation and stem rotation of the ball-and-socket prosthesis respects the kinematics of the native joint and the anatomical position of the metacarpal and evaluates the most common sites of impingement. CT-scans of the thumb base of 40 patients are included of which twenty patients without signs of osteoarthritis and 20 patients with signs of osteoarthritis. Different cup placements are compared to all commercially available neck shapes and lengths. The area of contact between the 1st and 2nd metacarpal is determined and is build on the outcomes of the previous aims.

The purpose of this study is to evaluate the different positional factors for improving the longevity of the prosthesis by 3D analysis.

Key words: arthroplasty, osteoarthritis, rhizarthrosis, trapeziometacarpal prosthesis

### **A-0931** COMPARISON OF OUTCOMES AFTER FDS TENODESIS AND CONVENTIONAL PROXIMAL PHALANGEAL DIGITAL AMPUTATION

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Background:

Based on the premise that MCP joint flexion is limited to 45 degrees after digital amputations at the level of the proximal phalanx the flexor digitorum superficialis (FDS) tenodesis technique was described to improve range of motion and grip strength in 2017. In this technique the FDS tendon of the amputated finger is affixed to the stump of the proximal phalanx using transosseous sutures. A near-normal postoperative range of motion has been described. To date no comparison

has been made between FDS tenodesis and conventional amputation.

**Aims:**

The aim of this study was to compare the outcome of FDS tenodesis with the conventional technique of proximal phalangeal digital amputation.

**Method:**

We started using the FDS tenodesis technique in our department in 2022. After a minimum follow-up of six weeks we invited patients who had undergone digital amputations at the level of the proximal phalanx for assessment. Patients with amputations of the thumb and patients who had contraindications to FDS tenodesis were excluded. At follow-up, we measured range of motion at the MCP joint, power grip strength as well as pinch grip strength of the affected digit(s) of both hands. We also collected data on adverse events.

For range of motion, the difference between the unaffected and the injured side was calculated. For grip strength, the ratio of observed and expected values was reported. Data are reported as mean (standard deviation). Groups were compared using Student's t-tests.

**Results:**

Seventeen patients with 22 digital amputations and a mean age of 47.8 (9.6) years were included in our study. Six patients with 8 amputations underwent FDS tenodesis while 11 patients with 14 amputations had had conventional digital amputation. The follow-up time was 3.3 (1.8) months in the FDS group and 17.4 (3.8) in the conventional amputation group. The mean range of flexion was 71.6 (15.2) degrees in the FDS group and 73.6 (13.1) degrees in the conventional amputation group ( $p=0.760$ ). There was no difference in loss of flexion at the MCP joint between in the FDS tenodesis group (16.4 (14.7) degrees) and conventional amputation group (13.3 (10.0) degrees,  $p=0.605$ ). The O/E ratio of power grip strength was 48.1 (27.0) % in the FDS group and 76.5 (23.3) % in the conventional amputation group ( $p=0.058$ ). The O/E ratio of pinch grip strength of the affected digit was 47.0 (31.6) % after FDS tenodesis and 33.0 (30.6) % after conventional amputation ( $p=0.329$ ). No adverse events occurred in the FDS group. In the conventional amputation group, a stump revision with resection of the condyles due to mechanical irritation was necessary.

**Conclusions:**

Contrary to previous assumptions the loss of range of flexion at the MCP joint after digital amputation at the level of the proximal phalanx is small. This study failed to show a difference in MCP joint flexion or grip strength between digital amputation with and without FDS tenodesis. An important limitation of the this study is the shorter follow-up time in the FDS group as range of motion and grip strength may still improve slightly with longer follow-up.

## **A-0932** PROSPECTIVE STUDY ON THE DIAGNOSTIC ACCURACY OF 4D CT FOR DIAGNOSING INSTABLE SCAPHOLUNATE DISSOCIATION

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**Objective:**

Early detection of scapholunate ligament (SLL) tears is essential after minor and major trauma to the wrist. The differentiation between stable and instable injuries determines therapeutic procedures and early treatment ideally prevents osteoarthritis. Arthroscopy has since been the diagnostic gold standard in suspected SLL tears because non-invasive methods have failed to exclude instable injuries reliably. In our center cineradiography became the preoperative

screening tool for suspected SLL-tears. During cineradiography, a specialized radiologist guides and instructs the patient during the examination under fluoroscopy. The method is time consuming and usually performed only in specialized hospitals . Therefore, we aimed to establish an easier, noninvasive dynamic method. This prospective study aims to determine the diagnostic accuracy of dynamic 4D CT of the wrist for diagnosing instable SLL tears compared to our previous standard method cineradiography as referenced by arthroscopy.

#### Methods:

Prospective study including 40 consecutive patients with suspected SLL tears diagnosed using 4DCT scans which were interpreted by two radiologists with more than 7 years of experience in musculoskeletal radiology. All patients underwent arthroscopy of the wrist afterwards. Radiologist were blinded to the results of arthroscopy and surgeons were blinded to the radiological reports. For comparison a historical cohort of 78 patients who were diagnosed using cineradiography were analyzed retrospectively. SL joints with and SL distance of  $> 3$  mm were interpreted as unstable. Interrater reliabilities of wrist kinematics were calculated and compared for 4DCT and cineradiography.

#### Results:

In both groups age and gender were comparable. Time from injury to diagnostic imaging and operation was longer in the group of 4DCT (Mean 215 d vs. 128 d). In our prospective group of 40 patients 33 showed unstable SLL tears intraoperatively , whereas in our historic cohort arthroscopy revealed 63 unstable SLL tears. The sensitivity of 4DCT was lower than in cineradiography in detecting unstable SLL tears (73% vs. 83%). Specificity of 4DCT was comparable to cineradiography (83% vs. 80%) . The positive predictive value was very high (96% vs. 95%) for both methods. The separation value of optimal sensitivity and specificity to detect unstable SLL tears was 2,275 mm for 4DCT and 2,925 mm in for cineradiography increasing sensitivity to 79% and 89% respectively. Interrater reliability tended to be higher for 4D CT compared to cineradiography. The diagnostic accuracies in patients presenting early ( $<43$ days) after trauma compared those presenting late ( $>43$ days) were the same for both methods.

#### Conclusion:

4D CT can detect unstable SLL tears which present with SL gaps wider than 2.2 mm during imaging with a sensitivity of 79% and a specificity of 83%. Diagnostic accuracy was higher for cineradiography in a historical cohort. This might be attributed to the shorter acquisition time of 4D CT since wrist kinematics can be studied with a high reliability on 4D CT scans. The new method has potential as a non-invasive screening tool in in- and out-patient care but thus far only contributes as one part of more extensive diagnostic workups.

### **A-0933** DESCRIPTION OF SURGICAL FINDINGS AND THEIR CORRELATION WITH PREOPERATIVE DUPLEX SCANNING IN PATIENTS DIAGNOSED WITH THORACIC OUTLET SYNDROME

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Thoracic outlet syndrome (TOS) is characterized by painful compression in the virtual funnel-shaped space that conducts nerve and vascular structures on their way to the upper extremity. The lack of a diagnostic test for TOS makes treatment of this syndrome, whether surgical or nonsurgical, very difficult; consequently, treatment is debated and long-term outcomes are poorly documented.

Few studies have been performed to corroborate the sensitivity and specificity of ultrasonographic diagnostic support and none compare it with the correlation of surgical findings.

The aim of this study is to evaluate the results, as well as the correlation between ultrasonographic findings and description of surgical findings, which helps us to reach a diagnosis and improve the prognosis.

The authors describe the correlation between doppler ultrasound and surgical findings in patients who underwent supraclavicular release surgery and report the results.

A retrospective descriptive observational study was performed including 23 patients with a diagnosis of thoracic outlet, who underwent bilateral brachial plexus doppler ultrasound and supraclavicular brachial plexus release over a period of time from 2018 to 2022.

Follow-up was performed at 6 months with systematic data collection, preoperatively and at 2 and 6 months. With a minimum follow-up of 6 months.

During the follow-up, the preoperative ultrasonographic findings were described, as well as clinical symptoms, the time of presentation, and pain according to the visual analog scale, the satisfaction questionnaire was carried out, the surgical findings were reported and complications and the need for reinterventions were reported.

### **A-0934** NEGLECTED MULTI-DIGITAL FLEXOR INJURIES , OUTCOMES OF SINGLE STAGE REPAIR BY HETERO-DIGITAL FLEXOR DIGITORIUM PROFUNDUS

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**Aims:** Restoration of satisfactory digital function after a neglected lesion or failure of flexor tendon repair remains one of the most difficult challenges in hand surgery. The aim of this study is to evaluate the results of heterodigital flexor profundus transfer in multi-digital flexor injuries (modified Duran/Oberlin technique)

**Materials and methods:** We treated two patients (women), age (16 and 35 years), neglected lesion for (eleven years after primary reparation for the girl, and two years for the adult woman) lesion in zone 2 of index and middle fingers, single stage repair by hetero digital flexor digitorum profundus from ring finger is split into two halves then re-routed to the recipient index middle finger and fixed with a pull-out suture over the nail, and sutured to the old FDP tendon stump, the tension is set to maintain the recipient finger in slightly more flexion than the normal resting cascade, Arthodesis DIP ring donor finger at 10 degrees, a dorsal splint is applied with the wrist in 45 degrees of flexion, MCP joints 45 degrees of flexion, and PIP joints left free to allow early mobilization. Patients were evaluated before and after surgery, passive and active range of motion of the MCP, PIP and DIP joints of the injured and donor fingers were measured. The main outcomes measured were the total active flexion (TAT) and the total active motion (TAM).

**Results:** According to Strickland criteria, patient demonstrated clinical improvement of active motion, recorded with pre op and post op videos.

**Conclusion:** This procedure has, in our hand, replaced the 2 stages procedure for digital lesions, our study demonstrates that the technique can be used in neglected multi-digital flexor lesions for several years. The better results of our technique can be explained: no need for a proximal tendon suture; the distal fixation, the pull-out technique, allows some immediate mobilisation, of course under the protection of a splint the wrist being completely flexed, during 6 weeks. The hemitendon FDP is sufficiently narrow to allow easy passage of the tendon through the original pulleys which are preserved in case of neglected injury.

## **A-0935** CLASSIC TYPE OF EPITHELIOID SARCOMA OF THE DISTAL UPPER EXTREMITY: CLINICAL AND ONCOLOGICAL CHARACTERISTICS

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**Background:** The classic type of epithelioid sarcoma (ES) is a rare, aggressive soft tissue neoplasm that most commonly affects the distal upper extremities of young patients. This study aimed to assess clinical features and provide a long-term report of the oncological outcome.

**Methods:** We retrospectively analyzed our clinical database for patients with ES of the distal upper extremities.

**Results:** Twenty-three patients with ES of the distal upper extremity were treated surgically between January 1990 and August 2018. ES affected most commonly the palmar side of young patients. The most common site affected by a sarcoma was the wrist in 47.8% of cases, followed by metacarpals and fingers with 34.8% and 17.4%, respectively. Most of the patients were treated according to the protocols of interdisciplinary tumor boards with multimodal therapy. A local recurrence was observed in 7 patients (30.4%). The 5- and 10-year recurrence-free survival was 80.4% (95% confidence interval [CI]: 68.6-76.8) and 60.9% (95% CI: 53.5-68.3), respectively. The 5- and 10-years disease-specific survival was 89.9% (95% CI: 87-92.8) and 61.9% (95% CI: 56.5-67.3), respectively. Five patients (21.7%) had metastasis in regional lymph nodes.

**Conclusion:** The classic type of ES represents a group of high-grade sarcomas, which affect the dominantly distal upper extremity. Specific clinical, diagnostic, and oncological characteristics make it difficult to diagnose and therapy. Wide tumor resection as a part of multimodal therapy remains a more viable and common treatment option for patients with ES on distal extremities. High rates of lymph node metastasis are typical for ES.

## **A-0937** COMPLICATIONS OF ULNAR IMPACTION SYNDROME TREATMENT: DISTAL RADIUS LENGTHENING OSTEOTOMY VS. ULNAR SHORTENING OSTEOTOMY

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### INTRODUCTION

The ulnar shortening osteotomy (USO) and the distal radius lengthening osteotomy (DRLO) are both acceptable and frequently indicated surgical solutions to treat ulnar impaction syndrome (UIS), usually originated by malunited distal radius fractures.

Until now, the therapeutic choice was based mainly on the surgeon preference and experience, essentially because of the data scarcity about the post-operative complications and clinical evolution (symptomatology, ROM, etc.).

The primary goal of this study is to shine a light on the incidence of these complications for both procedures.

### MATERIALS AND METHODS

In order to do this retrospective study, we included patients diagnosed with ulnar impaction syndrome who underwent an ulna shortening osteotomy or a distal radius lengthening osteotomy between January 2012 and June 2022.

Medical records of patients were assessed for our explanatory variables, reoperations, and reporting of symptoms. Bivariate and multivariable analyses were used to identify factors associated with reoperation after both procedures.

## RESULTS

We've found a higher number of complications after USO in comparison with DRLO, such as delayed union, pseudoarthrosis, plate related pain and soft tissue irritation.

The overall ROM associated results were satisfactory in both cases.

## DISCUSSION

There are a number of factors that are important to a more comprehensive understanding of these results, such as the type of osteotomy (transverse vs. oblique), type of plate/system (guided or not) and the theoretical definition of malunion and pseudoarthrosis.

Also, the proportion of radius vs. ulnar osteotomies is obviously high in our center, and would be advantageous if our comparison groups could be more homogeneous.

## CONCLUSIONS

It is clear to us that the DRLO has better results, both clinical and radiological.

## **A-0938** A SIMPLE SURGICAL TECHNIQUE FOR ARTHROSCOPIC REPAIR OF TRAUMATIC RADIAL –SIDE PERIPHERAL TFCC TEAR

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Conventionally TFCCs surgical procedures were complex in nature with open explorations and long hospital stays not to mention the added costs and the psychological stress for both the orthopedic and the patient. But nowadays, surgical procedures are looked at in a different light with the rapid progress of arthroscopic technology and equipments. To elaborate, here we introduced a simple surgical technique for arthroscopic repair of traumatic radial –side peripheral TFCC tear. In spite of the various surgical techniques found in the literature, the simplicity of the current technique, adequate satisfaction and eliminating the use of a targeting device, is what sets this apart. For emphasis, this technique is less time consuming and is cost effective with satisfactory result.

### Introduction

Traumatic tears of the triangular fibrocartilage complex (TFCC) are a common cause of ulnar-sided wrist pain. The TFCC is a complex structure that spans between distal ulna and the carpus, serving key functions of load transmission and stabilization of the ulnar side of the radiocarpal joint and the distal radioulnar joint. Arthroscopic repair of a peripheral triangular fibrocartilage complex (TFCC) tear is a promising, minimally invasive surgical technique for treatment of symptomatic TFCC tear. Arthroscopic treatment of type 1D in palmar classification is more technically demanded as tear is radial-sided and fixation needs bone tunnel and targeting device. We propose a simple technique for fixation of this type of TFCC tear which is cost-beneficial and does not need targeting device and present follow-up of two patients operated with this technique.

### Surgical technique:

The patient was under general anesthesia in supine position. After doing physical examination of the wrist under general anesthesia, using pneumatic tourniquet and traction of the wrist (3-5 kg), diagnostic wrist arthroscopy was performed with 2.7 arthroscope through the 3-4 and 6R portals. Radial –sided peripheral TFCC tear (Palmer type 1D) was confirmed

by viewing from 3-4 portal and using a probe from 6R portal (figure1).by rotating the forearm ,radial side of the ulnar head is easily observed and ulnar side of the distal radius is palpated by the probe(video1).first, . the leading edge of the torn peripheral TFCC was freshened by a shaver,simplicity of this technique is the next step that there is no need to use a targeting device to create trans osseous tunnel. an 18-gauge needle inserted in the safe zone along the ulnar aspect of the wrist between FCU and ECU tendons,as distal as possible in order to have more angle with the lunate fossa of the distal radius for creating trans osseous tunnel(figure2).when suitable position determined, we used an 0.54(1.4 mm) K-wire to create trans osseous unnnle in the direction of the needle from detachment area of the TFCC on the distal radius to lateral cortex(figure3) .as there is radial inclination in distal radius anatomically, k- wire always penetrate the lateral cortex of distal radius.Then a 16 –gauge needle passed through the tunnel from lateral to medial and viewed in the wrist joint (figure4).then again by inserting an 18-guage needle from safe zone along the ulnar aspect of the wrist between FCU and ECU tendons, a monofilament suture is passed from the leading edge of the TFCC and it is pushed into the 16 –gauge needle which is in the tunnel simply by attaching tip of the both needles to each other (figure 5).t the suture is retrieved from the tunnel at the lateral cortex by pulling 16- gauge needle. .another monofilament suture is passed in this manner .finally intra articular side of both sutures are retrived from 6R portal and tied to each other so that by pulling from lateral of the tunnel one of the sutures is retrieved and another one makes a mattress suture on the leading edge of the TFCC.(figure 6).now while looking at the repair site from 3-4 portal(video1)both sides of the suture could be tied to each other on the lateral cortex of the distal radius in different ways including using anchor suture or button or as we prefer passing one suture from the bone at the entrance of the tunnel at the lateral cortex of the radius.after the operation, A compressive dressing and long-arm cast wer applied in neutral to 45° forearm supination. At 2 weeks postoperatively, the skin sutures were removed and a well molded short-arm cast was applied in the same position of rotation for an additional 4 weeks.. At 6 weeks after surgery, the cast removed and active exercises started .strengthening exercises started after 12 weeks.

#### Outcomes

Table 1 demonstrate outcome of two patients who operated with this technique.

No demo DASH satisfaction VAS Fovea

tendernes

s

Grip

strength/normal

side

1(Before) 36-M 60 6 + 70%

1(after) 20 Very

satisfied

1 - 95%

2(before) 43-F 80 7 + 50%

2(after) 30 satisfied 3 - 75%

Table1:outcome of two patients operated with our technique

Comparing outcomes of these patients demonstrates comparable results to the previous techniques (.....)

Complications

There was no complications including superficial or main nerve injury or other complications related to wrist arthroscopy in our patients

Conclusion

Our new simple technique for traumatic radial -sided TFCC repair eliminates the need to use targeting device and has promising results as other techniques. It is necessary to bring to attention, in developing countries, where the health and medical costs burden both the government and the community, such alternatives are imperative and can greatly cut down costs. We highly recommend future studies focus such alternatives and do a more extensive research.

### **A-0939** LUNATE TYPE 2 MAY STABILIZE AN ACUTE SCAPHOID FRACTURE

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#### Introduction

Scaphoid fractures are treated according to our perception of their stability and their initial extent of dislocation. The criteria for the diagnosis of an unstable fractures are based on limited evidence. The morphology of the lunate in the midcarpal joint is known to affect joint range of motion and development of degenerative changes after injury. We hypothesized that the lunate shape will affect the stability of an acute scaphoid fracture as depicted by fracture displacement.

#### Methods

The archives of two tertiary hospitals were searched for CT scans of isolated acute scaphoid fracture in adults over a period of 10 years. The shortest distance between the triquetrum and capitate was measured on coronal reconstructions of CT scans. A distance of over 4 mm was considered to depict a lunate type 2 morphology of the midcarpal joint. Displacement of the scaphoid fracture was rated as gap or step-off greater than 1 mm in any of the CT scans planes. The fracture group measurements were compared with a healthy group, patients with acute wrist injuries but no diagnosed pathology on CT scans.

#### Results

Acute scaphoid fractures in 147 patients were compared with 87 healthy wrists. A significantly higher rate of type 2 lunates was found in the fracture group (66%) compared to the healthy group (47%; p-value 0.005). We found 47% of the displaced fractures to have type 1 lunates and 71% of nondisplaced fractures to have type 2 lunates (p = 0.044).

#### Conclusions

The lunate morphology has an effect on scaphoid fracture stability. Scaphoid fractures are more common in lunate type 2 wrists but will be more frequently displaced in the lunate type 1 wrists. This data suggests that the more stable configuration of a midcarpal joint with a type 2 lunate can prevent scaphoid displacement.

### **A-0940** ADAPTATION OF THE CLAVIEN-DINDO CLASSIFICATION SYSTEM FOR NEGATIVE OUTCOME EVENTS IN HAND SURGERY

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Introduction/objective: Quality of care has become over time a central concern for health actors, patients, and politics. A standardized and reliable method of classification of complications is therefore needed to measure them. In general surgery since 1992 the Clavien-Dindo classification is used, this classification system is world-wide recognize by general surgeons

for his objectivity, relevance, and reliability. By using the treatment of the complication rather than the complication itself, this classification made it possible to erase subjectivity of surgeons involved in the treatment and differences between centers, in particular, by avoiding down-rating major negative outcomes. We aimed to develop an analog classification system for negative outcome events in hand surgery.

**Material and method:** Based on the modified Clavien-Dindo classification already adapted for orthopaedic surgery we developed a classification system for hand surgery. Two trained hand surgeons discussed each original item and transposed it to hand surgery. In a second stage the hand adapted classification system was presented to trained and in trainee hand surgeons. Finally, to evaluate the hand adapted classification system we randomly selected negative outcome events that occurred in our clinic, trained (>6 years of surgical experience) and in trainee hand surgeons were asked to classify them according to the new hand adapted Clavien-Dindo classification system.

**Results:** The hand adapted classification system retained 5 grades. After consensus was reached for the hand adapted classification system 15 negative outcome events were submitted to 10 hand surgeons (5 trained and 5 in trainee). As the original Clavien-Dindo staging and the orthopedic modification, our transposition showed great interobserver reliability. **Discussion and conclusion:** Application of a classification system for negative outcome events to hand surgery will be a tool to evaluate et compare them. The next step is now the prospective implementation of the hand-adapted Clavien-Dindo classification system and his evaluation.

#### **A-0941** TRIBOLOGY STUDY IF EXPLANTED PYROLYTIC CARBON IMPLANTS OF HAND AND WRIST

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Pyrolytic carbon implants have been used in the hand and wrist for two decades. Little is known about the expected life span of these implants. A study of in vivo abrasive wear of explanted implants has been conducted to evaluate possibility of prediction on life span of pyrolytic implants in hand and wrist. Secondly implants are examined for damage, maybe due to the handling with metal surgical material.

16 implants that were removed from the thumb base, wrist or PIP joint are examined with a digital microscope and a tactile 3D profilometer. They are compared to 1 new pyrolytic carbon implant. The results showed very little abrasive wear. Some damage was seen on several implants, including breaking on edges, and 1 total fracture of the implant. There is insufficient data to conclude on the abrasive wear of pyrolytic implants in relation to the time in vivo, but strong indication that abrasive wear is very limited. Other damage is seen, and can be due to impaction wear, peroperative handling or fretting wear.

#### **A-0944** PERSPECTIVES ON REMOTE LEARNING OF ORTHOTIC FABRICATION BY PRACTICING CERTIFIED HAND THERAPISTS

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**Background:** The recent Covid-19 pandemic caused many professional organizations to adhere to social distancing guidelines, limit mass gatherings, and convert to virtual platforms for meetings and continuing educational programs. In

addition, various continuing educational opportunities were offered to the hand therapy community via online platforms. These courses included virtual orthotic fabrication courses. It is important to study the effectiveness and benefits of virtual orthotic fabrication courses for educating both novice and experienced clinicians to see if this method of remote learning has continued merit and relevance, even after social restrictions have been limited.

Purpose: To investigate the value and effectiveness of orthotic fabrication courses taught in a virtual method

Study Design: Web-based survey.

Methods: A 31-item survey was electronically delivered to 4452 Certified Hand Therapists listed on the Hand Therapy Certification Commission website. The survey was available between July 13, 2022 until August 8, 2022. One additional email reminder was sent on July 26, 2022.

Effectiveness, ease of following instructions and satisfaction with the instruction were the main focus areas of the survey. Spearman's Rank Correlation Coefficient was used to analyze nonparametric correlations, Chi-Square analysis examined relationships between categorical values and unpaired t-tests were utilized for the comparison of means.

Results: Of the nearly 459 respondents, the majority reported high satisfaction with online instruction but noted that clinical experience and knowledge from previous courses contribute greatly to this experience. Most of the comments reported that novice clinicians and students would not gain enough skills and confidence from online courses.

Conclusions: Online learning opportunities and orthotic fabrication courses are readily available since the Covid 19 pandemic halted in person instruction. Respondents of this survey reported that while online learning is valuable and effective, it is most beneficial for experienced clinicians. Many comments focused on the lack of confidence and feedback necessary for hands -on skill development with student and novice therapists. Advantages noted include convenience of time, cost, accessibility and ability to revisit the topic. Online learning is a sustainable option for practicing therapists for continuing educational opportunities.

## **A-0945 TREATMENT OF PHALANGES' AND METACARPALS' NON-UNIONS WITH AUTOLOGOUS BONE GRAFTING, EXTERNAL FIXATION AND BIOPHYSICAL STIMULATION**

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Introduction: Complex traumas of the hand simultaneously affect both the skeletal component and the surrounding soft tissues (skin, tendons, vessels, nerves, etc). They are often associated with important loss of substance of the integuments with soft tissue contamination both at superficial and deep level. The presence of skin damage, the loss of tendinous substance and recent skeletal contamination are contraindications to internal fixation. In these conditions the use of external fixation allows to reconstruct even complex skeletal lesions reducing the risk of infection and tissue necrosis while permitting cutaneous or tendinous healing.

Aim: The aim of this study is to report the results of our technique. It involves the interposition of a cortico-cancellous bone graft taken from the ipsilateral olecranon and the use of external fixation associated with biophysical therapy in the post-operative period.

We used ad axial external fixation which offers an easy installation associated with very low implant costs.

The key points of the success of the reconstructive intervention proposed by us are the consolidation of the fracture and the filling of the bone defect, the absence of complications and the absolutely contained technical costs.

**Materials and methods:** We present our technique of interposition of a cortico-cancellous bone graft, the use of external fixation associated with biophysical therapy in the post-operative period. From 2013 to 2018 we treated 18 cases with recent outcomes of complex trauma to the hand treated urgently in other Hospitals and with the presence of an important bone defect associated with damage to the surrounding soft tissues.

In 8 cases a second surgical tenolysis or teno-arthrolysis time was performed with the use of the antiadherencial Dynavisc (in order to reduce pain and facilitate tendon and joint sliding) to implement the ROM of the already stiff MF or VET.

These 8 patients promptly underwent an intensive phisiotherapy.

In our study we report a series of complex cases illustrating the various applications of our technique.

**Results:** All our cases obtained complete osteointegration of the graft and skeletal consolidation in a short time (mean 60 days; range 30-90 days) with no complications of the soft tissues and good wound healing.

**Conclusions:** This type of fixation provided good stability at the level of the graft and it permitted the consolidation in a short time with the aid of biophysical stimulation. The absence of complications and the optimal healing obtained in all treated cases demonstrate the goodness of the technique we used.

The use of the autologous graft is fundamental to the success of the intervention and the biophysical stimulation (Igea) increased the success rates reducing osteointegration time.

## **A-0948** THE EFFECTIVENESS OF REHABILITATION INTERVENTIONS ON PAIN AND DISABILITY FOR COMPLEX REGIONAL PAIN SYNDROME; A SYSTEMATIC REVIEW AND META-ANALYSIS

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**Objectives:** To summarize and critically appraise the body of evidence on conservative management of Complex Regional Pain Syndrome, we conducted a systematic review and meta-analysis of randomized controlled trials (RCTs).

**Methods:** We conducted a literature search from inception to November 2021 in the following databases: Embase, Medline, CINAHL, Google Scholar, PEDRO, and Psycinfo. Two independent reviewers conducted risk of bias and quality assessment. Qualitative synthesis and meta-analysis were the methods for summarizing the findings of the RCTs. The GRADE approach was used to rate the overall quality and certainty of the evidence on each treatment outcome.

**Result:** Through database search, 751 records were found, and 33 RCTs were eligible for inclusion. Studies were published between 1995 to 2021. The overall risk of bias for two studies was low, eight studies was unclear, and 23 studies was high. Low-quality evidence suggests that mirror therapy (as an addition to conventional stroke rehabilitation interventions) and graded motor imagery program (compared to routine rehabilitation interventions) may result in a large improvement in pain and disability up to 6-month follow-up in post-stroke CRPS-1 patients. Low-quality evidence suggests that pain exposure therapy and aerobic exercises as an additive treatment to PT interventions may result in a large improvement in pain up to six-month follow-up. The evidence is very uncertain about the effect of all other targeted interventions over conventional PT or sham treatments on pain and disability.

**Discussion:** There is an ongoing need for high-quality studies to inform conservative management choices in CRPS.

Keywords: Complex Regional Pain Syndrome; CRPS; Physical Therapy; Occupational Therapy; Conservative management; Systematic review; Meta-analysis

## **A-0949** ORTHOTIC INTERVENTION WITH CUSTOM-MADE THERMOPLASTIC MATERIAL IN ACUTE AND CHRONIC MALLET FINGER INJURY: A COMPARISON OF OUTCOMES

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**Objectives:** This study aimed to compare the effect of using custom-made orthosis on improving extension lag and reducing disability in acute and chronic mallet fingers.

**Methods:** Fifty-one patients with acute or chronic Doyle type-1 mallet fingers approved to participate in this study. A custom-made thermoplastic anti-mallet finger orthosis was fabricated for patients to wear full time for six weeks and further two weeks at nighttime. The primary outcome was extension lag and measured at the enrollment, six- and twelve-week follow-up and interpreted by modified Miller's criteria. The secondary outcomes were disability and satisfaction. Disability was evaluated by the Disability of the Arm, Shoulder, and Hand (DASH) questionnaire at enrollment and 12 weeks. Satisfaction with treatment outcome was evaluated on a 0-10 scale at 12 weeks follow-up. The Overall outcome of the patients were graded with the Crawford criteria. Univariate Analysis of Variance (ANOVA) and one-way repeated measure mixed model analysis of covariance (ANCOVA) and independent-sample t-test were used for data analysis.

**Results:** A total of 43 participants with either acute (25) or chronic (18) mallet fingers completed 12-week evaluation. No significant difference was detected between the two groups regarding extension lag improvement at either of the follow-up time points ( $P=0.21$ ). Disability was improved in both acute and chronic groups at the follow-up ( $P < 0.05$ ). Both groups were satisfied with the treatment outcome with no statistically significant difference ( $t=0.173$ ,  $P=0.51$ ). We could detect no clinically significant difference between the two groups in terms of extension lag, disability, and satisfaction at follow-up. Ninety-six percent of the patients in acute group and 88% of the patients in chronic group demonstrated good to excellent results considering Crawford criteria.

**Conclusion:** Orthotic intervention with custom-made thermoplastic material in acute and chronic mallet fingers could be considered a safe and non-invasive approach to improve extension lag and disability, and both groups were satisfied with the treatment outcomes.

**Keywords:** mallet finger; orthotic intervention; splint; extension lag; disability;

## **A-0952** INTERPRETATION AND CONTENT VALIDITY OF THE ITEMS OF THE HAMILTON INVENTORY IN TO EVALUATE OUTCOMES IN PERSIAN SPEAKING PATIENTS WITH CRPS: A COGNITIVE INTERVIEW APPROACH

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### Background

The Hamilton Inventory for Complex Regional Pain Syndrome (HI-CRPS) is a multidisciplinary assessment tool to evaluate signs and symptoms in patients with CRPS, developed in the English language. This study aims to translate and cross-culturally adapt this tool for Persian-speaking patients with CRPS. Furthermore, this study aimed to understand how 1) Persian speaking experts and patients interpret and calibrate responses to items on the Hamilton Inventory and 2) compensatory strategies that might affect responses.

### Methods

Ten health care providers and ten patients with CRPS were interviewed using cognitive interviewing techniques (talk aloud, semi-structured interview probes). All interviews were recorded and transcribed verbatim. A directed content analysis was done to analyze the interviews using a previously established framework.

### Results

Overall, the items on the Hamilton Inventory were well received by participants. Areas where questions were unclear to some participants were recorded and categorized into five themes: Clarity and Comprehension (100%) in item 1 from the health professional tool and (65%) from the eleven items of the patient-reported tool. Perspective modifiers of culture influenced the calibrations of items "I feel my condition has negatively affected my relationships." (12%) and "My symptoms affect my comfort level with intimacy." (20%) from the patient-reported tool.

### Conclusion:

The findings of this study demonstrate that there is no need for substantive changes to the items of the Hamilton Inventory, as they tend to be understood by Persian-speaking experts and patients with CRPS.

## **A-0953** OCCUPATIONAL PERFORMANCE, ACTIVITY LIMITATION AND PARTICIPATION RESTRICTION ONE YEAR AFTER DISTAL RADIUS FRACTURES BASED ON THE CLIENT'S PERSPECTIVE AND ICF FRAMEWORK

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Background: Distal radius fractures (DRF) are common injuries due to disability, which can compromise independent functioning. To describe disability experienced by patients one year following distal radius fracture (DRF) based on their responses from the COPM tool and related interview using the International Classification of Functioning, Disability

and Health (ICF) linking rules. A secondary purpose was to describe the relationship between a person-centred score of occupational performance (COPM) versus standardized measures of function (patient-reported wrist evaluation, PRWE) and participation (participation behaviour questionnaire, PBQ).

**Method:** In this cross-sectional study, 120 patients were assessed one year following injury, using a semi-structured interview guided by the Canadian Occupational Performance Measure (COPM) which captures self-perceived problems in three areas of self-care, productivity, and leisure. The extracted results from the COPM were linked to the ICF hand core set. Patients also completed a patient-reported wrist evaluation (PRWE) and participation behaviour questionnaire (PBQ). **Results:** Patients reported difficulties in domestic life (85%), self-care (60%), major life area (53%), community Social, civic life (53%), and interpersonal interaction and relationships (44%). One area of concern raised by patients was not included on either the brief or comprehensive core set for hand conditions, e.g., D930: Religion and spirituality. A greater level of occupational performance was significantly associated with a greater level of participation and satisfaction with performance.

**Conclusion:** Patients with DRF can experience difficulties in different occupational performance areas, not correlated with the level of disability reported by standard outcome measures. Using the COPM may contribute to a broader understanding of the limited function.

#### **A-0954** A DESCRIPTION OF THE BARRIERS, FACILITATORS, AND EXPERIENCES OF HAND THERAPISTS IN PROVIDING REMOTE (TELE) REHABILITATION; AN INTERPRETIVE DESCRIPTION METHODOLOGICAL APPROACH

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**Introduction:** Telerehabilitation is increasingly being used to meet the rehabilitation needs of situations where face-to-face therapy is not possible. Nevertheless, reports on barriers and facilitators of implementing this method from the perspective of therapists remain limited.

**Purpose of the study:** The purpose of this study was to explore the experiences of hand therapists in implementing telerehabilitation and to explore the difficulties, facilitators, and barriers they encountered during implementation.

**Methods:** Semi-structured interviews were conducted with 14 therapists from different countries via zoom meetings. The interviews were recorded, transcribed, and qualitatively analyzed using thematic analysis. The process of interpretive description guided interviews and analysis of the interviews to identify key barriers and facilitators in providing remote(tele) rehabilitation.

**Results/Discussion:** Six main themes and corresponding sub-themes were constructed concerning facilitators and barriers to telerehabilitation: factors related to patient, therapy, therapists, injury, technology, and policy. Therapists implemented different coping strategies in their interventions and measurements to facilitate therapy. However, some parts of interventions, such as orthotic fabrication, could not be done online. Educating therapists, providing a standard method, and integrating with in-person rehabilitation can overcome the barriers related to telerehabilitation in hand therapy.

## Conclusion:

Technology was the main facilitator and, on another side of the coin, a barrier for providing online hand therapy interventions. Despite all barriers, Telerehabilitation can be considered part of hand therapy interventions with face-to-face therapy as a hybrid method. The barriers and facilitators experienced by therapists in this study contribute to the existing set-up of what is already known about this topic in knowledge of telerehabilitation in hand therapy and may be used to inform clinical practices and future research.

## **A-0955** A NEW ARTHROSCOPIC CLASSIFICATION OF TFCC DISORDERS

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### Background

Palmer's Classification of TFCC disorders (1989) is still in use despite the more recent description of a myriad of sub-types. There is no current comprehensive and updated arthroscopic classification of TFCC disorders. The authors propose a new arthroscopic comprehensive classification of TFCC disorders based on a view from the 3-4 portal.

### Methods

A total of 150 wrist arthroscopies for TFCC disorders and 10 diagnostic arthroscopies in fresh cadavers form the basis of this study. The authors used the 3-4 portal with a probe in 6R portal to provide a visual description of all components of the TFCC and their disorders.

### Results

Three types of TFCC disorders may be seen from a 3-4 portal, whether they are traumatic or degenerative. The "R" type represent all traumatic "DRUJ destabilizing" TFCC disorders. R1 is a foveal avulsion. The "W" type represent all traumatic injuries of the medial wall joining the TFCC and the carpus. The "D" type represent all injuries of the disc. They may be traumatic or degenerative.

### Discussion

Since Palmer's classification of TFCC disorders, a number of sub-types have been described. However, there is no updated comprehensive classification of TFCC disorders. We provide a new classification that is arthroscopic, easy to remember, and has therapeutic implications related to the vascularity of the tissues and potential for healing. For the first time, combined disorders can be described.

## **A-0956** NEW COMPUTERIZED ELBOW AND FOREARM CLINICAL SCORES

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### Background

Current elbow clinical scores are scarce with limited comparability between them. None of them are computerized yet. There is no forearm clinical score assessing all anatomical components of forearm disorders such as the Essex-Lopresti injuries. The aims of this paper were to present new computerized elbow and forearm clinical scores.

### Methods

These new computerized elbow and forearm clinical scores include four clinical criteria: pain, function, active range of motion and muscle strength. To each criterion is given a numerical value among 5 grades. The weight of each criterion is equivalent so that patient's and physician's related scores are equally balanced.

#### Results

Clinical scores components are automatically included into diamond-shape graphs and tables that can be directly exported into PowerPoint presentations for demonstration and comparison purposes.

#### Discussion

These user-friendly updatable clinical elbow and forearm scores are based on four classic clinical criteria, pain, function, motion and strength that are expressed into grades. They were designed to evaluate any osteo-articular elbow or forearm disorder regardless to the etiology. These scores are open since they may be modified in future versions.

### **A-1290** CHANGES IN ORGANIZATION OF ACTIVITY OF HAND SURGERY DEPARTMENT DURING THE COVID-19 PANDEMIC

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#### Background.

The COVID-19 pandemic has impacted many medical specialties throughout the world, including hand surgery. Emergency hand surgery deals with a wide spectrum of injuries, including bone fractures, nerve, tendon and vessel cuts, complex injuries and amputations. These traumas occur independently to the phase of the pandemic.

#### Objective.

The objective of this study was presentation of changes in organization of activity of hand surgery department during the COVID-19 pandemic.

#### Material and Methods.

Modifications of the activity were described in details. Over a period of the pandemic (from April 2020 to March 2022), a total of 4150 patients were treated, in this number 2327 (56%) with acute injuries and 1823 (44%) with common hand diseases.

#### Results.

Forty-one (1%) patients were diagnosed COVID-19 positive, 19 (46%) with hand injuries and 32 (54%) with hand disorders. One case of work-related COVID-19 infection was registered in the 6-people clinic team in analysed period.

#### Conclusion.

Results of this study show effectiveness of measures undertaken in the author's institution to prevent the coronavirus infection and viral transmission in hand surgery staff

### **A-1291** HAND INJURIES IN POLYTRAUMA PATIENTS

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#### Background.

Hand and forearm injuries are relatively rare in polytrauma patients; their incidence is estimated on 2-5%. They are usually not life threatening, and, therefore are considered of secondary importance, replaced by serious injuries of other

body parts. However, they should be treated immediately after stabilization of the general condition of the patients, as their delayed fitting may result in serious dysfunction of the hand.

**Objective.** The aim of this study was determine the incidence, distribution and methods of treatment of hand and forearm injuries in the patients treated in Polytrauma Centre of the SPSK 1 in Szczecin, over the period of 4 years.

**Material and Methods.** Medical records of 16 patients, 11 men (65%) and 5 women (35%) at the mean age of 34 years (range 19-62) who were treated in Polytrauma Centre and sustained an additional injury to the hand and/or forearm were analysed.

**Results.** The most common component of polytrauma with associated hand injury was major bone fractures (spine, pelvis and extremities) - 12 cases (70%), followed by chest - 11 (65%), maxillofacial - 9 (53%), brain - 8 (47%) and abdominal injuries - 5 (29%). The most common injury of the distal upper limb was fracture of the distal radius - in 9 patients (53%). Two patients sustained excessive crush-degloving injuries which were primary cause of their admission into Polytrauma Centre. Nine patients required surgery, predominantly fixation of the distal radius with plate. All patients survived.

**Conclusion.** Results of this study show the importance of the correct fitting of hand injuries, promptly after stabilization of the general condition of polytraumatized patients.

**Keywords:** polytrauma; upper limb trauma; epidemiology

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