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A-0004 Pronator quadratus repair after volar plate fixation in distal radial fractures: evaluation of the clinical and functional outcome and of the protective role on the flexor tendons – a randomized controlled study

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The objective was to evaluate pronator quadratus (PQ) repair following volar plating of distal radial fractures on clinical and functional outcome aswell as flexor tendon friction during the first 12 months in ideally positioned plates (Soong 0). Confounding factors like variation in plate positioning, anatomical consolidation of the fracture and associated lesions were excluded.

80 patients were included with distal radius fracturestreated by volar locking plate in Soong grade 0 position,who were randomized to group PQ repair and group no repair. 65 patients completed the 1-year follow-up: group PQ repair (n = 35) and group no repair (n = 30). Primary outcomes included range of motion, grip strength, pain level and QuickDASH. Secondary outcomes included distance between flexor pollicis longus (FPL) and volar rim and largest distance between FPL and plate (soft tissue thickness occupied by PQ), assessed by ultrasonography. Mobility, grip strength and QuickDASH revealed no significant differences, except extension was significant higher only in first 3 months and radial deviation was significant higher only at 6 weeks after PQ repair. Pain level was significantly lower after PQ repair only in the first 3 months. Distance between FPL and volar rim and largest distance between FPL and plate were significantly higher after PQ repair. No friction contact between FPL and volar rim was measured in both groups at all measurement moments. Consequently, protective flexor tendon effect of PQ repair could consequently not be concluded.

In conclusion, clinical and functional shortterm benefits, except improved wrist extension and reduced pain in the first 3 months, were not proven in this study. In Soong grade 0, PQ repair is probably not necessary to prevent flexor tendon pathology. In Soong grade 1 or 2, this is still to be investigated.

A-0012 What does preoperative pinch strength predict in case of carpal tunnel syndrome?

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Objective: Decreased grip and pinch strength are common but not mandatory symptoms of carpal tunnel syndrome. Our hypothesis was that the decrease of pinch strength does not affect the postoperative results.
Materials and method: We reviewed our prospective database on patients operated for carpal tunnel syndrome between 2017 and 2019. In all cases open neurolysis was performed without synovectomy. They were distributed into two groups according to the difference in pinch strength between the affected and the unaffected hand. Patients in group 1 had a difference in pinch not bigger than 2 kg, while in group 2 their difference in pinch was 3 kg or higher. Daytime numbness, nighttime numbness, nighttime pain, overall satisfaction (VAS 1–10) and grip and pinch strength (kg) were registered preoperatively, then at 1 week and 6 weeks postoperatively. Significance was evaluated using two sample T-test (p = 0,05).
Results: 88 complete questionnaires were found. Group 1 had 62 patients, the average age was 62 years and 84% were female. Group 2 had 26 patients, the average age was 63 years and 73% were female.

In group 1 the preoperative measures were the following: 7,16 daytime numbness; 7,85 nighttime numbness; 7,35 nighttime pain; 16,35 kg grip strength and 4,62 kg pinch strength. 1 week postoperatively daytime numbness was 4,46; nighttime numbness was 2,82; nighttime pain was 1,35; grip

was 9,24 kg, pinch was 4,09 kg and satisfaction was 9,04. 6 weeks postoperatively daytime numbness was 3,05; nighttime numbness was 1,48; nighttime pain was 1,27; grip was 14,16 kg, pinch was 4,96 kg and satisfaction was 8,57.

In group 2 the preoperative measures were the following: 6,77 daytime numbness; 8,38 nighttime numbness; 7,8 nighttime pain; 15,15 kg grip strength and 4,8 kg pinch strength. 1 week postoperatively daytime numbness was 4,76; nighttime numbness was 3,04; nighttime pain was 1,77; grip was 9,58 kg, pinch was 4,05 kg and satisfaction was 8,18. 6 weeks postoperatively daytime numbness was 4,04; nighttime numbness was 1,92; nighttime pain was 1,46; grip was 17,46 kg, pinch was 6,15 kg and satisfaction was 9,32.

Conclusion: Prior the operation the only significant difference was in the difference of pinch strength. Otherwise the two groups were homologous. 1 week after the surgery the group with low pinch difference had significantly higher satisfaction. The other values did not show any statistically significant difference. However, 6 weeks postoperatively the group with high pinch difference was significantly more satisfied compared to group 1. By this time their pinch strengths improved significantly compared to the preoperative measures and it was significantly higher than the values of group 1. Based on our results pinch strength does affect the postoperative results thus our hypothesis failed. Patients who have decreased pinch strength preoperatively, must be informed to be patient after the operation as their pinch strength will improve in a slower manner.

A-0020 Repair of ruptured extensor pollicis longus with running interlocking horizontal mattress suture technique

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Introduction: Running interlocking horizontal mattress suture (RIHMS) technique is reported to offer a strong suture for tendon repair with short repair time in the cadaveric study, but there are few studies about clinical application for tendon repair. We describe the clinical cases of extensor pollicis longus (EPL) rupture who underwent tendon repair surgery using this technique.

Materials and Methods: We repaired complete ruptured EPL in zone TI–TIV with RIHMS technique in 24 thumb of 24 patients including 19 male and 5 female with mean age of 47.3 year. The patients suffered with other tendon or joint injuries were excluded from this study. Ruptured EPL was repaired with RIHMS, and interphalangeal (IP) joint was fixed temporarily in 3 weeks with use of Kirshner wire. IP joint was exercised after wire removal followed by night splint for 6 weeks postoperatively. Active range of motion of thumb, grip strength, pulp pinch, Quick Disability of the Arm, Shoulder, and Hand (qDASH) score were evaluated postoperatively.

Results: As postoperative complication, an additional debridement was required in one patient for the treatment of postoperative soft tissue infection, and the Riddle evaluation of this patient was 'poor'. With mean 9.9 months follow-up, mean degree of active flexion of IP joint was 61.1 (from 35 to 80), and extension loss was −4.5 (from 0 to −28). Finally, mean %TAM (affect site/contralateral side of active range motion in IP + MP joint) was 92.8%. Moreover, sufficient grip and side pinch strength were obtained in most patients; that is, mean %grip strength and %pulp pinch (affect site/contralateral side) were 96% and 98.5%, respectively. Mean qDASH score was 2.8 with sufficient satisfaction. With Riddle evaluation, 'excellent', 'good' and 'poor' were 13, 10 and 1 patient, respectively.

Conclusion: This RIHMS technique, which offers stiffer repair with less tendon shortening and repair time, is appropriate suture for extensor tendon repair, especially tendon ruptures in distal zone where is difficult to repair with use of strong core suture.

A-0023 Rivastigmine induces angiogenesis by regulating HIF-1α/VEGF pathway to promote the survival of random flaps in rats

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Background: Random flaps are commonly used to repair wounds and improve the clinical appearance. However, flap necrosis is frequently encountered in the clinical setting. Rivastigmine, a cholinesterase inhibitor, is primarily used to treat Alzheimer's disease and improve cognitive function. It has been

proven to reduce neuroinflammation and oxidative stress, improve cerebral blood circulation, promote angiogenesis and relieve ischemia-reperfusion injury.
Objectives: This study aimed to explore the mechanism of rivastigmine by regulating the HIF-1α/VEGF pathway to induce angiogenesis to promote the survival of rat random flaps.
Methods: A modified McFarlane flap was created on the backs of the rats. Sixty healthy male Sprague-Dawley rats were randomly divided into three groups: control group, low-dose rivastigmine group and high-dose rivastigmine group. Rats in the low-dose and high-dose groups were given oral rivastigmine 0.5 mg/Kg and 1 mg/Kg, twice a day, while the control group received the same dose of corn oil. On the seventh day after operation, the rats were sacrificed to obtain skin flaps. The area of flap survival was gauged and the tissue samples were subjected to appearance analysis, such as skin color and thickness. Pathological changes in the flaps, such as neutrophil infiltration and microvessel density (MVD), were examined by hematoxylin and eosin staining. Immunohistochemistry was used to detect the expression levels of inflammatory cytokines TNF-α, IL-1β and IL-6. In addition, the level of oxidative stress was evaluated using malondialdehyde (MDA) and superoxide dismutase (SOD) kits. The laser Doppler blood flow meter was used to monitor the blood perfusion volume of the flap microcirculation. Angiogenesis was assessed by oxide-gelatin angiography. Immunohistochemistry revealed changes in hypoxia inducible factor (HIF-1α) and vascular endothelial growth factor (VEGF).
Results: Compared with the other two groups, the high-dose rivastigmine group had a larger tissue survival area and less edema ($P < 0.05$). The expression of HIF-1α and VEGF was significantly up-regulated, and the angiogenesis and microcirculation were improved. Furthermore, the high-dose rivastigmine group also significantly improved the activity of SOD, lowered the average MDA level as well as reduced the expression of inflammatory cytokines.
Conclusions: According to the comparison of the three groups, rivastigmine promotes angiogenesis by regulating the HIF-1α/VEGF pathway, reduces inflammation and ischemia-reperfusion injury. These findings demonstrate that rivastigmine increases flap survival of random skin flaps in rats.

A-0025 Impact of age on outcomes of flexor tendon rupture following distal radius fracture

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Objective: Flexor tendon rupture is a less common complication of distal radius fracture compared to extensor tendon (e.g. extensor pollicis longus) rupture. This study examined the outcomes of flexor tendon rupture following distal radius fracture according to patient age.
Methods: This was a retrospective case series review. Between 2012 and 2019, 15 digits of 10 consecutive patients with flexor tendon rupture following distal radius fracture were surgically treated at our institution. The patients consisted of one man and nine women, with a mean age of 75 years (range: 58–91 years) at the time of tendon reconstruction. There were eight tendon ruptures in four patients with malunion of the distal radius. Of these patients, three exhibited a palmarly displaced ulna head due to a dorsally tilted radius, followed by malunion. The fourth patient exhibited a bony prominence on the palmar surface of the distal radius. The remaining six patients (eight flexor tendon ruptures) underwent palmar locking plate fixation. Five of the ruptured tendons were flexor pollicis longus, three were flexor digitorum profundus (FDP) of the index finger, two were FDP of the middle finger, two were FDP of the ring finger, three were FDP of the little finger, and one was flexor digitorum superficialis of the index finger. The average time between initial injury and tendon rupture was 115 months (range: 28–264 months). All ruptured flexor pollicis longus tendons were treated with a free tendon graft from the palmaris longus tendon. End-to-side tendon transfer using the neighbouring intact FDP tendon was performed in all cases of FDP tendon rupture. On the first postoperative day, digit mobilisation was initiated via a combination of active extension and passive and active flexion, using a protective splint. The average follow-up period was 52 weeks (range: 26–80 weeks). Active range of motion (AROM) was measured with a goniometer. All measurements are expressed as a percentage of the value in the non-injured hand (%AROM). Functional outcomes were graded according to the Strickland criteria.
Results: The average AROM of the proximal and distal interphalangeal joints of the finger was $122 \pm 30^{\circ}$, while the average AROM of the interphalangeal and metacarpophalangeal joints of the thumb was $93 \pm 25^{\circ}$ at the final evaluation. The mean %AROM was $69 \pm 16\%$. A significant negative correlation was observed between age and %AROM

($r = -0.837$, $p < 0.0001$). According to the Strickland criteria, four digits had excellent outcomes, while two, seven, and two digits had good, fair and poor outcomes, respectively. No grafted or transferred tendon rupture was encountered, and no digit required tenolysis.
Conclusions: The %AROM after flexor tendon reconstruction was decreased with age. Flexor tendon rupture following distal radius fracture occurred mainly in the elderly patients after an extended post-injury period. It may be difficult to obtain good clinical reconstruction outcomes in cases of flexor tendon rupture following distal radius fracture. These findings suggest that flexor tendon rupture must be avoided in elderly patients with distal radius fracture.

A-0031 Five-year outcomes of surface replacing arthroplasty at the proximal interphalangeal joint

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Objective: The aim of this study was to analyse the subjective and clinical outcomes of patients with a surface replacing implant (CapFlex, KLS Martin, Germany) at the proximal interphalangeal (PIP) joint 5 years after surgery.
Methods: In our ongoing prospective registry, all patients receiving a CapFlex surface replacing arthroplasty at the PIP joint are documented before surgery and up to five years after surgery. At follow-up, patients complete the brief Michigan Hand Outcomes Questionnaire (brief MHQ, score 0–100) and rate pain during daily activities on a Numeric Rating Scale (0–10). Active range of motion (ROM) of the PIP joint is measured with a goniometer. Within-group changes between baseline and five years were determined using a paired t-test.
Results: Between May 2010 and February 2015, a total of 88 patients received 92 CapFlex-PIP arthroplasties. For the analysis of the clinical and subjective 5-year outcomes, data from 65 patients with 68 implants and a mean age of 65 years (±10) were available. The mean brief MHQ score at baseline was 45 (±15), which increased to 71 (±17) at five years ($p \leq 0.001$). Baseline pain decreased from 6.4 (±1.9) before surgery to 1.8 (±1.9) at 5 years ($p \leq 0.001$). Active ROM increased from 46° (±21) at baseline to 54° (±24; $p \leq 0.001$) at five years. Four of the originally implanted 92 prostheses (4.3%) had to be revised. One due to implant loosening, the other three implants were revised because of a stiff PIP joint in two cases and rupture of the radial collateral ligament and stiffness in one patient. Revision surgery included two conversions to silicone arthroplasty and arthrodesis in two other patients.
Conclusion: Five years after PIP surface replacement with the CapFlex implant, patients show good subjective hand function and functional active joint ROM. There was only one implant-related revision, while the other revisions were caused by soft-tissue problems which may occur in a similar way with other implant types. Our revision rate is low and comparable to revision rates for silicone arthroplasties published in the literature.

A-0032 Capsular resection or suture in thumb carpometacarpal joint implant arthroplasty?

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Background: To further facilitate the rehabilitation and enhance range of motion (ROM) of the thumb carpometacarpal (CMC) joint, it has been suggested to perform capsular resection in total joint arthroplasties (TJA). So far, the effect of capsular release compared to capsular suture has never been investigated.
Objective: We aimed to compare the effects of CMC I arthroplasty with capsular resection (CR) versus capsular suture (CS) on subjective and clinical outcomes of patients operated with the Touch® CMC I total arthroplasty.
Methods: In a registry, our patients with a Touch® CMC I total prosthesis are prospectively documented before surgery, 6 weeks, 3 months and 1 year thereafter. Patients complete the brief Michigan Hand Outcomes Questionnaire (brief MHQ; score 0–100) and have their pinch strength and thumb opposition (Kapandji score) assessed. The patients' radiographs are analysed for implant failures. We used the Mann-Whitney U test to compare between-group differences and the Wilcoxon signed-rank test to compare baseline with one-year outcomes.
Results: Between June 2018 and November 2020, 111 patients (62.9 [±8] years) were operated. The capsule was resected in 65 patients and sutured in 46 patients. In the CR group, brief MHQ scores

increased from baseline 44.6 (±13.7) to 89.8 (±13) after one year ($p \leq 0.01$). The CS group increased from 46.2 (±13.7) to 73.4 (±24.1; $p \leq 0.05$), respectively, with a significant between-group difference after one year ($p \leq 0.05$). In both groups, Kapandji scores significantly increased from baseline to one-year post-surgery ($p < 0.05$), with no between-group differences at any timepoint. Pinch strength in the CR group was 5.0 kg (±2.7) before surgery and after one year it was 7.0 (±2.1; $p \leq 0.05$). For the CS group, key pinch was 4.9 kg (±2.6) and increased to 5.4 (±1.4; $p \leq 0.05$), respectively. Patients in the CR group had significantly higher key pinch strength at 6 weeks and one year. We report one complication in each group. In the CR group, a neck/stem component dislocated from the cup in the first 2 weeks postoperatively. In the CS group, cup loosening and a fractured trapezium were observed after 3 months, with suspected insufficient primary stability and osteointegration. A causal relationship between the surgical procedures and these complications is uncertain.

Conclusion: These findings confirm that patients recover fast after the implantation of the Touch® CMC I total arthroplasty. Capsular resection shows promising results by maintaining strength even shortly after surgery and increasing thumb opposition.

A-0035 High-resolution ultrasound is a more useful primary diagnostic tool than magnetic resonance imaging for subungual glomus tumors

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Introduction: Glomus tumors are rare benign hamartoma of vascular origin arising from the Glomus' body. Glomus tumors often exhibit a classic presentation of pain, cold sensitivity, and exquisite point tenderness. An imaging study has been proceeded in that case-patients don't present the typical symptoms and in localizing the lesion for complete surgical removal. We designed this study to compare the usefulness of Magnetic Resonance Imaging (MRI) and Ultrasound (US) in characterizing subungual glomus tumor.

Materials and Methods: During the period January 2017 – April 2020, Twenty-two patients were examined with MRI and US before surgical exploration. We analyzed the clinical data and radiologic findings of MRI and US retrospectively. Diagnostic confirmation and measurement of mass size were made by histological study. Nine cases were referred to our hospital under suspicion of subungual glomus tumor after checking ultrasound evaluation.

Results: Twenty-two patients, including seventeen women and five men, were found to have subungual glomus tumor. Ages ranged from 19 to 72 years (mean 47 years). The average duration from initial symptoms to diagnosis is seven years two months (5 month ~ 30 yrs). Only nine (41%) patients elicited classic symptomatic typical triad. MRI detected the mass in nineteen(86%); only the enhanced signal was identified in three cases. The mean diameter of the undetected 3 cases was 2.4 mm. All of the masses were detected under Ultrasonography. Four (18%) cases were evaluated as glomus tumors less likely. Nine (41%) cases had visible rich blood flow in tumor tissues at Doppler ultrasonography. MRI and US showed bone erosion in eight cases and fifteen cases, respectively.

Conclusion: We think the US is as useful as MRI in the diagnosis of subungual glomus tumor. US has a much lower cost in relation to MRI. We believe that the US is more suitable as a primary imaging method in patients with suspected subungual glomus tumor than MRI.

A-0038 Measurement properties of the EQ-5D-5L questionnaire in patients after thumb carpometacarpal arthroplasty, rotator cuff repair or shoulder arthroplasty

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Background: The EQ-5D-5L is a 5-item questionnaire to quantify general quality of life. However, its measurement properties have hardly been assessed for patients with hand or shoulder conditions.

Objective: The aim was to investigate the validity, responsiveness, minimal important difference (MID), minimal important change (MIC) and discriminative ability of the EQ-5D-5L questionnaire in patients after thumb carpometacarpal (CMC I) arthroplasty, arthroscopic rotator cuff repair (RCR) or total shoulder arthroplasty (TSA).

Methods: In this prospective study, all patients completed the EQ-5D-5L before surgery and six months and one year after surgery. At each time point, CMC I patients also completed the brief Michigan Hand Outcomes Questionnaire (brief MHQ), RCR patients the Oxford Shoulder Score (OSS) and TSA patients the Shoulder Pain and Disability Index (SPADI). Construct validity was tested by calculating Pearson's correlation coefficient (r) and responsiveness by calculating the effect size. The MID and MIC

were determined using different anchor-based approaches. Floor and ceiling effects of the EQ-5D-5L were calculated. To test discriminative ability, EQ-5D-5L scores of patients who were in a patient acceptable symptom state (PASS) or not at follow up were compared using the Mann-Whitney U test.
Results: We included 151 CMC I, 153 RCR and 150 TSA patients. All patients had a mean EQ-5D-5L score of 0.69 (SD 0.22) before surgery and showed an increased quality of life one year after surgery with a mean score of 0.90 (SD 0.13; $p \leq 0.001$). The EQ-5D-5L correlated with the brief MHQ ($r = 0.61$), OSS ($r = 0.73$) and SPADI ($r = -0.65$). The effect sizes of the EQ-5D-5L were 1.3 (CMC I and RCR group) and 1.1 (TSA group). The MID and MIC ranged from 0.027 to 0.209 depending on the patient group and calculation method. Ceiling effects were observed. The EQ-5D-5L differed significantly between patients being in a PASS versus patients who were not in a PASS.
Conclusion: The EQ-5D-5L shows good construct validity, responsiveness and discriminative ability in patients after CMC I arthroplasty, arthroscopic RCR and TSA. Despite the ceiling effects, the EQ-5D-5L seems to be a suitable tool for quantifying quality of life in patients with hand or shoulder conditions, which is necessary when calculating, for example, quality-adjusted life years (QALYs) for cost-utility analyses.

A-0044 Evaluation of Re-adhesion and Flexion Contracture After Flexor Tenolysis

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Introduction: Most reports about flexor tenolysis focus on postoperative active range of motion, and rarely focus on occurrence of postoperative re-adhesion of the flexor tendon and flexion contracture of the finger joint. Therefore, we measured both active and passive range of motion postoperatively for evaluation of re-adhesion and flexion contracture. The purpose of this study is to determine the degree of postoperative re-adhesion and flexion contracture following flexor tenolysis.
Materials and Methods: This study included 12 fingers in 9 patients (4 men, 5 women) with flexor tendon adhesions; patients with post-repair of flexor tendon injuries were excluded. The mean age was 50 years old and follow-up period was 24 months. The causes of adhesions were fracture in 9, infection in 2 and tendinitis in 1. Tenolysis was performed under axillary brachial plexus block, and the A2 and A4 pulleys were preserved as much as possible. After tenolysis, the range of motion was confirmed to be equivalent to that in preoperative passive flexion when traction was applied to the flexor tendon in a healthy area. Postoperatively, all patients underwent Foucher-type rehabilitation protocol, that is, the fingers were held in flexed position with bandage during rest, and the fingers were actively extended during therapy.

Total passive motion (TPM) was defined as the sum of the passive range of motion of the distal interphalangeal (DIP), proximal interphalangeal (PIP) and metacarpophalangeal (MP) joints. The angle of adhesion was defined as the difference between the TPM and total active motion (TAM), and the angle of flexion contracture was defined as the sum of the extension deficit of the DIP, PIP and MP joints. These angles were evaluated preoperatively and at the final follow-up. These measurements were also assessed by a functional evaluation using original Strickland criteria.
Results: Flexor tenolyses were performed at a mean of 7 months after primary disease onset. TPM changed from 232° to 234°, TAM changed from 143° to 217° and the angle of adhesion changed from 89° to 17° after tenolyses. The angle of adhesion significantly improved from 82° to 5° in the flexion direction and non-significantly changed from 7° to 12° in the extension direction. There was a non-significant change in the angle of flexion contracture from 8° to 10°. Results according to the original Strickland criteria were excellent in 7, good in 2, fair in 2 and poor in 1 finger.
Conclusion: After flexor tenolysis, sufficient active range of motion were acquired with no worsening of adhesion or flexion contracture. Although hold in flexed position reported to cause worsening of flexion contracture and adhesion of the extensor tendon, no adverse effects were observed in this study. Appropriate postoperative therapy was thought to prevent re-adhesion of the flexor tendon and flexion contracture of the finger joint after flexor tenolysis.

A-0045 Peripheral Nerve Regeneration Using an Adipose-Derived Stem Cell Sheet

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Introduction: We created cell sheets of adipose-derived stem cells (ADSCs) to carry more stem cells locally and investigated the effects of an ADSC sheet on artificial nerve grafts, processed nerve allografts, and nerve autografts. The hypothesis of this study was that ADSC sheets promote peripheral nerve regeneration.
Methods and Results: A 15-mm excision of the sciatic nerve was performed in each rats to establish a nerve defect model. 1.5 g of adipose tissue was collected from the inguinal region of the rats, and ADSCs were separated and cultured. Ascorbic acid was then added to the medium to prepare an ADSC sheet. The ADSC sheet was cross-linked by collagen secreted from ADSCs themselves. In Experiments 1 to 3, the defect of the sciatic nerve was reconstructed using artificial nerve grafts, processed nerve allografts, and nerve autografts, respectively.

Experiment 1: Using a bioabsorbable tube made of polyglycolic acid as an artificial nerve, the results of a group with an artificial nerve graft alone, a group with an artificial nerve graft with ADSC suspension, and a group with an artificial nerve graft with an ADSC sheet were respectively compared and examined. At 12 weeks after the treatment, the group with the artificial nerve graft with the ADSC sheet showed a significant improvement in the wet muscle weight of the tibialis anterior muscle and the lower limb motor function evaluation (sciatic functional index, SFI).

Experiment 2: Using the processed nerve allograft (PNA), the results of the group with the PNA alone, the group with PNA withd the ADSC sheet, and the group with a nerve autograft were compared. At 12 weeks after treatment, the group with the PNA with ADSC sheet did not perform as well as the nerve autograft group. On the other hand, the group with the PNA with an ADSC sheet showed a significantly larger increase in the S-100 staining positive area and the neurofilament staining positive area in the transverse section of the regenerated tissue compared to the group with the PNA alone.

Experiment 3: Using the nerve autograft, the results of the group with the nerve autograft alone, the group with a nerve autograft with ADSC suspension, and the group with a nerve autograft with an ADSC sheet were compared and examined. At 8 weeks after the treatment, the group with the nerve autograft with the ADSC sheet showed significantly larger improvements in the evaluation of the wet muscle weight of the tibialis anterior and of the SFI.
Discussion: Possible mechanisms of ADSCs underlying nerve regeneration have been reported to include the promotion of Schwann cell migration by the release of growth factors, the promotion of neovascularization, and the inhibition of neuronal apoptosis. Therefore, it has been suggested that the effect of ADSC is reinforced by organizing ADSCs into a sheet that could hold a larger number of ADSCs locally. In addition, we found that the ADSC sheet improves the results of the nerve autograft as well as those of the artificial nerve graft and the PNA.

A-0052 A New Clinical Pathway for the Management of Paediatric Distal Radius Torus Fractures – Fewer Appointments and Safe Care

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Aim: Torus fractures are a common cause of paediatric Emergency Department (ED) attendance. In recent years, increasing evidence has emerged encouraging the use of non-rigid immobilisation and discharge at first review. We describe the management of torus fractures of the distal forearm in children in our centre before and after the introduction of a new clinical pathway.
Methods: We assessed all distal radius fractures of patients aged 0–16 seen in our Hospital's fracture clinic over four distinct three-month periods from 2017 to 2019. The data was collected retrospectively using the electronic health records system. X-rays were reviewed and only distal radius torus fractures included. Bicortical injuries, physeal injuries and patients who failed to attend follow up were excluded. Primary outcomes were days from presentation in fracture clinic to discharge and the specific fracture management. Secondary outcomes were days from presentation in ED to discharge, number of appointments per patient, number of radiographs per patient, re-presentations to ED and complications. Our interventions were the introduction of a virtual hand fracture clinic, a patient information leaflet and a new evidence-based treatment pathway. Initially, children had four weeks of rigid immobilisation with removal of fibreglass cast at four weeks in clinic. The new treatment pathway was discharge from first fracture clinic appointment in a prefabricated removable splint or soft cast, for removal by the child's parents at home at four weeks.
Results: The study included 88 patients with mean age of 9.7 years. The mean rate of rigid fibreglass casting in fracture clinic fell from 64% to 11% over the time period. The mean rate of discharge after first fracture clinic appointment increased from 38% to 80%. The mean number of follow up appointments per patient fell from 1.4 to 0.1. The number of days from presentation in ED to discharge from

fracture clinic fell from 24.7 to 13. The mean number of radiographs per patient in fracture clinic fell from 0.75 to 0.1. After the interventions there were no complications and no re-presentations to the ED.

Conclusions: Torus fractures of the distal radius are among the most common fractures in children but management varies widely. Our study demonstrates a new clinical pathway of a virtual hand fracture clinic, a patient information leaflet and a rationalised treatment pathway maintained clinically effective care with fewer patient episodes, fewer radiographs, greater patient convenience and no safety concerns.

Keywords: distal, radius, torus, fracture, paediatric

A-0057 Major complications associated with Trapeziometacarpal Total Arthroplasty (TMCA) in Valdecilla Hospital

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Introduction: The treatment of trapezometacarpal (TMC) ostheoarthritis with arthroplasty is an expanding field. Improvements in design and technology have contributed to the decrease in post-surgery complications but have not eliminated them completely. These complications could be classified as minor or major, the latter possibly resulting in a loss of implant. This study was designed to review the major complication cases observed after different model TMC implants were employed in the hospital of Valdecilla.

Methods and materials: This retrospective study examines a total of 166 TMC implants surgically introduced in the period between March 2006 and March 2020. The paper analyses demographic data, prosthesis models, use of X-ray placement control, clinical and radiological follow-up of major complications (luxation, mobility, TMC fractures, implant infection and debilitating pain), as well as salvage procedures, implant survival, and X-ray studies (measurement of the cup angle in respect to the proximal articular surface of the trapezium (PAST) via Roberts X-ray view). Implant survival in the last review and statistics.

Results: The study examines 156 patients, 10 of whom received bilateral treatment and in 70 (45%) of cases the dominant hand was operated. The average age of patients is 59 (46–78); 132 of patients are women (85%). Implants: 45 Arpe® (from March 2006 to November 2016), 5 Elektra® (from January 2008 to May 2009), 14 Ivory® (from July 2011 to May 2013), 7 Maïa® (from July 2013 to February 2014), 81 Isis® (from April 2014 to March 2020) y 14 Touch® (from September 2018 to March 2020). X-ray placement control was performed in 100% of Isis® and 64% of Touch® implant procedures.

Twenty-five (15%) major complications were registered.

Arpe®: 3 luxations, 2 displacements, 1 trapezium fracture, 1 infection, 1 case of debilitating pain. PAST angle: 8,85° (0–25), implant survival: 95,5%

Elektra®: 3 luxations, 5 displacements, implant survival: 0%

Ivory®: 2 displacements, 1 case of STT pain. PAST angle: 6,6° (1–18), implant survival: 92,8%

Maïa®: No major complications. PAST angle: 14,4° (0,8-46), implant endurance: 100%

Isis®: 2 trapezium fractures, 2 metacarpal fractures. PAST angle: 3.8° (0–9), implant survival: 100%

Touch®:1 luxation, 1 metacarpal fracture. PAST angle: 5,95° (1–18,4), implant survival: 100%

Conclusions: We have experienced very few major complications in performed trapezometacarpal (TMC) ostheoarthritis arthroplasties, with a high index of implant survival except in the case of Elektra®. Use of X-ray imaging improves the placement of the cup and diminishes the occurrence of luxation and implant displacement with the passage of time.

A-0058 Genetic risk predictors of clinical characteristics and recurrence of Dupuytren disease

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Background: Dupuytren disease (DD) is a common trait with a not completely understood etiology and varying severity and comorbidities. DD is a highly heritable trait with an estimated proportion of phenotypic variance attributable to genetic variants of 80%. Genome-wide association studies (GWAS) have identified a number of risk loci and further analysis revealed highly significant genetic correlations with body mass index (BMI), triglycerides (TG), high-density lipoproteins (HDL) and type 2 diabetes mellitus (T2D). Here we examine whether genetic risk of DD is associated with clinical variation and severity of the illness.

Materials and Methods: We used a well-characterized cohort of 1,669 DD patients with available genetic data. Phenotype data include characteristics such as age of onset, recurrence, and family history of disease. Imputation and quality control of genotype data was completed using standard procedures. Polygenic risk scores (PRS) of DD as well as for T2D, BMI, TG, and HDL, were obtained from the most recent GWAS studies and calculated using the PRSice algorithm. Control data were available from the Lifelines cohort and biobank. Regression analyses between patient characteristics and PRS were performed in R.
Results: Genetic data of 1,514 patients passed quality control. PRS could be calculated for 1,420 DD patients and 27,265 controls. PRS was significantly associated with positive family history for DD (variance explained 31.6%), parental history of DD (17.7%), age of onset (19.6%), age of onset <50 years (32.1%), disease status (23.6%), and surgical recurrence (23.8%) were significantly associated with PRS. There were no significant correlations between PRS for DD and T2D, BMI, TG, or HDL.
Conclusion: Genetic risk for susceptibility to DD is associated with clinical variation and severity and explains 17.7–32.1%. Understanding the contribution of genetic variants to patient characteristics and DD recurrence is a necessary steps towards accurate prognostication of this highly heritable disease. Genetic profiles may influence the choice of initial treatment and aid in personalized medicine in future.

A-0064 WALANT as a Safe, Reliable and Beneficial Modality for the Trainee Hand Surgeon – Analysis of a Consecutive Personal Patient Series

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Introduction: WALANT hand surgery provides numerous benefits and educational opportunities for the trainee, as this approach brings independence from time as well as resource constraints.

However, the junior hand surgeons perspective has not yet been adequately analysed.

Using the first author's personal patient series during a two-year period as a trainee hand surgeon, the objective of this study was to demonstrate the reliability and safety of WALANT when used by a surgical resident and highlight the inherent benefits of the WALANT approach for acquiring surgical skills.
Methods: The first author's series of more than 300 consecutive procedures as primary surgeon using the WALANT approach was investigated. Those procedures included peripheral nerve decompression, metal removal, tendon surgery – repairs, transfers and tenolysis, closed and open fracture fixation, nerve repair, trigger finger release, soft tissue tumor excision, ligament repair/ reconstruction, etc.

Parameters include achieving a near-bloodless field, need for temporary tourniquet use, intraoperative pain/need for local anaesthesia top-ups, need of conversion to other anaesthesia-method, patient distraction, need for patient sedation, complications (e.g. infection, haematoma, structural lesion or circulatory compromise).
Results: A near-bloodless field was achieved in all but 8 patients with impaired visibility and temporary tourniquet use was only applied in 5 cases. The insufficient vasoconstriction occurred in cases at the beginning of the trainee's learning curve and in cases with impaired distribution of the local anaesthetic/epinephrine due to scar tissue and too short of a delay between injection and incision (<20 min).

Intraoperative pain requiring local anaesthesia top-ups was recorded in only 5 cases (all metacarpal fracture fixations) as a technical failure due to insufficient infiltration at the beginning of the learning curve.

Conversion to general anaesthesia or patient sedation was never necessary. No major complications, e.g. tissue necrosis or neurovascular injury, occurred.
Conclusion: The WALANT approach proofs to be a safe and reliable modality in the hands of the trainee hand surgeon. Inherent benefits of the modality include acquiring a meticulous preparation technique, as immediate feedback by accidentally injured vessels occurs and the lively anatomy, e.g. palpation of arteries, helps to improve anatomic orientation. The intraoperative feedback of biomechanics enhances the understanding of the significance of the technical details, instills confidence and therefore promotes the surgical learning process.

Based on our experience we strongly recommend that hand surgery departments set up a WALANT surgical protocol with the trainee's needs in mind to enhance the skill-set and to facilitate and accelerate the surgical learning process of junior hand surgeons.

A-0067 Long-term outcome of distal oblique bundle reinforcement for chronic bidirectional DRUJ instability after TFCC injury

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Along with the triangular fibrocartilage complex (TFCC), the distal part of the interosseous membrane – the distal oblique bundle (DOB) – is the most important stabilizer of the distal radioulnar joint (DRUJ) and enables unrestricted pro- and supination of the forearm. Dynamic bidirectional instability of the DRUJ, as a result of TFCC injury, is often underestimated or missed but can be highly disabling due to pain and significant functional impairment. Stabilization of the DRUJ may offer relief in cases where malunion and osteoarthritis of the DRUJ are ruled out. In 2015, we described a new percutaneous tenodesis technique for DRUJ stabilization at the position of the DOB using a tendon autograft, usually the palmaris longus. The goal of this study was to evaluate the long-term outcome of this percutaneous DRUJ stabilization technique.

Between January 2011 and December 2020, all patients treated using this percutaneous DOB reinforcement technique were prospectively enrolled in this study. All patients suffered from chronic bidirectional DRUJ instability. Bidirectional instability was defined as a combination of ulnar palmar subluxation in supination and ulnar dorsal subluxation in pronation. The majority of patients suffered from TFCC injury after a previous distal radius fracture. In case of simultaneous malunion of the distal radius, only patients with persistent bidirectional instability after malunion correction were included. In all patients, functional outcomes using Quick DASH and PRWHE scores were determined prior to treatment and at final follow up. Pro- and supination were measured prior to surgery and at final follow up. Median follow up was 4.5 years (0.5–9.9 years).

33 patients were treated using this percutaneous DRUJ stabilization technique. All patients suffered from abnormal and painful laxity in the DRUJ in both dorsal and palmar direction, leading to chronic ulnar discomfort and pain during loaded supination. QuickDASH scores determined at 54 months postoperatively (range 6–118 months) showed an improvement of 30 points. PRWHE scores showed an improvement of 31 points. Three cases of recurrent bidirectional instability of the DRUJ were observed during follow-up (9%).

The technique of percutaneous distal oblique bundle reinforcement is an effective and easy technique for treatment of chronic instability of the distal radioulnar joint in patients with chronic DRUJ instability. The long-term results are very promising and as a result our technique offers a good alternative to existing more invasive procedures in patients with clinical symptoms of chronic instability or laxity of the DRUJ due to TFCC injury. Further research and especially prospective comparative studies including other procedures for treatment of DRUJ instability would be useful.

A-0069 Peripheral Nerve Regeneration with Enhanced Nerve Autograft using Adipose-derived Stem Cell Sheets

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Objectives: Nerve autograft is the gold standard treatment for peripheral nerve defects; however, even nerve autografts may not achieve sufficient functional recovery in such patients. Adipose-derived stem cells have been reported to promote axonal regeneration through the secretion of angiogenic, neurotrophic, and anti-apoptotic growth factors. Adipose-derived stem cell sheets (ADSC sheets) are prepared by adding ascorbic acid to ADSCs and cross-linking cells with type 1 collagen. Using the ADSC sheet, ADSCs can be reliably supported locally. Thus, the purpose of this study was to evaluate peripheral nerve regeneration with enhanced nerve autograft using adipose-derived stem cell sheets.
Methods: The adipose tissue removed from the inguinal region of the rat was subjected to enzyme treatment and isolated culture, and ascorbic acid was administered after three to four passages to prepare ADSC sheets. The left sciatic nerves of twelve-week-old Wistar rats were resected at a length of 15 mm, and the defect was bridged by a resected nerve autograft. We added ADSC sheets around the nerve autograft in the ADSC sheets group ($n = 10$) and added saline to the control group ($n = 10$).

To assess the functional recovery of rats after implantation, the Sciatic Function Index (SFI) score and tibialis anterior wet muscle weight ratio were measured, and electrophysiological and histomorphological evaluations of the tibialis anterior were performed at 12 weeks post-implantation.
Results: The wet muscle weight ratio of the tibialis anterior muscle was 62% in the ADSC sheets group

and 55% in the control group, and the wet weight of the muscle was significantly better in the ADSC sheets group than in the control group. SFI score was −68.4 in the ADSC sheets group and −72.5 in the control group. Nerve conduction studies showed that the amplitude was 61% in the ADSC sheets group and 49% in the control group, and the motor nerve terminal latency was 183% in the ADSC sheets group and 191% in the control group. The results of SFI, distal latency, and amplitude were not significantly different between the two groups. However, these results tended to be better in the ADSC sheets group than in the control group.

Conclusions: Using the ADSC sheet with nerve autograft, we obtained better results than treatment with nerve autograft alone. Although further studies are needed, this study indicates that ADSC sheets may improve the clinical results of nerve autografts in the treatment of peripheral nerve deficits.

A-0070 Alternative for two-stage tendoplasty in treatment of chronic tendon flexor digitorum profundus injury in no-man's land

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Objectives/Interrogation: We aimed to realize and compare two methods of delay flexor digitorum profundus (FDP) reconstruction in scarry-changed fibro-osseous canals such as two-stage tendoplasty and alternative method of temporary FDP isolation.

Methods: We have data on observation of 18 patients that underwent surgery of 24 FDP reconstructions within fibro-osseous canals at the time 4–6 weeks after trauma. All adult patients (13 male and 5 female) at the age from 19 to 49 were treated in our clinic. Their both flexor tendons were damage from cut wounds without vessels and nerves trauma. Patients treatment was late due to diagnostic mistakes or due to heavy epidemiological COVID-19 situation in our region. According to long period after trauma we hade planned two type of two-stage surgery for all patients. During the revision we founded obliterated fibro-osseous canals in 15 patients on 19 fingers. At the surgery it could be connect FDP ends and perform suture without or with slight tension.

Four patients underwent two-stage tendoplasty. To form the canal wall polymeric tubes were implanted, and 3.5 months after that performed autoplastic reconstruction of the FDP.

Restoration of deep flexor tendons in 14 patients was carried out by the new method developed by us – after suturing FDP tendon was covered and fixed by longitudinally dissected polymeric tube. Postoperative external fixation of the hand and finger was not performed. Passive and active motor rehabilitation began after edema reduction from about 3 days after surgery. The tube was removed 4 weeks later under local anesthesia.

Results and Conclusions: The patients treated by the new method returned to their job 2.5–3.5 months after tube removal. The rapid recovery of hand function occurred as a result of the beginning of rehabilitation from the first days after the operation. After 6 months there were no tenogenic contractures of the fingers. The results estimated by Strickland were good and excellent.

After two-stage tendoplasty patients returned to job 6.5–8 months after start of treatment. Two out of four people later had a decrease in range of motion of more than 40% and underwent tenolysis. One year later these patients showed good results of treatment according to Strickland.

There were no infection complications in our patients.

We presented how a new method of tendon temporary isolation solves the problem of tendon sliding surface and its sheath restoration after delayed FDP suturing in no-man's land. The method should be recommended as an alternative to two-stage authooplasty when the tendon suturing provides slight tension. Early active rehabilitation without external immobilization does not lead to rupture of the suture zone because the FDP was immobilized and protected by tube and motion stress transferred outside the tube. Movements from the first days after the FDP reconstruction lead to simultaneous finger function restoration and return ability to work after 2.5–3.5 months.

Keywords: tendon surgery, no-man's land, tendon isolation, two-stage tendoplasty

A-0075 Electric cutters, a health care issue

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Introduction: Electric cutters (EC) are readily available to buy and responsible for severe hand trauma. A lot of manual workers are admitted in the emergency room of our Hospital for hand trauma caused by EC. The lesions caused by this etiology are poorly described in the literature. The present work aimed

to characterize the EC lesions, including its prevalence, type of lesion, severity and economic burden.
Methods: A retrospective evaluation was performed on the patients who were submitted to surgical intervention for hand injury during a 2-year period by one of the 8 emergency teams. The lesions were evaluated with the Hand Injury Severity Scoring System'' (HISS).
Results: A total of 61 patients had EC as the etiology of the trauma. About 0,9 patients per/day were submitted to surgical intervention due to EC trauma. EC were the etiology of 22% of the hand trauma and regarding the trauma caused by these machines, 83% were in hand and wrist. Most of the accidents (62%) were in domestic activities. Thirty percent of the patients had a bone fracture, the most common being the middle phalange. According to the HISS score, 2% were classified as major lesion, 6% as severe, 32% as moderate and 60% as minor. The motor components were the most affected, followed by neurologic, skeletal, neurologic and integumental. Ninety five percent of the patients had extensor tendon lesion, the most frequent being the extensor digit common in 34% of the cases.
Discussion/Conclusion: According to our data, about 3 patients per/day in Portugal have EC related trauma with need for surgical intervention. According to the HISS score and previous stablished correlations, the patients were in average 6,5 weeks off work and had an America Medical Association total body impairment of 9%. The EC are sold without restrictions and are responsible for severe and common hand trauma, most of the times during recreational activities. On this basis, we believe that further security measures should be implemented, both to improve the safety of the machines as to restrictions for its market.

A-0078 Is core decompression an effective treatment for Kienböck's disease in middle-aged patients?

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Introduction: For the treatment of Kienböck's disease, the distal radius core decompression provides the surgeon with a biologic-based technique that does not alter the anatomy of the radiocarpal, ulnocarpal, or radioulnar joints. Significant improvement in functional activity, motion and reduction of pain has been reported with this technique. However, a biological healing technique also needs a good healing potential. Since the regeneration potential deteriorates with the advancing age of a patient, we asked following question: Is a higher age associated with a poorer outcome and maybe a contraindication to this technic? Our study aims to compare the outcomes of patients with Kienböck's disease, under and over 45 years old, treated with core decompression.
Material and Methods: 36 patients treated with core decompression for Kienböck's disease were included in this retrospective study. Patient were allocated to two cohorts according to their age at surgery. 22 patients (8 women) under 45 years old (mean: 28 y) were compared with 14 patients (8 women) 45 years old or older (mean: 52 y). The mean follow-up was 7 years (range, 1–18 years).

Clinical evaluation included preoperative and postoperative pain recorded using the visual analog scale, the active range of motion of the wrist in flexion and extension and the grip strength.

Subjective and objective clinical outcomes were assessed with help of the modified Mayo wrist score. We performed statistical comparisons using t-tests for parametric and the Mann-Whitney test for non-parametric data. Significance was set at less than.05.
Results: Preoperatively the mean VAS was 6.8 (range: 5–10) in patient under 45 years old and 5.6 (range,3-10) in patients over 45 years old. At the final follow-up the average VAS was 1.7 (range: 0–8) and 1.2 (range: 0–6) respectively. The improvement from preoperative to the end of the follow-up was significant in both groups (<45 years: $p < 0.001$; >=45 years: $p = 0.003$).

However, the difference between both age groups was neither significant preoperatively ($p = 0.075$) nor postoperatively ($p = 0.445$).

Also, in the other postoperative measurements (ROM, grip strength and Mayo score) there wasn't any significant difference. However, from preoperative to postoperative the grip strength increased significantly in the younger age group (71% to 77%), but the increase of grip strength wasn't significant in patients over 45 years old (72% to 80%).
Discussion: In this study a cohort of patients over 45 years old treated with core decompression for Kienböck's disease were compared with a younger cohort. Similar clinical outcomes were showed, no matter to which age group patient belonged. Our results suggest that the radius core decompression is a simple, less invasive procedure that

demonstrated favorable results also in a middle-aged patient cohort between 45 and 61 years old.
Conclusion: Core decompression should be considered as an important surgical alternative, also in middle-aged patients older than the ''typical patient'' with Kienböck's disease.

A-0082 Out–of–sheath corticosteroid injections through the dorsal webspace for trigger finger and trigger thumb. A prospective case series

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Background: Steroid injections are effective in the treatment of trigger digits but the pain during the injection is an always–present accompanying effect. The palmar midline technique is the most widely used. As the palmar aspect of the hand is much more innervated than the dorsal one, injecting through the dorsum may theoretically be less painful than injecting through the palm.
Objective: The aim of this study was to assess the effectiveness and perceived pain during an out–of–sheath corticosteroid injection through the dorsal webspace in the treatment of trigger digits.
Material and Methods: 126 consecutive patients were included. A subcutaneous (out–of–sheath) corticosteroid injection was performed through the dorsal webspace in all digits. In cases where signs or symptoms persisted, a second injection was offered. VAS for pain during the injection, DASH questionnaire, success rate and complications were collected.
Results: They were 86 women and 40 men with a mean age of 61 years. The mean VAS for pain during the injection was 3.8. Twelve patients were lost to follow-up. The overall success was 68% and success after a single injection was 54%. The best result was achieved on the middle finger. Patients who were not previously operated on carpal tunnel syndrome responded better. No complications were noted.
Conclusions: The extra–sheath corticosteroid injection through the dorsal webspace is effective and safe. It seems to be less painful than the reported scores for the palmar midline technique although it should be assessed in a comparative study.

A-0084 Antibiotic Prophylaxis in Clean Hand Surgery: Prospective Analysis of Major & Minor Complications

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Introduction: The indications for prophylactic antibiotics in hand surgery remains controversial, particularly in clean soft tissue procedures. Current evidence is based primarily on readmission and reoperation for surgical site infection, often ignoring minor infectious complications treated on an outpatient basis in addition to complications from antibiotic therapy seen postoperatively. The first aim of our study is to analyze major and minor infection rates after clean hand surgery in a prospective cohort and identify any predictive factors. The second aim of our study is to assess the frequency of antibiotic-related complications following clean hand surgery.
Methods: We conducted prospective consecutive cohort study over a one year period. Patient and operative data was obtained at the first postoperative visit following the index surgery. Primary outcomes assessed were (1) major infection, defined as admission or reoperation for infection, (2) minor infection, defined as use of postoperative oral antibiotics on an outpatient basis, and (3) complications from antibiotic therapy. Patients were assessed via direct examination at the first post-operative visit.
Results: A total of 413 patients underwent operations to the upper extremity and were evaluated at an average of 12.7 days postoperatively. Complications from antibiotic therapy were seen in 6.7% of patients, including one hospitalization for C. difficile. In soft tissue procedures, 10 of 106 patients receiving preoperative antibiotic therapy required postoperative antibiotics, this was not statistically significant ($p = .40$) versus the 8 of 123 patients requiring postoperative antibiotics who did not receive preoperative antibiotic therapy. Likewise, rates of minor infection in hand procedures was not statistically significant between cohorts, with 4 of 64 patients in the preoperative antibiotic groups requiring postoperative oral antibiotics and 10 of 126 patients in the no preoperative antibiotic groups requiring postoperative oral antibiotics ($p = .67$). No major infections requiring hospitalization or reoperation were seen in either group.rnCONCLUSION: The rate of minor infections has previously been underreported by large retrospective studies, and occured in 7.3% to 7.8% of postoperative courses according to our study. Complications from preoperative antibiotic therapy occurred in 6.7% of the patients in our study.

Preoperative antibiotics do not demonstrate a clear benefit in reducing this outcome in hand and soft tissue procedures of the upper extremity, yet are associated with medical complications and financial cost and can adversely affect patient outcomes and satisfaction.rn

A-0085 Comparing Heterotopic Ossification Prophylaxis Options for Elbow Trauma: A Meta-Analysis

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Introduction: Heterotopic ossification (HO) can be a potentially serious and devastating complication following traumatic injury to the elbow. Rates of HO at the elbow are quoted as high as 10–30% following traumatic injuries. HO can cause significant pain, restricted motion and lower quality of life. HO prophylaxis options include non-steroidal anti-inflammatory (NSAID) medications and radiation treatment. While both modalities have been studied extensively, there exists little consensus on the most effective form on HO prophylaxis in the elbow following trauma comparatively. Furthermore, there exists even less evidence on long term functional outcomes following either HO prophylaxis method. The purpose of this review is to compare effectiveness and outcomes between NSAID and radiation prophylaxis for HO about the elbow following a traumatic injury.
Methods: We performed a systematic review of PubMed and Cochrane Library for cases of heterotopic ossification prophylaxis following elbow trauma following PRISMA guidelines (Figure 1). HO prophylaxis was primary (prior to development of HO) or secondary (after excision of previously developed HO). Articles were excluded for HO etiology other than fracture about the elbow or subjects that received both prophylactic interventions. A total of 36 articles were included in final analysis. Separate analyses were subsequently performed for range of motion (ROM) at final follow up in flexion and extension arcs ($n = 20$) as well as pronation and supination arcs ($n = 10$). Continuous variables were examined using weighted means and Walds test for p values. Categorical variables were examined via proportions testing.
Results: A total of 826 elbows were included in the final analysis, 203 of which received radiation prophylaxis and 623 received NSAID prophylaxis (Table 1). The average age of combined subjects is 41.6 in the radiation group and 36.9 in the NSAID group ($p = 0.220$). 68.5% of the radiation group is male and 64.7% of the NSAID group is male ($p = 0.693$). Follow up duration is 20.7 months on average in the radiation group and 29.4 months in the NSAID group ($p = 0.109$) Rates of HO formation or recurrence following elbow trauma were similar between radiation and NSAID prophylaxis (15.6 vs 22.2%, respectively $p = 0.457$). ROM was similar in flexion and extension arc (109.0 degrees in radiation vs 112.8 in NSAID, $p = 0.459$) and in pronation and supination arc (118.9 degrees radiation vs 134.7 degrees NSAID, $p = 0.322$).
Conclusion: There is no statistical differences in HO development, recurrence, or final ROM when using NSAID or radiation prophylaxis following trauma about the elbow. As such, we would recommend the use of either technique based on patient characteristics and surgeon preference.

A-0086 Scaphoid Nonunion Management with Headless Screw versus Volar Locking Plate Fixation: A Meta-Analysis

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Introduction: Headless compression screw fixation with bone grafting has been the mainstay of treatment for scaphoid nonunion for the past several decades. Volar plate fixation, however, has gained popularity as a technique for scaphoid fixation, especially for recalcitrant or multifragmented nonunions. The purpose of this meta-analysis was to compare union rates and clinical outcomes between volar plate fixation and headless compression screw fixation for the treatment of scaphoid nonunions.
Methods: We performed a literature search of studies documenting outcomes for scaphoid nonunion treatment with either screw fixation, plate fixation, or both using PubMed, SCOPUS, Cochrane Library, and Google Scholar from 2010 to 2020. Inclusion criteria consisted of (1) adult patients with average age > 18 years, (2) primary study using either screw fixation, plate fixation or both, with discrete data reported for each procedure, (3) average follow up of at least 3 months. Exclusion criteria consisted of (1) studies with incomplete or missing data on union rates. Data from each study was weighted, combined within treatment groups, and compared across treatment groups using generalized linear models.
Results: A literature search resulted in 925 articles from 2010 to 2020 before inclusion and exclusion criteria were applied. Ultimately, 23 articles were

included for analysis. These articles consisted of 17 distinct cohorts treated with screw fixation and 12 cohorts treated with plate fixation. In total, 395 patients treated with screw fixation and 209 with plate fixation were included for final analysis. Preoperatively, patients treated with plate fixation had significantly longer time from injury to surgery ($p = 0.001$) and were more likely to have had prior surgical intervention ($p = 0.011$). There was no significant difference between union rates at 92% and 94% for screw and plate fixation, respectively ($p = 0.642$). However, plate fixation resulted in longer time to union ($p = 0.02$) and lower modified Mayo wrist scores ($p = 0.001$).

Conclusion: Patients treated with plate fixation were more likely to present with recalcitrant nonunions. There was no statistically significant difference in union rates between screw and plate fixation. The results from this meta-analysis support the use of plate fixation for scaphoid nonunion, especially recalcitrant nonunions and those that have failed prior surgical intervention.

A-0088 Intramedullary Screw Fixation of Metacarpal Fractures: An Anatomic Analysis for Optimal Screw Choice

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Background: Headless cannulated screws are being used more frequently for the intramedullary fixation of metacarpal fractures. However, there is considerable variation in metacarpal dimensions from between fingers and between the genders which can affect the most appropriate screw selection. The purpose of this study is to investigate variations in metacarpal anatomy as it relates to intramedullary fixation of metacarpal fractures in order to determine appropriate headless screw dimensions for a variety of patients.

Methods: A retrospective analysis of posteroanterior and oblique radiographs of 120 metacarpals across 30 patients (15 men, 15 women) was performed. Patients were aged 18 to 50 years old. Exclusion criteria included previous metacarpal fractures, degenerative changes, and anatomic abnormalities. Each metacarpal was measured using Sectra IDS7^{TM} imaging platform. The metacarpal dimensions, including isthmus diameter, head dorsal entry point, cascade, and isthmus combined cortical thickness, and head cross-sectional area were assessed radiographically and analyzed. Sex differences were analyzed via two sample T-test. These measurements were compared to a list of commercially available headless screws used for intramedullary fixation.

Results: On PA and Oblique, the small metacarpal had significantly larger medullary isthmus diameter (3.8 mm and 3.4 mm respectively) compared to other metacarpals ($p < 0.05$). Average cascade angle between middle and index, middle and ring, and middle and small metacarpals were 0°, 24°, and 27° respectively. Dorsal entry point ranged between 25–35% of metacarpal head anteroposterior width, with significant sex differences ($p < 0.05$) between all metacarpals except the small and ring. The index metacarpal had the greatest cortical thickness (5.7 mm on average) with no statistically significant differences between metacarpals. Men had statistically greater combined cortical thickness compared to women in all metacarpals except the Index ($p < 0.05$ vs $p = 0.3$). Dimensions of 17 commercially available screws by 5 manufacturers were compared. The leading head diameter ranged from 2 to 6.5 mm and trailing head diameters ranged from 3 to 8.1 mm. The trailing head of the available screws occupied 3.2–23.2%, 3.2–23.5%, 4.6–33.7%, and 2.3–39.6% of cross-sectional area of index, middle, ring, and small metacarpal heads respectively.

Summary: Dorsal entry point and cascade angle can be used to approximate appropriate screw placement and reduction fluoroscopically. Surgeons should be cautious with these screws and be aware of anatomic variations between men and women, specifically with cortical thickness. Future direction involves designing headless cannulated screw with dimensions suggested by this study to ensure optimal fixation and operative technique

A-0089 Wide Awake Local Anesthesia Surgery with Epinepherine is Safe: A Series of 4,287 Consecutive Hand & Upper Extremity Procedures

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Introduction: Hand and upper extremity surgery performed wide awake involves the use of a local anesthetic and epinephrine. Controversy persists as to whether epinephrine is safe for use in the hand. This study aimed to evaluate the safety of epinephrine in hand and upper extremity surgery. The hypothesis was that epinephrine is safe and may be utilized for a wide breadth of surgical procedures in the hand and upper extremity.

Methods: A four-year retrospective chart review was conducted of consecutive patients undergoing wide awake surgery with local anesthesia and epinephrine by two surgeons at a single institution. Data collected included patient demographics, procedure volume, procedure types, surgical setting, and complications relating to epinephrine use.
Results: Over the study period, 4,054 consecutive patients underwent 4,287 procedures utilizing wide awake surgery with local anesthesia and epinephrine. The average patient age was 59 years, and 64% of patients were females. There were zero complications related to the use of epinephrine, with no cases of tissue necrosis, phentolamine reversal, anaphylaxis, or readmission. There were no cases where conversion to general anesthesia or monitored anesthesia care was required.
Conclusion: This analysis of over 4000 consecutive patients undergoing wide awake hand and upper extremity surgery with epinephrine confirms that epinephrine use is safe; with no cases of tissue necrosis, reversal, readmission, anaphylaxis, or anesthetic conversion identified.

A-0093 Is there a correlation between the clinical and radiological outcome after radius core decompression for Kienböck's disease?

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Introduction: For the treatment of Kienböck's disease with distal radius core decompression, significant improvement in functional activity, motion and reduction of pain has been reported. However, in spite of these good clinical results we observed a radiological progression in a certain degree in the middle and long-term follow-up, as described also in other techniques. Is there a negative correlation between the clinical improvement of the patients and the radiological progression of the disease after core decompression? Our study aims to figure out the correlation between the clinical improvement in Mayo wrist score and the radiological progression in the Lichtman classification in patients treated with core decompression for Kienböck's disease.
Material and Methods: 24 patients (mean age: 38 y; 10 women) treated with core decompression for Kienböck's disease were included in this retrospective study. In 9 patients the dominant side was affected. The mean follow-up was 9.7 years (range, 3–18 years).

Clinical evaluation included preoperative and postoperative pain recorded using the visual analog scale, the active range of motion of the wrist in flexion and extension and the grip strength.

Subjective and objective clinical outcomes were assessed with help of the modified Mayo wrist score. We performed statistical correlation testing with the Spearman test. Significance was set at less than .05.
Results: At end of follow-up 9 had an excellent result, 13 had a good and two a fair result. This was an average improvement of two levels in the Mayo classification. The pain was reduced by average 5.1 points in the VAS. The radiologic progression in the Lichtman classification was seen in 9 patients (five patients of one level, three patients of two and one patient of three levels). The Spearman correlation coefficient wasn't significant: he was −0.056 between Mayo and Lichtman classification and 0.161 between VAS and Lichtman classification.
Discussion: Our results suggest, that there isn't a clear correlation between the clinical and radiological outcome of patients after a distal radius core decompression in a middle to long-term follow-up. A radiological progression seems possible in the years after treatment, but patients keeps a satisfactory clinical outcome. In natural course of the Kienböck's disease in elderly patients similar results were found by Taniguchi et al.
Conclusion: The clinical outcomes seems not to suffer in spite of a radiological progression in the Lichtman classification of patients treated with core decompression for Kienböck's disease.

A-0094 Anconeus nerv revised

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Introduction: The anconeus nerve is the longest branch of the radius proximal to the sulcus, which facilitates its connection to the axillary nerve in Brachial plexus lesions. This makes him suitable as a donor side for the neurotization to the axillary nerve. The aim of this study was to take a precise look on the Anconeus nerve, his origin and insertions

of the muscular branches and to map the topographical course of this important branch of the radial nerve. We investigated these in detail in reference to clear anatomical landmarks, all of which can be palpated precurtain with ease.

Materials and Methods: We performed an anatomical dissection in 15 fresh frozen elbows specimens. The radial nerve was followed distally until the anconeus nerves was discernable and starts to detach from the radial nerve. This point was defined as the apparent origin and was recorded in relation to the intercondylar line (ICL). The anconeus nerve was further traced distally between the lateral-long head and medial head, piercing into medial head of triceps up to its entry to the anconeus. A concomitant innervation or nerve branches to the medial head of triceps brachii were visualized and the diameter of the nerve was measured at its apparent origin and in his muscular insertion. The relation between the topographic course of nerve as regard of chosen landmarks (Tip of the olecranon, medial and lateral epicondyle) were assessed.

Results: The Anconeus nerve separated with an initial diameter of average 1.5 mm (SD: 0.2) from the radial nerve at about 16.4 cm (SD: 1.5 cm) proximal to the lateral epicondyle, on the postero-medial side of the humerus. The nerve run between the lateral and the medial head of the triceps muscle, before entering the medial head ad an average of 10.2 cm (SD: 2.4 cm) proximal the intercondylar line (ICL) and running intramuscular until to the distal humerus. Exiting the muscle for a short distance, the nerve lies on the periosteum of the distal humerus and the dorso-lateral articular capsule of the elbow joint, before entering the anconeus muscle with an average diameter of 0.5 mm (SD:0.1 mm)

Two different types of Anconeus nerves were found: eight nerves innervate also the lateral head of the triceps and the other seven nerves only contribute two branches to his innervation.

Discussion: Our study describes the topographic course of the anconeus nerve and his relations to easily palpable bony landmarks. Although the course of anconeus nerve has already been described we missed some clear topographic relationships of the nerve in relation of applicable bony landmarks, so that we saw the necessity to review the course of the anconeus nerve.

Conclusion: Hand surgeons should, be aware of the course of the anconeus nerve, to know the option of this nerve as a valid donor side for the transfer to the axillary nerve. We want to underscore the critical passage of the nerve on the periost and the articular joint capsule, between the medial head of the triceps and the insertion into the anconeus nerve.

A-0095 Stability of the first carpometacarpal joint during trapeziectomy with tendon suspension and interposition

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Objective: There are no quantitative data on the intraoperative stability of the thumb carpometacarpal (CMC I) joint after trapeziectomy and the amount of added stability after tendon suspension and interposition (resection-suspension-interposition arthroplasty [RSI]). Therefore, our study objective was to measure CMC I joint stability during RSI. The contribution of the various surgical steps to stability was analysed and its relation to preoperative clinical and patient-reported measures was assessed.

Methods: Preoperative pinch grip, thumb mobility (based on the Kapandji score) and hypermobility (using the Beighton score) were determined. In addition, patients completed the brief Michigan Hand Outcomes Questionnaire. During surgery and upon removal of the trapezium, the surgeon subjectively rated the degree of CMC I stability either as ''stable'', ''medium stable'' or ''unstable''. A measurement system with integrated force sensor was used to measure intraoperative CMC I stability. Briefly, a reposition forceps was attached to the base of the MC I and to a linear slide with integrated force sensor in a standardized pinch grip position. The thumb ray was displaced manually by 10 mm towards the scaphoid and the counteracting force measured over the entire displacement. Objective stability was determined as the maximal measured force after trapezium resection, tendon suspension and interposition.

Results: We included 26 patients with a mean age of 70 years (±8.1). The surgeon rated half of the thumbs as ''stable'' after trapeziectomy, 15% as ''medium stable'' and 35% as ''unstable''. The objective intraoperative stability was 15 N (±5.5) after trapeziectomy and significantly increased to 19 N (±5.8) after ligament reconstruction ($p \leq 0.01$). Stability was similar after final tendon interposition at 19 N (±7.9) ($p = 0.655$). Neither the subjective rating nor other clinical or patient-reported variables correlated highly with the objectively measured stability after trapeziectomy (Spearman's correlation coefficient ranged between 0.05 and 0.31).

Conclusions: Tendon suspension appears to be the most important step in stabilizing the metacarpal base after trapeziectomy for the surgical treatment of thumb CMC I osteoarthritis. Tendon interposition

had no significant additional effect regarding stability, at least immediately after surgery. However, it remains unclear whether the added intraoperative stability with the tendon suspension is needed for a good clinical result, especially in the long term.

A-0098 The predictive value of grip strength in carpal tunnel syndrome

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Some of the patients with carpal tunnel syndrome have measurably decreased grip strength on the affected side, compared to the unaffected hand. Our hypothesis was that a patient with decreased grip strength will have a worse outcome after carpal tunnel release compared to the patients with normal grip strength.

Material and method: In our unit, we have a prospective data collection system. All the data of every operated patient are registered. From this database, we could involve in this study 120 patients from the last two years. We evaluated their data in 3 different groups based on the difference in grip strength between the affected and unaffected side: group 1 (difference less than 2 kg) n = 30; group 2 (difference 3–10 kg) n = 36; group 3 (difference more than 10 kg) n = 22. The daytime numbness, nighttime numbness, and overall satisfaction was registered (visual analogue scale 1–10). The groups were compared using T-probe. For significance the p-value was 0,05.

Results: Before the operation the only difference between the groups was the grip strength. The average age, the level of numbness, the gender distribution was similar in the three groups (no significant difference). 1 week after the operation the daytime numbness was 3,8–4,8–5,8 VAS points in the three groups. The tendency is obvious, and the difference between the first and the third group is significant. At 6 weeks postoperatively the same values are 2,6–3,0–3,6 VAS point. All of them improved, but the weaker grip strength resulted in significantly (group 3 compared to group 1) worse results at this point as well. In the nighttime numbness values, the same tendency can be observed. At one week the values of group 2 and 3 had significantly worse results compared to group 1. At 6 weeks only the big drop in grip strength (group 3) resulted in significantly worse VAS values. The values in the three groups: 1,2–1,6–2,1. At the 6 weeks checkup the difference in the grip strength disappeared, and the average was close to the values of the unaffected side. The measured grips strength values were 16,3 kg – 14 kg and 15,5 kg in the three groups.

In the satisfaction of the patients, this difference in the remnant numbness did not show up. The values of the three groups were not significantly different neither at one week nor at 6 weeks.

Conclusion: Based on our study we can state, that the grip strength of a carpal tunnel syndrome patient has a predictive value. If a patient comes to the office with carpal tunnel syndrome and the grip strength is decreased, we can predict a slower recovery of the numbness, and we can call the patient's attention, that he/she can count on some remnant numbness even at 6 weeks. Despite this the operation should be offered, and the patient will be satisfied.

A-0100 Cost analysis of operative versus nonoperative treatment for acceptably reduced intra-articular distal radius fractures

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Purpose: To assess health economic evaluation from a multicenter, randomized, controlled trial of plaster cast immobilization versus volar plate fixation in patients with a displaced extra-articular distal radius fracture

Methods: A cost-effectiveness analysis (costs per quality-adjusted life-year (QALY)) was performed from a multicenter, randomized, controlled trial conducted in 13 hospitals in the Netherlands. Ninety patients were randomly assigned to plaster cast immobilization orvolar plate fixation. Resource use per included patient was documented prospectively for up to 12 months after randomization and included direct medical costs, direct non-medical costs and indirect non-medical costs owing to the distal radius fracture and the received treatment. Analyses were performed according to the intention-to-treat principle.

Results: The total costs during the 12 month follow-up period were €4,836 (95% bcaCl 4318 to 5485) for operative treatment and €4,579 (95% bcaCl 3693 to 5872) for non-operative treatment, with a mean cost difference of €258 (−1138 to 1391) in favor of non-operative treatment.

The mean QALY at 12 months was significantly higher in the operative group (0.748; 95% bcaCl 0.678 to 0.813) than in the non-operative group (0.603; 95% bcaCl 0.5470 to 0.813), with a mean

difference of 0.15 (95% bcaCl 0.056 to 0.243). The incremental cost-effectiveness ratio (ICER) was €1,777 (95% bcaCl −8503 to 16126) per QALY, in favor of nonoperative treatment. In subgroup analysis of patients having a paid job, the ICER was 3,097 per QALY in favor of the operative group for patients with a paid job.
Conclusion: Patients in the operatively treated group had better quality of life and functional outcome than patients treated in the nonoperative group at 12 months, especially when they had a paid job. However, operative treatment is marginally more expensive than nonoperative treatment. As operative treatment is lower than the willingness to pay threshold, it can be considered cost-effective, and we recommend current treatment practice takes this into account.

A-0104 Treatment of minimally displaced metaphyseal both-bone fractures of the distal forearm in children: long-term results of a randomised controlled multicenter trial

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Background: Children with minimally displaced metaphyseal both-bone forearm fractures, who were treated with a below-elbow cast (BEC) instead of an above-elbow cast (AEC), experienced more comfort, less interference in daily activities and similar functional outcomes at short-term FU. The objective of this study was to evaluate outcomes at long-term FU.
Patient and methods: A secondary analysis was performed of the 7 years follow-up data of our RCT (equivalence design). The original RCT was registered in ClinicalTrials.gov NCT 00397995. Ethics approval was obtained for this post-trial FU study with protocol number NL41839.098.12. Primary outcome was loss of forearm rotation compared to the contralateral forearm. Secondary outcomes were Patient Reported Outcome Measures (PROM's) consisting of the ABILHAND-kids and the DASH questionnaire, grip strength, radiological assessment and cosmetic appearance.
Results: The mean length of FU was 7.3 (± 1.4) years. Of the initial 66 children who were included in the RCT, 51 children (77% response) were evaluated at long-term FU. There was no statistically significant difference in loss of forearm rotation between the two treatment groups: −0.72(−4.5–3.1) degrees in the AEC group and 0.58(−5.1–6.2) in the BEC group, p = 0.6. There were no statistically significant differences in secondary outcomes.
Interpretation: This study revealed that at long-term FU there are no significant differences in loss of forearm rotation, patient-reported outcome measures and radiological outcomes between the groups treated with AEC or BEC. Based on these results, we conclude that children with minimally displaced metaphyseal both-bone forearm fractures should be treated with a below-elbow cast.

A-0105 Dupuytren's disease in the UK: Prevalence, incidence, and lifetime risk of surgical intervention – A population-based cohort analysis

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Aims: To determine 1) the prevalence and incidence of Dupuytren's disease (DD), 2) incidence of first surgical intervention, and 3) lifetime risk of surgical intervention in the UK National Healthcare Service (NHS).
Patients and Methods: In this population-based dynamic cohort analysis, data of the Clinical Practice Research Datalink (CPRD) was linked to Hospital Episode Statistics (HES), to characterize the diagnosis and surgical treatment of DD. Secular trends of incidence of DD diagnosis and first surgical treatment were calculated for the period 2000–2013. A multi-state Markov model was designed to estimate the lifetime risk of first surgical treatment for DD.
Results: A total of 10,553,454 subjects were included in the analyses, 5,502,879 (52%) females. 38,707 DD patients were identified. Point prevalence in 2013 was 0.67% (99%CI: 0.66–0.68). Incidence of DD almost doubled from 0.30 (99%CI: 0.28–0.33) per 1000 person-years in 2000, to 0.59 (99%CI: 0.56–0.62) in 2013. Incidence of first surgical intervention similarly increased from 0.29 (99%CI: 0.23–0.37) to 0.88 (99%CI: 0.77–1.00) in the same period. A man or woman newly diagnosed with DD at age 40–55 has a lifetime risk of surgical intervention of 24% and 13% respectively, decreasing to 20% and 11% respectively if diagnosed at 80.
Conclusion: DD is an important health condition in the elderly population, since prevalence and

incidence rates have almost doubled in the last decade. Estimated lifetime risk of surgical treatment is high and almost twice in males compared with females. These data will allow primary care physicians to accurately inform newly diagnosed patients about the expected course of their disease, and will be useful for healthcare commissioners.

A-0107 Flexor pulley reconstruction – clinical results for chronic cases: 5-years follow-up

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Introduction: Release of the A1 pulley is the standard treatment for trigger fingers and therefore probably the most frequently performed "small" intervention in surgical practice. It is performed by general, plastic, trauma and hand surgeons worldwide with a wide variety of experiences. Unfortunately every now and then not only the A1, but also the A2 pulley is dissected with subsequent bow-stringing of the finger resulting in malfunction of the finger and hand. Furthermore traumatic rupture following blunt or sharp trauma can result in pulley insufficiency requiring adequate reconstruction.
Methods: We present a series of 23 pulley reconstructions utilizing double or triple loop technique according to Okkutsu. after iatrogenic or traumatic rupture of at least two adjacent flexor tendon pulleys. Mean follow-up was 4,66 years after reconstruction of mostly A2 pulleys in a single-surgeon setting. Meassured outcome contains ROM, NRS pain, satisfaction, DASH- and Krimmer-Score, Buck-Gramco-Score, Jamar-Grip strength and pinch-Grip as well as vigorimetry in comparison to the uninjured side. The collected data was compared to other studies from the literature
Results: The follow-up approximately 5 years after treatment of this relatively large patient population (n = 23) with a mean age of 52.7 years show overall acceptable satisfaction (NRS 1–10: 6.6) and a good DASH (median: 9.5). The grip strength on the Jamar dynamometer shows only a mild reduction of 13% in comparison to the uninjured side. The resulting force development of the operated fingers on the virgometer is almost 60% of the opposite side and the finger-palm distance of the operated finger was reduced from 2,2 cm to 1,45 cm. The other scores – both Krimmer (82.2) and Buck-Gramcko (10.9) – support these quite good results accordingly.
Conclusion: The double or triple loop reconstruction of the A2 and A3 pulley shows – even in the medium term – good functional results with acceptable patient satisfaction and good function of the finger in everyday patients life.

A-0112 Preoperative Patient Reported Wrist Evaluation (PRWE) should guide the indication for open reinsertion of the Triangular Fibrocartilage Complex (TFCC) reinsertion

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Purpose: To determine thresholds in preoperative patient-report outcome measures (PROM) in patients electing Triangular Fibrocartilage Complex (TFCC) surgery in order to identify patients that could benefit the most from surgery.
Methods: This study included consecutive patients with open TFCC repair between December 2011 and December 2018, in the Xpert clinics in the Netherlands. All patients were asked to complete the Patient Reported Wrist Evaluation (PRWE) questionnaires at baseline as well as at 12 months post-operatively. Patient, disease, and surgery factors were extracted from digital patient records. T tests and chi-squared tests were performed to test difference between outcomes and satisfaction in patients that did or did not reach minimal clinical important difference.
Results: Between December 2011 and December 2018, a total of 544 patients had received an open TFCC reinsertion at our centers. We excluded 61

patients due to incomplete or missing PRWE questionnaires at baseline. Another 204 patients were excluded due to incomplete or missing PRWE questionnaires 12 months post-surgery, or because they were operated on the same hand within 12 months after open TFCC reinsertion. In total, 274 patients were included.

While most patients improved and demonstrated less pain and functional problems after 12 months, a total of 25% of patients had an improvement of less than 17 points. Patients who did not reach MCID had a longer history of complaints (mean difference 13 months) and more complications ($p = 0{,}003$). The chances of reaching MCID for patients with a low baseline PRWE score are slim. In our cohort, of patients with a score below 30 at baseline only 12% reached the MCID, while in patients with a baseline score of 30 and higher 84% reached the MCID.

Conclusion: A baseline PRWE Total score less than 30 should be strong signal to reconsider operating a patient for open reinsertion of the TFCC as their chances of reaching clinically meaningful outcomes are slim.

Level of Evidence: II

A-0117 Hand osteomyelitis in arterial calcification, diabetes mellitus and end stage renal failure: a comparison of 210 cases over 12 years

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Aims: Hand osteomyelitis may be associated with poorer outcomes among patients with digital artery calcification. This study aimed to identify whether this specific radiological finding confers any useful diagnostic, prognostic, or therapeutic information.

Methods: A cohort of 210 patients diagnosed with phalangeal or metacarpal osteomyelitis over 12 years (2008 to 2019) in our tertiary referral centre, were reviewed retrospectively for evidence of arterial calcification on plain xrays.

Results: Digital artery calcification was present in 29/210 patients (14%) with hand osteomyelitis. Overall 71 patients had diabetes mellitus and/or end-stage renal failure, including 28 of 29 patients with calcification. Ipsilateral arteriovenous fistulae were prevalent in the calcification group ($n = 17$), as was steal syndrome ($n = 5$), and digital ulceration or skin necrosis ($n = 15$). Compared with controls ($n = 181$), those with calcification experienced higher rates of polymicrobial infection, digit amputation, had more bones affected, surgical procedures, phalanges amputated, and higher mortality at one year ($n = 12$), five years ($n = 20$), and study completion ($n = 24$), as a result of comorbidities. Absence of calcification in patients with diabetes and/or end stage renal failure ($n = 43$) was associated with better outcomes on all the above parameters.

Conclusion: Hand osteomyelitis with arterial calcification evident on plain x-rays is associated with increased rates of digit amputation, and higher one-year mortality compared with hand osteomyelitis in the absence of arterial calcification. Early amputation to maximise disease-free survival may be appropriate for patients with hand osteomyelitis and arterial calcification.

A-0119 Practice makes perfect: A review of published tendon trainer repair models

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Aims: To objectively evaluate published tendon repair training models and introduce a novel modification to enhance replicability and transferability to the operative environment.

Methods: Seven models were evaluated: urinary catheter, liquorice, fishing lure, dental rolls, drinking straw, silicone sealant and silicone sealant encased in surgical tape. 2 consultant hand surgeons and 7 Plastic Surgery registrars performed a 2-strand modified Kessler core repair supported by a continuous running epitendinous repair on each model. Instruments and suture materials were homogenous between surgeons. Surgeons rated the models with Likert scale for qualitative elements; ease of use, handling, suture glide and grasp, knot tying, usefulness for teaching and confidence in transferability of skills learnt to the operative environment ($1 =$ strongly disagree, $5 =$ strongly agree). Kruskal-Wallis tests were used to identify statistical differences between scores for models, both individual elements and cumulative. Dunn's post-hoc testing was used to evaluate the significance of the differences between models.

Results: The highest scoring model across individual domains and cumulatively was the author's novel

modification; silicone sealant encased in surgical tape (36.4 ± 4.1). This was a significant difference when compared to all models, across all domains ($p < 0.05$), with the exception of the silicone sealant alone. The straw model was the lowest scoring model (15.3 ± 5.2).

Conclusions: Silicone-based simulation models offer a robust model for trainees to perform core and epitendinous repair. Our novel modification, to enhance replication of in-vivo tendon properties, with circumferential surgical tape, objectively increases the fidelity of the significantly superior silicone sealant model. We offer trainees in Plastic Surgery and Trauma and Orthopaedic Surgery a cost effective (less than £10 for multiple trainer tendons), accessible and easily reproducible training model to support their surgical skill acquisition.

A-0123 Wide-Awake Hand Surgery Experience in 10 to 18 Years of Age

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Recent reports have shown that adult patients are mostly happy with their hand surgery experience under WALANT (wide-awake non-tourniquet local anesthesia). Although the WALANT method is known to be used for hand surgery under the age of 18, it has been reported poorly so far. In this study, we investigated the frequency of WALANT method use in hand surgery in 10–18 age group. We also assessed patients' experiences of their operation performed under WALANT.

All patients in the 10–18 age group operated on their hand in June 2016- March 2020 were identified. The patients whose operation was possible under WALANT were included in the study. The number of patients who agreed to be operated under WALANT was determined to calculate the frequency of its use (%). Then, patients who had undergone surgery with WALANT over the previous year were contacted by telephone and the patients' surgical experience was evaluated via questionnaire. Patient's pain level during local anesthesia injection and during surgery were assessed on a numeric analog scale (NAS). Additionally, patients were asked to compare their operation to a dental treatment and to their expectation pre-operatively and whether they would like to have surgery with the same anesthesia technique again.

Of the 69 patients who were offered WALANT for their operation, 46 of them were operated under WALANT (67%) and 23 (33%) under general anesthesia (GA). The mean age of the WALANT patients was 14.5 ± 2 and the rate of male patients was 43%. Sixteen patients who had undergone surgery in the previous year were reached by telephone. Those patients reported pain level of 0.8/10 during anesthesia injection and 0.4/10 during surgery. Sixty-two percent (10/16) of the patients found their operation easier than a dental treatment, 62% (10/16) found it easier than they expected and 87.5% (14/16) would like to undergo a surgery under WALANT again. Only one patient could not tolerate the surgery under WALANT and she was operated under GA later.

This study showed that most patients in the 10–18 age group accepted to be operated under WALANT and those patients had a positive experience of their operation. For its various advantages, the WALANT technique should be considered for hand surgery for compliant patients in this age group. However, despite being very rare, patients in this age group may fail to tolerate local anesthesia.

A-0125 Partial resection of volar plate for patients with stiff finger

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Several surgical techniques have been suggested to manage stiff finger, but their outcomes are not always satisfactory. The purposes of this study were to introduce a novel surgical technique and to present its clinical outcome.

We retrospectively reviewed 21 stiff finger joints of 18 patients who underwent partial resection of volar plate and were followed-up for more than 1 year. Of 21 joints, eleven were proximal interphalangeal (PIP) joints and 10 metacarpophalangeal (MCP) joints. Changes in the range of motion (ROM) of finger joints and patient satisfaction using Likert scale (1 represented ''very satisfied'' and 10 represented ''very dissatisfied'') at the final follow-up were evaluated.

The ROM in all stiff fingers improved at average 3.5 years follow-up. The average ROM of 11 PIP joints improved from 21° to 82° and that of 10 MCP joints improved from 34° to 88°. Satisfaction to the surgery averaged 1.4 ± 0.8 in Likert scale. Complications of instability, surgical site infection, wound dehiscence, and revision surgery were not observed.

In conclusion, partial resection of volar plate might be an effective surgical option for the patients with stiff finger while enhancing mobility and preserving stability.

A-0126 Non-operative treatment versus suture refixation of the nail plate in paediatric fingernail avulsion injuries

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The study compared a non-operative treatment, consisting of ointment dressing only, with the standard surgical nail plate refixation for simple fingernail avulsion injuries in children. A non-inferiority hypothesis was tested in a single-centre, prospective cohort study.

The quality of the new nail was the primary outcome and was assessed with the Nail Appearance Score. The secondary outcome was patient and parental satisfaction, which was assessed with the Patients' and Parental Nail Satisfaction Score. Fifty-one patients were enrolled; 39 (76%) chose the non-operative treatment and 12 (24%) the standard operative therapy.

Comparison of the two groups confirmed the non-inferiority hypothesis with a risk difference for the new nail of 0.02 with a 95% confidence interval of (−0.05, 0.01). The outcome was excellent in all fingers with no significant differences regarding either the primary or secondary outcome. In view of associated risks and costs for surgery, we recommend ointment dressings for such injuries.

A-0128 Biomechanical analysis of a single-sided locking side-to-side suture technique for tendon transfers

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Purpose: The Pulvertaft weave technique is considered to be the ''gold standard'' suture technique in tendon transfers. Although this technique has proven to meet the requirements of strength and stiffness, it has several disadvantages. Weaving of the tendons requires length of the donor tendon and a considerable diameter of both tendons to allow for weaving in perpendicular directions. In addition, the reconstruction is bulky and the increased friction on the surrounding tissue may lead to adhesions. In this study, we present a single-sided locking side-to-side (STS) suture technique as a possible alternative for the Pulvertaft weave in tendon transfers. The aim of the study was to compare the biomechanical characteristics of the single-sided locking STS reconstruction with Pulvertaft and double-sided nonlocking STS reconstructions.
Methods: Twenty-four human cadaveric extensor digitorum communis tendons and 24 flexor digitorum superficialis tendons were randomly assigned to 1 of 3 groups, resulting in a total of 8 flexor tendons and 8 extensor tendons per group: Pulvertaft, double-sided nonlocking STS, and single-sided locking STS reconstructions. Load to failure was measured with a tensile testing machine. Increase in cross-sectional area following reconstruction was used as a measure of bulkiness at the reconstruction site.
Results: In extensor tendons, single-sided locking STS reconstructions showed a higher load to failure than Pulvertaft reconstructions, whereas no difference was found in load to failure between single-sided locking and double-sided nonlocking STS reconstructions. In flexor tendons, single-sided locking STS reconstructions showed a higher load to failure than Pulvertaft reconstructions. However, load to failure of single-sided locking STS reconstructions was less than double-sided nonlocking STS reconstructions. In both extensor and flexor tendons, the percent increase in cross-sectional area at the reconstruction site was higher in Pulvertaft reconstructions than single-sided locking STS reconstructions, whereas no difference was found between single-sided locking STS and double-sided nonlocking STS reconstructions.
Conclusions: Single-sided locking and double-sided nonlocking STS reconstructions are suitable alternatives to the Pulvertaft technique for tendon transfers owing to a higher strength and less bulkiness. In addition, both STS techniques do not require splitting and weaving of tendons, resulting in less interference in the normal tendon architecture and possibly a less harmful effect on tendon healing. Since the single-sided locking STS reconstruction is performed on only one side of the reconstruction, it is plausible that the single-sided locking STS reconstruction

results in less strangulation than the double-sided nonlocking STS reconstruction. Furthermore, a higher amount of suture material could lead to an increased foreign body reaction, resulting in fibrosis of the surrounding tissue. Since load to failure of both STS reconstructions did not differ in extensor tendon transfers, the single-sided locking STS reconstruction seems especially suitable for extensor tendon transfers.

A-0134 Evidence of Lumbrical muscle incursion into the Carpal Tunnel: An Ultrasonographical Study

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Introduction: During finger flexion, the tendons of flexor digitorum profundus migrate proximally, along with the attached origin of the lumbrical muscles. The aim of this study was to use high resolution ultrasound sonography to objectively measure the distance of lumbrical migration during finger flexion, relative to the distal border of the Transverse Carpal Ligament.
Methods: 15 healthy adult hands with no history of hand injuries were evaluated with neuromuscular ultrasound imaging. The ultrasonography was jointly conducted by two experienced sonographers by using an E9 GE machine using the linear matrix probe (8–16 MHz). The lumbrical muscle migration was measured as the participant move their fingers from full extension to 50% flexion, and then 100% flexion.
Results: The mean age of participants was 41 (SD = 6.73) and BMI was 26.5 (SD = 4.23). The lumbrical incursion was evident in all the participants' hands during full finger flexion (mean incursion = .56 mm, SD = .32 mm), with increase percentages of lumbrical migration as finger flex. Of the 60 lumbricals measures, the incursion occurred at 13% of fingers at 50% finger flexion, but increased to 72% during full finger flexion. The MCP joint range of motion of the index finger at the point where the lumbrical entered the distal border of the Transverse Carpal Ligament was 83.3° (SD = 7.6°) for the dominant hand, and 89.0° (SD = 11.40°) for the non-dominant hand. The mean (SD) of Carpal Tunnel circumference for the dominant hand was 1.57 (0.32) cm2 and 1.65 (0.17) cm2, and for the non-dominant hand was 1.33(0.25) cm2 and 1.56 (0.37) cm2 during finger extension and flexion, respectively.
Conclusion: This study showed direct evidence of lumbrical incursion into the Carpal Tunnel during finger flexion. The circumference of Carpal Tunnel increased during full finger flexion in comparison to full finger extension, supplementing the evidence of increase content, and possibly pressure, within the Carpal Tunnel.

A-0135 Metacarpal Subsidence Following Trapeziectomy

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Purpose: It is controversial whether subsidence after trapeziectomy prognosticates pain, poor outcomes, and need for revision. The aim of this study was to investigate the degree of subsidence following trapeziectomy and whether subsidence contributes to poor outcomes.
Methods: An IRB approved retrospective review of all patients who underwent trapeziectomy for osteoarthritis of the first carpometacarpal (CMC) joint was conducted from 2003 to 2019. Patients with available radiographic imaging greater than three months postoperatively were included. Patients with arthritis of the metacarpophalangeal joint of the thumb, arthritis of radiocarpal, distal radioulnar, and midcarpal joints were excluded. Demographic information, pain scores, and revision procedures were recorded. Conolly-Rath patient function scores were determined. Subsidence was measured by the ratio of the difference between the trapezial space (TS = distance from base of thumb metacarpal to scaphoid) preoperatively and TS postoperatively over the TS preoperatively. Patients were divided as having a high degree of subsidence ($\geq$50%) or low degree of subsidence (<50%). Pain scores (median and interquartile range) were compared before and after surgery, as well as between high and low subsidence groups using Mann-Whitney U tests. Age was compared between the two groups using an unpaired t-test. P value < 0.05 was considered significant.
Results: One-hundred-eighty-six patients, who underwent 211 primary trapeziectomies, were included. The average age at the time of surgery was 61 years (range 18–86). Eighty-five percent of patients were female. Average follow-up was 38.2 ± 31.9 months (range 3–146.5 months).

Metacarpal subsidence was present in all patients after trapeziectomy (average 58.0 ± 20.8%). There was no significant difference in age ($p = 0.49$), pre-

op ($p = 0.19$) or post-op ($p = 0.72$) pain between patients with high and low subsidence.

Sixty-eight percent of patients had high subsidence ($69.2 \pm 13.6\%$). The average age was 60 ± 10.6 years (range 18–86 years) and 80.9% were female. Pain decreased significantly from 6 (5–8) to 1 (0–2) ($p < 0.001$) after surgery. Based on Connolly-Rath scores 25.7% had good, 48.7% fair, and 25.7% poor outcomes.

Thirty-two percent of patients had low subsidence ($34.6 \pm 12.1\%$). In this group, the average age was 61 ± 8.7 years (range 37–84 years) and 87.4% were female. Pain decreased significantly from 7 (6–9) to 0 (0–3) ($p < 0.001$) in this group and there were 8.9% good, 33.9% fair, and 57.1% poor outcomes.

There were 7 revisions in 5 patients (revision rate 3.3%). There was one male and 4 female patients. All patients were right-handed. Right side was revised in 3 cases and left side in 4. In this cohort, after primary trapeziectomy, the average subsidence was $76.7 \pm 24.0\%$ (range 33.1%-100%). In 4 cases, the trapezial space increased after revision surgery (subsidence decreased from $72.0 \pm 28.0\%$ to $56.9 \pm 0.1\%$ after revision); in 1 case the subsidence increased (from 59.2% to 70.2%). One hundred percent subsidence persisted in 2 cases. Three patients had good outcomes, 1 fair, and 3 poor outcomes based on Conolly-Rath scores after revision.

Conclusions: Post-trapeziectomy, pain scores improved significantly in patients with both high and low subsidence. While all patients subside after surgery, it is rare that subsidence is symptomatic and requires revision.

A-0138 Venous congestion complications after digital replantation treated with medicinal leeches

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Aim: The aim of this study is to recall the importance and usefulness of using leeches for the treatment of digital after replantation venous congestion.

Materials and Methods: We included in the study 22 cases with complete amputations of the fingers with different level of amputation and only those cases in which the trauma mechanism was avulsion, thus where microsurgical anastomoses were not possible or the rate of vascular thrombosis, especially of the venous one, was high. Out of the 22 study cases, in 6 cases the amputation was at first phalanx (F1) level, in three cases arterial and venous anastomoses and in the remaining 3 cases only arterial anastomosis being performed. On postoperative day, two cases with venous congestion occurred from the ones without venous anastomosis. In the other three cases, venous thrombosis occurred on postoperative day 3. In 12 cases, the level of amputation was at second phalanx (F2). In 10 cases arterial anastomosis could be performed but the vein could not be microsurgicaly anastomosed, and in other two cases neither arterial nor venous microanastomoses were possible. In the four cases who underwent distal amputation (distal phalanx – F3) none of the necessary arterial or venous microanastomoses was performed, but only the reattachment of the amputated segment at bone and skin level. The application of medicinal leaches was initiated several hours postoperatively in cases of distal digital amputation when no vascular anastomosis was performed, as well as in cases where conventional treatment was not effective. In the remaining cases, medicinal leeches were placed after the first signs of venous congestion were present. Leeches were applied at the level of the "skin window" in the finger pulp, initially made for the local administration of heparin. Antibiotic treatment was administered in all cases for the prophylaxis of infections due to the most often intense contamination of lesions but also for the prophylaxis of possible Aeromonas hydrophila infections due to the use of medicinal leeches.

Results: The number of used leeches was two to four per day, and the length of treatment ranged between 4 and 7 days. Blood transfusion was not indicated in any case although hemoglobin levels fell below 9 mg/dL in four of the cases of F1- level digital amputations. No intolerance to leeches or psychological or emotional reactions during their application were recorded. MLT was used until the disappearance of venous congestion. The amputated segment survived in all cases

Conclusions: Biological leeches have in their saliva over 20 bioactive molecules with analgesic, antiinflammatory, platelet inhibitory, anticoagulant, thrombin regulatory, and antimicrobial functions. MLT cannot be defined as an alternative but rather complementary method. Its main advantages are: low-cost, relative ease of use, and high effectiveness. Patient consent and collaboration, as well as psychological preparation before using MLT are essential. The usefulness and use of leeches are possible and indicated not only in plastic surgery but also in the treat pathologies.

Keywords: finger amputation, replantation, venous congestion, leeches

A-0140 Surgical management of persistent dislocation of ulnohumeral joint after failed surgery for fracture-dislocation of the elbow

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Failed surgery for fracture-dislocation of the elbow is of problematic. Persistent dislocation of ulnohumeral joint results in pain, instability, and limited elbow motion, which ultimately develops into early arthritic changes. Revision procedures range from reconstructive surgery with or without hinged external fixator to total elbow replacement arthroplasty, but results are unsatisfactory. We introduce a novel surgical technique and describe its outcome after treating a consecutive prospective series of patients at our institute.

We evaluated five consecutive patients with persistently dislocated ulnohumeral joints after failed surgical treatment for fracture-dislocation of their elbows. For all patients, preemptive reduction and internal fixation of the dislocation was done using three transolecranon Steinmann pins. Then, reconstructive procedures for coronoid process, radiocapitellar contact, and lateral collateral ligament complex were performed. The pins were maintained for four weeks. The outcomes were evaluated using the Mayo Elbow Performance Score and quick Disabilities of the Arm, Shoulder and Hand (DASH) score. Degenerative changes in the joints were assessed using the system of Broberg and Morrey.

With an average follow-up period of 7.7 years (range, 5.9～10.1 years), stability was restored in every patient. The average DASH score was 11.6 (range, 4.2～20.4) and the average Mayo score was 90.0 (range, 75～100), with three excellent and two good results. The average extension/flexion arc of ulnohumeral motion was 124.0 (range, 95～140) degrees. One patient showed radiographic sign of arthrosis (grade 1). None of the patients required secondary intervention or experienced complications.

In conclusion, a stable and functional elbow could be restored in patients with persistent instability after failed surgery for fracture-dislocation by preemptive reduction and internal fixation of the ulnohumeral joint followed by reconstructive procedures.

A-0145 Why do patients with breast cancer visit hand clinic?

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Breast cancer is the most common type of cancer for women. Advancement in early diagnostic tools and in targeted therapy led to increased survival rate. This led quality of life to become an important issue for breast cancer survivors. Meanwhile, upper extremity morbidity is a significant complication following curative treatments for breast cancer. Lymphedema occurs in 36% after surgery, which results in stiff shoulder, rotator cuff tear, and upper extremity weakness. Chemotherapy, radiation therapy, or hormone therapy might result in pain at upper extremity. However, the actual incidence of the symptom and the causal relationship with the cancer are yet to be defined. For breast cancer survivors at our institute, therefore, we sought to describe their visits to hand clinic, and identify cancer-related factors that are predictive of the diagnosis.

Our retrospective study included patients with breast cancer who visited hand clinic at our institute from March 1995 to February 2019. We excluded the patients whose visit was because of traumatic injury or infection, whose visit was made before the diagnosis of breast cancer, or whose follow-up was less than six months. For 108 patients whose average age at visits was 57.3 years, we collected the diagnosis and treatment results. For the diagnoses, we searched for any presence of correlation with cancer-related factors.

The most common diagnosis was compressive peripheral neuropathy including carpal tunnel syndrome and cubital tunnel syndrome (46 cases), which was followed by trigger finger (42 cases), epicondylitis (20 cases), DeQuervain's disease (19 cases), ganglion cyst (16 cases), small joint arthritis (15 cases), lipoma (two cases), and palmar fibroma (one case). There were 30 nonspecific cases for which finger pain or stiffness could not be explained. Surgical managements were performed in 33 cases (10 cases for trigger finger, 19 cases of neurolysis, two cases for DeQuervain's disease, and two cases of mass excision), and the remaining 158 cases including the 30 nonspecific cases were conservatively managed. In cases of compressive peripheral neuropathy, past history of chemotherapy was found in 89% (41 among 46 cases), which was higher than in cases of other diagnoses. Among the 30 nonspecific cases,

73% (22 cases) were detected during hormone therapy, of which the value was significantly higher than that in other diagnoses.

In conclusion, breast cancer survivors were likely to experience a variety of hand-related symptoms. Patients who had history of chemotherapy were highly likely to have compressive neuropathy. Patients who visited the hand clinic during hormone therapy were highly likely to have no pathologic findings and their symptom might improve by observation. For appropriate management, a close communication is required between the physicians and the hand surgeons.

A-0150 High-energy, focussed shock wave therapy (ESWT) for delayed bone healing or non-union of forearm and hand

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In our department, ESWT was established as non-operative treatment option as well as a supplementary procedure, applied intraoperatively, to treat delayed bone healing (DBH) or non-union of the upper extremity.

A retrospective data analysis of our first case series 2014–2017 investigated the effect of ESWT with regard to the healing rate and time until consolidation, performed in 60 cases of 58 patients with DBH or non-union following a fracture, an arthrodesis or an osteotomy. The influence of age, location, time until ESWT, and treatment before and concomitantly with ESWT was analysed. The overall healing rate was 70% for both, DBH and non-union. The time until consolidation was at a mean 2.4 months with DBH and 2.8 months with non-union. The patients' age averaged 39 (DBH 46, non-union 36) years. Those, who healed, were non-significantly younger (DBH 44, non-union 35 years) than those with persistent non-union (DBH 51, non-union 37 years). Among DBH, 37% were smokers, 50% among non-union. The healing rate of the smokers was 68%, that of the non-smokers 70%, both without significant difference. The time between trauma/surgery and ESWT was 4.2 months with healed and 3.7 with persistent DBH, and 27 months for both, persistent and healed non-unions.

With regard to the preceding treatment before ESWT, the worst healing rate was found in patients, with conservative treatment (55%), followed by patients with $\geq$2 previous surgeries (66%), those without any previous treatment (73%), and those with one preceding surgery (75%). There was no statistically significant difference between groups. Statistics showed a moderate influence of the kind of surgery, previous to ESWT. The healing rate was 85% after a sole osteosynthesis, 64% if there was no preceding surgery, and 57% after ORIF with bone debridement/grafting.

Intraoperative ESWT, concomitant with bone debridement/grafting and osteosynthesis (n = 30) had in both groups a healing rate of 67%. ESWT alone or with partial removal of irritating osteosynthesis material (n = 23) resulted in 70% healing rate (DBH 60%, non-union 77%). An ESWT combined with osteosynthesis (n = 7) resulted in 86% healing rate (DBH 1 patient 100%, non-union 67%). Groups did not significantly differ.

With regard to the location, the best healing rate was seen in metacarpals/finger/thumb (10/11 = 91%), followed by the forearm shaft (7/8 = 88%) and meta-/epiphysis of the forearm (8/12 = 67%), and at last carpal bones with 59% (17/29). Statistics showed a moderate (non-union) and high (DBH) influence of the location on bone healing.

Conclusion: ESWT showed the best healing rate for metacarpals, finger and thumb, and worst for the carpus. A bone defect that necessitates debridement of the fragments and/or grafting, preceding or concomitant with ESWT, has the worst healing rate. The time between trauma/surgery and ESWT seems to play a minor role. No effect was seen for patients' age and smoking. Therefore, ESWT is effective in every stage of delayed bone healing or non-union, applied as sole treatment or as supplementary with surgery, including osteosynthesis and/or grafting.

A-0152 Acute and long-term costs of 268 peripheral nerve injuries in the upper extremity

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Background: Peripheral nerve injury in the upper extremity is linked to high socioeconomic burden,

yet cost-analyses are rare and from small cohorts. The objective of this study was to determine the costs and long-term socioeconomic effects of peripheral nerve injuries in the upper extremity in Germany.
Methods: We analyzed data of 250 patients with 268 work-related upper extremity nerve injuries from acute treatment to long-term follow-up on rehabilitation, sick-leave and disability-pension.
Results: Patients were on average 39.9 ± 14.2 years old, male (85%) and mean inpatient treatment was 7 ± 6 days. Location of nerve was 8% (N = 19) proximal to the wrist, 26% (N = 65) at the wrist and metacarpus, and 66% (N = 166) at phalangeal level. Acute in-patient treatment for (single) median nerve injury accounted for 66% with hospital reimbursement of 3.570€, ulnar nerve injury for 24% and 2.650€ and radial nerve injury for 10% and 3.166€, all including finger nerve injuries. The remaining were combined nerve injuries, with significantly higher costs, especially if combined with tendon 5.086€ or vascular injury 4.886€. Based on location, nerve injuries proximal to the wrist averaged 5.360 ± 6.429€, at the wrist and metacarpus 3.534 ± 2.710€ and at the phalangeal level 3.418 ± 3.330€. 16% required rehabilitation with average costs of 5.842€ and stay of 41 ± 21 days. Sick leave was between 11–1109 days with an average of 147 days with socioeconomic costs of 197€/day, equaling on average 17.640€. 30% received a mean yearly disability pension of 3.187€, that would account to 102.167€ per lifetime.
Conclusion: This large German patient sample indicates that nerve injury has a major impact on function and employment, resulting in significant health care costs. Both proximal and distal nerve injuries led to long-term disability, subsequent sick-leave and in 30% to permanent disability pension. These data are determined to support future studies and health economical work on prevention, treatment and rehabilitation of these often small injuries with great consequences.

A-0155 Improvement of lunate perfusion after radial closing wedge osteotomy in patients with Kienböck's disease

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Background: Radial closing wedge osteotomy is a widely accepted treatment for Kienböck's disease. However, despite favorable long-term clinical outcomes, its impact on lunate perfusion has not been documented. The purpose of this study was to determine whether radial closing wedge osteotomy improved lunate perfusion in gadolinium (Gd)-enhanced magnetic resonance imaging (MRI).
Methods: We conducted a retrospective review of 12 patients with Kienböck's disease who received radial closing wedge osteotomy. The average age at the time of surgery was 25 years. Non-contrast or contrast MRI was performed in all patients preoperatively. After bone union, implants were removed and contrast MRI was used. One patient was classified as Lichtman stage II, three as stage IIIA, and eight as stage IIIB. The percent volume of the perfused portion of the lunate was assessed through MRI, and pre- and postoperative values were compared.
Results: At the most recent follow-up, the average DASH score for all patients had improved from 43.7 to 6.2. Fragmentation, collapse, and perfusion of the lunate were assessed qualitatively using preoperative and postoperative MRI. For seven patients who received contrast-enhanced MRI pre- and postoperatively, perfusion increased from 24% preoperatively to 54% postoperatively ($p = 0.018$) when using our method of measuring the perfused portion of the lunate. This method showed satisfactory reproducibility.
Conclusions: Radial closing wedge osteotomy yielded excellent clinical outcomes and increased lunate perfusion in Gd-enhanced MRI. This surgery appears to both heal and unload the lunate.

A-0156 Long term Results of Elektra prosthesis compared to resection-suspension arthroplasty for thumb carpometacarpal osteoarthritis

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The present study compares 34 patients with thumb carpometacarpal osteoarthritis (37 thumbs) treated with the Elektraprosthesis, with 18 patients (18 thumbs) treated with resection-suspension arthroplasty, with an overall mean follow-up period of 13.3 years. Evaluation with disability of arm and shoulder scores, pain via visual analogue scale and range of motion (radial and palmar abduction, and opposition) indicated no significant difference. However, the cohort with a surviving prosthesis

showed significantly better subjective grip strength (p ¼ 0.04). Complications occurred in 23 of the 37 thumbs in the prosthesis group compared with two in the resection-suspension arthroplasty patients. Seventeen prostheses required revision. At revision operations, we observed local signs of metallosis in 15 of 17 cases. The patients receiving resection-suspension arthroplasty were more satisfied with their treatment (p ¼ 0.003). Therefore, we cannot recommend the implantation of Elektraprosthesis and we speculate that the key problem of aseptic cup loosening is a result of the metal-on-metal bearing.

A-0158 Creation of a ''Bio-Screen'' through Multiple Nerve Transfers to a Single Target Muscle for High Fidelity Prosthetic Control

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Background: Muscles are effective translators of neural function. In recent years we have demonstrated the feasibility of man-machine interfacing via ''Bio-Screens''. This is achieved by redirecting nerves, which have lost their target after amputation, to new targets. Yet only basic extremity function of myoelectric prosthesis can be provided, as the amount of muscle signals is insufficient for intuitive control. Here we present a novel procedure by transferring multiple nerves onto a single target muscle to increase the resolution of neural signaling and thus prosthetic control in a rat model.
Methods: Using a surgical microscope, the anatomy and surgical feasibility was evaluated. In the main trial, the distal branch of the ulnar nerve alone or together with the anterior interosseus nerve were transferred to reinnervate the long head of the biceps muscle in Sprague-Dawley rats. After twelve weeks of regeneration, we analyzed the muscle function by estimating the motor unit number using newly developed thin-film multi-channel EMG-electrodes. Structural analyses included retrograde labeling and quantification of muscle fiber type populations.
Results: Constant anatomy was given in all animals and all nerves presented successful reinnervation. The number of motor units significantly increased in both single and double nerve transfer groups compared to untreated muscles (hyper-reinnervation). Muscle fiber type populations are expected to become physiologically similar to the originally innervated muscle. As analyses are ongoing, detailed results will be presented at the conference.
Conclusion: This rat model demonstrates, that a muscle can reliably host multiple nerves and that topographically distinct compartments will emerge within the target muscle that can be activated independently. This approach thus leads to a polytopic neural matrix that can display sets of motoneurons of the entire motoneuronal population of the amputated limb. High density EMG pick-up electrodes and adequate signal processing can decipher the neural code and be used for high-fidelity prosthetic control.

A-0159 MR imaging of peripheral nerves using targeted application of contrast agents: an experimental proof-of-concept study

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Introduction: Current imaging modalities for peripheral nerves display the nerve's structure but not its

function. Based on a nerve's capacity for axonal transport, it may be visualized by targeted application of a contrast agent and assessing the distribution through radiological imaging, thus revealing a nerve's continuity. This concept has not been explored, however, may potentially guide the treatment of peripheral nerve injuries. In this experimental proof-of-concept study, we tested imaging through MRI after administering gadolinium-based contrast agents which were then retrogradely transported.

Methods: We synthesized MRI contrast agents consisting of paramagnetic agents and various axonal transport facilitators (HSA-DTPA-Gd, chitosan-DTPA-Gd or PLA/HSA-DTPA-Gd). First, we measured their relaxivity values in vitro to assess their radiological suitability. Subsequently, the sciatic nerve of 24 rats was cut and labeled with one of the contrast agents to achieve retrograde distribution along the nerve. One week after surgery, the spinal cords and sciatic nerves were harvested to visualize the distribution of the respective contrast agent using 7T MRI. In vivo MRI measurements were performed using 9.4 T MRI on the 1st, 3rd and the 7th day after surgery. Following radiological imaging, the concentration of gadolinium in the harvested samples was analyzed using inductively coupled mass spectrometry (ICP-MS).

Results: All contrast agents demonstrated high relaxivity values, varying between 12.1 and 116.0 mM−1s−1. HSA-DTPA-Gd and PLA/HSA-DTPA-Gd application resulted in signal enhancement in the vertebral canal and in the sciatic nerve in ex vivo MRI. In vivo measurements revealed significant signal enhancement in the sciatic nerve on the 3rd and 7th day after HSA-DTPA-Gd and chitosan-DTPA-Gd ($p < 0.05$) application. Chemical evaluation showed high gadolinium concentration in the sciatic nerve for HSA-DTPA-Gd (5.218 ± 0.860 ng/mg) and chitosan-DTPA-Gd (4.291 ± 1.290 ng/mg).

Discussion: In this study a novel imaging approach for the evaluation of a peripheral nerve's integrity was implemented. The findings provide radiological and chemical evidence of successful contrast agent uptake along the sciatic nerve and its distribution within the spinal canal in rats. This novel concept may assist in the diagnostic process of peripheral nerve injuries in the future.

A-0163 Is sufficient treatment of Kienböck's disease possible using the osteochondral flap from the lateral femorla condyle?

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Introduction: Cause of Kienböck's disease is still not clear, so the approaches of surgical treatment are versatile. In our opinion vascularization is the central problem of the lunate. Because of this we use the vascularized osteochondral flap from the medial femoral condyle (MFCC) since many years for this indication, many times with continuing good results. Aim of this procedure is to reconstruct the most time damaged proximal articular surface of the lunate and to revascularize the bone.

In cases, where the approach to the medial condyle is not possible or the region is altered because of trauma or prior surgery, we use since some years, the osteochondral flap from the lateral femoral condyle (LFCC). Vascularization of this region is well documented and dependably.

Methods: Between 2012 and 2019 we operated on 17 patients because of Kienböck's disease using the LFCC. The patients suffered from different stages of Kienböck's, most of them stage 3. There have been nine women and eight men.

We used volar or dorsal approaches to the carpus, depending on the most affected part of the lunate. The flaps were fixed press fit or with K-wires or screws. The wrists were stabilized with forearm cast for eight weeks following intensive hand therapy. The knees were not fixed, weight bearing mobilization started three days after surgery. Physiotherapy is focused on strengthening the quadriceps especially centering of the patella.

Bony healing is checked using CT scan.

Results: Median age of the patients was 36.6 years (19 to 66). They suffered on wrist pain between six and 70 months. Eight of the patients showed balanced ulna length, four an ulna plus and four an ulna minus variant.

Approach had been carried out from volarly in six and dorsally in ten patients. Without two, all patients showed sufficient bony healing in the follow-up. Two patients reported same pain level or worsening compared to before the operation. The remainders

reported significant pain reduction up to total pain relieve.

Radio-scaphoid angle remained nearly constant with median 60,85° before and 58,5° after reconstruction. We found similar results of modified carpal-height ratio with a median of 1,405 before and 1,43 after operation.

Donor site troubles lasted two to three months in most of the affected. Only two patients indicated from pain after walking downhill over longer time. There have been no reports of instability or luxation of the patella. X-rays showed no signs of arthritis.

Conclusion: In our hands the LFCC seems to be an interesting and reliable alternative to the MFCC in treatment of Kienböck's disease. Especially in stage 3a-c, there you can reach nearly anatomical results with good functional outcome.

Because of midterm follow up to 70 months we think that further progression of the lunate destruction can be avoided in many cases. Many of the affected can come back to their earlier job.

Limitations from donor-site fade away after two to three months on average and comeback to sport is possible most time.

A-0164 Intramedullary screw fixation of metacarpal and phalangeal fractures – a systematic review of 682 patients

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Introduction: Intramedullary fixation with cannulated headless compression screws has been increasingly used as an alternative treatment option in metacarpal and phalangeal fractures of the hand. Several cohort studies have yielded promising results. The aim of this systematic review is to gain insight on the clinical and radiological outcome reported in literature following this novel fracture fixation method.

Methods: A comprehensive literature search of Pubmed, Embase, CENTRAL and CINAHL databases was conducted on November 5th 2020. All studies reporting on fracture union, complications (non-union, delayed union, loss of reduction, infection, limitation of joint motion, screw protrusion, and complex regional pain syndrome), functional and patient-rated outcomes of intramedullary screw fixation of metacarpal and/or phalangeal fractures were included.

Results: In total two prospective and 15 retrospective cohort studies were included with a total of 682 patients and 780 fractures (553 metacarpal, 191 proximal phalangeal and 36 middle phalangeal). Union was ultimately attained in all fractures. Delayed union occurred in five patients with proximal phalangeal fractures accounting for a delayed union rate of 0.7% for the entire study population and 2.6% for the subgroup with proximal phalangeal fractures. The overall complication rate was 4.1%. The most frequent complication was joint stiffness occurring in 1.9%. The incidence of other complications including loss of reduction, infection, and screw protrusion did not exceed 1%. Overall mean total active motion averaged 245 degrees and grip strength reached 97.7% of the contralateral side. The duration of sick leave averaged 6.9 weeks and the DASH score amounted to 3.3 points at latest follow-up.

Conclusion: According to the findings in this systematic review, intramedullary screw fixation is a safe method for both metacarpal and phalanx fractures with a low complication profile yielding promising results in the short- to medium-term follow-up.

Keywords: osteosynthesis, intramedullary screw, metacarpal fracture, phalangeal fracture

A-0167 Diagnostic accuracy of history taking, physical examination and imaging for non-chronic finger, hand and wrist ligament and tendon injuries: a systematic review update

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Objective: The diagnostic work-up for ligament and tendon injuries of the finger, hand and wrist consists of history taking, physical examination and imaging if needed, but the supporting evidence is limited. The main purpose of this study was to systematically update the literature for studies on the diagnostic accuracy of tests for detecting non-chronic ligament and tendon injuries of the finger, hand and wrist.

Methods: Medline, Embase, Cochrane Library, Web of Science, Google scholar ProQuest and Cinahl were searched systematically from 2000 up to 6 February 2019 for eligible studies. Methodological

quality was assessed, using the Quality Assessment of Diagnostic Accuracy Studies (QUADAS-2) checklist. Sensitivity (Se), specificity (Sp), accuracy, positive predictive value (PPV) and negative predictive value (NPV) were extracted from the eligible studies.
Results: A total of 23 diagnostic studies were finally identified, assessed and interpreted. Two studies had low risk of bias on all quality domains. In 8 of the 23 studies, patient selection was not well documented. Furthermore, the risk of bias was predominantly influenced by the lack of a proper description of the index test (30%, 7/23) or the reference standard (65%, 15/23). Regarding flow and timing, not all patients received the reference standard in four studies (22%, 5/23).

None of the studies evaluated the diagnostic accuracy of history taking. Physical examination for diagnosing lesions of the triangular fibrocartilage complex (TFCC) showed Se, SP, accuracy, PPV and NPV ranging from 58–90%, 20–69%, 56–73%, 53–71% and 55–65%, respectively (2 studies). For physical examination in hand and finger injuries the Se, Sp, accuracy, PPV and NPV ranged from 88–99%, 75–100%, 34–88%, 91–100% and 75–95%, respectively (3 studies). The accuracy of Magnetic Resonance Imaging (MRI) with high-resolution (3 tesla) techniques for TFCC and interosseous ligaments of the proximal carpal row ranged from 89–91% and 75–100%, respectively (4 studies). The accuracy of MRI with low-resolution (1.5 tesla) techniques for TFCC and interosseous ligaments of the proximal carpal row ranged from 81–100% and 67–95%, respectively (4 studies).
Conclusions: Our systematic review showed that there is still a gap in knowledge regarding valid diagnostic tests for non-chronic wrist ligament and tendon injuries. Additionally and for the first time, the lack of high-quality evidence for the diagnosis of ligament and tendon injuries in the hand and fingers has been highlighted as well. Most studies showed a considerable underreporting of important quality domains. Although a common practice in hospital care, no studies were identified on the diagnostic accuracy of history taking for non-chronic ligament and tendon injuries of the wrist in previous reviews and in current systematic review update. This systematic review update included one new study on physical examinations for diagnosing non-chronic ligament and tendon injuries of the wrist, which did not affect the previous conclusion that physical examination is of limited value for diagnosing non-chronic ligament and tendon injuries of the wrist. Some imaging modalities seemed to be acceptable for the diagnosis of ligament and tendon injuries in the wrist in patients presenting to secondary care.

A-0168 Psychometric qualities of the PRWHE-DLV in patients with wrist complaints in primary care

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Objective: The course, disability, and functionality of wrist complaints is still compendious in primary care guidelines, despite the high prevalence and the fact that these patients are most likely to be treated by their general practitioner. By quantifying subjective complaints and disabilities the Patient Reported Outcome Measure prevents observer bias and enables the GP to monitor the symptoms in time. It was of great importance that the psychometric qualities of the Patient Rated Wrist/Hand Evaluation (PRWHE-DLV) were investigated, since a limited amount of research has been conducted in this area and research in primary care was not available.
Methods: A prospective cohort study was conducted to examine psychometric qualities of the Dutch version of the PRWHE-DLV among adults with (sub)acute wrist complaints in primary care. The inclusion criteria were: (sub)acute wrist pain (traumatic, non-traumatic), age of 18 year or older, wrist complaints located distal of the ulna and radius and proximal of the phalanges and duration of the wrist pain less than 3 months. The content validity was validated by assessing the floor and ceiling effects of the PRWHE-DLV. To assess whether the PRWHE-DLV produces reproducible, consistent results on repeated administration moments, we tested the test-retest reliability between T0 (the first contact moment with the patient) and T1 (2–5 days later) by determining the Intra-class Correlation Coefficient (ICC two-way mixed single measures). The construct validity was assessed based on the correlation between the PRWHE-DLV and the Quick-DASH, Physical Component Score (SF-12), VAS-function, Physical Functioning (SF-12), VAS-pain and Bodily Pain (SF-

12). Responsiveness was defined as the ability of the PRWHE-DLV to detect clinically important changes within 3 weeks after T0, by calculating ES (T2-T0)/SDT0) and SRM (T2-T0/SDchange).

Results: A total of 43 patients (27 women) with a mean age of 44.7 years (SD 17.5) were enrolled into the study. Regarding content validity, none of the 97 completed questionnaires had the best score (95–100 points) and only 12.7% scored between zero and five, which was below the predefined threshold of 15%. Test–retest reliability for the PRWHE-DLV total (n = 29; ICC = 0.90; 95% CI 0.80–0.95), PRWHE-DLV function (n = 29; ICC = 0.90; 95% CI 0.80–0.95) and PRWHE-DLV pain (n = 32; ICC = 0.86; 95% CI 0.74–0.93) was excellent. SEM (n = 29) was measured to be 3 (9.48 * $\sqrt{}$0.10). In general there was a strong correlation of the PRWHE-DLV with the different questionnaires for comparison. Patients with no meaningful changes (n = 13) scored a decrease in mean of 9.73 (95%CI = −17.95 to −1.51) and patients who defined their complaints as much better (n = 11) scored −22.86 (95%CI = −31.98 to −13.75). This resulted in a MIC of −13.13. MDC was calculated for 29 patients to be 8.32.

Conclusions: Psychometric qualities demonstrated high content validity, excellent reliability, high construct validity with the validated Quick-DASH and VAS score and high responsiveness. Therefore, the PRWHE-DLV is strongly recommended for the primary care guidelines and further research.

A-0171 The upper limb falling reflex; the dynamics of how we fall

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Ethical considerations limit the ability to perform real life assessments of falling. We have had access to published videos of skateboarders falling.

The hypotheses were that there would be typical patterns of falling and the fingers typically avoided impact with he ground until after the wrist.

The aim of the study was to assess in detail the upper limb biomechanics when falling.

Methods: We had access to the original videos of films published on YouTube of skateboarders falling thus ethically allowing detailed analysis.

We assessed the speed of the individual,and the height and duration of the falls by using the standard length of the skateboard (80 cm) as the measure of distance. Mostly we undertook a qualitative analysis assessing the motions of falling and in particular what part of the upper limb impacted the ground first.

Results: We assessed 24 falls in nine young men aged 13–16 years old. The calculated time of the fall was a mean of 0.36 (range 0.20–0.50) secs. There were 16 falls predominantly forwards and eight backwards. Fifteen fell first onto their right hand. There was a mean speed of 4.3 (15.5 kph) (range 2.7–6.9) m/s. This is strikingly comparable to other reports of skateboarding speeds.

The patterns of movement of the upper limbs were repeated consistently with the arms elevating (flexing for a fall forwards or extending for a fall backwards) at the shoulders and extending nearly but not fully at the elbows. Quickly the arms align roughly parallel to the line of the fall and adapt to continue to be parallel as the body position changes. The wrists initially extend to c. 40–500 with the fingers mildly flexed at the metacarpo-phalangeal joints and straight at the inter-phalangeal joints. This upper limb ''ready'' position was achieved within a mean of 0.13 (range 0.035–0.3) secs.

As the hands approach the ground the fingers start to hyper-extend at the MP joints gradually over < 0.1 secs. To allow MP joint hyper-extension the wrists flex less to around 300 of extension. The pulps of the fingertips impact the ground first. The fingers hyperextend maximally almost as a rolling motion as the fall continues until the distal palms impact the ground with the main force apparently being taken through the proximal palms. Wrist extension increases to a maximum as the fall force is applied. Mostly the wrists extended maximally to 70–900.

Discussion: This is the first study to show the dynamics of upper limb movement upon falling. It shows that ''normally'' the fingers impact the ground first contrary to our hypothesis. This explains the frequency of finger injuries. The mechanism of the upper limb falling reflex helps to maximise the surface area of impact so minimising peak forces across the wrist. It also shows that the mechanisms to fall safely are complex hence why they can fail leading to injury.

At what age the reflex starts and how it changes with ageing are not established.

A-0172 Treatment Strategies for Injuries of the "Unforgiving" Radial Sensory Nerve

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Introduction: Neuropathic pain of the superficial branch of the radial nerve (SBRN) caused by adhesions or neuroma formation remains challenging to achieve satisfactory results in pain relief. This study was conducted to compare different surgical treatment methods for SBRN neuralgia. In addition, we explored the prognostic value of a pre-operative diagnostic nerve block.
Materials and Methods: We performed a retrospective cohort study and included patients with SBRN neuralgia caused by lesions or adhesions; compression neuropathies were excluded. Surgical records were searched for procedures on the SBRN between 2001 and 2009 in Rotterdam, and between 2015 and 2019 in Utrecht, performed or supervised by a single surgeon. Patient satisfaction was scored as satisfied or unsatisfied. The second outcome was pain intensity, scored with the numerical rating scale (NRS), measured pre- and postoperatively, and after a diagnostic lidocaine block.
Results: We included 71 patients: 25 male, 46 female, mean age 43 years (SD 14 years), 43 patients with a SBRN neuroma and 28 patients with SBRN adhesions. The mean duration of pain was 34 months (SD 47 months). An iatrogenic cause was found in 79%. The mean follow-up duration was 32 months (SD 24 months). In patients with a neuroma, more patients (53% vs 0%, $p < 0.001$) were satisfied after proximal denervation and burying into the brachioradialis muscle (BRM) compared to other burying techniques. In patients with adhesions of the SBRN, 39% was satisfied after neurolysis. If neurolysis or denervation did not suffice, an additional 38% was satisfied after denervation of the LABCN or PIN. In patients with a poor nerve block effect (<3.5 decrease in NRS), the post-operative NRS pain scores were significantly higher (4.3 vs 7.3, $p = 0{\cdot}005$) and none were satisfied. In addition, we found that a lidocaine block can predict the effect of denervation and burying into BRM.
Conclusions: From the results of this retrospective study, we can provide treatment strategy of neuralgia of the SBRN caused by (suspected) injury. After a good result of a diagnostic nerve block, either a neurolysis or proximal denervation and burying into the BRM should be performed. If pain persists, denervation of the LABCN followed by the PIN should be considered.

A-0173 Alterations in Myelinisation of the Painful Nerves, Proximal to the Site of Injury

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Introduction: Neuropathic pain due to nerve injury and neuroma formation is difficult to treat. Damage to motor neurons is often accompanied by cell death in the dorsal root ganglia, which can be prevented by reconnection to a target muscle. After damage to sensory nerve fibers, pain may develop despite of reconstructive surgery. In these patients, usually denervation surgery remains their last option to treat the pain. Previous studies have shown that after nerve lesion, electrophysiological changes develop proximal to the injury, which indicates possible irreversible changes. With this study, we aim to demonstrate these proximal structural changes in the sensory nerve after nerve damage on a histopathological level.
Materials and Methods: Surplus of human painful nerve specimen were obtained during routine proximal nerve denervation surgeries. Also, human non-painful nerve specimen were obtained from patients with nerve surplus due to other surgical interventions. Nerve specimens were cut transversely and myelinated and non-myelinated axons were analysed by an experienced neuro-pathologist. Signs of demyelinisation and remyelinisation were counted. This study was approved by the Review Committee Biobank.
Results: We obtained 11 human painful nerve specimens: 2x radial superficial nerve (RSN), 2x saphenous, 2x peroneal, 1x occipital, 2x palmar branch of the median nerve (PBMN), 1x posterior interosseous, 1x lateral antebrachial cutaneous nerve and 2 control nerve specimen: occipital and sural nerve. Painful nerves showed a loss of large myelinated fibers in 73% (8/11), control nerves did not. Interestingly, all painful nerves had a normal count of non-myelinated C-fibers. Two painful nerves show onion bulbs (i.e. concentric layers of Schwann cells surrounding axons), a sign of repetitive demyelinisation and remyelinisation and two painful nerve shows delamination of the myelin sheets.

Conclusion: A majority of the painful nerves show loss of myelinated nerve fibers, but no loss of unmyelinated fibers, and thus an altered ratio of myelinated axons/non-myelinated axons. To our knowledge, this histopathological finding of structural changes in the nerve end proximal to the nerve injury are new. Our results concur with previous reports of reduced conduction velocity in the proximal nerve end. We feel that the imbalance between myelinated and non-myelinated nerve fibers may contribute to the development of chronic pain.

A-0180 Reconstruction of severely hypoplastic thumb by non-vascularized metatarsal graft with abductor digiti minimi opponensplasty

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Pollicization of index finger has been usually recommended for Blauth IIIb and IV hypoplastic thumb. Although functional result of the pollicization is satisfied, majority of the family desires to keep the number of the digits. We developed two-stage reconstruction procedure, distal two-thirds of the fourth metatarsal bone graft (non-vascularized) with widening of the first web followed by abductor digiti minimi (ADM) opponensplasty.

From 1980–2018, 76 patients (41 boys and 35 girls) were reconstructed. In the first stage, the distal two-thirds of the fourth metatarsal is transplanted in the reverse manner to form the first carpometacarpal joint without microvascular anastomosis. Widening of the first web is performed using a dorsal sliding flap. More than six months later, ADM opponensplasty is carried out. Extensor indices proprius (EIP) and flexor superficialis of ring finger (FDS-R) transfer was respectively added in the second stage. 41 patients were classified to IIIb and 35 were IV. Average ages at the surgery was 3.2 years old. In type IV, metatarsal bone graft was indicated under the condition that the thumb is larger than small finger. Fourth metatarsal head was used in 64 cases and fourth metatarsophalangeal joint including proximal phalanx was used in 12 cases. Follow-up periods were from 5.2 months to 277 months, average 77.2 months.

Except one case, bony union between grafted metatarsal and distal part of first metacarpal was acquired without significant bony absorption. Fracture of the grafted bone was seen in two cases and additional bone grafts were performed. In the majority of the cases, epiphysis of the grafted bone was remained open more than five years and the functional results are acceptable with high degree of family's satisfaction. Carpometacarpal joint mobility and metacarpophalangeal joint stability were important for good functional results. Metatarsal bone graft with epiphysial plate could be an alternative procedure to pollicization of index finger.

A-0182 A review of nerve transfers for ulnar nerve injuries

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Background: Ulnar nerve injuries have a lower chance of motor recovery when compared to the median nerve for similar injuries. Prior to the advent of nerve transfers, a high ulnar nerve injury would not result in any useful recovery in intrinsic musculature in an adult. The likely reason for this is that the long re-innervation distance in a mixed nerve would result in an irreversible loss of motor end plates and muscle atrophy. This leaves the patient with a loss of dexterity, weakness of grip, sensory loss and a noticeable aesthetic deformity. Tendon transfers were historically used to treat these injuries, but they are physically limited by the principles of singular, linear function and struggle to emulate the natural, intricate multi-faceted functionality of the intrinsics. With the knowledge that muscles had to be re-innervated in 12–18 months to prevent chronic denervation, nerve transfers have been gaining popularity over the last 2 decades for the treatment of high ulnar nerve injuries, transporting expendable regenerating axons close to the motor end plates for the best possible outcome. Methods: We performed an extended review of the literature for all articles published on the treatment of ulnar nerve injuries using nerve transfers. We included the Medline, PubMed, Cochrane and CINAHL databases. There were 19 articles in total, 14 were using median innervated donors and 3 of these were comparative studies. 3 articles were using radial innervated donors for combined ulnar and median nerve injuries. The two articles not included in the tables were one with nerve transfers for wrist amputations and one that looked at pure sensory nerve transfers. We only included peripheral nerve injuries and excluded studies with compressive or inflammatory pathology. In studies with combined aetiology, we included them if individual data was provided for just the traumatic injuries. Results: We report the outcomes from the published literature on

nerve transfers for ulnar nerve injuries as well as discuss the various techniques including the end to end (ETE) or end to side (ETS) transfers and also looked at literature comparing nerve transfers to repair and nerve grafting alone. Most of the studies employed the use of the anterior interosseus nerve (AIN) transfer to the motor branch of the ulnar nerve (MUN), either alone or combined with a sensory transfer. Conclusion:Further research is needed to prove the efficacy of ETS neurorrhaphies and the most effective technique for this but in the interim we recommend using conventional ETE nerve transfers for Sunderland grade IV-V injuries in the proximal ulnar nerve. Although a clinical equipoise might exist with regards to the treatment options for most nerve injuries due to lack of evidence, we believe that high ulnar nerve injuries in particular have sufficient evidence to warrant a distal nerve transfer and units treating upper limb injuries should be aware of this to avoid unwarranted delay in treatment that could adversely affect outcome. If these techniques are not within the treating surgeon's armamentarium, patients should be referred on to peripheral nerve injury centres that offer them.

A-0184 Prosthetic Replacement of the Wrist

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Purpose: Current indications for total wrist arthroplasty include patients with symptomatic end stage post-traumatic wrist arthritis, rheumatoid arthritis, PRC failures and Kienböck disease. We reported our experience with 3 different models of total wrist arthroplasty according to patients demand as an alternative to arthrodesis.
Methods: Since 2003 we performed 50 prosthetic replacements of the wrist joint, TWA in 46 patients (2 bilateral) with a long term follow-up (average follow-up 10 years, min 1 max 17) and 2 emi-arthroplasty. Among the overall TWA in 13 cases patients were affected by posttraumatic conditions and 33 patients were affected by rheumatoid arthritis, 34 females and 12 males. In 11 cases we used a Re-Motion device, in 26 cases we used a Universal 2 semiconstrained prosthetic device and since 2015 we performed 11 Freedom implants. Objective and subjective data were recorded at follow-up including standard X-rays controls, Short and long-term complications are discussed. The rehabilitative program utilizes range of motion active exercises with a Hand Therapist after two weeks, while protecting the arthroplasty with volar static splint for four weeks.
Results: All cases returned for radiological and clinical follow up evaluation except two (deceased). All patients had good or complete relief of pain. Average patient satisfaction was rated as 9 (0–10), hand grip and pinch strength improved post-operatively when compared to pre-operative evaluation scores. There was improvement in the range of movements and improvement of functional scores (Q-DASH and PWRE). We recorded 5 minor short-term complications (2 marginal skin necrosis, 1 imbalance, 1 ulnocarpal abutment, 1 radio- carpal synostosis), 6 implants were converted to Swanson silicon spacer or TWF, in 8 cases we performed a revision surgery.
Conclusions: Total wrist prosthetic replacement provides pain relief and improves function in severe degenerative arthritis/arthrosis. Our numbers and results with TWA are encouraging and represent a good alternative to arthrodesis. Indications to prosthetic arthroplasties can be extended to post-traumatic conditions according to the improved biomechanic features of the most recent prosthetic models

A-0186 Autologous Fat Transplantation for Thumb Carpometacarpal Joint Osteoarthritis (Liparthroplasty): A Case Series with 2 Years of Follow-up

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Adipose-derived stem cell therapy is currently in the focus of regenerative medicine and is evolving into a promising, less-invasive approach to osteoarthritis treatment compared to common surgical techniques, e.g. trapeziectomy or prosthesis implantation. The present study aims to examine the effect of 1 ml intraarticular autologous fat transplantation in 31 thumb carpometacarpal osteoarthritis patients (27 woman and 4 men) with a median age of 58 (inter-

quartile range (IQR): 10) years and Eaton-Littler stage 2 or 3. Median pain levels assessed via visual analogue scale significantly decreased from 7 (IQR: 2) to 4 (IQR: 6) after 6 months ($p < 0.0001$) and 2 (IQR: 5) after 2 years ($p < 0.0001$). Median pre-interventional DASH Scores of 59 (IQR: 26) significantly reduced to a value of 40 (IQR: 43) after 6 months ($p = 0.004$) and to 35 (IQR: 34) after 2 years ($p < 0.0001$). Subjective grip strength showed no significant, postinterventional improvement. Potential time until recurrence of initial symptoms was noted. Satisfaction rates were 68% after 6 months and 74% after 2 years. In conclusion, autologous fat transplantation represents a promising option to reduce pain and functional impairment as well as to postpone surgery for a certain time.

A-0187 Outcome of Simple Decompression of Primary Cubital Tunnel Syndrome based on Patient Reported Outcome Measurements

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Purpose: The aims of this study were to evaluate the patient reported outcomes of patients with primary cubital tunnel syndrome and to assess whether preoperative symptom severity affects the postoperative outcomes.
Methods: Patients who underwent simple decompression for primary cubital tunnel syndrome were selected from a prospectively maintained database. Outcome measurements consisted of the Boston Carpal Tunnel Questionnaire and visual analogue scales for function, pain and satisfaction with their hand at intake and 6 months postoperative. Also, 6 months postoperatively, patients received a question about how satisfied they are with the overall treatment. To determine a possible influence of preoperative symptom severity on postoperative outcomes, the population was divided into quartiles based on symptom severity at intake.
Results: One hundred and forty-five patients were included in the final analysis. All patients improved on average on the Boston Carpal Tunnel Questionnaire and the visual analogue scales of function, pain and satisfaction with hand function. The subgroup of patients with the mildest symptoms at intake did not improve significantly, while the patients with the most severe symptoms at intake did. However, all subgroups did significantly improve on the Visual Analogue Scale of pain. Moreover, no difference in satisfaction with treatment result between the severity of symptoms at intake was found.
Conclusions: This study shows that simple decompression of primary cubital tunnel syndrome is an effective treatment in terms of patient reported outcomes. All patients report to be equally satisfied with treatment result, which shows that this is not dependent on the symptom severity on intake. This indicates that satisfaction with treatment result is mostly determined by pain reduction. The findings of this study can be implemented in clinical practice to improve preoperative counselling of patients with primary cubital tunnel syndrome.

A-0193 Wrist Angle Measurements in Predicting the Presence of a Scaphoid Fracture

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Hypothesis: Some studies have evaluated the associations between radiographic measurements and scaphoid malunion or nonunion. While we believe these radiographic measurements may be helpful in predicting instability and the ultimate development of nonunion, it is unclear how helpful these measurements are to diagnose a suspected scaphoid fracture. We hypothesized that four angles used to evaluate wrist alignment (lateral scapho-lunate, radio-scaphoid, radio-lunate, and radio-capitate angles) and the cortical ring sign do not predict the presence of a displaced scaphoid fracture.
Methods: A retrospective evaluation of wrist radiographs and corresponding CT scans performed as standard of care for patients with the diagnosis of a scaphoid fracture between 01/01/2017 and 03/01/2018 was performed. Exclusion criteria included radiographs of poor quality or scans with pathology other than the diagnoses listed. Plain radiographs of the wrist were used to assess for the presence of a cortical ring sign and to measure the lateral scapho-

lunate (SL), radio-scaphoid (RS), radio-lunate (RL), and radio-capitate (RC) angles. Two blinded observers performed the measurements. Analysis for agreement between observers and the association between measured angles and scaphoid fracture was performed. Five degrees of angle measurement was considered a significant difference. Computer tomography (CT) images were used to determine the presence of fracture. Analysis differentiated between displaced and nondisplaced fractures.

Results: Fifty radiographs and CT scans were eligible for the study. Agreement between the observers for the cortical ring sign was (Kappa = 1.00, p = <0.001) however agreement for angle measurements was in general poor: SL angle: no agreement in 68.4%, RS angle: no agreement in 68.4%, RL angle: no agreement in 47.4%, and RC angle: no agreement in 31.6%.

The only measurement that was significantly associated with (displaced) scaphoid fracture was the SL angle p = 0.05.

Conclusions: 1) Our results suggest that radiographic angle measurements have a limited role in diagnosing scaphoid fractures.

2) Three-dimensional imaging is helpful (and may be mandatory) in diagnosing these fractures not only in nondisplaced fractures but also in displaced fractures. This result may be due in part to the great interobserver variability of angle measurements that was found in the study.

3) Further study to increase the number of readings, number of observers and to compare to three-dimensional imaging is needed and may indicate utility of these measurements to predict fracture stability.

A-0195 Outcomes of Anterior Interosseous Nerve Transfer to Restore Intrinsic Muscle Function after High Ulnar Nerve Injury

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Introduction: High ulnar nerve injuries cause significant morbidity and loss of function due to poor recovery of the intrinsic muscles of the hand due to long re-innervation distances. Tendon transfers classically used to treat these injuries cannot give an elegant result as nerve transfers can, emulating the natural, intricate multi-faceted functionality of the native intrinsic muscles. The most practical of these is the anterior interosseus nerve (AIN) to motor branch of the ulnar nerve (MUN) transfer. We present our experience of these transfers in the setting of traumatic ulnar nerve injuries and a review of the current literature in this field.

Methods: During the period of 2011–2018, 17 consecutive patients who underwent AIN to MUN nerve transfers for high ulnar nerve injuries were evaluated. Our retrospective review included all traumatic aetiology for high ulnar nerve injury as well as non in-continuity lesions from oncological resection. We analysed patient demographics, mechanism and level of injury, interval between injury and nerve transfer, transfer techniques and outcomes. We performed an extended review of the literature for all articles published on the treatment of ulnar nerve injuries using AIN nerve transfers.

Results: 16 patients met the inclusion criteria with a mean follow-up period of 17 months (range 12–18). The average age was 39.4 (range 19–77, SD = 19.7). The median delay to nerve transfer procedure was 0.8 months (range 0–18 months, mean = 3 months, SD = 4.9 months). The injury site was above the elbow in 5 cases (31.3%), at the elbow in 8 cases (50%) and at the proximal forearm in 3 cases (18.8%). Mechanism of injury included sharp transection of the nerve in 63.5% of cases (10/16), blast injuries in 18.75% (3/16), 2 cases of traumatic traction and one case of a post-traumatic neuroma resection. Neurorrhaphy was end-to-end in 7/16 cases (43.8%), hemi end-to-end in 7/16 cases (43.8%) and supercharged end-to-side in 2/16 cases (12.5%). 5/16 patients achieved MRC 4 or above (31%) while 13/16 achieved MRC grade 3 or above (81%) intrinsic recovery (range 2/5- 5/5, SD = 0.86, p = <.05). The correlation between age and outcomes was r(16) = .13, (p-value = .64) and the correlation between delay to transfer and outcomes was r(16) = .34, (p-value = .09).

Conclusion: The AIN to motor branch nerve transfer proves to be a reliable method of regaining intrinsic function in high ulnar nerve injuries with good motor recovery in 81.3% of our patients. Further research is needed to prove the efficacy of ETS neurorrhaphies and the most effective technique for this but in the interim we recommend using conventional ETE or hemi ETE nerve transfers for Sunderland grade IV-V injuries in the proximal ulnar nerve. We believe that high ulnar nerve injuries in particular have sufficient evidence to warrant a distal nerve transfer and units treating upper limb injuries should be aware of this to avoid unwarranted delay in treatment that could adversely affect outcome.

A-0198 Predictors and Functional Impact of Scaphoid Malunion

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Purpose: Scaphoid malunion is rarely reported. Previous literature has attributed loss of carpal height and degenerative changes to scaphoid malunion, but the percent of asymptomatic malunions remains unknown. The authors of this study aim to define predictors of malunion and functional outcomes associated with scaphoid malunion.
Methods: Institutional board review was obtained prior to evaluating medical records of patients 18 and older, who were treated for scaphoid fractures and/or nonunion between 2000—2020. The following data was collected for each patient: age, gender, fracture location, surgical technique, time to union, and whether malunion resulted. Pain scores, range of motion (ROM), and secondary surgery were also evaluated.
Results: 355 scaphoid injuries, including 196 acute fractures and 159 nonunions, were evaluated in this analysis. Of these, 55 scaphoids (15%) met the definition of malunion. 23% of patients were female. The mean age at time of injury was 29 years. Nonunion cases were more likely than acute cases to be associated with malunion. Compared to scaphoid injuries without malunion, malunited scaphoids were not associated with any significant difference in pain score, ROM, or secondary surgery. 10 patients (3.3%) without malunion and 2 patients (3.6%) with malunion went on to a secondary surgery. Final extension/flexion was 66.6/67.3 degrees and 56.0/59.3 degrees in non-malunion and malunion groups, respectively, but these differences were not statistically significant.
Conclusions: Compared to scaphoid injuries that do not result in malunion, scaphoid injuries that heal into malunion have statistically similar outcomes. While scaphoid malunion in a single case or series may be associated with poor outcomes, this study suggests that scaphoid malunions do not have worse functional outcomes.

A-0204 The effect of unilateral carpal tunnel release on the non-operated, contralateral hand

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Carpal tunnel syndrome frequently involves both hands. It has been suggested that patients with bilateral disease may benefit in the non-operated hand after unilateral surgery.
Objectives: The objective of this study was an investigation into the effect of unilateral carpal tunnel release on the non-operated, contralateral hand.
Methods: In 186 patients with bilateral carpal tunnel syndrome, the following measurements were performed prior to the operation: subjective pain intensity on a numeric rating scale, digital sensibility with filaments, grip strength and the Levine questionnaire. Objective measurements were performed in both hands. Patients received mini-invasive carpal tunnel release in one hand, under local anaesthesia, with the use of a tourniquet. Upon discharge, the patients were scheduled for the next hand operation, with a mean of 3 months delay. Of the 186 patients who underwent operation on the one hand, 170 (91%) were admitted to the hospital for surgery to the other hand. The same measurements were performed as prior to the first operation. The results of these measurements were compared.
Results: All subjective variables were statistically significantly better in the hand which was scheduled for operation as the second one. Pain intensity was lower by a mean of 0.8 in NRS; the Levine symptom and function scores were lower by a mean of 0.7 and 0.3, respectively. Digital sensibility and grip strength were also better, but with no clinical or statistical significance. Asked directly about status of the non-operated hand, 109 patients (64%) reported improvement, 40 (23%) noted no change and 21 (13%) deterioration.
Conclusion: Regardless of the reasons for improvement, this study demonstrates that 64% of patients feel partial relief in the non-operated hand after unilateral carpal tunnel release.

A-0214 Rearticulating total wrist arthrodesis to a total wrist arthroplasty. 11 patients followed 5 (3–13) years

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Introduction: Whereas total wrist arthrodesis was the treatment of choice for painful wrist arthrosis for more than a century, total wrist arthroplasty has become a viable alternative in recent decades. Wrist arthrodesis is not necessarily final surgery

for many of the patients, and some never accept residual pain and reduced function that accompany a stiff wrist. There are only anecdotal reports on conversion from a stiff wrist to an arthroplasty. We present a prospective series of such conversions.

Patients and methods: 11 (7 men) patients, 54 (42-67) years of age were converted to a total wrist arthroplasty (Motec wrist system, Swemac AB, Linkoping, Sweden) 8 (3–17) years after wrist arthrodesis. The indication for the original arthrodesis was SNAC/SLAC (6), sequela distal radius fracture (2), lunato malacia (1), Madelung's deformity (1) and hand replantation (1). The patients had undergone 49 prior wrist surgeries. 5 suffered from ipsilateral problems (ulna, DRUJ, CMC 1, tendons/nerves), and 2 had bilateral wrist problems. The surgical procedure included resection of a bone segment corresponding to the proximal carpal row to make space for the introduction of the components and the articulation. The patients wore a cast for 6 weeks after which they received hand therapy and were encouraged to use the wrist and hand freely. Preoperatively, and at yearly follow up, wrist AROM, grip and key pinch were measured. The patients also completed QDASH and VAS pain scores on the ulnar and radial side at rest and activity, and radiographs were taken.

Results: One patient with a loose Aptis arthroplasty and proximal fracture of the ulna which had been removed during the conversion, developed a severe extension contracture resistant to hand therapy and surgery, ending in a new fusion. At the last follow up 5 (3–13) years after conversion, the patients had AROM = 106 (70–148)°, increased supination (60 to 80°), reduced QDASH (43 to 28), PRWHE (54–31), and reduced pain scores (radial VAS rest 26 to 10, radial VAS activity 44 to 31, ulnar VAS rest 27 to 11 and ulnar VAS activity 57 to 15). Radiologically all arthroplasties were well fixed and osseointegrated. The patients were satisfied. None regretted the surgery knowing the outcome.

Conclusion: In a carefully selected and motivated patient group, conversion from arthrodesis to an arthroplasty yielded good functional results and high patient satisfaction. We obtained long lasting implant fixation and high range of motion. Fixed malposition in one patient ended in rearthrodesis. In retrospect we believe we should have removed the failed Aptis and performed the rearticulation after a rehabilitation period. In less complicated patients rearticulation is an option even after many years of arthrodesis.

A-0219 Protective effects of Paeoniflorin on the survival of random flaps

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Background: Random flaps can be used to repair wounds and improve shape and functional reconstruction, but inflammation and necrosis limit their application. Paeoniflorin (PF) is the main pharmacologically active ingredient extracted from Paeonia lactiflora. It has significant anti-inflammatory, antibacterial, antioxidant and immunomodulatory therapeutic effects, can enhance angiogenesis and ameliorate ischemia/reperfusion injury. In this experimental study, we aimed to identify the effect of Paeoniflorin on random flap survival.

Methods: Dorsal McFarlane flaps were harvested from 60 rats divided into three groups, The high-dose group was intraperitoneally injected with 50 mg/kg/day Paeoniflorin, the low-dose group was treated with 20 mg/kg/day Paeoniflorin, and a control group administered normal saline in an identical manner. On day 7 after flap construction, the survival percentage of the flap model was calculated. Hematoxylin and eosin staining (H&E) was used to evaluate the histopathological status of the flaps and microvessel density (MVD). Lead oxide/gelatin angiography was used to detect angiogenesis, and laser Doppler flow imaging (LDF) was used to detect blood perfusion. The levels of superoxide dismutase (SOD) and malondialdehyde (MDA) in the middle areas of the flaps were measured to show the level of oxidative stress. The expressions of Toll-like receptor (TLR4),nuclear factor-kappa B (NF-κB), high mobility group proteinB1 (HMGB1), interleukin (IL)-1β, IL-6, tumor necrosis factor-α (TNF-α) and vascular en-dothelial growth factor (VEGF) were detected by immunohistochemistry.

Results: Paeoniflorin significantly increased the average survival percentage of the flaps and reduced ischemia and necrosis of the distal end of the flaps. SOD activity significantly increased, while MDA significantly decreased, indicating that Paeoniflorin reduces oxidative damage. The expression of inflammatory immunoregulatory proteins (TLR4, NF-κB,HMGB1) was downregulated, and the levels of inflammatory factors (IL-1β, IL-6 and TNF-α) were lower. In addition, Paeoniflorin upregulated VEGF expression, promoted angiogenesis, and increased blood perfusion.

Conclusion: In random flap transplantation, a high dose of Paeoniflorin is beneficial to flap survival.

A-0220 Pedicled vascularized bone graft for 100 refractory scaphoid nonunions

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Introduction: For refractory scaphoid nonunion, such as proximal nonunion, long-standing nonunion, previous scaphoid surgery, proximal necrosis, and humpback deformity, it has been reported that pedicled vascularized bone graft (VBG) is more useful than conventional iliac bone graft. To date, the author has performed pedicled VBG on 100 cases of scaphoid nonunion, with the bone healing rate of 90%. In this study, we investigated the factors of non-healing in 100 cases of scaphoid nonunion.
Methods: In 100 patients who underwent VBG for scaphoid nonunion by a single surgeon, we were compared 90 hands of healing (H group) and 10 hands of non-healing (N group). For H group: N group, mean age were 32.9:45.8 years, 80: 10 males, 9: 1 females, postoperative follow-up period 18.5:31.0 months, average time from injury to surgery 69.4:183.0 months, the Zaidemberg method 65:6 hands and the Makino method 25:4 hands, respectively. The factors of non-healing in these nonunion cases were investigated by univariate and multivariate analysis. Confidence interval was set at 95% ($p < 0.05$).
Results: The ratio of H group: N group of refractory scaphoid nonunion was 23: 2 hands for proximal part, 16:4 hands for reoperation, 18:4 hands for long-standing nonunion more than 10 years, 81.0:42.9% for proximal necrosis with low MRI-T1 and 58:3 hands with modified DISI with RL angle of 10° or more. In univariate analysis, age was significantly greater in the N group ($p = 0.148$). In multivariate analysis by logistic regression, age ($p = 0.0784$) and previous surgery ($p = 0.0803$) were not significantly greater in N group, but were more likely to be non-healing.
Conclusions: We should weigh the elderly cases and the re-operation cases in using pedicled vascularized bone graft for refractory scaphoid nonunion.

A-0221 Evaluation of outcomes in patients following arthroscopically assisted surgery of scaphoid nonunion

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Evaluation of outcomes in patients following arthroscopically assisted surgery of scaphoid nonunion

Aim: the aim of this study was evaluating 3 years followup of Arthroscopic assisted surgery of scaphoid nonunion

This study was carried out on patients with isolated and non-complicated nonunion and follow-up for one year in terms of unionization (based on imaging methods) and function with the parameters of the range of active motion based on the angle between the forearm and the third metacarpal (by hand goniometer), grip strength (by dynamometer), and the standard disability questionnaires such as Hand, Arm and Shoulder (DASH) score and Patient-Related Wrist Assessment (PRWE) score and Modified Mayo Wrist Score. Complications associated with the surgical procedure were also carefully recorded.
Method: 15 patients with scaphoid nonunionwho treated arthroscopically were examined, union rate (based on imaging methods) and function with the parameters of the range of active motion, grip strength, and the standard disability questionnaires such as Hand, Arm and Shoulder (DASH) score and Patient-Related Wrist Assessment (PRWE) score and Modified Mayo Wrist Score. Complications associated with the surgical procedure were also carefully recorded.
Results: According to simple radiographic findings, the fracture of all patients was satisfactory united after 3 months. None of the patients had direct complications associated with surgical procedures such as ery sitesurg infection or sensory impairment. In terms of function, the mean range of motion and the strength of wrist were compared in two parameters including grip and pinch. According to the patients answers to the DASH questionnaire, their satisfaction with treatment was evaluated and in 47% of patients, the results were excellent, 40% good and 13% were weak. Overall, the average score of patients was 13.54 and was equivalent to good function. According to the PRWE questionnaire, the satisfaction was answered by patients with a mean score of 16.11. According to the MAYO scoring system, the performance of the wrist was evaluated and 27% of the patients had excellent outcome, 27%

had good, 40% had satisfactory, and 6% had poor result.

Conclusion: According to the obtained data, the arthroscopic treatment of scaphoid nonunion seems to be an effective method with low complications and favorable results.

A-0228 A new technic of mobilisation after the lesion of the extensor apparatus at the level of the medial band with surgery protocol

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Introduction: Lesions of the extensor system in zone 3 are often of an unfavourable prognosis. Most authors propose an immobilization of 6 weeks to ensure healing of the injured tendon, which often causes stiffness in extension of the PIP.

We wanted to present a new method of early mobilization following this type of lesion which would be treated surgically. The technique has been verified in the anatomy laboratory.

Material and Method: We performed a cadaveric study at the Nîmes Faculty of Medicine laboratory on a fresh corpse. The extensor system was dissected in its dorsal part until the DIP.

Displacements of the medial and lateral bands were filmed and measured with the MCP in flexion, PIP and DIP in extension, then MCP in flexion, PIP in flexion and DIP in extension and finally, MCP, PIP and DIP in flexion.

Flexion of the MCP causes a displacement of the medial band.

The tensioning of the various bands was tested.

We applied these results on a cohort of 41 patients, 42 tendons with core sutures with multiple strands.

Results: 62% of the patients obtained a flexion greater than 90° at the level of the PIP with a flexion of the DIP greater than 50° in 48% of the cases. All patients were treated according to the principle of Fast Track Surgery. 79% of patients achieved active extension between 0 and minus 10°.

There was no rupture in the series.

Discussion: Flexion of the MCP leads to progress of medial band by advancing the intrinsic system and release totally the mobility of PIP. This displacement makes it possible to flex without tension the PIP up to 90° and without risk of damage to tendon repair.

Conclusion: The recovery of the flexion of the PIP without risk avoids stiffness in extension of this key-link of the digital chain. It is carried out without risk by maintaining the flexion MCP during treatment.

A-0232 Proximal row carpectomy: with or without radial styloidectomy?

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Introduction: Impingement between the radial styloid and the trapezium can give serious complaints after a proximal row carpectomy (PRC). We hypothesized that a PRC with primary radial styloidectomy reduces the risk of radial impingement and consequently prevents secondary radial styloidectomy, while it does not affect clinical- or functional outcome.

Methods: Fifty-six patients, who underwent a PRC between 2008 and 2013, were included in this retrospective cohort study. All patients were divided into two groups: PRC with or without primary radial styloidectomy. Patient related outcome, strength and range of motion after proximal row carpectomy were measured in a subgroup of twenty-seven patients. The data was analyzed using a Fisher's exact test or Mann-Whitney U test depending on the type of data.

Results: No differences in gender, age, side or etiology were observed between the groups with ($N = 29$) and without primary radial styloidectomy ($N = 27$). The occurrence of radial impingement was significantly higher in the group without primary radial styloidectomy (19% vs. 0%; $p = 0.015$; table 1). Also, significantly more patients in the group without primary radial styloidectomy required secondary surgery to perform a radial styloidectomy (15% vs. 0%; $p = 0.031$; table 1). No differences in active range of motion or strength were found. Furthermore, patient related outcome measurements were not significantly different, but PRWHE score tended to be better after PRC with radial styloidectomy (36 vs. 20; $p = 0.13$).

Conclusions: PRC without primary radial styloidectomy resulted in a higher rate of secondary surgery, while no complications or negative effect on function of a primary radial styloidectomy were observed. We therefore recommend including a radial styloidectomy as routine part of the procedure.

A-0236 SORL-reverse procedure: a dynamic tenodesis to restore distal interphalangeal joint flexion in chronic flexor digitorum profundus lesions. A cadaveric study

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The treatment of neglected isolated FDP tendon injuries is still debated, especially for lesions in zone Ib and Ic according to Moiemen and Elliot classification. One stage and two stage reconstruction are always possible solutions but not without risks and work-related days lost. In case secondary tendon reconstruction is not chosen, static tenodesis represents the main surgical indication in alternative to DIP arthrodesis, with consequent loss of DIP flexion. We propose a novel surgical strategy based on the creation of a dynamic tenodesis between the extensor lateral band and the distal stump of the ruptured flexor tendon, in order to restore DIP flexion. In this paper, the results of this surgical procedure are tested and reported on a cadaveric model. In 8 fingers from fresh cadavers, an FDP lesion was artificially created 1 cm proximal to the terminal insertion on the distal phalanx. The lateral band of the extensor was isolated, passed dorsally to the PIP joint and volarly to the DIP joint, and finally sutured to FDP distal stump to create a dynamic tenodesis between extensor and flexor mechanisms. At this point before and after the procedure, flexion and extension of the finger were evaluated along with the load needed to obtain a full range of motion. Active DIP flexion was improved from 3° to 25°, even finger TAM was increased of about 56°. Instead, DIP extension was not impaired after the procedure. The force applied to obtain a complete finger flexion was reduced after the dynamic tenodesis.

The dynamic tenodesis between lateral band of extensor mechanism and FDP could be a valid alternative surgical technique to restore active DIP flexion in case of untreated, isolated FDP lesions in zone Ib and Ic.

A-0238 A systematic review of outcome measurement in studies of adult hand flexor tendon injury

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Introduction: Flexor tendon injuries are a common presentation to the plastic surgery trauma service and cause significant morbidity, especially in the working-age population. There is no current consensus on the optimal repair technique or rehabilitation protocol, with many studies attempting to establish the ideal interventions. The best methods to assess the outcomes of these interventions also remain unclear with significant variation across studies. This systematic review aimed to describe outcome measurement in studies of interventions for adult hand flexor tendon injuries.
Methods: A PRISMA-compliant systematic review was performed with bespoke search strategies applied to MEDLINE, EMBASE, PsycINFO, CENTRAL, CINAHL and AMED from database inception to 25th May 2020. Pre-specified stepwise inclusion criteria were used to identify studies describing adult patients undergoing acute interventions for flexor tendon injuries of the hand. Studies were reviewed for patient-reported, clinician-reported, adverse and health economic outcome measures.
Results: Of the 4844 studies, 114 met final inclusion criteria (108 full-text articles, 4 trial registries and 2 conference abstracts). Of the full-text articles, describing 8127 participants with 9071 injured digits; 24 were randomised controlled trials, 19 were cohort studies and 61 were case series. Nine different PROMs were used in 24 studies (22%); three site-specific PROMs (Disabilities of the Arm, Shoulder and Hand (DASH), QuickDASH and the Michigan Hand Outcomes Questionnaire (MHQ), one generic quality of life measure (Short Form-36) and four visual analogue scales were used (pain, hand function, satisfaction and ADLs).

Clinician-reported outcome measures were used in 103 studies (96%). Range of motion (ROM) most commonly reported (n = 102, 94% and was classified into grading systems, with Strickland and Glogovac (n = 41) and Buck-Gramcko (n = 19) most frequently

used. A further clinician reported outcome was measured in 33 studies (31%); grip strength (n = 22) and pinch strength (n = 11).

Adverse outcomes were reported in 96 studies (89%); tendon rupture (n = 58, 54%), infection (n = 13, 12%) and adhesions (n = 5, 5%) most often. Need for re-operation was reported in 21 studies (19%). Length of work absence was the most commonly reported health economic outcome measure used in 10 studies (9%).

Conclusion: There is significant heterogeneity in PROMs, clinician reported, adverse and health economic outcomes used to study interventions for flexor tendon injuries with limited consensus on choices and timing of their use. An independent systematic review of the psychometric properties of the identified outcome measures and a specific multi-stakeholder consensus process may support optimal outcome measure choice and standardisation between studies.

A-0241 Complications of the nonoperative versus operative treatment of displaced and reduced distal radial fractures in adults: a systematic review

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Introduction: Reduction followed by cast immobilization or volar plating are the most used techniques to treat displaced and reduced distal radius fractures. Both treatments have been extensively researched in the literature. However, no conclusions can be drawn regarding which treatment is superior. Complications are infrequently described and if present, only mentioned as a minor detail. This study was initiated to provides insight into the rate of complications to add value to this discussion.

Methods: A review protocol based on the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA)-statement was developed. A comprehensive search was conducted in three bibliographic databases. Suitable studies were randomized controlled trials and retrospective trials that compare reduction followed by cast immobilization and volar plating and reported on complications or suboptimal outcome of the different treatment options.

Results: Six studies, of which two randomized control trials and four retrospective studies, were included. In total 467 patients with a distal radius fracture were analyzed. Comparing both treatment options, no difference was found regarding tendon injuries, carpal tunnel syndrome and posttraumatic arthrosis. Complex regional pain syndrome, symptomatic malunion and severe ulnar pain might be in advance for the operative group. However, the operative treatment is associated with operation initiated complications and hardware removal. P-values were rarely described.

Conclusion: Overall, no conclusions can be drawn on the optimal treatment of displaced and reduced distal radius fractures according to the incidence of complications. Complex regional pain syndrome, symptomatic malunion and severe ulnar pain might occur more frequently in the nonoperative treatment group. The operative treatment, however, is associated with operation initiated complications and the need for hardware removal. Future research is necessary, to provide insight into the rate and impact of complications from reduction followed by cast immobilization and volar plating.

Keywords: Nonoperative treatment, volar plating, distal radius fractures, wrist fractures, complications, adults

A-0242 Universal 2 Total Wrist Arthroplasty for Rheumatoid Arthritis

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Introduction: Total Wrist Arthroplasty (TWA) for Rheumatoid Arthritis (RA) of wrist allows pain relief and preservation of the movements. Revision still remains a major issue in Total Wrist Arthroplasty for Rheumatoid Arthritis.

Purpose: The aim of this study was to evaluate the mid- to long-term outcomes and complications in patients affected by rheumatic diseases treated with the Universal 2 total wrist arthroplasty

Methods: This was a retrospective review of case notes of 65 Universal-2 total wrist arthroplasty procedures performed from 2008 to 2015 at our institute. The three patients who were lost to follow-up and two patients died at two and five years following TWA, due to un-related causes.

Therefore study included 60 TWA procedures. Residual pain, preoperative ROM, postoperative ROM increases, grip strength, radiographic changes, long-term complications, and reasons for revision or failures were evaluated.

Results: The indication was RA in 54 wrists, six had psoriatic arthritis. Two patients had bilateral wrist replacements. Mean age of the patients was 61

years (36 to 82 years) and mean follow-up was of 82 months (48 to 124 months).

All patients had good or complete pain relief, the mean visual analogue scale pain score was 1.52. The mean grip strength improved and postoperatively was 8 kg (Jamar). The mean total ROM of flexion–extension was 52 degrees; radial–ulnar deviation 21 degrees. The mean QuickDASH score of 45. 10 a revision surgical procedure in nine patients (15%): in four cases, a carpal component revision procedure and in five cases, total implant failures requiring either conversion to a wrist joint fusion.

Conclusion: Pain relief and patient satisfaction following wrist arthroplasty procedures were consistently high in our series. Our results at a mid- to long-term follow-up with the U2 prosthesis were encouraging and represent, when indicated, a valid alternative to fusion which is less appealing for RA patients.

A-0245 Biomechanical evaluation comparing Pulvertaft weave and Side-to-Side tenorrhaphy using porcine tendons

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Aims: Pulvertaft Weave (PTW) and Side-to-Side (STS) repair are accepted techniques of tenorrhaphy in tendon transfer surgery. This biomechanical study compares these two methods of tenorrhaphy in terms of lengthening with cyclic loading over time to illustrate differences in creep.

Methods: Fresh porcine flexor digitorum tendons were dissected and cross-sectional dimensions measured. A total of 10 PTW and 10 STS repairs were performed using porcine tendons with overlap of 50 mm of tendon. This allowed for 3 weaves in the PTW group and 4 cross sutures in the STS group. The tendon repairs were mounted vertically between two clamps 70 mm apart and tested by applying tension up to 25N for 100 cycles, followed by tension up to 75N for 100 cycles. Finally, the repairs were loaded until failure (taken as deformation of over half the overlap – 25 mm).

Force-displacement data was used to determine the creep of the repaired tendon after each cycle of loading. The number of repairs surviving in each group was compared using Fisher's exact test and the mean creep was compared between the two groups using ANCOVA with cross-sectional area as covariate.

Results: There was no difference in the cross sectional areas ($p = 0.12$) between PTW and STS groups.

All tendons in both groups survived 100 cycles loading at 25N. After 100 cycles at 75N, all STS survived but only 4 PTW survived. This was a significant difference (Fisher's exact test, $p = 0.01$).

Difference in creep is summarised below:

- 25N: x1 cycle – mean elongation of PTW is 3.0 mm greater than STS ($p = 0.046$, 95% CI 0.1–5.8)
- 25N: x100 cycles – mean elongation of PTW is 4.4 mm greater than STS ($p = 0.008$, 95% CI 1.3–7.4)
- 75 N: x1 cycle – mean elongation of PTW 20.0 mm greater than STS ($p = 0.003$, 95% CI 2.4–11)
- 75 N: x100 cycle – only 4 PTW repairs survived, all STS survived ($p = 0.01$), the mean elongation of the surviving PTW repairs was 8.9 mm ($p = 0.003$, 95% CI 3.8–14) larger than the STS repairs.

The mean load to failure was 85N for the PTW group and 336N in STS group ($p = 0.004$).

Conclusions: STS repairs show smaller mean creep with cyclic loading at 25N and 75N than PTW. All STS repairs all survived but only 4 of the PTW repairs survived 100 cycles of loading at 75N. STS tenorrhaphy creeps significantly less and can survive higher cyclic loads than PTW. STS may give better function over time compared to PTW.

A-0247 Enhancing Acellular Nerve Allografts with Mesenchymal Stem Cells and Surgical Angiogenesis Improves Immune Response and Revascularization

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Background: Addition of adipose-derived mesenchymal stem cells (MSCs) or surgically induced angiogenesis (adipofascial flap) has previously been shown to improve acellular nerve allograft (ANA) function in a rat sciatic nerve defect model. Two crucial determinants of ANA survival are immune tolerance and adequate revascularization. While MSCs promote neoangiogenesis by secreting proangiogenic factors, they also modulate local immune responses by suppressing natural killer (NK) and cytotoxic T cells. The purpose of this study was to investigate the immune response and revascularization patterns of ANAs after combined stem cell delivery and surgical

angiogenesis in a rat sciatic nerve defect model at 12 and 16 weeks.

Methods: Sixty Lewis rats were divided in five groups (N = 12 per group). Unilateral sciatic nerve defects were repaired with either (I) autografts, (II) ANAs, (III) ANAs wrapped with a pedicled superficial inferior epigastric artery fascia (SIEF) flap to induce surgical angiogenesis, combined with ANAs seeded with either (IV) undifferentiated MSC (uMSC) or (V) MSC differentiated into Schwann cell-like cells (dMSC). On postoperative day (POD) 3, 7 and 14, peripheral blood (N = 5 per group) was collected to perform immune cell phenotyping. Levels of CD45+, CD4+, CD4+CD25+, CD8+ and CD161+ immune cell subsets were measured by flow cytometry. In a non-survival evaluation at 12 and 16 weeks, Microfil® contrast compound was injected in the abdominal aorta to preserve vasculature. Nerve grafts and untreated control nerves (N = 6 per group per time point) were collected and cleared. Vascular volume was evaluated using microcomputed tomography scans and expressed as percent of total nerve volume.

Results: On POD3, levels of circulating CD4+ helper T cells and CD8+ cytotoxic T cells were significantly reduced in group V compared to all other groups. Both group IV and V showed significantly lower levels of CD8+ cells on POD7 and 14 compared to group II. Circulating CD4+CD25+ regulatory T cells were significantly increased in group III, IV and V compared to group II on POD3 and 7. Moreover, CD161+ NK cells in peripheral blood were significantly reduced in group III, IV and V compared to group II on POD7 and POD14. Unseeded ANA were found to have a significantly lower vascular volume compared to control nerves and ANAs seeded with uMSC or dMSC wrapped with a SIEF flap at both 12 and 16 weeks postoperative. At 12 weeks, surgical angiogenesis alone also resulted in a significant increase of revascularization compared to unseeded ANAs.

Conclusion: Surgical angiogenesis improves the early immune response to transplanted ANAs. Combining surgical angiogenesis with stem cell seeding of ANAs further reduces allograft immunogenicity. Revascularization was also enhanced when surgical angiogenesis was combined with uMSC or dMSC seeding.

A-0249 Long-term Follow Up after first dorsal extension osteotomy in early thumb carpometacarpal arthritis

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Preliminary results

Purpose: To evaluate the long-term outcomes and survival of first metacarpal extension osteotomy (Wilson osteotomy) for early thumb carpometacarpal (CMC) arthritis.

Methods: Patients who underwent an extension osteotomy of the first metacarpal in our department between years 2013 and 2020 were identified. Demographics, complications, and reoperations were recorded. These patients will be enrolled for a follow-up examination in the outpatient clinic. The Patient Rated Wrist/Hand Evaluation (PRWHE) and the Quick Disabilities of the Arm, Shoulder and Hand (QuickDASH) questionnaires will be submitted to each patient. Further clinical evaluation will include the following criteria: pain, palmar abduction of the thumb, carpometacarpal joint opposition of the thumb (Kapandji), range of motion of the metacarpophalangeal joint and strength. Progression of osteoarthritis will be evaluated on follow-up radiographs.

Results: On retrospective analysis, 46 procedures in 39 patients (7 males and 32 females) were identified (mean age, 45.7 y, mean follow-up 11.6 months, range 3–36 months, 79.5% dominant hand). Analysis of patient records showed no cases of nonunion. 22 of 46 thumbs underwent removal of the osteosynthesis material (47.8%). In 36 out of 46 thumbs were reported little to no pain at last follow-up (78.2%). 10 patients reported persistence or progression of their symptoms. In 7 thumbs a radiological progression of arthritis according to the Eaton-Littler classification (15.2%) was observed. All these patients were symptomatic and underwent or were recommended a revision (overall 15.2% revision rate, either trapeziectomy or arthroplasty). 40 thumbs (87.0%) retained a Kapandji score for carpometacarpal joint opposition of 8 or more, full extension in CMC I was always achieved.

Conclusions: Retrospective data suggests good pain relief with high patient satisfaction in short-to-mid term follow-up after first metacarpal extension osteotomy. A 15.2% progression rate of arthritis was observed, corresponding with the revision rate. These rates give reason to hope for good long-term results in first metacarpal extension osteotomy for early thumb carpometacarpal arthritis.

A-0251 The Morphology of Soft Tissue Abnormalities in Radial Longitudinal Deficiencies: Multiple Tissue Analysis in Experimentally Generated Malformations with the Chicken Model

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Introduction: Operative correction of patients with radial longitudinal deficiency (RLD) remains challenging due to a high rate of recurrence. There is increasing evidence that the underlying problem lies in the soft tissue rather than the skeletal anomalies. However, detailed knowledge of the soft tissue morphologies in RLD remains lacking. The purpose of this study is to examine the soft tissue morphology in experimentally generated RLD using the chicken model. In particular, we study the muscle and nerve changes associated with a missing or underdeveloped radius.
Methods: It has been shown that ectopic Sonic hedgehog (SHH) supresses radius formation when present on the anterior limb bud, reliably producing the condition of RLD. Chicken embryos were manipulated in this manner at 3.5 days of development (equivalent to Carnegie stage 13). In addition, we titrated the amount of SHH with higher concentrations so as to induce more severe deformities. Embryos were fixed at 7 days of development, prior to ossification and soft tissue deviations were examined with a novel technique called hybridisation chain reaction fluorescent in situ hybridisation (HCR FISH). Wholemount HCR FISH was used with SOX9 as a marker for cartilage, MYOD for muscle and SERAF to examine the pattern of innervation in limbs with induced RLD. Changes in pattern were visualised with fluorescent wholemount and confocal microscopes.
Results: Application of SHH induced RLD both in associated polydactyly and as an isolated forearm anatomy. Radial polydactyly is commonly associated with abnormal SHH expression and our result additionally indicates that isolated RLD may constitute a further phenotype on the spectrum of developmental differences caused by abnormal SHH expression. Limbs with induced RLD had altered innervation patterns and musculature patterning.
Conclusions: The management of RLD remains an unsolved problem. High recurrence rates plagued the surgical community, whatever the technique used. An analysis of the soft tissue morphology in RLD may provide valuable data that can be extrapolated to human pathology. Predicting abnormal patterns of muscular insertions can provide surgical algorithms that can be applied during surgery. Aberrant innervation patterns can shed light on the development of musculotendinous units. HCR FISH is a powerful technique to visualise multiple tissues and can be utilised in further experimental settings to explore congenital limb differences. Results of our studies will be presented, as well as their implications for surgery.

A-0252 Fracture-dislocations of the forearm joint. A systematic review of the literature and a comprehensive locker-based classification system

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Background: Monteggia, Galeazzi and Essex-Lopresti injuries are the most common types of fracture-dislocations of the forearm. Uncommon variants and rare traumatic patterns of forearm fracture-dislocations have been sometimes reported in literature.

In this study we systematically reviewed the literature in order to detect and classify any case of forearm joint injury pattern according to the forearm joint and three lockers concepts.
Methods: A comprehensive research of Pubmed database was performed based on major pathological conditions involving fracture-dislocations of the forearm. Essex Lopresti injury, Monteggia and Galeazzi fracture-dislocation and proximal and/or distal radioulnar joint dislocation were researched. After articles retrieval, the types of forearm lesions were classified in a numerical algorithm as state: Proximal forearm joint 1 (including PRUJ dislocation with or without radial head fractures); Middle radioulnar joint 2, if concomitant radial fracture R, if concomitant interosseous membrane rupture I, if concomitant ulnar fracture U; Distal radioulnar joint 3 (including DRUJ dislocation with or without distal radial fractures).
Results: Eighty hundred and eighty-four articles were collected through Pubmed and bibliography research After duplication removal and study screening 462 articles were selected. According to exclusion criteria 44 full text articles describing atypical forearm fracture dislocation were included. Three

historical review were added separately to the proceedings.

We were able to detect rare patterns of two lockers injuries with transverse instability sometimes named as variant or equivalent types of Monteggia and Galeazzi injuries. Furthermore, we identified a group of three lockers injuries different from Essex-Lopresti injuries. These rare patterns were associated with ulnar and/or radial shaft fractures causing longitudinal instability.

In addition to fracture-dislocations commonly referred with historical eponyms (Monteggia, Galeazzi, Essex-Lopresti) our classification system allowed us to include all types of dislocations and fracture-dislocations of the forearm joint reported to our knowledge in the literature.

Conclusions: According to this classification, and similarly to the elbow, we could distinguish between simple dislocations and complex dislocations (fracture-dislocations) of the forearm joint.

All the injury pattern may be precisely identified with an alphanumeric code. This might avoid confusion in forearm fracture-dislocations nomenclature and might help surgeons in the detection of lesion guiding surgical treatment.

A-0254 Treatment of Spastic Forelimb Hypertonia with Cognitive Muscle Reinnervation in Upper Motor Neuron Syndrome

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Introduction: Development of limb spasticity is one of the ''positive'' features of upper motor neuron syndrome that occurs due to pyramidal and parapyramidal fibres' dysfunction and is characterized by a velocity-dependent increase in the tonic stretch reflexes. Spinal reflexes are all afferent-dependent, relying upon some sort of sensory feedback from the periphery. In the literature it is demonstrated that selective posterior rhizotomy results in lessening flexor spasticity by interrupting the γ-neuron circuit. Another recent study suggested a novel approach to improve spasticity and increase limb functionality through contralateral C7 nerve root transfer in patients with chronic cerebral injury. However, the effect of hyperselective nerve transfers on spasticity on a more distal level has never been explored. We established a new animal model to investigate the electrophysiological, functional, molecular-biological and histological outcomes of denervation-cognitive reinnervation of spastic muscles in the rat's forelimb in upper motor neuron syndrome.

Materials and Methods: After thorough literature research and contact with numerous international labs, we found that hemi-transection of the pyramidal tract on brainstem level results in reliable, long-lasting and reproducible ipsilateral forelimb spasticity. We, therefore, perform unilateral pyramidotomy to create spastic hemiplegia in the rat. In the therapy group we carry out a transfer of the contralateral motor branch of the ulnar nerve to the nerve branch for the long head of the biceps. Electrophysiological assessments evaluate changes in muscle excitability (H-reflex), while biopsies from the spastic and reinnervated muscles are obtained for histological and molecular-biological studies. The contralateral side serves as internal control.

Expected results: Our hypothesis is that chronic spasticity may lead to fibrotic changes in muscle, reduce the satellite cell population and thus the muscle's regenerative capacity, diminish the number of muscle motor units and switch the muscle fiber type. We also assume that early cognitive reinnervation may protect the muscle against these adverse events and reverse the pathological muscle hyperexcitability.

Conclusions: This is the first time that a causative rather than symptomatic treatment for spasticity after stroke is attempted and outcomes are assessed comprehensively (electrophysiologically, immunohistologically, functionally and molecular-biologically). This revolutionary concept can open the window to a new era of therapeutic possibilities for stroke victims.

A-0259 Time until union in Absolute vs. Relative Stability in 12A1 and 12A2 humeral fractures

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Introduction: Simple fractures (type A) that require surgical treatment are best treated with an AS technique where anatomical reduction and interfragmentary compression can easily be achieved. However, cohorts of patients with humeral shaft fractures treated with a RS through a MIPO approach including simple fracture patterns are increasingly being reported.

Recent studies have sought to determine whether biology, represented by an ORIF or MIPO approach, or biomechanics, represented by an AS or RS technique, contributed greater to the time to union. These studies fail to reach an agreement.

The objective of this study is to evaluate the effect of absolute stability vs. relative stability in AO/OTA 12A1 and 12A2 fractures on healing and the time to radiographic union.

Materials and Methods: This was a retrospective cohort study of all patients treated with plate fixation for AO/OTA type 12A1-A2 fractures at a single institution. Only patients with a minimum follow-up of six months were included. Patients were grouped according to the type of stability used in their surgery. Time until radiographic union was estimated using the Kaplan Meier method, which was compared by long-rank test between both types of surgical techniques.

Results: A total of 70 patients were included in this study with 35 patients in each group. Both groups were comparable with respect to demographics. The median follow-up was 9 (IQR 6–14) months. The median time to radiographic union was significantly lower in the AS group than in the RS group: 12 (IQR 10–14) weeks versus 18 (IQR 16–19) weeks, respectively ($p < 0.001$). Non-union was seen in two cases (7%) in the relative stability group. Three patients in the RS group developed a post-operative radial nerve palsy.

Conclusion: The main finding of this study is that the median time to radiographic union was significantly shorter in the patients treated with AS compared to those with a RS technique. These findings support the recommendations of the AO Foundation in that simple metaphyseal fractures (type A) that require surgical treatment should be treated with an AS construct. RS techniques should be reserved to multifragmentary fractures where fragment preservation of blood supply is paramount.

A-0262 What is the Infection Rate in Carpal Tunnel Syndrome and Trigger Finger Release Performed Under Wide Awake Anesthesia?

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Background: High infection rates have been reported in hand procedures using the wide-awake local anesthesia no tourniquet (WALANT) method, causing some to question the validity of this approach. However, little evidence exists surrounding the direct use of WALANT compared with monitored anesthetic care (MAC). This study was conducted to directly compare postoperative infection rates of carpal tunnel syndrome (CTS) and trigger finger (TF) release surgeries performed under WALANT and MAC.

Methods: A retrospective study comparing postoperative infection rates between patients undergoing carpal tunnel and trigger finger releases was conducted. Our primary outcome measure was postoperative infection. Our secondary outcome was postoperative complications. Comparative statistics were used to compare means of infection between the groups.

Results: A total of 526 patients underwent CTS release (255 with WALANT and 271 with MAC) and 129 patients underwent TF release (64 with WALANT and 65 with MAC). Patients undergoing WALANT and MAC were statistically comparable in terms of sex, smoking status, diabetes, and ASA physical status classification. In patients undergoing CTS release there were no infections with WALANT and 6 infections (2.2%) with MAC. In patients undergoing TF release there were no infections in either group. There were similar rates of complications in patients undergoing WALANT and MAC for CTS and TF releases.

Conclusion: There was no increased risk of infection with WALANT as compared to MAC in carpal tunnel or trigger finger surgeries. These surgeries can be safely conducted with lidocaine and epinephrine without a concern for increased risk of infections or complications.

A-0263 Image quality and radiation exposure of the Mini C-arm versus the C-arm; is there a cut-off point between both device?

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Background: The mini C-arm has gained popularity among hand surgeons due to their overall practicality, cost effectiveness, better image quality and easier maneuverability. According to the manufacturer, the mini C-arm can also be used for larger extremity areas such as the forearm, elbow, and knee. The goal of this study is to compare image quality and radiation output between a mini C-arm and a conventional C-arm for different centimeters of tissue thickness, to determine if there is a cut-off point between the two.
Methods: The image quality was determined through an observer-based subjective image quality study using a contrast detail phantom. Different layers of perspex were used to mimic human tissue (1–12 cm) and per fluoroscopic image a reversed image quality factor was derived. Radiation output, both skin entry dose and scatter radiation, was measured for each recording and for both C-arms separately with a 15cc and 500cc air ionization chamber respectively.
Results: The mini C-arm showed a better image quality for the 1 cm ($p < 0.01$) and for the 2 cm (ns) recording. For the 3 cm recording, image quality was comparable between both devices, and above 3 cm the image quality was in favor of the conventional C-arm. Both skin entry dose and scatter radiation output for all 12 different layers of perspex was significantly higher using the mini C-arm ($p < 0.01$).
Conclusion: Looking at our results, one could state that the mini C-arm should not be used in body parts thicker than hands or wrists. Beyond 3 cm of tissue thickness the image quality of the C-arm exceeds that of the mini C-arm. Also bearing in mind that the mini C-arm generates higher radiation exposure to patient and staff, the C-arm is then preferred. The use in wrist surgical procedures is debatable, but a surgeon may prefer the mini C-arm based on its above mentioned benefits.
Clinical Relevance: The results of this study may benefit all users of the mini C-arm and may determine their fluoroscopic device of choice.

A-0268 Increase of Fat Graft Survival by Mesenchymal Stem Cell Recruiting Effect of Platelet Rich Plasma (PRP): in vivo and in vitro Study

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Introduction: Fat grafting is routinely and frequently used, and its roles in hand surgery are scleroderma/systemic sclerosis treatments, masking various congenital anomalies and hand rejuvenation purposes. The most important complication of this technique is the high resorption rates of the fat graft.

Adding mesenchymal stem cells is widely accepted method to prevent this complication and to increase fat graft survival. However purifing stem cells is challenging. It has been proven in the current literature that PRP can accumulate mesenchymal stem cells in the medium.

It is aimed to present the application method of PRP, which should be combined with fat graft in order to increase mesenchymal stem cell recruiting effect of PRP.
Materials and Methods: in vitro:

Fat graft was obtained manually from a patient with a medium-sized fat removal cannula and a low-pressure injector. Venous blood obtained from the same patient and centrifuged at 1100 rpm and 3800 rpm. Under laminar flow, 40 mg of fat were placed on standard size dishes. Stem cells adhering to plastic dishes were removed and subjected to flow cytometric examination by labeling with CD 45, CD 73, CD 90, CD 105.

in vivo:

PRP was prepared from 10 Wistar-Albino rats (platelet count of 2x105/μL). PRP was obtained in 3 different concentrations.

64 Wistar-Albino rats were divided into 8 groups:

Injections were performed on the right inguinal fat pad (Donor area): 0.2 ml serum; 0.2 ml PRP/4; 0.2 ml PRP/2; and 0.2 ml of PRP were injected, and groups were named 1D, 2D, 3D, 4D, respectively.

Injections were performed to the right subscapular area (Recipient area): 0.2 ml serum; 0.2 ml PRP/4; 0.2 ml of PRP/2 and 0.2 ml of PRP were injected, and groups were named 1R, 2R, 3R, 4R, respectively.

Since maximum stem cell output was detected on the 10th day in the in vitro study, fat transfers were performed 10 days after the injections in all groups in the in vivo study. 1.2 ml of fat grafts were transferred to all recipient areas.

Rats were sacrificed after 90 days. Immunohistochemical examination using anti-VEGF antibodies and histopathological examination were performed.

Results: in vitro:

Maximum stem cell output to dishes was on the 10th day.

in vivo:

There was a statistically significant difference in the vascularity in the specimen in the 3D and 4D groups compared to the 1D group. Similarly, the 3R group showed significant increase in vascularity compared to the 1R group. Also 4R group was better compared to the 1R and 2R groups. The cellular integrity of the fat cells was significantly superior in the 4R group compared to the 1R group. Cyst and vacuolization were significantly suppressed in the 4D group compared to 1D, 2D and 3D.

The lower the PRP concentrations, the closer the results to the control groups were obtained.

Conclusion: It has been shown that fat grafts given on the 10th day after PRP injection in high concentrations to the recipient area can achieve more permanence.

A-0270 Microcirculation of Median Nerve in Carpal Tunnel Syndrome

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Background: The objectivity of the physical and electrodiagnostic tests are limited in detecting carpal tunnel syndrome (CTS) and its recurrence. Predicting the median nerve blood supply using superb microvascular imaging (SMI) will allow exact diagnosis and a good follow-up system. The aims of the study include, using the superb microvascular imaging (SMI) to correlate with electromyography (EMG) diagnosis, and to determine the impact of surgery on improvement in SMI.

Methods: Between July of 2019 and January of 2020, 32 wrists of 21 patients were evaluated prospectively. After preoperative electrodiagnostic studies and vascular index measurement with SMI, open carpal tunnel release was performed by a single surgeon and three months later standardized SMIs were performed. Preoperative vascular indexes were compared with the mild, moderate, and severe electrodiagnostic study results. Preoperative and postoperative vascular index results were compared.

Results: The average of the preoperative and postoperative SMI groups were 2.77 and 1.48, respectively, and there was a statistically significant difference between the two groups ($p < 0.05$). While no significant difference was found between preoperative and postoperative vascular index values in patients presenting with mild CTS ($p > 0.05$), there was a significant decrease in vascular index values in patients presenting with moderate and severe CTS after the surgical decompression.

Conclusions: Superb microvascular imaging is emerging as a groundbreaking, new, and reliable technique. Evaluation of median nerve blood supply is a reliable method that would be helpful for early diagnosis, planning treatment, determining the severity of carpal tunnel syndrome as well as postoperative follow-up.

A-0272 Effect of tourniquet in atraumatic common hand surgery on perioperative pain and short-term patient reported outcomes: a randomized controlled trial

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Background: As tourniquet use in hand surgery under local anesthesia is still common but uncomfortable for most patients, we primary aimed to evaluate the effect of tourniquet use on intraoperative experienced pain of patients. Secondary outcomes concerned patient reported outcomes, satisfaction and postoperative complications.

Methods: A randomized controlled trial (RCT) has been performed in patients planned for open carpal tunnel release (CTR) or trigger finger release (TFR) under local anesthesia with or without tourniquet. Directly postoperatively, injection-, tourniquet- and

overall pain were recorded with the visual analogue score (0–10). After 6 and 12 weeks, outcomes on the Boston Carpal Tunnel Questionnaire (BCTQ), QuickDASH questionnaire, satisfaction- and complication scales were determined.

Results: Of the 163 patients approached, 142 patients (52 men) consented to participate. The average experienced tourniquet pain (4,1) was comparable to the injection pain (4,4) and did not affect the overall pain (2,4). QuickDASH and BCTQ scores improved significantly in both groups during follow-up, without difference between both groups. Comparable high satisfaction and low complication rates were found in both groups.

Conclusion: Although tourniquet use is experienced as painful as an injection, it does not increase the pain sensation of the entire procedure; both the injection and the overall mean pain was similar in the tourniquet and no-tourniquet group. After three months of follow-up, short-term outcomes and complications in both groups were comparable, suggesting that it is save not to use a tourniquet in minor hand surgery under local anesthesia conditions other than WALANT without waiting for the vasoconstrictive effect of epinephrine.

A-0275 Arthroscopic synovectomy of the wrist in patients with rheumatoid arthritis: a systematic review and meta-analysis

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Introduction: Arthritis of the wrist occurs in 75% of patients with rheumatoid arthritis (RA) and can lead to pain, progressive joint destruction and loss of wrist function. Primary treatment consists of Disease-Modifying Anti-Rheumatic Drugs (DMARDs), often combined with local or systemic corticosteroids. In case of local therapy-resistant arthritis of the wrist, arthroscopic synovectomy can improve symptoms and prevent local disease progression. To our knowledge, functional outcomes of this technique have not been systematically investigated.

The purpose of this systematic review was to evaluate functional outcomes and pain scores following arthroscopic synovectomy of the wrist in patients with RA.

Methods: This systematic review and meta-analysis was performed according to the PRISMA guidelines. The medical databases MedLine, Embase, Cochrane Central Register of Controlled Trials, Web of Science and Google Scholar were searched on May 1st 2020. All studies describing functional outcomes or pain scores following arthroscopic synovectomy in RA patients were included. Data collection included patient characteristics, details of surgical procedure, Visual Analogue Scale (VAS) pain score, Modified Mayo Wrist Score (MMWS), flexion-extension arc, radiographic progression, secondary surgery and complications. The MMWS assesses wrist function using a 0–80 scale (higher score indicates better outcome). The methodological index for non-randomized studies (MINORS) criteria were used to assess risk of bias of the included studies. Data of individual studies were pooled for the meta-analyses.

Results: The search resulted in 582 studies, of which 38 full-texts were screened and six were included. All six studies were non-comparative cohort studies, including 153 arthroscopic synovectomies of the wrist in 138 patients. Mean age was 45.7 years and 80% of patients was female. Disease duration of RA was 56.8 months (range: 6–240). The mean follow-up was 49.4 months (range: 6–118). Studies included both early and late stage radiographic wrist arthritis. All studies described a dorsal arthroscopic approach with four to six portals. Postoperative treatment included fast mobilization in all studies. The mean VAS pain score improved from 7.7 to 2.2 ($p < 0.05$). The mean MMWS improved from 43.3 to 70.4 ($p < 0.05$), the mean flexion-extension arc improved from 71.8 to 89.4 degrees ($p < 0.05$). Radiographic progression of arthritis was seen in 43% of the wrists. The only complication was neuropraxia, which occurred in two cases (1.3%) and resolved spontaneously. Three patients required secondary surgery, consisting of re-arthroscopic synovectomy ($n = 1$) and a Sauve-Kapanji procedure ($n = 1$). The MINORS criteria assessment resulted in scores of 8–10 out of 16 points.

Discussion: Arthroscopic synovectomy of the wrist in patients with RA results in improvement of pain, wrist function and range of motion, while complication rates are low. It be can be regarded as a save and non-time consuming intervention. This review was limited by the quality of the included studies.

Conclusion: Arthroscopic synovectomy can be a valuable addition to the management of rheumatic wrist arthritis. Further research is needed to compare this technique to other local therapies, such as intra-

articular corticosteroid treatment, by means of prospective comparative trials.
Keywords: rheumatoid arthritis, wrist, synovectomy, wrist arthroscopy, patient-reported outcome

A-0276 Silver Ion Doped Hydroxyapatite Coated Titanium Pins Prevent Bacterial Colonization

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Silver Ion Doped Hydroxyapatite Coated Titanium Pins Prevent Bacterial Colonization
Objectives: Long-term survival and favorable outcome of orthopedic implant uses are determined by bone-implant osseointegration and absence of infection. K wires are one of the most used implants in orthopaedics surgery, plastic surgery, and hand surgery. In order to provide increased biocompatibility as well as antibacterial activity to the orthopedic implant, we studied an implant coating which containing silver ions and calcium phosphate bio-ceramics [hydroxyapatite] by electrospray method. We hypothesized that mixing these two nano-powder (Ag+- HA) for coating the titanium pins by especially electrospray method may better prevent from bacterial colonization as compared with uncoated pins while obtaining very fine, homogenous, and very resistive coating on these circular titanium materials.
Materials and Methods: Sixty-six titanium pins were divided into three groups of 22 implants. First group were coated with silver ion doped hydroxyapatite nano powder by using electrospray method. Second group were coated with pure hydroxyapatite. Surface quality of coated pins were check by scanning electron microscope. The remaining pins were used without any coating. Staphylococcus epidermidis clinical isolates were used for the study. Each pin was placed in 1x104 CFU/mL bacterial suspension containing tube and at quantitative culture of bacteria on the broth and on the pins were performed at 24 h. The antibacterial culture tests were repeated on day 2 and weeks 2, 4, 6 and 8th. The minimum inhibitory concentration value of silver ions was determined. Free silver ions were determined by atomic absorption method.
Results: Bacterial growth was statistically higher in broth containing uncoated pins compared to silver ion-coated, and hydroxyapatite-coated pins at 24 hours ($p = 0.036$ and $p = 0.009$, respectively). The release of bacteria from silver ion-coated pins was statistically less compared to pure hydroxyapatite coated pins and uncoated pins ($p = 0.039$ and $p = 0.002$, respectively). No differences were detected between the hydroxyapatite coated and uncoated pin groups MIC levels for 5% silver ion powder was 8 μg/mL for Coagulase Negative Staphylococcus. No free silver ions were detected in the broth media.
Conclusion: Ag+- HA nano size powder coated titanium pins by electrospray method reduced the bacterial colonization significantly besides obtaining very fine and homogenous coating by that method. This method can be applied for classic stainless steel wire to check effectivity of coating. Using silver ion doped materials in the hand surgery operations can be a good option to prevent from implant related infection, and early failures.
Keywords: Key WordsSilver ion, bacterial colonization, coated pin, infection, hand surgery

A-0278 Percutaneous DIP joint arthrodesis – outcomes over the last 10 years of performing this technique

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Aims: Distal Interphalangeal (DIP) joint arthrodesis can be effectively performed using mini Acutrak screws (standard screws in thumbs) and this procedure can be successful done percutaneously (without preparation of the joint surface) (1). The advantage of this procedure is that there is less trauma to the soft tissues as the DIP joint does not need to be opened up. There is a small incision, requiring limited dressing, allowing the patient to mobilise and use the finger immediately. The procedure also reduces the operative time.

This study adds to the evidence that has previously been presented and reviews the outcomes of patients undergoing percutaneous DIP joint arthrodesis using this method.
Methods: The procedure is performed by making a stab incision at the tip of the distal phalanx. The guidewire is inserted under image guidance from the tip of the distal phalanx into the middle phalanx. The length of the screw is measured, a reamer is used to open the cortex and the screw is inserted with fluoroscopic guidance. This procedure can be done for any indication where an arthrodesis of the DIP joint is required.

Retrospective analysis of patients undergoing percutaneous DIP joint arthrodesis with this method was undertaken to review the outcome, complications and length of follow up.
Results: Total number of patients and joints:

- 22 joints in 17 patients during a period of January 2010 to December 2014.
- 33 joints in 22 patients during a period of January 2015 to December 2019.

The indications and outcome:

- Osteoarthritis: total number = 35, fused – 32, non-union – 3
- Upper limb spasticity: total number = 15, fused – 13, non-union – 2
- Mallet finger: total number = 5, fused – 4, non-union – 1

Total number = 55, fused – 49, non-union – 6

Of the 6 patients who had non-union, 3 required revision to compact hand plates, the others were asymptomatic.

There were 5 cases of suspected infection in the osteoarthritis group and 1 infection in the upper limb spasticity group that needed implant removal. No other patients in the study required implant removal.

The shortest follow up time was 6 weeks (17 patients) and the longest follow up time was 56 weeks (patient with non-union). Median follow up was 8 weeks.

Conclusions: Percutaneous DIP joint arthrodesis using a mini Acutrak screw is a safe and effective method of performing this procedure. Complications are uncommon and in this cohort 89% of joints fused using this method.

1. A Malhotra, M Gandhi, D Ford, S Pickard; Outcomes following distal inter-phalangeal fusion in the hand using Acutrak screws; presented BSSH 2015

A-0280 Follow up of Distal radius volar plating – No role for post-operative radiographs

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Background: There is no consensus on radiographic follow up for distal radius fractures after fixation. In our institutional practice all the patients will have intra-operative image intensifier screening to check the adequacy of reduction and implant position. The usual protocol is to review them at 6 weeks and 6 months with follow up radiographs. These radiographs are scrutinised for implant position and fracture union. We propose that if the patient is asymptomatic there is no need for follow up radiographs.

Materials and Methods: We retrospectively looked at all the distal radius fractures operated in our hospital in the last 10 years. Data was collected from the electronic patient records for patients who had revision surgery or metal work removal. Clinic notes of all the patients were reviewed to assess the patient symptoms, radiographic findings and indications for implant removal. All the patients had a minimum follow up of 6 months post-operatively after which if they were asymptomatic were discharged from the clinic.

Results and Discussion: Total of 900 distal radius fracture fixations were done in our hospital during the 10year period. Of these 747 were volar plating. 49 patients had volar plates removed. 14 patients had metal work removal and joint release for stiffness. Another 6 had the plate removal and neurolysis for carpal tunnel syndrome of which two had prominent plate which caused nerve irritation in the carpal tunnel. Dorsal (n = 7) and intra-articular (n = 4) screw prominence were also reasons for implant removal. Volar plate prominence and flexor pollicis longus tendon irritation was the indication in 6 patients (none of them had tendon ruptures). Dorsal wrist pain was the reason for metal work removal in 5 patients. The other indications for removal were reduction failure (n = 2), Infection (n = 2) and routine removal in paediatric patients (n = 3).

47 out of 49 patients who underwent implant removal were symptomatic on clinic follow up and one patient each with a prominent intra-articular screw and prominent dorsal screw had no symptoms but this was picked up on the radiographs and resulted in implant removal.

Conclusion: The use of intra-operative image intensifier has reduced the risk of mal-positioning of implants or inappropriate reduction in fracture fixation. Routine post-operative radiographs resulted in the change in management of only two out of 700 (0.3%) patients who were asymptomatic.

We suggest that radiographs have no role in the follow up of patients after distal radius fractures if they are asymptomatic and intra-operative image intensifier images are appropriate

A-0284 Hyper-selective ulnar nerve neurectomy at the wrist, proximal to Guyon's canal, a point of technique that has been developed based on cadaveric dissections and the Oswestry experience of applying this procedure

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Aims: Hyper-selective neurectomy of the motor branch of the ulnar nerve at the wrist may be useful in patients with spasticity to reduce intrinsic tightness. The objective of performing neurectomy proximal to Guyon's canal is that all motor branches of the ulnar nerve to the hand can be targeted including those to abductor digiti minimi and flexor digit mini while preserving sensation and avoiding scarring on weight bearing part of palm. This is a point of technique based on cadaveric studies.
Methods: For dissection, 5 forearms from fresh frozen cadavers were used. The ulnar nerve was exposed from the mid forearm to the hand. The ulnar nerve was identified at the level of Guyon's canal and dissected proximally to forearm. The motor branch of the ulnar nerve was separated from sensory branches distally and traced proximally until it started to interweave. The distance from the proximal border of pisiform to point where motor and sensory fascicles entwined proximally was measured.
Results: The distance the motor branch could be isolated from the proximal border of the pisiform until becoming entwined with the sensory fascicles in the cadavers were: 41 mm, 35 mm, 32 mm, 25 mm and 3 mm. (Median 32 mm, range 41–3 mm). The motor branch was the deepest fascicle of the nerve in all cadavers.
Discussion: Based on the cadaveric findings, our recommendation is for a 2 cm longitudinal incision along the radial border of FCU tendon to the distal wrist crease with the position of the pisiform as the distal landmark. The ulnar nerve is identified. The epineurium is incised, and fascicles are separated. The motor branch is the deepest fascicle. The fascicles are dissected and mobilised from the pisiform distally to 15 mm proximally. A nerve stimulator is used to confirm identification of the motor branch and a 1 cm segment is excised.

Our experience

At our unit, 9 patients have had this procedure. All patients had intrinsic tightness from upper limb spasticity. The demographics are given below:

- Gender: 6 female, 3 male
- Age: Median 49 (20–75) years
- Underlying diagnosis: Stroke – 5, Cerebral palsy – 2, Spinal cord injury – 2

All patients had had botox injection prior to the procedure and 5 patients had previously undergone distal intrinsic release but their fingers had relapsed.

In this series, 7 patients reported notable improvement in hand tightness.

One patient had some improvement but continued to have spasticity of the long flexors, subsequently requiring forearm hyper-selective neurectomies and one patient had failure of improvement in the index and middle fingers though ring and little fingers improved.

No reported complications from this procedure were reported post operatively.

Neurectomy of the motor branch of the ulnar nerve at the wrist can be a useful procedure in patients with spasticity to reduce intrinsic tightness and may be performed as a primary procedure in conjunction with myofascial lengthening of forearm flexors.

A-0286 Comparative study between tension band wiring and compression screw for proximal interphalangeal and metacarpophalangeal joint arthrodesis

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Introduction: Degenerative changes of the proximal interphalangeal (PIP) joint and the metacarpophalangeal (MCP) joint secondary to trauma, osteoarthritis, or inflammatory arthritis can lead to severe pain, instability and deformity. Arthrodesis is still the gold standard for the achievement of pain relief and stability. Tension band wiring (TBW) and compression screw (CS) are the most common methods of fixation used for proximal interphalangeal (PIP) and metacarpophalangeal (MCP) joint arthrodesis. Although there are biomechanical studies that compare the stiffness of both methods, there are few publications of comparative clinical trials.

The aim of this study was to compare outcomes between patients treated with those techniques.
Methods: For the purpose of this study, we retrospectively reviewed patients with PIP joint and MCP joint arthrodesis with either a tension band wiring or compression screw during a 10 years period. Patients with skeletal maturity treated because of osteoarthritis or autoimmune arthritis were included. Union rate and time, complications and re-operation rate were compared between both techniques.
Results: Fifty-six arthrodesis in 44 patients were evaluated with an average age of 52 years at the time of surgery. Group 1: 35 cases treated with TBW and group 2: 21cases with CS. The cause of arthrodesis indication was primary or secondary osteoarthritis in 24 cases (43%) and autoimmune arthritis in 32 cases (57%). PIP joint arthrodesis was done in 18 cases (32%) and MCP joint

arthrodesis in 38 cases (68%). Mean follow-up after surgery was 24 months. Union rate was 94,2% with an average healing time of 6,4 weeks in TBW group and 85,7% union rate with an average healing time of 7,2 weeks in CS group. Complication rate was 11,4% in the first group and 23,8% in the second group. Re-operation rate was 17,1% in the first group and 0% in the second group.

Conclusions: Despite the widespread use of the arthrodesis as a salvage procedure in hand surgery, there are few publications that compare both procedures. Our results showed that both methods allow high rates of bone union; however, in the CS group the non-union incidence was almost three times higher than in the TBW group and the complications rate was near 25%, all cases related to complications in bone healing. Re-operation rate was higher in the TBW group, mostly due to hardware removal.

A-0288 A Systematic Review of Vascularized Toe and Non-Vascularized Toe Phalangeal Transfer for Reconstruction of Congenital Absence of Digits or Thumb

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Purpose: Toe-to-hand transfer has been used to treat congenital absence or deficiency of digits or thumb, which can present with diverse morphologic forms. Non-vascularized toe phalanx transplantation was first described to lengthen or reconstruct missing fingers or thumb, though it is criticized for high rates of avascular necrosis. More recently, vascularized transfer has been described to improve graft survival, with adequate perfusion enabling increased growth. The aim of this study was to compare the indications, techniques, and outcomes of vascularized and non-vascularized toe-to-hand transfer surgery in patients with congenital hand differences.

Methods: A systematic review was conducted according to PRISMA guidelines. Studies containing data on indications, surgical technique, and outcomes for patients with congenital absence or deficiency of digits or thumb treated with toe-to-hand transfer were included. Confidence intervals (CI) were calculated for outcomes of the two toe transfer techniques. Failure was defined as resorption of the graft or necrosis necessitating removal. The 95% CIs were used to determine difference in outcomes. Statistical significance was determined using chi-square test.

Results: Forty studies published between 1978–2020 met inclusion criteria, containing a total of 534 patients and 865 transfers. Twenty-four studies (60%) described only vascularized/microsurgical toe-to-hand transfers, 15 (37.5%) described non-vascularized, and 1 (2.5%) included patients with both types of transfer. There were 133 males (53.4%) and 116 (46.6%) females. Three hundred twenty patients (59.9%) had vascularized transfers, and 214 patients (40.1%) non-vascularized. The mean age for vascularized transfers was 38.8 months (range 6 months-10 years 4 months) and for non-vascularized, 36.2 months (range 6 months-17 years).

Symbrachydactyly was the most common indication in both groups (46.1% of the vascularized group and 26.4% of the non-vascularized group). The most commonly transplanted vascularized toe was the second one (91.5%). The next most common were the great toe (6.7%) and anatomically undefined digits (1.8%). The fourth toe was most commonly used in the non-vascularized group (61.9%). Forty-eight third toes were used (20.3%), 22 fifth toes (9.3%), 20 second toes (8.5%).

Vascularized toe transfers were most commonly used to reconstruct the thumb (52.0%) or unspecified fingers (27.3%). Middle and ring fingers in this group were reconstructed in 9.8% and 7.0% of cases, respectively. The thumb was also most commonly reconstructed in non-vascularized transfers (29.4%), followed by the middle (19.4%), ring and pinkie (18.0% each), then index finger (14.7%).

The time to final follow-up for the vascularized group was 1 to 11 years and 6 months to 35 years in the non-vascularized group.

Vascularized toes showed better stability, healing, range of motion, and growth. In the vascularized group, there was a higher success rate of 99.3% (95% CI 98.5%-100.1%). The non-vascularized group had a success rate of 89.4% (95% CI 86.4%-92.3), ($p < 0.001$).

Conclusions: Overall, both vascularized and non-vascularized toe transfers are good options for reconstruction of congenital absence or deficiency of digits or thumb. Our study found a higher success rate in vascularized when compared to non-vascularized transfers. Indications and approach for each technique varied between patients treated by the same author.

A-0290 Influence of the 1st carpometacarpal joint fusion on thumb-tip movement

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Background: Trapeziometacarpal arthrodesis provides stability and strength of the thumb, while fixation of the trapeziometacarpal joint restricts motion of the thumb, which may consequently impair the activity of daily living. The purpose of our study was to investigate how length and how large area of the thumb-tip trajectory were reduced after the trapeziometacarpal joint fusion.
Methods: 6 fresh-frozen cadavers were used. Optical markers were fixed to the scaphoid, trapezium, first midcarpal, proximal phalanx, and distal phalanx of the thumb and the base of the custom-built fixation apparatus for the coordinate reference system. Each specimen was fixed to our original jig by clamping four 2.4-mm threaded pins drilled into the proximal and distal third metacarpals and distal and middle radius.

Tension was applied to the distal tendons of 4 extrinsic thumb muscles (extensor pollicis longus, flexor pollicis longus, abductor pollicis longus, and extensor pollicis brevis) by the servomotors, while 4 intrinsic muscles (abductor pollicis brevis, opponens pollicis, flexor pollicis brevis, and adductor pollicis) was applied tension along with muscle berries by static weights. Thumb-tip trajectory was examined by a motion capture system in six different intrinsic muscle tensions before and after the trapeziometacarpal joint fusion.
Results: When tension was applied to the intrinsic muscles, the length of thumb-tip trajectory decreased in all conditions compared with before trapeziometacarpal joint fusion, while when pulling the extrinsic muscles, only the trajectory decreased when the abductor pollicis longus was pulled. Overall trajectory area of the thumb-tip when the trapeziometacarpal joint fusion was reduced to approximately 30% compared with before trapeziometacarpal joint fusion.
Conclusions: Thumb-tip trajectory was mainly restricted by trapeziometacarpal joint fusion approximately to 30% of before the fusion. These reduced area were mostly found in a tolerable area in daily activity. Thus, arthrodesis can be a choice in patients who wished to engage in physical labor without any difficulties.

A-0291 Histological Analysis of the TFCC: An Examination on the Meniscus Homologue, Ulnar Collateral Ligament and Ligament Subcruentum

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Background: The components of the TFCC were originally defined by Palmer and Werner in 1981, including the meniscus homologue and the ulnar collateral ligament, among other structures. Nakamura et al. in 1996 examined the TFCC anatomically and histologically, and defined the functional ulnar collateral ligament as the sheath floor of the ECU and surrounding loose ligamentous structures. Kleinman in 2007 described the ligamentum subcruentum as the deep layer of the RUL. To clarify existence and nature of these 3 structures, a, histological analysis was again performed.
Methods: A histological analysis was performed using 6 fresh frozen cadavers (age 17–44). Before sectioning, each upper extremity was fixed in the neutral position of the forearm and the wrist using multiple K-wires to prevent changes in the ulnar variance or rotation of the DRUJ or wrist position. The wrist was cut 6 cm proximal to the DRUJ, preserved in phosphate buffered 10% formalin, embedded in paraffin, and 10μ coronal sections were made to obtain serial sections from dorsal to volar. Sections were stained with Azan, and light microscopic observation was made.
Results: The meniscus homologue was noted as internal wall area of distal component of the TFCC, which faced to the triquetrum. These are loosely oriented fibers mostly showing a thickened joint capsule and in the very palmar area the well-oriented fibers to the triquetrum was seen, corresponding to the ulnotriquetral ligament. No meniscus-like structure was found, but there were fibrocartilaginous tissue against the triquetrum in one specimen. This may be fibrocartilaginous transformation by the pressure from the triquetrum. There is no meniscus homologue of the wrist in this analysis.

There were loosely-oriented fibers from the ulnar styloid to the triquetrum, without ligamentous insertion neither to the ulnar styloid or the triquetrum. There was adipose tissue just beneath the not well-oriented fibers inside. There is no ligament on the ulnar side of the TFCC based on histology.

Our histological examination showed vacant space between the styloid fibers and fovea fibers of the radioulnar ligament which may confirm Henle's description of bundles of vessels between the superficial and deep radioulnar ligaments.
Conclusion: Contrary to papers of Palmer, Nakamura and Kleinman, there was no ulnar collateral ligament or meniscus homologue in the human wrist, and the term ligamentum subcruentum should be used as it was originally, for a vascular structure and not as a term for the deep ligament.

A-0292 The effect of TFCC injury and ulnar styloid fracture on the DRUJ stability in the distal radius fractures -The evaluation using DRUJ arthroscopy-

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Objectives: DRUJ arthroscopy permits a direct evaluation of the TFCC tear of foveal attachment. We investigated the effects of distal TFCC tears, foveal TFCC tears, and the ulnar styloid fractures on DRUJ stability in the distal radius fractures.
Method: The subjects were 40 surgical cases of the distal radius fractures(mean 64 years old). There were 5 cases of AO classification A type, 5 cases of B type, and 20 cases of C type. Ulnar styloid fractures were complicated in 24 cases, including tip fractures in 7 cases, middle part fractures in 3 cases, base fractures in 12 cases, and oblique base fractures in 2 cases. After reduction and fixation of the radius, a radiocarpal arthroscope showed 15 cases of peripheral injury in the distal part of the TFCC, 18 cases of disc injury, and a DRUJ arthroscopy showed partial tear of the fovea in 20 cases and complete tear of it in 9 cases. In the DRUJ ballottement test under general anesthesia after radial fixation, there were 17 cases of gross instability without an endpoint in either or both the palmar and dorsal directions. We hypothesized that ulnar styloid fractures excluding tip fractures, distal TFCC tears including disk and peripheral tears, and complete foveal TFCC tears were factors that affected 17 patients with gross DRUJ instability. A simple regression analysis was performed from each cross table, and the difference was tested by Fisher's exact test ($p < 0.05$).
Results: Out of 17 cases of ulnar styloid fractures excluding tip fractures, 33 cases of TFCC proximal tear, and 9 cases of complete TFCC foveal tear, only complete TFCC foveal tear was significantly affected ballottement test ($p = 0.61$, 0.98, 0.00, respectively). All cases of complete foveal TFCC injury showed gross DRUJ instability.
Conclusion: Only foveal TFCC tear affected the stability of DRUJ in the distal radius fractures. Assessing foveal TFCC tear with a DRUJ arthroscopy was considered necessary in determining treatment strategies for the distal radius fractures.

A-0295 Complications and safety of the transplanted organ after upper extremity surgery in patients receiving immunosuppressant therapy after solid organ transplantation

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Purpose: The purpose of this study was to evaluate the complications of upper extremity surgery in patients receiving immunosuppressant therapy after solid organ transplantation (SOT) and the safety of the transplanted organ in these patients.
Methods: patients who underwent upper extremity surgery after SOT between 2009 and 2018 were included. Demographic information, data related to SOT and upper extremity surgery, and complications at a minimum of follow-up of 1 year after upper extremity surgery were reviewed. The complications were categorized according to the Clavien–Dindo classification system. Data on the following transplanted organ-specific indicators were collected before, immediately, and 3 and 12 months after upper extremity surgery: serum creatinine level for the kidney, serum total bilirubin level for the liver, serum amylase level for the pancreas, and ejection fraction of the left ventricle on transthoracic echocardiography for the heart.
Results: Seventy-two transplant recipients underwent 104 upper extremity surgeries after SOT at our institution. Trigger/tendon release ($n = 36$, 34.6%) was the most frequently performed upper extremity surgery, followed by incision and drainage for infection ($n = 16$, 15.4%). All patients had an American Society of Anesthesiologists score of 2 or 3, and 75 (72.1%) surgeries were performed under regional or local anesthesia. All surgeries were performed in patients who had undergone single SOT; the most commonly transplanted organ was the kidney ($n = 40$), followed by the liver ($n = 32$). All surgeries were performed under immunosuppressant; tacrolimus-based regimens were predominately administered ($n = 82$), followed by mycophenolate ($n = 66$). Postoperative complications occurred in 10 (9.6%) patients. Surgical site infection was the most common complication ($n = 5$), and all surgeries of these patients were performed under

methylprednisolone medication. According to the Clavien–Dindo classification, complications in three patients were classified as grade I, those in three patients were classified as grade II, and those in four patients were classified as grade III. Regardless of the transplanted organ, the transplanted organ-specific indicators did not significantly change after upper extremity surgery.
Conclusion: In patients who underwent SOT, the complication rate of upper extremity surgery was considerable. Surgical site infection was the most common complication. The function of the transplanted organ was well preserved after upper extremity surgery. Upper extremity surgeons should pay attention to the risk of postoperative infections in patients who have undergone SOT and reassure patients regarding the safety of the transplanted organ before surgery.

A-0297 A microbiological analysis of 210 cases of hand osteomyelitis

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Introduction: Osteomyelitis of the hand in adults often requires debridement of necrotic tissue and antibiotics targeted at organisms isolated from bone samples. This study aimed to evaluate organisms isolated from hand osteomyelitis.
Methods: A retrospective review of the organisms isolated from 210 patients with osteomyelitis of the phalanges and metacarpals of the hand in a major trauma centre was performed over twelve years.
Results: Microbiological cultures were performed for 195 patients, including 122 with positive bone cultures. In seven cases with cultures, no organisms were isolated from any source. Staphylococcus aureus was identified in 101 patients (52%), with coagulase negative staphylococci in 56 (29%), and 88 were polymicrobial infections (42%). Arterial calcification was associated with more polymicrobial infections ($p < 0.01$), enterobacterales and enterocci ($p < 0.01$), and diabetes mellitus associated with more streptococci ($p < 0.01$) but fewer coagulase negative staphylococci ($p < 0.01$).
Conclusions: The high incidence of polymicrobial infections and coagulase negative staphylococcus in this series suggests that for suspected cases, early microbiological and histopathological confirmation, ideally via bone biopsy, is optimal for management of osteomyelitis of the hand.

A-0299 Hand osteomyelitis: a review of the literature over the last 30 years

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Introduction: Hand osteomyelitis poses a challenge to hand surgeons, and evidence was reviewed to guide treatment
Methods: The literature was searched in HDAS, MEDLINE, CINAHL and EMBASE for English language articles containing series of osteomyelitis of the phalanges or metacarpals of the hand published in the 30 years between 1990 and February 2020. Google Scholar, and the Cochrane Database were searched separately over the same period. Reference lists were searched for further articles. Series of metacarpal or phalangeal osteomyelitis as part of a larger series of hand infections, or as part of a series of osteomyelitis at multiple other sites, were included.
Results: Twelve articles published between 1990 and February 2020 were identified with analysis of at least five cases of hand osteomyelitis, the largest with 69 patients. Series focussed on particular aetiologies, specific comorbidities or employment, or unusual organisms. Follow-up and reporting of complications varied widely, as did outcomes. No national or international guidelines for management of hand osteomyelitis were identified, contrasting with over 20 such guidelines for foot osteomyelitis. Oral antibiotics are sufficient for hand osteomyelitis in adults after debridement (if diabetes and vascular phenomena are excluded), and in children. Osteomyelitis associated with human bites at metacarpophalangeal joints often requires serial washouts. Hand osteomyelitis with renal failure is associated with with severe systemic upset and sepsis. Delayed presentation from the initial infection

is common and if > 6 months from onset, is associated with high amputation rates. Osteosynthesis or other reconstruction may be performed after debridement and 6 weeks antibiotics.

A-0300 Median nerve entrapment syndrome in the elbow and proximal forearm. Anatomic causes of compression and 55 cases series surgical treatment outcomes at seven years mean follow-up

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Background: Proximal median nerve (NM) neuropathies are responsible for 1% of upper extremity compressive neuropathies. The literature reports two clinical pictures depending on the location of the compression process: pronator teres syndrome (PRS) and anterior interosseous nerve syndrome (SNIOA).
Hypothesis: There is no correlation between the symptoms and the location of the proximal compressive structures on the NM or NIOA trunk.
Patients and Methods: Clinical and paraclinical data from 55 surgical releases of NM in the elbow and proximal forearm area were analyzed retrospectively. The mean age at diagnosis was 56 ± 15 years. Preoperative sensory and motor deficit signs were present in 89% of cases.

A reduced conduction speed in the NM and/or neurogenic anomalies in its distribution territory were present in 94% of the cases. The details of the intraoperative compressive structures observed have been collected. The patients included were reviewed in consultation to assess the evolution of symptoms and initial deficits.
Results: The mean follow-up time was 84 ± 70 months. Objective motor deficit signs persisted in 18 patients (18 cases) among the 35 patients in consultation. Nineteen cases presented objective sensory signs. A compressive anatomical structure had always been found. There were at least two NM compression sites in 13 cases (24%). No isolated compression of the NIOA has ever been found. There was a significant link between the duration of symptoms and the persistence of objective sensory signs ($p = 0.002$).
Discussion: There was no anatomo-clinical correlation between the site of compression and the signs of examination. Surgery requires exploring all potential sites of compression. The improvement may remain incomplete in the event of late treatment.

A-0312 Atypical fractures of the proximal ulna associated with long-term bisphosphonate therapy: Four cases of three patients

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Introduction and Purpose: Long-term bisphosphonate use has been suggested to result in decreased bone remodelling and increased risk of atypical fractures. Atypical fractures associated with long term bisphosphonate use occur typically in the subtrochanteric region or shaft of the femur. However, atypical fractures associated with long-term bisphosphonate use other than femur have been rarely reported. We experienced four atypical fractures of the proximal ulna of three patients and describe the characteristics and treatment for fractures
Methods and results: All three patients are female and all fractures occurred at meta-diaphyseal junction of the proximal ulna. The average age they sustained fracture was 83 years old. All fractures were from minor trauma, non-comminuted, minimally displaced, transverse in configuration with no beak, had endosteal sclerosis. Two patients had whole body bone scan taken at other department before the symptomatic fractures (6 months, 8 months before, respectively) and increased uptake was noted at the same site of fractures but was not recognized as pathologic findings at that time. One patient with both proximal ulna atypical fractures had four year interval between the fractures. All three patients had a more than at least 10 years of bisphosphonate use for the treatment of osteoporosis. All four atypical fractures were treated operatively using locking olecranon plate with at least more than 6 cortical purchasing distally without bone graft. In one fracture with severe endosteal sclerosis, recanalization using drill was performed before plating. All four fractures were united at an average of 7months after surgery without complication. Bisphosphonate therapy was stopped after surgery and restarted after the union of fracture.
Conclusion: Atypical fractures of the proximal ulna in patients with long-term bisphosphonate therapy reveal characteristics similar to those for atypical femoral fractures and is thought to be more popular in the future. Therefore, physicians should be aware

of the typical findings of these fractures for the proper diagnosis and treatment.
Keywords: Atypical fracture, proximal ulna, bisphosphonate

A-0317 Test-Retest Reliability and Construct Validity of the Satisfaction with Treatment Result Questionnaire in Patients with Hand and Wrist Conditions: a Prospective Study

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Background: Satisfaction with treatment result is often measured, as it is an important outcome domain in striving for Patient-Centered and Value-Based Health Care. However, to the best of our knowledge, test-retest reliability and construct validity of satisfaction with treatment result measures has not been established yet.
Questions/Purposes: To investigate the test-retest reliability and construct validity of the Satisfaction with Treatment Result Questionnaire in patients treated for their hand or wrist condition.
Methods: Prospective study using two samples from the Hand Wrist Study Group cohort: one sample of 174 patients that were evaluated at the end of their treatment to evaluate test-retest reliability, and one sample of 3750 patients at 3 months post-treatment to evaluate construct validity. Satisfaction with treatment result was measured as the patients' level of satisfaction on a 5-point Likert scale (question 1) and the willingness to undergo the treatment again under similar circumstances (question 2). Test-retest reliability was evaluated with a mean time difference of 7.2 (±1.6) days and construct validity was evaluated using hypothesis testing.
Results: We found high reliability for question 1 (Intraclass Correlation Coefficient: 0.86 (95% Confidence Interval: 0.81 to 0.89)), and almost perfect agreement for both question 1 (Weighted Kappa: 0.86 (0.80 to 0.91)) and question 2 (Kappa: 0.81 (0.70 to 0.92)) of the Satisfaction with Treatment Result Questionnaire. Construct validity was good to excellent, as 80% of our hypotheses were confirmed.
Conclusions: The Satisfaction with Treatment Result Questionnaire has satisfactory construct validity and very high test-retest validity in patients with hand and wrist conditions, indicating that this questionnaire can be used with confidence in striving for patient-centered care and value-based health care. Future research should investigate predictors for variation in satisfaction with treatment result.

A-0318 Which Factors Independently Contribute to Satisfaction with Treatment Result Following Common Treatments for Hand and Wrist Conditions? A Large Cohort Analysis

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Background: Satisfaction with treatment result is an important outcome domain in striving for Patient-Centered and Value-Based Health Care. Although some studies have investigated factors associated with satisfaction with treatment result, most studies used relatively small samples and none have investigated the independent contribution to this satisfaction of baseline sociodemographics, change in Patient Reported Outcome Measurements (PROMs), baseline psychological characteristics, and Patient Reported Experience Measures (PREMs).
Questions/Purposes: To investigate the independent contribution of baseline sociodemographics, change in PROMs, baseline psychological characteristics, and PREMs to satisfaction with treatment result at 3 months post-treatment in a large sample of patients treated for common hand or wrist conditions.
Methods: In this prospective cohort study, we included 1824 patients that underwent carpal tunnel release, nonsurgical or surgical treatment for thumb base osteoarthritis, a trigger finger release, limited fasciectomy for Dupuytren's contracture, or nonsurgical treatment for midcarpal laxity. The Satisfaction with Treatment Result Questionnaire was

administered at 3 months, by asking the patients' satisfaction on a 5-point Likert scale (question 1, good/excellent/poor/moderate/fair) and the patients' willingness to undergo the treatment again under similar circumstances (question 2, yes/no). Hierarchical logistic regression was used to identify whether baseline sociodemographics, change in PROMs (including quality of life, hand function, and pain), baseline psychological characteristics (including treatment credibility and expectations, illness perception, pain catastrophizing, anxiety, and depression), and PREMs contributed to each question of the Satisfaction with Treatment Result Questionnaire 3 months post-treatment. We dichotomized question 1 of the questionnaire, with the answering options ''good'' and ''excellent'' attributed to ''satisfied'' and ''poor'', ''moderate'', and ''fair'' to ''dissatisfied''.

Results: We found that a greater decrease in pain during physical load, more improvement in satisfaction with the hand, multiple aspects of PREMs, baseline illness perception, and baseline treatment expectations together explained variance in question 1 of the satisfaction with treatment result questionnaire with an area under the curve of 0.86. For question 2, symptom duration, greater decrease in pain during physical load, greater improvement in hand function, more improvement in satisfaction with the hand, multiple aspects of PREMs, baseline illness perception, and baseline treatment credibility explained variance in outcome with an area under the curve of 0.82.

Conclusions: We identified several factors that independently contribute to satisfaction with treatment result in a large sample of 1824 patients that underwent treatment for common hand and wrist conditions. Many of these factors, such as PREMs, baseline illness perception, and baseline treatment expectations or credibility can be influenced directly or indirectly by clinicians and thus could be used in future studies for developing interventions aiming to improve satisfaction with treatment result.

A-0321 Arthroscopic isometric inside-out suture technique for TFCC foveal repair

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The aim of this current study is introducing inside-out technique with isometric suture technique and its e results for TFCC foveal repair

Technique & methods: 3–4, 4–5 portal, DRUJ-R and DRUJ-U are created. 1.9 mm wrist arthroscope is iused. The hook test, and the floating sign, in which TFCC around fovea is floating during suction with a shaver, is usually helpful to make decision from RCJ. TFCC foveal region is checked from DRUJ scope directly. From DRUJ-R, scope is inserted, and debridement is performed from DRUJ-U with shaver. 1.5 cm longitudinal skin incision is made just volar to the ulnar styloid. Single lumen curved guide is inserted through the 4–5 portal, targeting the fovea. The isometric point is just dorsal and radial to the recess seeing from RCJ according to literature (1.2). In neutral or slightly supinated position, the needle through the curved guide is easier to aim towards the center of fovea because the ulnar styloid moves volar direction. Passing wire with suture tape is drilled via the curved guide through the TFCC and distal ulna bone and comes out on the ulnar aspect of ulna cortex, and fixed to ulnar cortex using Swieve Lock system. 100 patients were surgically treated for foveal tear. Plaster fixation with the arm neutral was applied for 3weeks. Active ROM starts from cast removal, and passive ROM starts 6 weeks after operation. All patients were evaluated with modified Green &O'Brien scoring system.

Results: Averaged VAS improved from 8.8 to 0.8, and returned their previous work or sports. Clinical score with modified Green and O'Brien scoring system averaged 93.1 points.

Conclusion: Recent reports (3.4) suggested the TFCC at Fovea was great role on DRUJ stability. Our current results encourage the repair of the TFCC at Fovea arthroscopically. In spite of the good results, whether the factor of age (traumatic or degenerative), and duration from injury to surgical repair effect on the result was considered in the future problem.

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A-0323 Another modification of the side-to-side suture technique

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Objectives/Interrogation: In tendon surgery early mobilisation is the key to have superior outcomes. It reduces adhesion formation, improves tensile strength, vascularity and cellularity of the repair site. The side-to-side(STS) technique was developed to provide the adequate strength to allow early mobilisation. The original description suggests to pull through the graft tendon on the host before making the repair. In some cases the thinner tendons just don't make this possible without risking the weakening of the tendon at the insertion site. The idea of this study was to measure how does it affect the strength of the suture if we make an insertion or not.
Methods: Flexor digitorum profondus tendons were freshly harvested from mangalica pig front legs.

We used standard 7 mm wide tendons. We used 3 samples to measure the original strength of the tendon. For the STS repair we measured the originally suggested 4 cm overlap region, secured it with two end stitches, and made the running cross sutures on both sides of the repair. In half of the samples we made an insertion in the other half we did not. All mechanical tests were carried out using a fatigue testing machine(Instron8874). The free ends of the repairs were wrapped in wet gauze and secured with clamps. All tendons were pre-conditioned, were allowed to stress-relax for 30secs, and then were elongated to failure. The tendons were kept wet with physiological saline solution. We measured load of first failure, ultimate load and repair stiffness.
Results and Conclusions: All but one failure occurred in the repair region, one occurred at the clamp as all the controls did. There was no significant difference between the simple STS sutures and the ones with the insertion at ultimate load or stiffness (slope of the linear region of the load deformation curve). The main result of this study was that both STS suture method tested here was comparable in strength and stiffness. So the technique can be safely used without making an insertion between the graft and the host tendon.

A-0326 Revision of Arpe trapeziometacarpal arthroplasty by isolated head and linear exchange in 5 cases

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With the increase in the number of trapeziometacarpal arthroplasties, the indications for revision for implant wear will also increase significantly in the coming years. The isolated linear exchange in the context of polyethylene wear without osteolysis or loosening of the implants is already well known in the case of hip arthroplasty. This revision option offers the advantages of reduced morbidity, faster recovery and bone preservation.

We retrospectively reviewed 5 patients who benefited from revision with isolated polyethylene exchange. Revision surgery was performed at an average of 17.6 years (10.75–21.33 years). The indication for revision was dislocation in 4 cases and prophylactic revision for wear and limited osteolysis of the acetabulum.

Mean follow-up was 48.7 months (36–60). One patient had a recurrent dislocation 4 years after revision and required iterative revision by unipolar cup revision. The other patients had no instability and no complications were reported. The mean DASH score was 11.93 (4.5–15.9). Pinch strength was 102.5% (90–120) and Jamar strength was 91.75% (70–110) relative to the opposite side. Radiological evaluation showed no abnormalities at the last follow-up.

Trapezectomy is often the solution of choice in the surgical revision of arthroplasties. Unipolar revision of the cup exposes the risk of trapezius fracture, especially when the cup is well integrated. The technique we report allows to save bone and to simplify the surgical procedure with a result corresponding to those of a first-line arthroplasty. The isolated change of polyethylene is an interesting option in the revision of trapeziometacarpal arthroplasties with a good short-term result

A-0329 Psychometric qualities of the PRWHE-DLV in patients with wrist complaints in secondary care

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Objective: Hand- and wrist complaints have a high prevalence and are therefore common in primary- and hospital care. For optimal treatment it is necessary to include a patient's perspective regarding health, illness and benefits of the health care intervention. The Patient Rated Wrist/Hand Evaluation (PRWHE) is used for several years in hospital care. Nevertheless, a limited amount of research concerning the psychometric qualities of the questionnaire has been conducted. Therefore, the aim of this study was to evaluate the psychometric properties of the PRWHE for patients with hand and/or wrist complaints who are treated in the hospital.
Methods: A prospective cohort study was conducted in the department of orthopedics at Reiner the Graaf hospital. Inclusion criteria were: hand- and/or wrist pain, age of 18 year or older and understanding of the Dutch language. The construct validity was assessed by hypotheses testing with predefined correlations between PRWHE and other questionnaires (Michigan Hand outcome questionnaire (MHOQ), visual analoge score (VAS), and short form health questionnaire (SF-12)). It was tested as valid when more than 75% of the predefined hypotheses were confirmed. The reliability was tested by test-retest and internal consistency using follow up moment T0 (primary visit) and T1 (two days after primary visit). For the test-rest reliability, the intra-class correlation (ICC) was determined and for the internal consistency, the Cronbach's alpha (value between 0.70 and 0.95). The responsiveness assessed follow up moment T0 and T3 (3 months after primary visit) with an anchor-based method using the Global Perceived effect questionnaire (GPE). The GPE was used to detect the clinically important change within 3 months after T0. A floor-or ceiling effect at each time point was considered present if more than 15% of the patients achieved the minimal or maximal score.
Results: A total of 121 patients (81 women) with a median age of 54.0 years (IQR 24.0) were enrolled into the study. Most of them had chronic complaints (>3months, N = 104). Construct validity demonstrated a good valid with a confirmation of 8 out of 9 predefined hypotheses (88,8%). Test–retest reliability for the PRWHE-DLV total (n = 105; ICC = 0.918; 95% CI 0.880–0.944) and PRWHE-DLV function (n = 105; ICC = 0.903; 95% CI 0.857–0.934) were excellent, and PRWHE-DLV pain (n = 105; ICC = 0.895; 95% CI 0.857–0.934) was good. PRWHE-DLV cosmetics scored poorly (n = 105, ICC = 0.537; 95% CI 0.317–0.686). The internal consistency was demonstrated as good for the whole questionnaire except the PRWHE-DLV cosmetics with a value of -0.031. MIC was 11. PRWHE-DLV cosmetics showed a ceiling effect at T1 (17.9%), T2 (20.6%), and T3 (23.0%). At T3, a floor effect was seen in PRWHE-DLV total and PRWHE-DLV function of 15.4% and 19.2%, respectively.
Conclusions: Psychometric qualities of the PRWHE-DLV demonstrated high construct validity, internal consistency, and excellent test-retest reliability. Therefore, the PRWHE-DLV is recommended for the hospital care in patients with hand-and/or wrist complaints. The psychometric qualities of the PRWHE-DLV cosmetics are poor and use of this sub-questionnaire is not recommended.

A-0332 Study of Dupuytren's contracture in Japan

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Introduction: There have been no nationwide reports of Dupuytren's contracture in Japan, as far as we are awere. In this study, we investigated the regional bias in the number of Dupuytren's contracture patients in Japan, using DPC (Diagnosis Procedure Combination) data. DPC is a system equivalent to DRG (Diagnosis Related Groups) in the United States, and is a bundled payment system per day based on the diagnosis group classification for acute inpatient medical care, which was introduced in April 2003 for 82 special function hospitals.
Materials and Methods: We extracted data from the DPC data of the Ministry of Health, Labour and Welfare on patients admitted to DPC hospitals with Dupuytren's contracture during a 5-year period from April 2011 to March 2016, and investigated the regional bias in terms of the number of patients admitted

by prefecture. The regions were divided into 8 regions: Hokkaido region, Tohoku region, Kanto region, Chubu region, Kinki region, Chugoku region, Shikoku region, and Kyushu/Okinawa region.
Results: A total of 7401 patients of Dupuytren's contracture were hospitalized over a 5-year period, including 6757 males and 644 females, with a mean age of 69.0 ± 2.5 years. There were 1449 DPC registered hospitals in 2011, 1505 hospitals in 2012, 1496 hospitals in 2013, 1585 hospitals in 2014, and 1580 hospitals in 2015. To descrive each region, the average number of patients per year per hospital was 1.2 in Hokkaido region, 1.0 in Tohoku region, 1.0 in Kanto region, 1.0 in Chubu region, 1.0 in Kinki region, 1.1 in Chugoku region, 1.0 in Shikoku region, and 0.7 in Kyushu and Okinawa region.
Discussion and Conclusions: The incidence of Dupuytren's contracture is considered to be higher in Northern Europe, and a regional bias has been reported on a global scale. In this study, the number of patients per hospital was significantly higher in Hokkaido region than in Kyushu and Okinawa region, but there was no regional bias in the other regions. The mean age of Dupuytren's contracture patients in this study was similar to that reported in previous regional health examinations in Japan. The male to female ratio was higher than in previous regional reports, and cases leading to surgery were found to be particularly common in males.

A-0336 Trapezo-metacarpal arthroplasty (TMC) under Wide Awake Local Anesthesia with No Tourniquet (WALANT) versus Locoregional anesthesia with peripheral nerve blocks (LAPNV) : result on peri and post-operative pain and early functional result, about 30 cases

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Hypothesis: We think that the preservation of intraoperative motor skills with WALANT would allow better functional recovery, by ensuring perioperative analgesic comfort similar to Locoregional anesthesia with peripheral nerve blocks (LAPNV).
Materials and Methods: We realized a retrospective, mono-centric study,in day surgery unit, comparing 2 types of surgery:

- arthroplasty LAPNV,
- arthroplasty WALANT.

We included 15 patients per group.

We measured pain during anesthesia performance, per operative pain, postoperative pain at rest at last follow up, postoperative pain during activity at last follow up, overall satisfaction with the surgery (analog digital scale) and time to resume daily activities and hard work.

The statistical analysis was performed on SAS software with an ANOVA analysis. The significance threshold was set at 0.05.
Results: Procedures performed under Walant showed a significantly better functional score than patients with Locoregional anesthesia with peripheral nerve blocks (LAPNV).

The main result for each group are respectively: PTM under WALANT; PTM under LAPNV:

- QuickDash: 4.93 (0–7); 13.47 (7–15) ($p = 0.01$).
- We did not find any loosening, dislocation or major complication.

Conclusion: We found that trapezometacarpal arthroplasty under walant generates better earlier functionnal outcome compared to the procedure being performed under LAPNV, with comparable per and post operative analgesia level.

A-0340 Lateral epicondylitis: ultrasound release versus arthroscopic release: a short retrospective series

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Introduction: Lateral epicondylitis (LE), is a painful condition that affects the common wrist extensor tendon at its insertion at the lateral epicondyle. The minimally invasive procedure under US guidance was proposed as an innovative technique.

The purpose of the study is to compare outcomes of arthroscopic release of the Extensor Carpi Radialis Brevis (ECRB) to the US guided technique.

The authors hypothesized that the clinical outcomes of US guided surgery would be equivalent to arthroscopic treatment.
Material and Methods: A retrospective case control study was conducted in Caremeau University Hospital (France) Orthopaedics Unit between 2014 and 2019. The cohort included 16 patients, managed for LE using either US guided or arthroscopic release.

All were assessed pre and post operatively using the Disabilities of the Arm, Shoulder, and Hand (DASH) score and the visual analog scale (VAS) pain

score. Time to return to work, complication rate, as well as satisfaction were reported.

Unpaired Student's t-tests and Pearson correlation coefficient was used to statistically evaluate changes in the parameters. A value of $p < 0.05$ was chosen as the level of statistical significance.

Results: Eight patients were operated under US guidance, while the other 8 had arthroscopic surgery, constituting the control group.

The difference in terms of mean follow-up between the ultrasound-guided surgery (9.5 months) and arthroscopy (39 months) was largely significant ($p = 0.001$).

All patients showed improvement for DASH score and VAS pain score with both techniques.

Nevertheless, the comparison of both groups results showed the absence of a significant difference in DASH improvement ($p = 0.20$) and VAS score decrease.

The difference was also not significant for other parameters: time to return to work ($p = 0.11$) and the satisfaction rate ($p = 0.74$)

But the US group showed less complication and a decreased timeline for resumption of professional activies.

Conclusion: The hypothesis that the US release is equivalent to Arthroscopic technique is confirmed in our study, despite the different time frame of both techniques.

Even the US group showed less complication. And a decreased timeline for resumption of professional activities was also highlighted in our study.

LEVEL OF EVIDENCE III

Keywords: Lateral epicondylitis, tennis elbow, arthroscopy, ultrasound guided, extensor carpi radialis brevis

A-0344 Comparison between the Manometric Brace and Conventional Plaster Brace for Patients with Trapeziometacarpal Osteoarthritis: A Controlled Randomised Crossover Clinical Trial

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Introduction: The objective of this study was to investigate the non-operative management of the Manometric brace, a novel conceptual brace design produced through 3D scanning and printing technology, in comparison to the conventional plaster brace regarding patient satisfaction.

Methods: Fifty-two patients with symptomatic trapeziometacarpal (TMC) Osteoarthritis (OA) were enrolled in a nine-week crossover study, which was designed as a randomized, controlled trial of two periods: 4-week brace therapies, separated by a one-week wash-out time.

Patients were randomized into either group A (Manometric brace, wash out, conventional plaster brace) or group B (conventional plaster brace, wash out, Manometric brace).

Primary outcomes included patient satisfaction (measured with D-Quest test), patient compliance (measured with a daily log of self-reported brace usage). Secondary outcomes were pain (VAS), pain-related interference with (daily) activities (QuickDASH), and functional hand strength (pinch and grip strength tests). Finally, patients were questioned for the preference of wearing either Manometric or plaster braces.

Results: The Manometric brace showed a higher satisfaction rate and wearing time compared to those of the plaster brace in the D-Quest and patient compliance results ($p < 0.05$). Both the plaster brace as well as the Manometric brace slightly improved the daily activity disabilities and pain when compared to those of the QuickDASH ($p < 0.05$) and VAS ($p < 0.05$) baseline scores, whereas there were no significant differences between the two braces in those post-treatment results ($p > 0.05$). Further, the Manometric brace showed a higher grip or squeezing force than the plaster brace ($p < 0.05$). Finally, the patients preferred to use the Manometric brace (93.6%) rather than the plaster brace (6.4%) ($p < 0.001$).

Conclusion: In conclusion, the Manometric brace has a higher satisfaction and compliance rate in comparison to the conventional plaster brace. Treatment results were comparable for both braces, however further research regarding function and pain is needed in more patients.

A-0345 Limited progression of subclinical Dupuytren's disease: results from a prospective cohort study

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Aims: With novel promising therapies potentially limiting Dupuytren's disease (DD) progression, better patient stratification is needed. We aimed to quantify DD progression and development after seven years in a population-based cohort, and to identify factors predictive of disease progression or development.

Patients and methods: All participants from our previous prevalence study were invited to participate in the current prospective cohort study. Participants were examined for presence and Iselin's classification of DD, and were asked to complete comprehensive questionnaires. Disease progression was defined as progression to a next Iselin stage or surgery. Potential predictive factors were assessed using multivariable regression analyses.
Results: We identified 143/398 (35.9%) participants with DD, of which 56 (39.1%) were newly diagnosed. 20/93 (21.5%) participants had disease progression, while 6/93 (6.3%) previously affected patients showed disease regression. Disease progression occurred more often in patients with advanced disease. Multivariable regression analyses revealed that both ectopic lesions and a positive family history of DD are independent predictors of disease progression. Previous hand injury predicts development of DD.
Conclusion: Disease progression occurs in 22% DD patients from a general population. Disease progression occurs more often in patients with advanced DD than in patients with early DD. Both ectopic lesions and a positive family history of DD predict disease progression. These patient-specific factors may be used to identify patients that could benefit from treatment that prevents progression.

A-0349 Radiological measurement of trapezial dysplasia – variation of trapezial tilt and trapezial inclination

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Trapezial tilt is defined as the angle between the distal surface of the trapezium and the longitudinal axis of the second metacarpal. It has been used to quantify bony trapezial dysplasia and guide its treatment, but seems to vary with hand position when used in daily practice. Trapezial inclination is defined as the angle between the proximal articular surface of the trapeziuem and distal articular surface of the trapezium. Measurements are done on the same bone, making them less dependent of hand position or motion during radiographs. The purpose of this study was to compare trapezial tilt and trapezial inclination in order to define the most reliable method to evaluate trapezial dysplasia.

Fifty patients were included with at least 3 consecutive Eaton views and without radiographic signs of advanced osteoarthritis. Radiographs were taken without stress and with an adequate visualization of the TMC joint, carpometacarpal 2 joint, scafotrapeziotrapezoïd joints and both the first and the second metacarpals. In total, 150 radiographies were analyzed for trapezial tilt and trapezial inclination. Trapezial tilt was defined as the angle between the distal articular surface of the trapezium and the longitudinal axis of the second metacarpal. Trapezial inclination was defined as the angle between the distal articular surface of the trapezium and the proximal articular surface of the trapezium. Both trapezial tilt and trapezial inclination were measured by two independent observers on three radiographs for every patient. Inter-observer and intra-observer variability were assessed for both measurements.

The mean patient age at the time of the first radiograph was 61 years and the mean time between the first and third radiograph was 35 months. Average trapezial tilt was 136° and average trapezial inclination was 10°. For both observers, intra-observer variation and inter-observer consistency of trapezial inclination was significantly better when compared to that of trapezial tilt.

Our study suggests that trapezial inclination is a more reproducible measurement than the more frequently used trapezial tilt and might be a better parameter to define bony trapezial dysplasia and guide its treatment. Trapezial inclination is measured on the same bone and is less dependent of ligamentous laxity, variation in thumb position and shape of the second metacarpal. Further research is needed to define normal values of trapezial inclination in a population without TMC osteoarthritis and to find out whether trapezial dysplasia is a predicting factor for the development of TMC osteoarthritis.

A-0350 The significance of the relative position of capitate to radius to restore the volar tilt angle in distal radius fractures

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Restoring the volar tilt angle in distal radius fractures is important in that dorsal angulation of the distal radius can result in limited range of motion (ROM) of the wrist, decreased grip strength, attritional rupture of the tendons, or carpal tunnel syndrome. However, it is difficult to measure the volar tilt angle intraoperatively. We hypothesized that measuring the relative position of the capitate to the radius (RPCR) can be helpful to estimate the volar tilt angle.

We reviewed the wrist lateral radiographs of the postoperative wrists of 106 patients (91 female and 15 male; mean age: 63.3 years, range, 20 to 90 years) who were diagnosed as unstable distal radius fracture and underwent the volar locking plate fixation between November 2017 to November 2019. The patients were treated within 1 week from the date of trauma. We checked 2 kinds of distance from the center of the capitate head to the diaphysis of the radius; volar border of the radius to the capitate distance (vRCD) and dorsal border of the radius to the capitate distance (dRCD). The RPCR was defined as (dRCD – vRCD)/dRCD. If the RPCR is more than 100%, the capitate exists volar to the volar border of radius, if the RPCR is more than 50% and less than 100%, the capitate is present in volar half of the diaphysis of the radius. And the volar tilt angle (VTA) was measured. The relationship between RPCR and VTA was statistically analyzed.

The mean value of RPCR was 92.74%. The mean value of VTA was 10.53°. There was a statistically significant correlation between RPCR and VTA (Pearson's correlation coefficient = 0.855, $p < 0.001$). The predictive equation for VTA by linear regression analysis was: $y = -5.91 + 0.18x$ (y means VTA, and x means RPCR). In this equation, the coefficient of determination (R2) was 0.731 ($p < 0.001$).

This study includes the quantitative analysis of the position of the capitate and the volar tilt angle. When the capitate moves to volar side, the volar tilt angle increases. When correcting the sagittal alignment in distal radius fractures, assessment of the RPCR is easy and practical way to estimate the volar tilt angle.

A-0352 3D planning and patient specific instrumentation for intraarticular corrective osteotomy of trapezio-metacarpal and finger joints

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Introduction: Corrective osteotomies with the aim of restoring normal anatomy are indicated when post-traumatic bone deformities become symptomatic for reduced range of motion, joint instability or pain. A 3D planning tool and 3D printed patient specific bone surface contact drilling and sawing guides were applied for corrective osteotomies of malunions of intra-articular fractures concerning trapeziometacarpal and finger joints.
Methods: From February 2012 to February 2019 11 corrective osteotomies in 11 patients at the metacarpals (MC) and phalanges have been performed (7 MC base: 6 of the thumb and 1 of the small finger, 1 MC head; 3 proximal phalanx (distally) and 1 intermediate phalanx (distally). Preoperative CT scans were acquired of the malunited and the contralateral healthy bone for each case. Segmentation was performed with Mimics software (Materialise). An in-house developed software (CASPA) allows standard CAD functions and was therefore used for analysis of malposition and OP planning. Automatic volumetric fitting (overlay of mirrored healthy bone areas on malunited bone), quantification of malposition, calculation of screw axis and single plane cut and the complete design of individualized bone surface contact drilling and sawing guides (3d printed by Medacta) were performed using this software. The guides allow to perform an outside in (joint) osteotomy and repositioning of the fragment without arthrotomy.
Results: CT scans 2 months postoperatively showed intra-articular steps <0.5 mm and angulation errors <4°. All osteotomies consolidated between 2 and 3 months postoperatively. There was no infection so far. All patients improved function and pain and were satisfied with the results. Two of the patients involving the PIP joint had reduced ROM of E-F of 0–10-70° and 0–30-95° but no pain. Four patients needed removal of interfering osteosynthesis material. No arthritis requiring secondary intervention occurred so far.
Conclusion: This technology enables the surgeon to quantify deformities by overlaying mirrored areas, to visualize the intervention in a 3D model, to generate a surgical plan and manufacture guides for precise drilling, sawing and repositioning of bones without arthrotomy. According to our short time results of a small population accuracy and feasibility for intra-articular cases and patient satisfaction are given.

A-0355 Long-term follow-up of scapho-lunate reconstruction with the DRAW technique

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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.
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 $P < 0.05$.

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.

A-0358 Pain at Rest, Movement Evoked Pain, and their Ratio Predict Pain and Disability at Six- and 12-Months after Distal Radius Fracture

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Background: To examine the associations of indicators of pain such as pain at rest (PAR), movement evoked pain (MEP), and the ratio between those (MEPR) assessed at 8-weeks following distal radius fracture (DRF) with occurrence of chronic pain or disability at 6- and 12-months after the injury. The study also examined whether these pain indicators can classify individuals who do or do not transition to chronic pain and disability.
Methods: This secondary analysis of a prospective cohort study was done in Hand and Upper Limb Centre (HULC), London, Ontario, Canada. A total of 229 patients with DRF (159 (69.4%) women) who completed 8-weeks, 6-month, and 12-months evaluations were included in this study. Scores for the pain and function subscales of patient-rated wrist evaluation (PRWE) were extracted for 8-weeks, 6- and 12-months after DRF from an existing dataset. The associations between pain indicators with chronic pain and disability were examined using nonlinear quartile and logistic regressions. The area under the curve (AUC) obtained to examine the accuracy of the predictors in classifying those who experienced chronic pain and disability after DRF.
Results: The PAR $\geq$ 3 (AUC of 0.77), and MEP $\geq$ 6 (AUC of 0.78) predicted moderate to severe pain at 6-months after DRF. MEP of $\geq$7 predicted disability (AUC of 0.79) at 6-months. A score of 2$\leq$or $\geq$8 of MEPR was associated with adverse outcomes at 6- and 12-months, but prediction accuracy was low (AUC $\leq$ 0.50).
Conclusion: Pain at rest was more predictive of chronic pain, while pain with movement was more predictive of disability. The scores for PAR $\geq$ 3, and MEP $\geq$ 7 at 8-weeks should serve as a red flag for risk of chronic pain and disability after DRF.

A-0361 Comparison between dorsal capsuloplasty techniques for chronic injuries of the scapho-lunate ligament: Viegas vs Berger

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Scapho-lunate dissociation is a challenging problem. This study compares two dorsal capsuloplasty techniques widely used and validated for the treatment of chronic partial scapho-lunate ligament injuries: Berger/vs. Viegas techniques. This is a retrospective study of 39 patients (25 females and 14males) aged between 14 and 59 years (mean value 31.6yrs. $\pm$ 13.22) suffering from chronic partial scapho-lunate (SL) ligament injury type III in Geissler's classification. They were divided into two groups of 20 subjects each; group A received Viegas' technique while group B received Berger' technique. Inclusion criteria were as follows: chronic partial tear of the ligament (Geissler type III); absence of joint chondropathy; follow-up $\geq$ 6 months. The outcome revealed clinically and statistically significant differences in favor of Viegas' technique in terms of recovery of autonomy, recovery of grip strength, reduction in the SL angle and, finally, recovery of wrist flexion. The study showed that Viegas' capsuloplasty is more effective than Berger's in terms of grip strength recovery, recovery of disability, range of motion, especially flexion, and correction of the carpal angles,especially the SL. The Authors believe that this is due to the biomechanical properties of Viegas technique. We also believe that this study also provides interesting information regarding the indication of one technique over the other to treat Geissler' type III lesions in relation to type of patient, work and sport activity performed.

A-0366 Validation of Patient Rated Wrist/Hand Evaluation: Confirmatory Factor analysis and Rasch analysis

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Background: The wrist/hand version of Patient-Rated Wrist Evaluation was developed as a wrist joint specific measure of pain and disability in hand condition. Rasch analysis has been endorsed as a newer method for analysing the clinical measurement properties of self-report outcome measures.
Purpose: The objective of this study was to test the clinimetric properties of PRWHE.
Study Design: The Rasch model was used to assess the overall fit, reliability, validity and construct unidimensionality; Confirmatory factor analysis was conducted to assess the factor structure. Higher order factor analysis was used to explore the hierarchical structure of the items.
Methods: A convenience sample of 206 patients (Men: Women-66: 139, with mean age of 40), with various hand injuries, from a Hand Rehabilitation Clinic, completed the Persian version of PRWHE (PRWHE-P) at 2-month post-injury. Rasch analysis and factor analysis was conducted using Winsteps and Lisrel software respectively.
Results: PRWHE items fit well to the Rasch model, except for one items from the pain scale: ''Pain – When it is at its worst''. The PRWHE-P had a good item reliability (0.82) and good internal consistency (0.7). The explained variance (67.2%) indicated good construct validity. Both Rasch analysis and Confirmatory factor analysis supported unidimensionality of the questionnaire.
Conclusions: The results of this study indicated that PRWHE-P is a reliable and valid assessment tool and could be used in patients with different wrist/hand disabilities.

A-0368 Determinants of Pain and Disability After Carpal Tunnel Release. Systematic Review

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Background: Carpal tunnel syndrome (CTS) is the most common nerve entrapment syndrome, and surgical release is a common intervention. While release is a very effective procedure with low rates of complications, some patients are left with persistent pain and disability. The aim of this review was to identify determinants of pain and disability in patients undergoing carpal tunnel release (CTR).
Methods: Four electronic databases (EMBASE, MEDLINE, CINAHL, and Google Scholar) were searched to find relevant papers. The risk of bias of the studies was assessed using the Quality in Prognosis Studies tool (QUIPS). Data extraction and risk of bias assessment were done by two independent reviewers. Discrepancies were resolved through

discussion with the third reviewer. Conducting qualitative synthesis, we summarized the findings by presenting the most frequent determinants of pain and disability separately with frequencies. We used Grading of Recommendations Assessment, Development and Evaluation (GRADE) principles to rate the quality of evidence.

Results: Out of 817 papers screened, 63 papers were assessed for eligibility by full-text, and 16 papers met our inclusion criteria. The overall risk of bias was low for three studies (19%) and was moderate for eight studies (50%). A total of 31 prognostic factors were identified through 16 eligible papers. Moderate quality of evidence was found for depressive symptoms (3 studies with 370 participants) and symptom severity (2 studies with 143 participants) as the predictors of pain intensity after CTR. The quality of evidence on the role of depressive symptoms (2 studies and 142 participants) and symptom severity (2 studies and 1123 participants) in predicting disability was low. Very low quality of evidence was found for the association between age and disability (2 studies and 253 participants) after CTR. Evidence on the role of baseline function status in predicting disability after CTR was conflicting and was rated as very low quality (4 studies and 1398 participants).

Conclusion: Higher symptom severity and depressive symptoms before surgery are associated with risk of post-operative pain intensity and functional limitations. Age was found to be associated with higher risk of functional limitations after CTR. Low to moderate quality of evidence was found for predictors of pain and disability after CTR. Therefore, making a definite conclusion about the magnitude of association between prognostic factors and outcomes was not possible.

Keywords: Carpal Tunnel Syndrome, Carpal Tunnel Release, Pain, Disability, Prognostic factors

A-0369 Diagnostic accuracy of sensory and motor tests for carpal tunnel syndrome diagnosis: a systematic review

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Background: Carpal tunnel syndrome (CTS) is the most common entrapment mononeuropathy of the upper extremity. The previous systematic review of the diagnostic tests for CTS was outdated. The objective of this study was to summarize and evaluate the evidence on the accuracy of sensory and motor tests used for the diagnosis of CTS.

Methods: MEDLINE, CINAHL, and Embase databases were searched on January 20, 2020. Studies assessing at least one diagnostic accuracy property of the sensory or motor tests for CTS diagnosis were selected by two independent reviewers. Diagnostic test accuracy extension of the PRISMA guidelines was followed. Risk of bias (ROB) and applicability concerns were rated using QUADAS-2 tool. Any reported diagnostic accuracy property was summarized. Study characteristics and any information on the accuracy of the sensory and motor tests for CTS diagnosis were extracted.

Results: We included sixteen clinical studies, of which thirteen had unclear or high ROB. Thirteen different sensory or motor tests were assessed. The most sensitive test for CTS diagnosis was the Semmes-Weinstein monofilament test (with 3.22 in any radial digit as the normal threshold) with sensitivity from 0.49 to 0.96. The most specific (Sp) tests were palmar grip strength (Sp = 0.94), pinch grip strength (Sp from 0.78 to 0.95), thenar atrophy (Sp from 0.96 to 1.00), and two-points discrimination (Sp from 0.81 to 0.98).

Conclusions: The evidence was inconclusive on which sensory or motor test for CTS diagnosis had the highest diagnostic accuracy. The results suggest that clinicians should not use a single sensory or motor test when deciding on CTS diagnosis.

A-0371 Distal radius fracture detection with convolutional neural network

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Wrist injuries and distal radius fractures are common and have been found to cause diagnostic problems and malpractice. Distal radius fracture diagnosis is based on clinical examination and x-ray images. The primary examination and x-ray image interpretation is often carried out by a general practitioner with varying degrees of experience. Sometimes fracture can be misdiagnosed.

Rapid development of artificial intelligence and its subclass machine learning have made it possible to develop algorithms to analyse and classify also medical images. In this study, we present the results of an AI model developed for DRF detection.

A retrospective x-ray image cohort of consecutive urgent wrist x-rays taken in six hospitals' emergency rooms during year 2016 was identified. 12 376 wrist x-rays were extracted from hospitals' Picture Archiving and Communication Systems. After exclusion of underaged and unsuitable images (oblique view, scaphoid or excess projections) 7570 x-ray images (50% postero-anterior and 50% lateral) were included in the study. After pseudonymization the dataset was divided into training and test sets (90 and 10%, respectively). The x-ray images in training set were analyzed by one hand surgery resident. The test set, that was not used in AI model training, was analyzed by three experienced consultant hand surgeons. If a distal radius fracture was present in the image, the area of interest was manually drawn on the image. In case of disagreement in test set, consensus was reached through discussion with all the consultants. Consensus was used as the gold standard for the assessment of the developed artificial intelligence model.

The training set was used to train a U-net type 25 layer convolution neural network with seven maxpooling pathways. The segmentation network produces fracture probabilities or confidence values for each image pixel that can be displayed as heat map. The results of the AI model were compared to the test set's ground truth set by the three hand surgeons.

Interobserver reliability calculated with Cohens kappa from the test set between resident and consultants' consensus was 0.981. The sensitivity to detect a distal radius fracture was 0.92, specificity 0.88, PPV 0.95, NPV 0.83 and ROC AUC 0.96.

Distal radius fracture detection with the developed artificial intelligence model is possible with promising results. Further research and development is needed. How the developed artificial intelligence model performs with datasets gathered prospectively and from different hospitals is not known.

A-0373 All Arthroscopic TFCC Fovea Repair with Suture Anchor in Athletes

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Objective: Disorder in the triangular fibrocartilage complex often appear in association with ulnar wrist pain and limited wrist function in work or sports. This study addressed the all arthroscopic fovea repair in the TFCC disorder with suture anchor, in a sample of 37 young adult athletes.
Methods: From July 2014 to February 2017, 37 patients underwent TFCC disorder treated with suture anchor by wrist arthroscopy. The mean follow-up period was 25.6 months (range, 22–28 months), and the patients' average age was 21.4 years. The study included 27 men and 10 women. All patients had TFCC foveal tears or disorder and no wrist fractures. The 1.3 mm all-suture anchor was used to repair or reconstructed the lesions and the wrist brace was applied for 6 weeks. After operation, patients were rehabilitated, reexamined, and followed up at the clinic. Complications were also recorded.
Results: The results were graded with a Mayo Modified Wrist Score. Twenty-five of the 37 wrists were rated excellent, 10 were good, and 2 were fair. Overall, 35 of 37 patients (93.1%) rated satisfactorily and returned to sporting activities. Two patients experienced mild pain during work or exercise. Although motion remained normal for these patients, grip strength on the affected hand was at least 85% of that on the other hand.
Conclusions: All arthroscopic foveal repair for disorder of the triangular fibrocartilage complex with all-suture anchor is a satisfactory method. The procedure can enhance patients' wrist function by relieving pain and increasing tolerance for sports activity.

A-0375 Application of Continuous Passive Motion machine in patients with distal radius fractures; Randomized Clinical Trial

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Objectives: The aim of this study was to know if applying Continuous Passive Motion (CPM) machine in addition to convenient exercises more effective than convenient exercises alone in pain reduction, range of motion and function improvement after distal radius fractures (DRFs).
Material and Methods: In this randomized controlled trial twenty-one patients with non-stabilized DRF after pin removal were randomly assigned to intervention and control group. Intervention group received stretching exercises with CPM machine for 2*15 minutes per session. Both groups received routine exercises for one hour three times a week for four weeks. The primary outcome measure was pain evaluated by Visual Analog Scale (VAS), and the secondary outcome measures were disability evaluated by the Patient Rated Wrist and Hand Evaluation (PRWHE) and range of motion (goniometry) at 4, 6 and 12 weeks. Univariate Analysis of Variance (ANCOVA) and A one-way repeated measure mixed model analysis of variance (ANOVA) were used for data analysis.
Results: Twenty-one participants completed 12-week follow-up. Pain relief, range of motion and function improvement revealed that the treatment was successful in both groups. We could detect no significant differences ($p > 0.05$) between the two groups at the end of follow-up regarding pain, range of motion, and function.
Conclusion: Using CPM machine had no additional effect on pain reduction, range of motion and function improvement compared with routine exercises in patients with DRF.

A-0376 Does the capitate anatomy affect on the load of radiocarpal joint after the proximal row carpectomy? Analyses of the capitate anatomy and finite element analyses

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Introduction: Proximal row carpectomy (PRC) is a reconstructive procedure for the management of osteoarthritis with maintaining a certain range of wrist motion. However, wearing of articular cartilage caused by the excessive load of the muscle can result in the postoperative osteoarthritis. There are anatomical variations of the capitate bone and some suggested that the articular surface of the radius is subjected to excessive load in some types of the capitate. In this study, we reviewed the shape of the capitate bone in our series and demonstrated the difference in the load on the radial articular surface using finite element analysis.
Patient and method: Fifty computed tomography (CT) scans of the wrist of the patients visiting our hospital were utilized for the analysis of the capitate anatomy. We generated 3 dimensional (3D) views and analyzed the shape of the capitate. Patients were categorized by Yazaki classification. Next, we examined load on the radial articular surface by performing finite element analysis to representative cases of each classification. A volumetric mesh was created using CT images. For the simulation of the PRC, the proximal carpal bone was excised in the CAD software, and carpal height was shortened along the radial inertial axis until the capitate contacted the distal radius. A load of 100 N was applied to the head of the 3rd metacarpal at the neutral wrist position, and the load at the distal radius was measured.
Results: In our series, 65% of the capitate were classified as type 1 (Flat), 35% were type 2 (Spherical). Our series did not include type 3 capitate (V-shape). We conducted load analyses for one case of type 1 and 2 respectively. In type 2, the averaged von Mises stress was 1.8 times greater than in type 1. Additionally, the stress in type 2 was localized in the very narrow space, indicating the capitate contact to the radius restrictively. The maximum load was 1.5 times greater than the type 1. A load of type 2 capitate mainly distributed volar surface of the joint, and that of type 1 distributed dorsally.
Discussion: The most popular anatomy of the capitate was type 1, and type 3 capitates were not included in our series. Our findings indicated that type 2 capitates subjected more load to the radius after the PRC, which are consistent with the higher postoperative osteoarthritis in PRC to the type 2 and 3 capitates. We presumed that type 2 and 3 capitates radii of curvature of the proximal capitate and lunate face mismatch. From the study, capitate anatomy may be one of the risk factors for postoperative osteoarthritis of PRC.

A-0378 Clinimetric Testing of the Persian version of the Patient-Rated Tennis Elbow Evaluation (PRTEE) and the Disabilities of the Arm, Shoulder, and Hand (DASH) Questionnaires in Patients with Lateral Elbow Tendinopathy

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Purpose: To evaluate the longitudinal validity and responsiveness of the Patient-Rated Tennis Elbow Evaluation (PRTEE) and the Disabilities of the Arm, Shoulder, and Hand (DASH) in patients with lateral elbow tendinopathy (LET).
Methods: Sixty-four patients with LET completed the PRTEE, DASH, and global rating of change scale (GRC) at baseline and six weeks. The external and internal responsiveness, floor and ceiling effects, minimal detectable change (MDC) and minimally clinically important difference (MCID) were calculated.
Results: No ceiling and floor effects were detected for either the PRTEE or DASH. External responsiveness was acceptable for both, but higher for the PRTEE (AUC = 0.90) versus the DASH (AUC = 0.80). The relative efficiency (1.21), standard effect size (1.14 PRTEE VS. 1.03 DASH), and standard response mean (1.34 PRTEE VS. 1.10 DASH) indicated slightly superiority in responsiveness for PRTEE. The MDC were 11 and 12, and MCID were 22 and 16 for the PRTEE and DASH, respectively.
Conclusion: Both the DASH and PRTEE were responsive in detecting improvement in patients with LET. The PRTEE was shorter, more efficient, and slightly more responsive which supports its use as a core outcome measure in evaluating patients with lateral elbow tendinopathy.

A-0380 Avoiding nerve suture line tension using Jabaley epineurial splint technique

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Introduction: The Jabaley technique derives from the Richter technique of epineural suture. The Jabaley's technique is a fascicular group (FG) suture technique in which the stress is taken-up by the epineurial splint – created by two epineurial flaps (one at the proximal end and the other at the distal end) – sutured at a different level than the FG suture according to Saint – Venant principle. The technique is more time consuming than a normal FG suture but more rapid than nerve grafting.
Material and Methods: Between 1989 and 2019 we performed 305 median and 419 ulnar nerves direct coaptations reconstruction in the forearm. In the median nerve, FG neuroraphy was performed in 58 cases with the Jabaley technique done in 26 cases. In the ulnar nerve we performed FG neuroraphy in 133 cases of which 58 were repaired by the Jabaley technique. The epineurial splint is created on the deep side of the nerve connected to the mesonerve, restoring the epineurial vascular support. The two flaps (proximal and distal) of the epineurial splint are taylored to be unequal. Thus the FG's suture line will be offset than the epineurial one. After precisely cutting the FG's the suture may be performed without any tension from deep towards superficial with 10–0 stitches. The technique maintains all the indications of the FG suture of the upper and lower limb.
Results: Were good and excellent in 77,08% for the median nerve repaired by usual FG suture and good and excellent rate (80,5%) by Jabaley repair. For the ulnar nerve, FG suture – treated as two nerves, one sensitive and the second motor – were good and excellent in 81,5% and 82,91% in Jabaley repair.
Conclusions: The advantages of this technique consists mainly of rendering possible a stressless FG neuroraphy in border-line situations that normally impose nerve grafting. Jabaley technique offers mechanical protection, resistance to elongation, internal and external gliding possibilities and vascular support by the epineurial vascularisation.
Keywords: microsurgical technique, nerve reconstruction, median and ulnar nerve

A-0381 How should we manage ligamentous injuries in Distal Radius Fractures

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Distal radius fractures are known to be associated with a high incidence of triangular fibrocartilage complex (TFCC) tear of up to 84%. However, despite with no treatment, not all patients suffered with signs and symptoms of TFCC insufficiency after the healing of distal radius fractures. Recently with the popularity of performing plate fixation for distal radius fracture, there has been a debate on whether TFCC needs to be repaired concomitantly. It is postulated that TFCC may heal after anatomical reduction and fixation of distal radius.

We studied the TFCC status in 88 patients who had union of distal radius fractures with volar plate fixation and were elected for removal of implants in 2 years. Concomitant wrist arthroscopy was performed. Prior

to the surgery, 35 patients had ulnar wrist pain and 55 were noted to have DRUJ instability on physical examinations. Wrist arthroscopy findings revealed 16 patients with intact TFCC while 62 with TFCC tears. 13 patients had combined tears and there were 23% of tears showed signs of healing. There was a trend of more TFCC tear in complex intraarticular fractures (90% in C3 distal radius fractures) as compared with extra-articular fractures (i.e. 50% in A2 distal radius fractures), though these differences were not statistically significant. There was no association between distal radioulnar joint (DRUJ) or ulnar styloid pain and TFCC tears. However, the presence of TFCC tears was significantly associated with clinical features of DRUJ instability (85% vs 15% $p = 0.038$) 32 TFCC tears were repaired as they were symptomatic, and their tears were deemed repairable. At 12 months post wrist arthroscopy, the average range of wrist movement, power and the DASH score were noted to be significantly improved for all 3 groups i.e. patients with intact TFCC, patients with un-repaired TFCC tear and patients with repaired TFCC. There was no difference in the DASH score and power between all groups for pre-arthroscopic period and post-arthroscopic period.

A large majority of TFCC tears remained to be unhealed after the union of distal radius fracture. However, their functional outcome may not differ from those with intact TFCC. For those with symptomatic DRUJ instability, a delayed TFCC repair can still improve their outcome.

A-0382 Predicting symptom improvement after carpal tunnel release: a machine learning approach

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Introduction: Improvement in symptom severity is an important goal for patients considering surgery for carpal tunnel syndrome. While multiple studies have investigated prognostic factors for symptom improvement, there is currently no model available for clinicians to predict the chance of symptom improvement for individual patients considering a carpal tunnel release. Therefore, this study aimed to develop a prediction model for symptom improvement six months after a carpal tunnel release.

Methods: We randomly split a cohort of 2119 patients who underwent a carpal tunnel release and completed the Boston Carpal Tunnel questionnaire (BCTQ) before and six months after surgery into training (75%) and validation (25%) data. Patients who improved more than 0.8 at the BCTQ symptom severity scale (SSS) were classified as ''improved'', others were classified as ''not improved''.

Patient characteristics, medical history, and baseline patient reported outcome measure (PROM) scores were available as predictors. To limit the number of predictors, thereby improving clinical usefulness of the model, we used recursive feature elimination to select which predictive features were necessary to obtain good predictive accuracy.

Prediction accuracy of three machine learning algorithms, i.e. logistic regression, random forest, and gradient boosting machine, was compared based on discriminative ability (AUC) and calibration in the validation set. Model performance of this model was further assessed in a hold-out dataset of 304 patients.
Results: 72.4% of the training cohort improved at least 0.8 on the BCTQ SSS six months postoperatively. A gradient boosting machine with five predictors was chosen as best model. These five predictors were all baseline PROM scores. In the hold-out dataset, this model had an AUC of 0.712 and a good calibration. The model had a sensitivity of 0.752 and a specificity of 0.567
Conclusion: We have developed a prediction model for improvement in symptom severity six months after carpal tunnel release, which required five predictor variables. The model has a reasonable discriminative ability and a good calibration in external validation. The model will be available online for clinicians and can be used to help shared decision making when patients are considering a carpal tunnel release.

A-0383 Indication extent for posttraumatic mutilated hand reconstruction by microsurgical toe transfer

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Objectives: Reconstruction of the thumb and complex mangled hand with fingers amputation are best solved by microsurgical toes transfer. Transferred toes-to-hand will be innervated much better than they were in the donor site, performance

explained by both the higher number of nerve fibers in the digital nerves of the hand compared to the toes and by cortex plasticity. Such phenomena occurring in cortical integration of the microsurgical transferred toes-to-hand is comparable to that following the digital nerve repair or replantation. We aimed to analyse whether the functional recovery of the metacarpal hand in a 70-year-old patient is possible by double toes 2–3 ''in block" transfer, which would allow the extent of indications to over 65 years of age in both replantations and in toe-to-hand transfer.
Material and methods: We performed 27 toe-to-hand transfer cases between 1998 to 2019 in which 9 great toe transfers (2 wraparound), 12 transfers of second toe and 6 ''in block'' transfers of second and third toes. Delay from injury to reconstruction was 5–19 months and respectively 9 years for a single case of amputation in childhood. The age of the patients ranged from 18 to 70 years. The 70-year-old patient received a double ''in block" transfer of 2–3 toes for the reconstruction of the right hand one year after the traumatic amputation at MCPJ 2–5.

Indications of toes transfer were based on the level of amputation after Merle. Assessment of the toe-to-hand cortical reintegration was made according to Medical Research Council for motor (M0-M5) and sensitive (S0-S4) recovery at every 6 months,1, 2 and 3 years. 12 patients were followed-up at longer time intervals (5–11 years). To assess recovery of sensitivity we also conducted qualitative and quantitative tests (Semmes – Weinstein, Dellon test).
Results: After evaluation of 2PD, patient interval results were: 6–8 mm(4), 9–12 mm(15) 13–16 mm (4) and in 2 patients>16 mm. Functional reintegration of the thumb reconstructed by wraparound process (Morison technique) offers the best cosmetic and functional result (6–8 mm), because the reconstructed thumb has dimensions very close to those of the normal thumb. In thumb reconstruction, functional recovery after Kapandji scale was 7–8 mm and in wraparound technique was 9–10 mm. Despite the unsightly appearance, motor recovery of the toe-to-hand offered patients the possibilities to use the mutilated hand and transferred toes-to-hand will be innervated much better than they were in the donor site. The 70-year-old patient, 6 months after the ''in block" transfer of the 2nd and 3rd toes to the right (dominant) hand, resumed his daily functions, improving the quality of the life.
Conclusion: Reconstruction of the mutilated hand by toe-to-hand transfer is a technique that provides better result if sustained by motor and sensory physiotherapy. Reinervated by digital nerve fibers of the hand, the toe pulp can achieve a smooth tactile perception. The extension of indications for toe-to-hand transfer over the age of 65 is possible considering the good results obtained in our patient aged 70 years.

A-0384 The prevalence of radiographic thumb base osteoarthritis: a meta-analysis

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Introduction: Osteoarthritis (OA) affects millions of people worldwide. In hand OA, the thumb base is the most affected single joint. The reported radiographic prevalence ranges from 0 to 100%, making the true radiographic prevalence unclear. Hence, we conducted a meta-analysis on the prevalence of radiographic thumb base OA.
Methods: We performed a search in Embase, Medline Ovid, Web of Science Core Collection, Cochrane Central Register of Trials, and Google Scholar. We included studies of the general population that reported thumb base OA for males and females separately based on a hand radiograph and reported the age of these groups. Using meta-regression, we estimated the odds ratio (OR) of having radiographic thumb base OA for age and sex, while adjusting for within-study correlation.
Results: The initial search yielded 4,278 articles; we finally included 16 studies that reported the age- and sex-stratified prevalence of 104 subgroups. The prevalence of radiographic OA for the 50-year-old male and female patients was 5.8% and 7.3%, respectively, while the respective prevalence for 80-year-old male and female patients was 33.1% and 39.0%. We found an OR for having radiographic OA of 1.06 (95%CI[1.055–1.065], $p < 0.001$) per increasing year of age, and 1.30 (95%CI: 1.05–1.61], $p = 0.014$) for women.
Conclusion: In the general population, radiographic thumb base OA is more prevalent in women and is strongly associated with age. Its prevalence doubles roughly every 11 years for both sexes, and women

have 30% higher odds than men to have radiographic thumb base OA at any point in time.

A-0387 The retinacular ligaments of the extensor aponeurosis revisited

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Purpose: To examine the anatomy of the retinacular ligaments and the role of the Oblique Retinacular Ligament (ORL) in finger motion. To confirm or dismiss findings in previous studies and address conflicting descriptions in the available literature.
Methods: After dissection of forty-eight fresh frozen fingers, the anatomy of the retinacular ligaments was analyzed and the thickness of ORL was graded. Four fingers were mounted through their metacarpals to a heavy metal plate and the arc of motion during flexion and extension in the proximal interphalangeal (PIP) and distal interphalangeal (DIP) joints was measured before and after sectioning the lateral bands or ORL.
Results: An ORL could be identified on both sides in all forty-eight fingers. The insertion on the proximal phalanx was distributed as 7/96 (7%) to the distal third, 70/96 (73%) to the middle third and 19/96 (20%) to the proximal third of the bone. About 25% of ORL sent fibers to the A2 pulley. Of the specimens, 29% were graded as being a strong bundle of fibers, 51% as well-defined and regular and 20% as thin and sparse. The ligaments were thicker in males. In the biomechanical study, we found that ORL had no role in the coordinated flexion of the PIP and DIP joints. Sectioning ORL had negligible impact on the ability to extend the DIP joint. After removing the lateral bands, ORL was able to extend the DIP joint with an extension lag of 10–22°. The limitation of flexion in the DIP joint, when the PIP joint is fully extended, retained after removing the lateral bands, but ceased when ORL was cut.
Conclusions: The retinacular ligaments are a part of the consistent anatomy of the fingers. Their major role is not finger motion, but to act as stabilizing links between the PIP and DIP joints. Contrary to several previously published articles, we found that they are taut almost all the way up to full extension and thereby not only active in specific uncommon finger positions, but have a role in ordinary usage of the fingers.

A-0388 Illness perception is associated with pain and function in patients with ulnar impaction syndrome scheduled for ulna shortening osteotomy: a cross-sectional study

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The amount of pain and dysfunction in patients with ulnar impaction syndrome (UIS) is poorly understood. Previous research suggests that disease characteristics are insufficient in explaining the variance in patient-reported pain and function and suggest that other factors play a role. There is increasing evidence that psychosocial concepts such as pain catastrophizing, depression and anxiety, and illness perception are related to patient-reported pain and hand function in orthopedic disorders. The role of these concepts is currently unknown in patients with ulnar sided wrist pain due to UIS, while these may provide target points for a non-invasive treatment to decrease pain and optimize the patient's situation for surgical treatment. This study aimed to investigate to what extent patient demographics and psychosocial factors explain the variance in patient-reported pain and function in patients with ulnar impaction syndrome scheduled for surgical treatment. We included 239 patients who were scheduled for ulna shortening and had completed the Patient Rated Wrist Evaluation (0–100; a higher score indicates more pain and dysfunction). We used a multivariable linear regression analysis to investigate the explained variance of patient demographics on the PRWE total score. Associations between the psychosocial concepts were determined in a subgroup of 96 patients who filled in the Pain Catastrophizing Scale, Patient Health Questionnaire, and Brief-Illness Perception Questionnaire. Patient demographics accounted for 2% in the variation of the preoperative PRWE total score. Females and smokers had higher PRWE total scores. The psychological factors explained 35% of the variance. Patients who

perceived more consequences from their illness and patients who attributed more symptoms to their hand illness had higher PRWE total scores. In conclusion, we demonstrated that patients' characteristics seem to have limited value for understanding levels of pain and function in patients with ulnar impaction syndrome scheduled for surgery, whereas, we found a strong association between psychosocial factors such as illness perception and patient-reported pain and function. Clinicians should be aware of the strong relationship between pain and psychosocial factors in patients with ulnar impaction syndrome. Patients may benefit from counseling by surgeons on their disease perception.

A-0390 Factors associated with the return to work after ulna shortening osteotomy: a sample of 104 consecutive patients

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The primary aim of this study was to analyze the median time until patients performed their original work again after ulna shortening osteotomy. The secondary aim was to identify factors influencing the median time until return to the original work. This is a prospective study using a consecutive sample from 25 outpatient clinics for hand surgery and hand therapy in the Netherlands. Patients with paid employment that underwent ulna shortening osteotomy were invited to complete a ''return to work'' questionnaire at 6 weeks, 3 months, 6 months, and 12 months postoperatively. The probability and median time until return to work were assessed using an inverted Kaplan-Meier or Cox regression. Differences between categorical subgroups were calculated using log-rank tests or Cox proportional hazard regression. In total, 104 patients who underwent ulna shortening osteotomy with a mean age of 46 were included. The median time to return to original work was 12 weeks. The probability of returning to work in the first year was 92%. Type of work was associated with return to work with a median time of 7, 12, and 14 weeks for light, moderate, and heavy physical work, respectively. There were no differences in return to work for age, duration of complaints until surgery, Patient Rated Wrist Evaluation score at baseline, whether the osteotomy was performed freehand or with an external cutting device, and whether the dominant hand was operated or not. In conclusion, half of the patients that undergo ulna shortening osteotomy fully performed their original work after already 12 weeks. Moreover, we found that 92% of the patients perform their original work again within the first year. The type of work -light, moderate or heavy-, strongly influences the time until performing their original work, ranging from 7 to 14 weeks. Hand surgeons can use these results to optimize their counselling with patients considering ulna shortening osteotomy.

A-0394 The prevalence, incidence, and progression of radiographic Thumb Base osteoarthritis in a population-based cohort: the Rotterdam Study

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This study aimed to describe the prevalence, cumulative incidence, and progression of radiographic thumb carpometacarpal (CMC-1) and trapezioscaphoid (TS) radiographic osteoarthritis (ROA) in the general Dutch population aged $\geq$55 y. This is a large cohort study, including 1394 participants aged $\geq$55 y, embedded within the Rotterdam Study. Data were collected between 2000 and 2005. Participants underwent two standard AP radiographs of both hands with an interval of four years. The CMC-1 and TS joints were evaluated using the Kellgren-Lawrence (K-L) classification. ROA was defined as

K-L grade ≥ 2. The prevalence and four-year cumulative incidence were calculated for males and females, left and right hand, and different age categories. Progression, defined as a change ≥ 1 K-L grade, was described for each K-L grade at baseline for males and females. At baseline, the prevalence of CMC-1 ROA for males and females ranged from 8–36% and 20–53%, respectively, depending on the age category. For TS ROA, the prevalence ranged from 1–21% for males and 2–34% for females. The four-year cumulative incidence of CMC-1 ROA was 7% (95%CI: 5–10%) in males and 11% (95%CI: 9–14%) in females, for TS ROA this was 2% (95%CI: 1–4%) and 4% (95%CI: 2–5%). Progression of CMC-1 ROA was found in 6% of the males and 10% of the females, while this was 2% and 4% for TS ROA. We present extensive data on sex and age-specific point prevalence, cumulative incidence, and progression of CMC-1 ROA and TS ROA in the general population. This study shows that within four years, there was minimal radiographic disease progression, which only occurred in milder cases.

A-0398 Risk factors for complications following cat bite injuries of the hand

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Objectives/Interrogation: Despite surgical irrigation and debridement as well as antibiotic therapy of cat bites infections of the hand, some patients develop complications that may require multiple operations with potential major sequelae. Predicting which patients will develop a complication is a difficult challenge. Aim of this study was to review our experience with these injuries in order to determine the incidence of complications following primary surgical debridement of such infections and to identify factors predictive of complications requiring further treatment.
Material and methods: Between 2011 and 2020, 96 patients, including eight patients with bilateral injuries (104 hands), underwent surgical debridement at our Institution between following cat bite injuries. Eight categories of predictors of complications were included: patient demographics (age at the time of surgery, gender); past medical history (hypertension, diabetes, immunodeficiency, smoking history); clinical findings at admission (pain, fever, redness, swelling, erythema, pus); laboratory values at admission (white blood cell count, platelet count, C-reactive protein); wound characteristics (site, location, depth, tendon and/or joint involvement; intraoperative microbiologic findings (Pasteurella, Staphylococcus, Streptococcus, Pseudomonas); surgical settings (injury-to-surgery interval, the shift work surgery during which the primary surgery was performed, the duration of surgery, the surgical experience of the primary surgeon; surgical procedure (the use of local antibiotic during surgery, the use of primary vs. secondary closure, the application of drainage).
Results and Conclusions: Postoperative complications following the primary irrigation and debridement occurred in 7 out of 104 hands (6.7%). In addition tot he already known predictors of increased risk of complication, such as immunodeficiency status and involvement of tendons, we identified two additional factors which are statistically significant correlated with high complication risk: thrombocytopenia and duration of surgery longer than 40 minutes.
Key words: Cat bites, hand infection, complication, risk factors

A-0399 Outcomes of a proprioceptive retraining program in patients with midcarpal instability; a cohort study of 194 patients

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Background and Aims: Midcarpal instability is a condition caused by laxity of the ligaments in the wrist and hand. It is an important cause of wrist pain and decreased hand function. Mainstay treatment option and first choice is a proprioceptive retraining program based on the principle that muscular activation can be used to compensate for the laxity of ligaments. Although this is the usual treatment option, outcomes are scarcely described. Surgical options have shown conflicting results in outcome and conservative treatment has only been evaluated by a retrospective cohort study mainly focussing on pain and not on hand function. Therefore, our aim is to describe the outcomes three months after starting a proprioceptive retraining program on hand function for patients with midcarpal instability.

Patients and Methods: Our study has a cohort design. Patients were recruited at 29 private clinics for hand surgery and hand therapy in the Netherlands. In total, 194 patients with midcarpal instability were included between 01/12/2013 and 20/11/2019. The intervention consisted of a proprioceptive retraining program of the wrist. The frequency of therapy sessions ranged from twice a week to once every two weeks, depending on patient and therapist preference. Treatment had a duration of approximately 3 months and was ended by a shared the decision of patient and hand therapist.

The primary outcome was hand function, measured with the Patient Rated Wrist Hand Evaluation (PRWHE) total score at baseline and 3 months. Secondary outcomes were pain, measured with the Visual Analog Scale (VAS), at baseline, 6 weeks, and 3 months and satisfaction with treatment results, measured at 3 months. Data were Analyzed using univariate mixed models.

Results: PRWHE total scores improved significantly from 53 ± 19 (mean $\pm$ SD) to 36 ± 24 points at 3 months (mean improvement of 17 points, 95%-CI 13 to 20; $p < 0.001$). All VAS scores demonstrated clinically relevant improvements at 6 weeks and 3 months (all: $p < 0.001$) compared to baseline values.

At 3 months, 79% of the participants would undergo the treatment again if they had the choice at the beginning of the treatment, and 16% rated their satisfaction with the treatment result excellent, 35% as good, 25% as fair, 17% as moderate, and 9% as poor.

Conclusions: We found that a proprioceptive retraining program yielded clinically relevant improvements in hand function and pain in a large sample of patients with midcarpal instability. Our findings support the choice for conservative treatment as the primary treatment for patients with midcarpal instability. Future research should focus on explanatory factors explaining the large variation in outcome found in this study.

A-0400 Microcomputed analysis of nerve angioarchitecture after combined stem cell delivery and surgical angiogenesis to nerve allograft

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Introduction: Detailed three-dimensional (3D) evaluation of microvasculature is evolving to be a powerful tool, providing mechanistic understanding of angiomodulating strategies. The aim of this study was to evaluate the microvascular architecture of nerve allografts after combined stem cell delivery and surgical angiogenesis in a rat sciatic nerve defect model.

Materials & Methods: In 25 Lewis rats, ten mm sciatic nerve gaps were repaired with (i) autografts, (ii) allografts and (iii) allografts wrapped in a validated pedicled superficial inferior epigastric artery fascia (SIEF) flap to provide surgical angiogenesis. In groups (iv) and (v) the allografts were seeded with undifferentiated mesenchymal stem cells (MSC) and MSCs differentiated into Schwann cell-like cells using dynamic seeding, respectively, prior to be wrapped within a SIEF flap. At two weeks, vascular volume was measured using microcomputed tomography (micro CT), and percentage and volume of vessels at different diameters were evaluated to describe vascular distributions.

Results: Revascularization of untreated nerve allografts occurred from both host stumps and left the mid longitudinal section of the nerve avascular. Allografts augmented with angiogenesis showed increase in the mesh network of microvessels sprouting into the nerve towards the mid-section. This was further increased when angiogenesis was combined with undifferentiated MSCs, resulting in microvessels along the entire length of the nerve graft. Objective quantification using micro CT showed that the vascular volume was significantly greatest in allografts treated with undifferentiated MSCs and surgical angiogenesis combined, compared to all experimental groups ($P < 0.01$ compared to autografts, $P < 0.0001$ to allografts, $P < 0.05$ to SIEF and SIEF combined with differentiated MSCs, respectively). Evaluation of the nerve angioarchitecture allowed for determination of the distribution of blood vessels in nerve sample groups. Vascular distribution analysis found that autografts were comparable to control. Moreover, vessels found in allografts were smallest in both volume and in diameter.

Volume and diameters of vessel segments in nerve allografts were enhanced by surgical angiogenesis and these distributions were further improved when surgical angiogenesis was combined with stem cells, with greatest increase found when combined with undifferentiated MSCs.

Conclusions: The interaction between vascularity and stem cells remains complex, however, this study provides some insight into its synergistic mechanisms. Stem cells are known for their paracrine properties and secrete various trophic factors when influenced by their environment and it is suggested

that the secretion of these factors is more important than the location of these stem cells.

In conclusion, surgical angiogenesis contributes to revascularization of nerve allografts.

The combination of surgical angiogenesis with undifferentiated MSCs specifically, results in the greatest increase of revascularization and vessel distribution, and stimulation of vessels to reach the middle longitudinal third of the nerve allograft.

A-0401 Evaluation of the effects of donor muscle strength and wrist range of movement in restoring finger extension using computer modelling

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Introduction: With an aging population, low energy, incomplete, peripheral nerve injuries present an ever-increasing challenge both in terms of pattern of deficit and associated comorbidities. Traditionally tendon transfer of the Flexor Capri Radialis (FCR) to the Extensor Indices Communis (EIC) will allow mass action finger extension thus restoring grip function. This function can be enhanced by wrist flexion via tenodesis and intrinsic interphalangeal joint extension. Traditional teaching requires the donor muscles to have a Muscle Power Scale (MRC) grade 4 or 5 and assumes that muscle donor strength will diminish by at least one grading post-surgery (Dunn et al, 2016) and yet extensor tenodesis with MRC grade 0 EIC can provide patients with improved functionality. The purpose of this study is to examine how MPC grading can affect the post-operative extensor movements of the fingers in an FCR to EIC transfer, when accompanied with appropriate tenodesis of the wrist. A mechanical model will be produced, which will include variable range of wrist movement and torque characteristics of the donor muscle according to MRC grading 1 to 5.
Methods: A biomechanical model of the hand (Blana et al, 2017) was adapted to accommodate the transfer of FCR to EIC using OpenSim (Delp et al, 2007). Dynamic simulations were run demonstrating how torque angle characteristics varied with differing wrist extension positions and MRC grading. The extent that a weaker donor muscle can be compensated by wrist extension was also measured and compared. The purpose of a biomechanical model simulating estimated post-operative movements is to inform surgical decision making when wrist range and/or donor power is compromised.
Results and Discussion: The output is presented as a three-dimensional simulation where the interrelationship between wrist range of motion, muscle power and the newly defined finger extension is outlined. Wrist extension tenodesis facilitates extension of the metacarpophalangeal joints and finger opening and grip release is achieved. If the donor muscle is reduced in strength, tenodesis can allow the muscle to operate nearer its peak force through the range of finger extension by movement of the wrist. The donor muscle is reduced in strength due to its increased excursion length thus reducing the peak torque of the muscle.
Conclusions: A biomechanical models are frequently used to simulate tendon transfer outcomes and can provide a useful frame of reference which can be further used to inform surgical strategies and interventions. This paper expands on the concept that computer modelling can describe single tendon transfers by introducing a variable outside the neuromuscular unit.

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A-0402 Surgical intervention for carpal tunnel syndrome in individuals with spinal cord injuries – patient characteristics, diagnostic considerations and treatment outcome

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Introduction: Carpal tunnel syndrome (CTS) is more common in patients with spinal cord injury (SCI) than in normal population. Studies specifically addressing diagnostics and outcomes after surgery of peripheral nerve entrapment syndromes are rare in people with spinal cord injury. This single-centre study highlights the demographics of CTS in persons with SCI and provides an algorithm for management.
Method: A retrospective investigation of patients with para- and tetraplegia undergoing surgery for CTS was conducted. We assessed medical history, diagnostics, surgery and outcomes of surgical treatment.

Results: We identified a total of 77 surgeries for CTS in 55 patients. The majority (47 persons, 68 surgeries) were paraplegic (level of lesion Th2 and below), 8 persons (9 surgeries) were tetraplegic (level of lesion Th1 and above). Sixty-six out of 77 patients patients reported total relief of symptoms. Neither nerve conduction velocity nor motor amplitude correlated well with the severity of CTS.
Conclusion: SCI patients with CTS respond well to surgical decompression of median nerve regardless of level and type of spinal cord lesion and risk factors. Nerve conduction parameters and clinical findings can provide additional diagnostic support of CTS although symptomatology and lack of effect of conservative treatment are the main indications for surgical intervention.
Keywords: carpal tunnel syndrome, peripheral nerve compression, tetraplegia, paraplegia

A-0403 No difference in recurrence rate and sustained straightness between collagenase treatment and needle fasciotomy for Dupuytren's Contracture – a five-year follow-up of a randomized study

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Objective: Percutaneous needle fasciotomy (PNF) and injection with Collagenase clostridium histolyticum (CCH) are two widely used minimally invasive treatments for Dupuytren's contracture. The results of this randomized study at one and two years have not shown any significant difference in recurrence or sustained straightness for treatment of MCP-joint contractures at one and two-year follow-up. The aim of this study was to investigate the five-year results of PNF and CCH in regard to recurrence rate.
Methods: Between November 2012 and October 2014, 156 patients (78 in each group) with Dupuytren's Contracture mainly affecting the MCP-joint, were enrolled in a randomized trial to either PNF or CCH. Five years after the beginning of the study, the patients were examined in either the outpatient clinic or had their medical files reviewed in case they had undergone surgery. Recurrence was defined as an extension deficit of $\geq 20^{\circ}$ or a second procedure in a successfully treated MCP joint. The study was approved by the regional ethical committee.
Results: The initial treatments were successful for 70 patients in the CCH-group and for 71 patients in the PNF-group, i.e. they had an MCP-contracture less than 5° measured after one week. Of these 141 patients, 130 were available for follow-up after five years. There were a total of 36 (56%) recurrences in the CCH group and 30 (45%) in the NF group. Among the participants available for a clinical examination at five years, 23 fingers (51%) in the CCH group and 27 fingers (47%) in the NF group were still straight, i.e presented with an extension deficit less than 5° The noted differences between the two groups was not significant when analysed with the chi-square test.
Discussion: This study, with a follow-up time of five years, suggests that the results after needle fasciotomy are similar to those of collagenase for the treatment of MCP joint contractures.

A-0404 Surgical Angiogenesis Modifies the Cellular Environment of Decellularized Nerve Allografts in a Rat Sciatic Nerve Defect Model

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Introduction: A well-vascularized bed for nerve grafts may diminish nerve rejection by altering the microenvironment and intricate paracrine mechanisms that control local cellular pathways. The purpose of this study was to determine how surgical angiogenesis alters the cellular environment of decellularized nerve allografts in a rat sciatic nerve defect model.
Materials & Methods: Unilateral sciatic nerve defects of Lewis rats ($N = 39$) were reconstructed using (i) autografts, (ii) decellularized allografts, or (iii) decellularized allografts wrapped with a validated pedicled superficial inferior epigastric artery fascial (SIEF) flap to provide vascularization. Animals were evaluated at two weeks ($N = 5$/group) for immune cell responses using flow cytometry and gene expression profiles. Gene expression was quantified by quantitative polymerase chain reaction (qPCR) analysis of representative biomarkers, including

angiogenic, neurotrophic, immunotrophic and extracellular matrix (ECM) genes. At 12 and 16 weeks, immunohistochemistry staining against neuronal markers (protein gene product 9.5 (PGP 9.5) and S100B) and blood vessels (CD34) was performed and evaluated.

Results: Immune expression: Flow cytometry revealed a significant increase in T helper population (CD4) in SIEF rats, compared to baseline, untreated rats ($P = 0.02$) after one week. Gene expression profiles of mmunotrophic markers indicated that distinct subtypes of T cells were altered near the grafts during nerve tissue repair.

Vascularity: Expression of all angiogenic markers, including Cd34, Pecam1/Cd31, Vegfa and Mmp2 ($P < 0.05$ compared to autograft), were significantly increased in SIEF samples. The increase in vascularity was also confirmed by immunohistochemistry at 12 and 16 weeks using antibodies against CD34.

Paracrine environment: ECM proteins such as collagen type I (Col1A1) and type III (Col3A1) were highest in SIEF samples ($P < 0.01$, compared to allograft).

Conclusions: Results obtained at both short (2 weeks) and long-term (12 and 16 weeks) suggest that surgical angiogenesis alters the cellular environment of nerve allografts. Of the 29 collagen types, collagen type I and III, specifically, are believed to provide mechanical support for axonal growth and regeneration after peripheral nerve injury. Surgical angiogenesis is found to increase vascularity when compared to allografts only and provides an immune tolerant environment. These data support our hypothesis that the provision of angiogenesis plays a role in suppressing nerve fibrosis after injury, by providing both an immune tolerant paracrine environment and increasing angiogenesis to the nerve allograft.

A-0413 Managing Acute on Chronic Distal Radius Fractures, a case series

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Introduction: Distal radius fractures are one of the most common fractures of the upper extremity. Non-operative treatment can lead to malunion. When a wrist with a malunited distal radius is fractured a second time, prior deformity is compounded and disfunction may appear or increase. No reports exist in the literature guiding the management of this situation. Restoring acceptable alignment is then challenging. To avoid functional disability, it may be necessary to restore anatomic alignment of the distal radius to or close to the native state. We present our experience managing secondary acute fractures of previously malunited distal radius fractures by correcting the prior deformity through the new fracture plane, using it as an opening wedge osteotomy and a using a volar plate for fixation.

Materials & Methods: We retrospectively reviewed the records of all patients treated at our facilities, from January 2009 to January 2019 for an acute distal radius fracture occurring on a wrist with a prior chronic malunion and using this technique. The Extended FCR Approach, a volar locking plate and the distal fragment first technique was used to correct volar tilt, radial inclination and length. Autologous bone graft and excision of contracted dorsal periosteum was performed in all cases. Office charts, therapy records, and radiographs were examined for functional results, radiographic reduction parameters, and complications.

Results: The correction achieved through the secondary (new) fracture plane allowed restoring proper distal radius anatomy (volar tilt, radial inclination, and ulnar variance) in all 13 patients. Radiographic union was achieved in all cases at an average of 11 weeks. Final range of motion and grip strength were comparable to published series of distal radius deformity correction procedures. No significant complications occurred. At the last visit many patients reported subjective improvement in function and appearance as compared to their pre-secondary fracture state.

Conclusion: An acute on chronic distal radius fracture can be managed by using the new fracture plane for correcting the pre-existing deformity. The surgical technique is exacting but the clinical results are acceptable and result in significant patient satisfaction. Complications were not found in our small series.

A-0426 Are there Advantages of Partial Ulnar Head Prostheses compared to Total Ulnar Head Prostheses?

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Introduction: Different surgical techniques are used for the treatment of distal radioulnar joint (DRUJ)

osteoarthritis. Beside the traditional procedures such as Sauve- Kapandji or distal ulna resection (Darrach), four types of ulnar head/DRUJ implants exist: total ulnar head, partial ulnar head, unlinked total distal radioulnar joint, and linked distal radioulnar joint. Studies of partial ulnar head implants with a considerable number of patients and long-term follow up are missing in the literature. The primary objective of this study was to analyse function, patient-rated outcome measures (PROMs), grip strength and DRUJ instability of partial ulnar head prostheses (pUHP) in comparison to total ulnar head prostheses (tUHP).

Method: All patients with an ulnar head implant of the type First Choice and Herbert Ulnar Head Prosthesis between December 2002 and December 2019 with a minimal follow up of 1 year were included. PROMs were assessed by the numeric rating scale (NRS) for pain, patient-rated wrist evaluation (PRWE) and Disabilities of Arm, Shoulder and Hand (DASH) questionnaire. During the clinical examination range of motion was measured with goniometer, grip strength with a dynamometer and pronation-supination strength with a torque force device. Additionally, the DRUJ stability was assessed on the degree of dorsovolar translation in a sonographic manner.

Results: During the seventeen-year time period 36 patients received an ulnar head implant (First Choice: 19 partial ulnar head and 3 total ulnar head, and 14 Herbert UHP) in order to address their DRUJ osteoarthritis. 20 patients with 21 DRUJ implants were available for a follow up examination (First Choice: 11 partial ulnar head and 2 total ulnar head, and 8 Herbert UHP) on average 7 years after surgery (range 1.5–17 years). PROMs did not show any significant differences with a mean NRS of 2.9 in pUHT and 2.4 in tUHP, a DASH score of 25 in both groups and a PRWE of 21 in pUHP and 17 in tUHP. Total active range of motion of pronation-supination was 130° (SEM 5.80) in patients with pUHP and 135° (SEM 4.91) in tUHP without a significant difference ($p = 0.56$). Mean force during Pronation and Supination was higher in patients with pUHP compared to patients with tUHP, but only the comparison of the supination force showed a significant difference ($p = 0.04$). There was no significant difference in DRUJ stability in patients with pUHP (stable DRUJs 7/11 patients) compared to patients with tUHP (6/10 patients).

Conclusion: The level of pain was low in both groups of patients with ulnar head implants and the PROMs are comparable. While the total active range of motion of pronation-supination showed only a marginal difference, higher pronation and supination strength is an advantage of the partial ulnar head implant, which may have a beneficial impact on daily activities.

A-0427 Determination of the Minimally Important Change of the Michigan Hand outcomes Questionnaire in patients undergoing open trigger finger release

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Purpose: The Michigan Hand outcomes Questionnaire (MHQ) is a widely used instrument to evaluate treatment results for hand conditions. Establishing the Minimally Important Change (MIC) is essential to determine if a change in outcome is clinically relevant. To date, no study has reported on the MIC of the MHQ in trigger finger patients. Therefore, the aim of this study was to determine the MIC of the MHQ total and subscale scores in patients undergoing open surgery for trigger finger.

Methods: This multicenter, prospective cohort study of patients that were planned to undergo open trigger finger release was performed in 23 outpatient clinics for hand surgery in the Netherlands. The MHQ was completed prior to surgery and three months postoperatively. At follow-up, patients answered an additional question about their satisfaction with the treatment result. The MIC of the MHQ total and subscale scores was determined using five anchor-based methods (i.e. two Anchor Mean Change methods and three Receiver Operating Characteristic methods), in which the anchor questions were based on satisfaction with treatment. The outcomes of the five methods were then triangulated to create a weighted mean, in which the median score was determined to represent the triangulated MIC.

Results: A total of 2158 patients were included in this study between 2011 and 2020. The MIC for the MHQ total score ranged from 7.7 to 14.4, with a triangulated estimate of 9.4. The triangulated MIC estimates for the MHQ subscales were 8.0 for 'hand function', 12.9 for 'work performance', 16.3 for 'pain', and 21.8 for 'satisfaction'. The MICs could not be determined

for the subscales 'activities of daily living' and 'aesthetics', due to low correlations with the anchor question.

Conclusions: These estimated MIC values can contribute to the interpretation of clinical outcomes following trigger finger release, for example when determining the proportion of patients with a meaningful improvement in comparative studies, the development of clinical prediction models, or assessment of power in prospective trials.

A-0428 Use of the Keystone Design Perforator Island Flap for Reconstruction of Upper Limb Defects

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Background: Soft tissue defects of the upper extremity due to trauma, infection or malignancy are common and represent a challenge for the reconstructive surgeon. Most of the time a flap coverage is mandatory for exposed tendons, nerves, bones and joints. Local, regional distant and free flaps are described in the literature for upper limb reconstruction. Keystone design perforator island flap (KDPIF) is a local advancement flap based on multiple perforators originally described by Behan in 2003 for reconstruction of defects after excision of skin cancer and since then has been used for the reconstruction of defects located on the head, neck, torso and extremities.

The aim of this study is to report the technique and the outcome of KPDIF for upper limb reconstruction.

Materials and methods: The authors retrospectively reviewed 14 patients with soft tissue defects on the upper limb, reconstructed with Keystone Design Perforator Island Flap from September 2018 till September 2020. Patient demographic data, etiology and localization of the soft tissue defect, surgical technique, hospitalization, complications and follow-up were evaluated.

Results: The localization of the soft tissue defects were shoulder 42%, arm 7%, forearm 14%, hand 28% and digit 7%. The etiology of defects was post carcinoma excision 57% post melanoma excision 14% and post trauma defects 28%. The mean age of the patients was 64 (range 34–86). Four patients were female and ten were male. All patients were operated with regional anesthesia with or without sedation. Mean operative time was 48 min (range from 20 to 78 min). The follow up of the patients was 3 months minimum. All wounds healed primarily with no additional surgery required. There was no infection, hematoma or seroma reported. One patient had a partial skin necrosis which was managed conservatively and prolonged the healing time. There was a transitory oedema of the digits in two cases which resolved after 2 weeks.

Conclusion: Our results indicate that the Keystone flap can be a safe, reliable and effective method for the coverage of soft tissue defects in the upper limb. The flap harvest is simple, less time consuming, has reliable vascularity and doesn't require microsurgical skills. Keystone flap has high rates of flap survival, low risk of significant complications, decreased pain, and quicker postoperative recovery time, therefore is an option to reconstruct most of the upper limb defects.

Keywords: Keystone design perforator island flap, upper limb reconstruction, soft tissue defects

A-0434 Hand motion analysis of functional tasks – repeatability and marker visibility

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Objective: The aim of this study was to demonstrate the feasibility of simultaneously measuring all finger joints, the wrist and the radio-ulnar joint during complex daily activities using a 3D motion capture system. The main interest was in verifying good marker visibility and quantifying repeatability of angular motion patterns during functional tasks.

Method: Twenty healthy volunteers were recorded with a motion analysis system consisting of 11 infrared cameras during the performance of eight functional activities: opening a jar, a bottle and yoghurt, lifting a 1 kg, 3 kg and a small object as well as writing and typing. A marker set with 46 skin markers was used to collect kinematic data of the hand, forearm, thumb and fingers simultaneously. To investigate the repeatability, each task was repeated five times and each subject was measured twice on two different days.

The visibility of the markers was reported as a percentage over the entire duration of the task. The intra- and inter-subject standard deviation (SD) between the angle curves was used as a measure of repeatability.

Results: Overall, the visibility of the markers was 97%. The markers for calculating the wrist, thumb and MCP kinematics achieved a high visibility of over 99%, the markers for the elbow and PIP > 95% and the markers for the DIP only 88.5%.

The averaged intra- and inter-subject SD over all tasks and joints was 5.1° and 10.4° respectively. The intra-subject SD was between 5–7° for the joints of fingers III-V and the interphalangeal joint of the thumb and between 3–5° for all other joints. The inter-subject repeatability was 9–10°, except for the tasks writing and opening a yoghurt (12.5°).

Conclusion: Overall, very good data quality was achieved, thus confirming the feasibility of assessing finger, wrist and radio-ulnar kinematics during complex daily activities. However, for some tasks the visibility of the markers for the DIP3-5 joints was limited. The identified values are helpful to choose an adequate setup and tasks in future studies, depending on the joint of interest.

It has been shown that the movements are repeatable within a subject, but that there are relatively large inter-individual differences. The order of tasks regarding repeatability varied, for example writing was the most repeatable activity within the subject (SD 3.4°), but the greatest differences between subjects were found for this task (SD 12.4°). Using a heavier dumbbell weight (3 kg vs. 1 kg) increased the repeatability of finger kinematics. The impact of the load on repeatability for other tasks should be investigated in future studies.

Good visibility of the markers and high repeatability within a subject are prerequisites for meaningful data evaluation. The angular motion patterns of the healthy volunteers show a relatively large (inter-subject) normal range. With the aim of quantitatively measuring hand function, future studies will investigate whether and to what extent patients' movement patterns and functional constraints can be distinguished from these normal values.

A-0436 Predicting preoperative pain levels of trigger finger patients scheduled for surgical release: a large cross-sectional study from the Hand and Wrist cohort

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Background and Aims: It is known that preoperative pain levels predict postoperative pain in patients undergoing trigger finger release. Although trigger finger is one of the most common diagnoses of pain in the hand in adults, little is known about factors predicting preoperative pain levels. Therefore, the aim of this study was to investigate if preoperative sociodemographics, clinical characteristics, Patient Reported Outcome Measures (PROMS) and psychological questionnaires, predict the preoperative pain levels in patients scheduled for surgical trigger finger release.

Patients and methods: In this cross-sectional study, baseline data on sociodemographics, clinical characteristics, clinical PROMS and psychological characteristics of patients scheduled for trigger finger release were collected. A hierarchical multivariable regression analysis was applied to identify predictors of preoperative pain levels, adding the predictors in separate steps. Pain levels were measured using the Michigan Hand outcomes Questionnaire (MHQ) pain subscale.

Results: 987 patients were included in this study. In the final model, female sex, Body Mass Index, presence of systemic comorbidity, worse hand function, less satisfaction with hand, worse pain catastrophizing, more negative perceptions of the consequences, more severe symptoms, a better understanding of the illness and a higher emotional response were independent predictors of higher preoperative pain levels. In the first model, sociodemographics alone explained 9% of the variance in preoperative pain levels. After adding clinical characteristics, the explained variance came to 13% and further increased to 33% after adding clinical PROMS in the third model. In the final model, the psychological characteristics were included and the explained variance increased to 49%.

Conclusion: We identified multiple factors predicting preoperative pain levels in patients scheduled for trigger finger release, which in total add up to 49% explained variance. These insights could help clinicians better comprehend the most important factors that determine the perception of pain in patients scheduled for trigger finger release. Furthermore, these factors may be useful when designing interventions to decrease preoperative pain levels, thereby improving the final outcomes.

A-0441 The keystone- lunate fossa fragment, volar displaced intra-articular distal radius fractures

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Introduction: Volar displaced fractures of the distal radius, including the eponymous Barton's and Smith's fractures are considered unstable and warrant operative management. We noted a subset of patients with volar displaced fractures and a separate lunate fossa fragment. The presence of a separate lunate fossa fragment with a depressed articular fragment, volar lip fragment or a combined injury may lead to further instability. We aim to review our long-term experience as a specialist orthopaedic institution in the management of this complex fracture pattern, exploring surgical technique which may better support improved treatment of distal radius fractures with specific lunate fossa fragment involvement.
Methods: The study was carried out at a tertiary specialist orthopaedic institution. All volar displaced distal radius fractures requiring open reduction and internal fixation over a 5-year period between 2015 and 2020 were identified from the hospital electronic patient records. All fractures were fixed by senior specialist hand surgeons experienced in the management of complex hand injuries. Inclusion criteria were: any displaced intra-articular volar distal radius fracture with lunate fragment involvement undergoing volar plate osteosynthesis and over the age of 16 years at time of operation. Volar displaced distal radius fractures without lunate involvement, shaft fractures, extra-articular fractures, open fractures, fractures fixed using k-wires or external fixation, patients referred for revision surgery and patients without follow-up at 6 weeks were excluded.
Results: A total of 468 distal radius fractures were assessed, 29 (6%) cases included lunate fossa fragment involvement. 20 (69%) of patients were female, mean age was 59 years (SD 12.4). Mean length of stay was 0.2 days and mean operative time was 96 mins (range 79–95). No patients had fracture fixation failure or return to theatre for any reason.
Discussion: Comminuted distal radius fractures with lunate fossa involvement are a challenging subset of fractures to treat. Further to loss of reduction or failure of fixation, the primary concern is that this may precipitate carpal subluxation. Fracture morphology is not always evident in plain radiographs and therefore the use of computed tomography will improve both the reliability and accuracy of fracture assessment and thereby aid treatment decisions. We adapted our surgical approach in order to address this more complex fracture pattern, so as to facilitate lunate fragment exposure and aid reduction. In our patients we utilised an extended flexor carpi radialis approach and intra-focal exposure. Volar plate osteosynthesis relies of optimal volar longitudinal coverage of the lunate fragment to capture the fracture fragment, whilst not crossing the watershed line which may lead to flexor tendon injury.
Conclusion: There is limited literature exploring of this particular injury, and our experience as a specialist orthopaedic centre with long-term results has helped us elicit important findings. We recommend the extended FCR approach and intra-focal exposure to undertake fracture reduction and fixation. The lunate fossa fragment is the keystone which deserves dedicated reduction prior to tackling the remaining fracture configuration.

A-0443 Changing patterns of treatment for Dupuytren's contracture – a retrospective and economic study of the introduction of needle fasciotomy in western Sweden 2010–2018

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Objective: Minimally invasive treatments for Dupuytren's contracture, e.g. needle fasciotomy and

collagenase, have come to provide a more simple option for patients than open fasciectomy and are substantially cheaper. The rationale for this study was to describe the changing treatment pattern in the western region of Sweden with a population of 1,6 million over an eight-year period and to calculate the economic consequences.

Methods: A retrospective study of records for all patients treated for Dupuytren's contracture between 2010 and 2018 at all public hospitals in the region was performed by the authors and collaborators. Since collagenase was not financially reimbursed in the region, needle fasciotomy was the only alternative to open fasciectomy. A prospective pilot study of the economic consequences performed 2012–2014 as well as an estimation by the economic departments in two of the hospitals led to an approximation of the cost difference between open fasciectomy and needle fasciotomy.

Results: A total of 3849 patients were treated during the study period. The ratio between open fasciectomy and needle fasciotomy changed drastically, from 26:1 to 3:10 between 2010 and 2018, and the total number of patient treated annually increased to a peak in 2014 but still remains higher. The average cost for an uncomplicated open fasciectomy in a regular operating room with staff was estimated to €2,900. The corresponding cost for PNF in a room in an outpatient clinic was €360.

Discussion: This study shows that needle fasciotomy has replaced open fasciectomy as the mainstay treatment for Dupuytren's contracture in the western region of Sweden, and that this treatment is significantly cheaper in the short term even if the total number of patients has increased. Some of the limitations are that recurrences were not accounted for and that no proper cost-effectiveness analysis could be performed.

A-0445 Outcomes and Complication Rates following the use of the MatOrtho PIPR Arthroplasty System in the Management of Proximal Interphalangeal Joint Osteoarthritis

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Introduction: Proximal Interphalangeal Joint (PIPJ) arthritis can be a chronically disabling condition. The previous use of a monobloc silicone spacer yielded acceptable clinical outcomes. In more recent years, new materials such as metal on polyethylene and pyrocarbon implants have been used with newer surgical techniques and tailored rehabilitation in an attempt to improve patient outcomes.

The PIP-R is a 2 part Cobalt-Chromium and polyethylene joint replacement designed to mimic the kinematics of a healthy PIPJ achieving good function via the preservation of functioning collaterals with a conforming anatomical bearing design.

Methods: A total of 50 patients (65 PIP Joints) with a mean age of 64 years (range 41–85) underwent PIP joint replacement using the PIPR implant between March, 2011 and December, 2017 at Brighton and Sussex University Hospitals NHS Trust. Patient records were used to assess the surgical approach, average arc of motion and complications of surgery including stiffness, deformity, dislocation and revision surgery.

A diagnosis of primary osteoarthritis was made as the underlying pathology in 92% of patients, secondary osteoarthritis (post traumatic) in 4% with inflammatory arthritis being present in the remaining 4%.

Results: Of the 65 arthroplasties 36% were performed via a dorsal approach, 58% via an ulna lateral approach and 6% via a volar approach. A total of 13 prostheses were implanted in the index finger, 31 in the middle finger, 19 in the ring finger and 2 in the little finger. There was post-operative data on range of movement available in 56 out of the 65 implants. The average arc of movement post operatively was 54 degrees (range 10–90 degrees) at an average of 14 weeks follow-up (range 6–24 weeks).

A total of 9 patients (13.8%) required revision surgery (3 revision arthroplasty and 6 revision to PIPJ fusion). The most common indication for revision was dislocation and central slip failure (5 cases) followed by persistent pain with fixed deformity (3 cases) and loosening (1 case). Soft tissue complications included 7 patients (10.7%) who required central slip repair and stabilisation for dislocation and 8 patients (12.3%) who had ongoing stiffness with a fixed flexion deformity (FFD) or fixed swan neck deformity requiring either a volar plate release or tenodesis. 1 patient required a SORL reconstruction and 1 underwent a Matev procedure.

2 patients (3%) had a superficial wound infection managed successfully with a course of oral antibiotics and 1 patient had an ulna digital nerve injury. A total of 24 (36%) arthroplasties required a subsequent surgical procedure with the most common complications being that of central slip failure and dislocation (17%) and persistent stiffness/deformity (hyperextension/FFD – 17%). There was no significant difference between the surgical approaches and the development of complications.

Conclusions: The use of third generation implants, such as the PIP-R remain a good option for PIPJ

osteoarthritis with both pain relief and improvement in functional scores reported (Flannery et al). However complication rates are not insignificant and patients need to be appropriately counselled about the potential for instability, persistent stiffness and deformity and re-operation rates.

A-0452 Patient-reported treatment injuries after hand surgery. A review of 1321 claims submitted to the Norwegian System of Patient Injury Compensation 2007–2017

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Objective: Hand surgery makes up a large proportion of procedures, ranging from simple to complex. Increased complexity places greater demand on hand surgery competence. Furthermore, when surgical expertise is not matched to the procedure complexity, treatment injuries might occur. The purpose of this study was to assess patient-reported claims submitted to The Norwegian System of Patient Injury Compensation (NPE).
Methods: We examined all the hand surgery claims submitted to NPE between 01.01.2007 and 30.06.2017. NPE records patient demography and variables such as diagnosis, type of injury, injury location, the reason for the compensation claim, and whether a claim was accepted or rejected.
Results: NPE received 1321 claims related to treatment injuries from hand surgery at a steady rate throughout the study period. A total of 532 of the claims were accepted (40.3%). The approval rate for trauma cases was significantly higher than for elective cases (45.5 vs. 34.2%, $p < 0.05$). The most common diagnoses were hand fractures, dislocations and ligament injuries, carpal tunnel syndrome and arthrosis of the first carpometacarpal joint. Tendon injuries had the highest percentage of accepted claims (52.6%). The most common reason for claims being accepted was 'failure of treatment'. 19.7% of all accepted claims involved a disability percentage > 15%. Elective surgery accounted for ⅔ of the approved disability cases.
Conclusion/Interpretation: This is the first national study of patient-reported injuries after hand surgery in Norway. The proportion of accepted claims is similar to that seen for orthopaedics. Acceptance levels were, however, higher for hand trauma cases than for disorders treated electively.

A-0453 Post-Proning Plexopathy in COVID-19 Critical Care Patients: a regional hand and nerve surgery service's experience and recommendations at a major critical care centre

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Background: The coronavirus (COVID-19) pandemic saw an unprecedented rise in ventilator-dependent intensive care unit (ICU) admissions. Mechanically ventilated hypoxic patients are often subjected to prone positioning as a well-documented means of reducing mortality from ARDS (Wu et-al 2019). However, 'proning' of sedated patients can be associated with accidental injury, notably brachial plexus damage, discernible as sensory and/or motor neuropathy in an anatomical distribution with neuropathic pain (Kwee et-al 2015). This is distinguishable from polyneuropathy and myopathy associated with prolonged critical care admission, which generally presents as flaccid symmetrical paralysis or painless mixed peripheral neuropathy (Shepherd et-al 2017)

This study aims to identify these injury patterns and provide guidance for specialist referral, management, and prevention, as well as recommendations for amendment of national practice.
Method: Patients were referred to our peripheral nerve service following discharge from the ICU for COVID-19, and reviewed on the rehabilitation ward for signs of neuropathic pain and sensory/motor peripheral deficits alongside neurophysiology tests. Of those with positive findings, a retrospective review of their admission was conducted using data obtained from the Trust electronic record 'PICS', focusing on demographics, comorbidities, and critical care stay (Miller et-al 2020).
Results: Of the 256 patients admitted to ICU for COVID-19 during the first wave (March-June 2020), 114 underwent prone positioning. Within these, 15 patients (12 male to 3 female) with a mean age of 55 years (39–69) exhibited subsequent brachial plexopathy. The most common comorbidity was hypertension (11/15) followed by diabetes and obesity (8/15 each). The mean ICU stay was 36 days (20–61), during which proning was performed on average 7

times (2–15). All patients complained of neuropathic pain and demonstrated motor weakness. 3 patients had suffered iatrogenic glenohumeral dislocations.

A total of 30 injured nerves were identified among them, the most commonly affected being the ulnar nerve (40%), followed by the lateral (14%), medial (10%) and posterior cords (10%). Most patients had muscle wasting consistent with high-grade injury (87%), especially in ulnar nerve injuries at the cubital tunnel where axonopathy was found in 90%. No injuries were deemed low-grade (neuropraxia).

Conclusion: Brachial plexus or peripheral nerve injury is a significant complication of proning practice that necessitates early specialist input to prevent chronic debilitation.

Our physiotherapists have been provided with the training to advise ward staff in correct patient management, rapidly recognise and escalate injuries, and initiate early intervention to optimise rehabilitation. A referral pathway based on a focused triage tool has since been implemented (Quick et-al 2020).

Emphasis has been also placed on patient education following discharge to encourage passive exercise as well as adequate positioning to avoid critical pressure points.

Recommendations have been made to amend current national guidance with regards to patient positioning, addressing amongst others the high incidence of shoulder girdle, proximal plexus, and ulnar nerve injuries (Power et-al 2020)

Meanwhile, studies are ongoing to further understand the common injury patterns and their outcomes, predictive patient and environmental factors, and the potential underlying presence of neuroinflammatory mechanisms which may contribute to clinical presentations and progression.

A-0454 Arthroscopic grafting of scaphoid nonunion – A Retrospective study of 32 cases

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Background: Scaphoid fracture is the most common carpal fracture. Nonunion rate has been reported around 10 to 15% of scaphoid fractures. Arthroscopic management of scaphoid non-unions has been advanced as a less invasive technique that allows evaluation of associated intrinsic and extrinsic ligamentous injuries. We report our experience with the arthroscopic treatment of 32 cases of scaphoid nonunion. We report our initial clinical and radiological results.

Material & method: This was a retrospective, multicentric, non-randomized study. All patients operated by this technique, between January 2016 to December 2019, were included. Inclusion criteria were a scaphoid nonunion without radiocarpal arthritis and without any time limit. Schernberg's and Alnot's classification were used to evaluate the nonunion. Pain, strength, range of motion as well as functional abilities were evaluated after the operation. A CT scan was performed 4 months after the operation to determine whether union was achieved.

Results: There were 29 men and 3 women with an average age of 25,7 years. 27 (84,37%) scaphoid nonunions healed successfully. 25 patients could be examined, between April 2020 up to September 2020, with an average follow up of 29 months (7–48). At the last follow-up, the mean flexion-extension arc was 112°, 90% compared of the healthy wrist. The mean grip strength was 38 kg, 95% compared to the healthy side. At last, the mean DASH score was 9,25.

We reported one complication (a cicatricial neuroma in the medial dorsal sensitive branch, from the radial nerve) and a mid-carpal arthritis requiring reoperation.

Conclusion: We described an arthroscopic technique for treating scaphoid nonunion with very promising results. Nevertheless, we reported a lower consolidation rate than other series using this surgical procedure.

A-0456 Adults with Arthrogryposis – Long Term Functional Follow Up

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Arthrogryposis multiplex congenita (AMC) and is a birth defect that involves congenital joint contractures in two or more joints including the limbs and spine. Function of these patients is highly variable. The purpose of this study was to identify long-term functional outcome of adults with AMC.

All patients with AMC treated for the past 30 years at the pediatric rehabilitation center (the national center for treatment of AMC) and were over the age of 18, were contacted. Twenty-four patients agreed to participate and were interviewed. The data collected included demographic and medical history and standardized outcome measures of quality of life, upper limb activity and physical activity (SF-36, quick-DASH, PASIPD questionnaires).

The average age of the study group was 33 with an equal distribution of males and females. Twenty-five percent of patients live independently. Participants were more likely to have a graduate degree and lower physical function scores than the general population. Quality of life was rated higher than the general population. Mobility was affected by any symptoms of the foot, such as pain, distortion, or impairment of function. A minority of patients chose to walk independently or with gait aids both indoors and outdoors, and the majority use wheelchairs. Two patients reported using pain medication on a regular basis despite high rates of musculoskeletal pain (60%, 50%, 25% and 58% reported pain in back, hip, shoulder-elbow and wrist, respectively).

Over 83% of participants had upper limb involvement. The patients who received only non-surgical care to the upper limbs reported better upper limb function then those treated with surgery ($p = 0.035$). Patients with scoliosis reported low levels of activity and function according to the PASIPD score ($p < 0.05$) as well as lower upper limb function according to the Quick DASH ($p < 0.05$). We found a decrease in upper limb function in participants with hip joint pain ($p = 0.039$), but not with shoulder, elbow or wrist symptoms.

The majority of our participants were well-educated, were employed and maintained a high degree of independence, despite high incidence of self-reported pain and physical limitations. Upper limb function was found to be most affected by spine and hip deformity and pain. Patients treated with surgery to the upper limbs did not achieve higher function than those treated without surgery.

A-0463 The effect of stem cells and local tacrolimus on neurite extension

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Introduction & Purpose: Application of mesenchymal stem cells (MSCs) or tacrolimus (FK506), an FDA approved immunosuppressant, to nerve grafts has been a topic of interest to enhance peripheral nerve regeneration. Systemically administered FK506 in immunosuppressive doses causes undesirable side effects. Moreover, one of the difficulties of transplanted MSCs is that its effect and survivability is impeded by the unfavorable immune microenvironment by potential immunological reactions. The aim of this study was to investigate the combined effect of MSCs and local delivery of FK506 on nerve regeneration when applied to nerve autografts and decellularized nerve allografts.rnrnMethods: A three-dimensional (3D) in vitro compartmented cell culture system, validated by Tajdaran et al (2019). This system consisted of rat neonatal dorsal root ganglion (DRG) adjacent to a 3.5 mm rat nerve autograft or decellularized allograft allowing for evaluation of isolated treatment. This model was used to evaluate regenerating neurites from the DRG into the peripheral nerve scaffold. Nerve autografts and decellularized allografts were augmented with (i) dynamic undifferentiated MSC seeding, (ii) local application of FK506 (100 ng/mL) or (iii) both ($N = 9$/group). Untreated nerve autografts and decellularized allografts served as negative controls. Local application was ensured by isolating the central system (i.e. DRG side) from the peripheral system (i.e. nerve graft side), where treatment was applied. After 48-hours of incubation, DRG-nerve graft constructs were collected, fixed, sectioned and stained against neurofilament-160 to measure neurite extension as a measure of nerve regeneration. CD90 staining was used to confirm stem cell characterization. rnrnResults: All grafts treated with MSCs confirmed CD90 expression. Compared to untreated autografts, neurite extension in autografts treated with FK506 and autografts treated with MSCs and FK506 combined were found superior ($P < 0.001$ and $P = 0.0001$, respectively), and comparable to

autografts treated with MSCs ($P = 0.12$). Compared to untreated allografts, allografts treated with FK506, and allografts treated with MSCs and FK506 were found superior ($P < 0.001$ and $P = 0.0001$, respectively), and allografts treated with MSCs were found comparable ($P = 0.09$). All autograft groups were found superior compared to their respective allograft treatment group ($P < 0.05$). Solely allografts receiving combined treatment were found superior to untreated autografts ($P < 0.05$). rnrnConclusions: MSCs or FK506 treatment improved neurite outgrowth and when combined, this resulted in significant synergistic neurite extension in both autografts and allografts in comparable patterns. Moreover, this study confirms the importance of cellular environment in nerve regeneration and requires the decellularized allograft to be treated with both MSCs and locally administered FK506 to surpass outcomes of the untreated autograft

A-0464 A review of 1321 patient-reported treatment injuries to the Norwegian System of Patient Injury Compensation 2007–2017 – Scaphoid fractures need a special focus

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Objective: Although scaphoid fractures are common, treatment-injuries frequently occur. The purpose of the present study was to 1) assess the number and causes of patient-reported claims filed to The Norwegian System of Patient Injury Compensation (NPE), 2) compare them with hand fractures in general and 3) evaluate the national incidence of accepted claims by using data from the Norwegian Patient Registry.
Methods: From the NPE database, hand surgery diagnosis from the period 2007–2017 for hand surgery were extracted based on specific codes. Data for hand- and scaphoid fractures were evaluated regarding patient demographics, along with variables such as reason for the claim, whether the claims were approved or rejected and whether the patient received compensation or not. In addition, a search was conducted in the Norwegian Patient Registry for all patients with these diagnostic codes to calculate the incidence of approved claims.
Results: In the period, 1321 claims relating to hand surgery were filed to NPE. This is 1/10 of the total number of claims in orthopedic surgery. There were 322 claims regarding S62, Fractures of the hand and wrist. Of these, 69 (21.4%) claims were due to S62.0 Scaphoid fractures. The number of granted claims was 44 (63%), which was 57% higher compared to hand- and orthopedic surgery and more than 100% higher than the 9 medical areas with the highest percentage of approved claims in Norway. Of these 44 patients, there were 37 males and 7 females, median age 26 (13–55) years. The reason for granting the claims was in 68% ''delayed diagnostic'' and in 30% ''failure in treatment''. Of the granted claims, 14% had a disability percentage > 15%. The NPR-data show that on average 3002 patients are treated for scaphoid fractures per year, giving 1,4 granted claims per 1000 treated patients per year.
Conclusions: Scaphoid fractures accounts for 1/20 of the claims filed to NPE for hand surgery. Although the number of claims is low compared to all the fractures which are treated, the proportion granted claims is much higher than claims after treatment of all hand fractures, all orthopedic surgery and other medical fields in Norway. As more than 2/3 of the cases were due to ''failure in diagnostic'', the lessons to be learned is that these fractures need a special focus in primary evaluation after the injury.

A-0465 Early bone biopsy and treatment failure rates in osteomyelitis of the hand: a study of 92 patient outcomes

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Introductions and Aims: Early, evidence based and aggressive management of suspected osteomyelitis in the hand is hypothesised to lead to improved patient outcomes and reduced rates of treatment failure. This study aims to evaluate the effects of early bone biopsy in cases of osteomyelitis within the hand.

Methods: A retrospective review was performed of 92 consecutive patients treated for hand osteomyelitis over a two year period (2018–2019) in a tertiary centre, including 57 positive microbiological bone cultures. Mean follow up time for the cohort was 105 days (SD 122, range 0–651). Treatment failure was defined as: further surgical procedure or antibiotic administration after 6 weeks following initial biopsy or surgical procedure and commencement of antibiotic therapy.
Results: Treatment failure was observed in 23 of 92 cases (25%). Early terminalisation or amputation (within 6 weeks from diagnosis) was not associated with treatment failure in any of ten cases ($p = 0.06$). Early bone biopsy (<4 days after first hand surgery review) was associated with treatment failure in 5/28 (17.86%) versus 18/64 (28.1%) in those biopsied at ≥ 4 days or not at all (odds ratio 0.56, 95% confidence intervals 0.18–1.69, $p = 0.43$).
Conclusions: Early bone biopsy and early amputation were associated with a non-statistically significant reduction in treatment failure rates in hand osteomyelitis in this series.

A-0467 Nerve Injuries and Delays in Treatment Negatively Impact Patient-Reported Quality of Life

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Background: Little emphasis has been paid to characterize quality of life (QoL) burdens experienced by patients seeking surgical treatment for nerve injuries. Based on a patient survey, the present study presents statistics on pre-surgery symptoms and QoL and how they were impacted by nerve surgery.
Methods: A retrospective survey was distributed to all patients ($N = 767$) from a single nerve surgeon's practice between 2014 and 2020. Data collected included demographics, specifics of the injury and symptoms, time to referral, and effects of the injury, surgery, and timing of surgery on QoL.
Results: Out of 767 patients, 209 (27.2%) completed the survey. Average age was 48.8 years; 68.9% female and 31.1% female. At presentation, 68% had symptoms for more than 1 year; 86.1% reported severity as being profound. 70% felt they should have been referred earlier for surgical evaluation. 51.2% were not told that nerve surgery was an option for their problem, and 68.8% were told that nothing could be done. 83.1% felt that earlier referral would have improved their QoL. After the surgery, symptoms were significantly mitigated in 55.5% of the patients, moderately mitigated in 21.5%. Patients reported their QoL were significantly (59.8%) or at least moderately (76.6%) improved by their nerve surgery treatment.
Conclusions: The majority of patients reported that nerve injuries imparted a moderate to severe impact on QoL, and that surgical treatment improved QoL. The majority of patients felt that earlier referral would have improved their QoL. Improved interdisciplinary coordination may be helpful in facilitating timely diagnosis and referral, and thus outcomes.

A-0469 Incidence of neuroma at a tertiary hand centre: a review of 418 amputations

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Background: Diagnosis of a painful neuroma continues to be a challenge to the nerve surgeon. A lack of agreement in diagnostic criteria has led to a high variance in the reporting of painful neuroma. Current literature suggests that the incidence of neuroma in the hand vary from 0–25%, with a higher incidence being seen post amputation compared to nerve repair.
Method: We conducted a retrospective study at the Queen Elizabeth Hospital Birmingham between January 2015 and December 2017. All patients who had undergone an amputation of the upper limb were included in this study giving a cohort of 418 amputations in 369 patients. Data was collected during a three year period from 2015–2017. Identification of neuroma was made using clinical judgement and in some cases, radiological evidence if required.
Results: We performed 418 amputations on 369 patients during the three years for a variety of reasons, the most common being trauma. We identified 27 neuromas in 23 patients giving an incidence of 6.46% (27/418). When the cohort is split into traumatic vs non-traumatic amputations, the neuroma rate is 8.19% vs 4.55%.
Conclusions: This study presents a lower incidence of painful neuroma post amputation than that in the literature. This may be due to different criteria to diagnose a neuroma, improved nerve handling intra-op or differing methodology in the literature.

A-0470 A randomised, double-blind, placebo-controlled study of celecoxib after collagenase injection for patients with Dupuytren's contracture at high risk of recurrence

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Background: Earlier clinical studies demonstrated a beneficial effect of Tamoxifen in minimally invasive surgical treatment for Dupuytren's contracture. However, the effect decreased once the medication was discontinued and the possible side effects of Tamoxifen were deemed too dangerous. NSAID's (non-steroidal anti-inflammatory drugs) have been used in the treatment of other fibroproliferative processes (desmoids tumours) and CCH (collagenase clostridium histolyticum) became the preferred treatment for Dupuytren's contracture.
Materials and Methods: A prospective double blinded randomized trial was started to evaluate the effect of adjuvant celexocib on the outcome of CCH treatment for severe finger contracture in 30 patients with a high fibrosis diathesis, based on the score of Abe. Peroral celecoxib 200 mg or placebo, once daily for 12 weeks, was administered, starting the day of the CCH injection All patients underwent the same standard rehabilitation protocol with an extension splint for 3 months and were clinically evaluated after three, six, twelve and twenty-four months. Primary outcome was the increase in Total Passive Extension Deficit (TPED)/ray and was measured on digital photographs by two independent investigators not involved in the treatment, using the Digimizer software (MedCalc Software Ltd, Ostend, Belgium). Secondary outcomes are the total passive extension deficits of the individual finger joints (PIP and MCP), DASH score (Disability of Arm, Shoulder and Hand) and VAS (visual analogue scale) for pain and satisfaction. Data were compared using a paired student t-test and correlation between the observers was calculated using Pearson's correlation coefficient.
Results: Thirty-two patients were included, 17 in the Celecoxib group and 15 in the placebo group. There was a high interobserver correlation between all measurements of the two investigators, with a Pearson's correlation coefficient of >0,9. We found no difference in TPED between the two groups at 3 and 24 months after the injection, although the Celecoxib group had a higher mean TPED before treatment. The difference in TPED increase at 3 months was deemed marginally statistically significant (P = 0,052) in favour of the Celecoxib group (mean of 60° versus 32°). For the PIP joint individually, the outcome in the Celecoxib group was significantly better (P = 0,032), for the MCP it was not. After 2 years, the mean gain in TPED was significantly better (P = 0,038) in the Celexocib group (mean of 44° versus 14°). In the PIP joint it no longer reached statistical significance, but in the MCP joint did reach statistical significance in favour of the Celexocib group: 30° versus 8°, with a P = 0,021. The recurrence rate, operation rate and changes in DASH score, VAS for pain or satisfaction at 2 years did not significantly differ between both groups.
Conclusion: Adjuvant peroral administration of celecoxib seemed to improve the gain in TPED in patients with Dupuytren's contracture and a high fibrosis diathesis, at 3 and 24 months after treatment with CCH.

A-0477 Ultrasound evaluation of the flexor pollicis longus tendon following volar plate fixation for distal radius fractures and its relationship to the Soong classification

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Introduction: Rupture of the flexor pollicis longus(FPL) tendon is a major complication after volar locking plate fixation of distal radius fractures. The Soong classification, which describes the prominence of volar plates relative to the volar rim of the distal radius on standard lateral wrist radiographs, has been discussed as predictors of potential flexor tendon irritation. However, X-ray measurements are influenced by rotation and standard lateral views are not always reproducible. This study used ultrasonography to assess damage to the FPL tendon after volar plate fixation and to measure actual distance from the FPL to the volar plate. The results showed that actual distance from the FPL to the plate was negatively correlated with higher Soong grading (more plate prominence), which means that the Soong criteria are meaningful with respect to the actual contact between the tendon and plate.
Materials and Methods: We evaluated 30 intra-articular distal radius fractures with ultrasound to evaluate the FPL tendon and the distance between the tendon and volar plate after surgical fixation. All surgeries were performed by the same surgeon and the pronator quadratus was repaired in all cases. The thickness of the FPL tendon and its distance to the volar plate in the involved wrists and to the volar rim in the contralateral uninjured wrist were measured on ultrasound exams taken three months post-operatively. Measurements of the involved wrists

were compared with those of the intact wrists. Plate prominence was graded on postoperative radiographs according to the Soong classification. The prominence of the plate from the radius was also measured on a lateral radiograph (defined as ''plate prominence on radiographs'') by measuring the distance between tangential lines drawn to the volar extent of the volar rim of the plate and the volar extent of the volar rim of the radius. The primary outcome measure was the relationship between plate-tendon distance and Soong classification.

Results: Eight cases were Soong grade 0, eighteen cases were Soong grade 1, and four cases were Soong grade 2. The mean plate-to-tendon distance in the involved wrist(0.93 mm, range 0.3–2.3) was considerably shorter than the mean volar rim-to-tendon distance(1.43 mm, range 0.7–2.8) in the intact wrist(Paired t-test, $p = 0.04$). There was no significant difference in FPL tendon thickness between the intact and involved wrists. The plate-tendon distances measured on ultrasound were negatively correlated with higher Soong gradings on radiographs. A negative correlation was also found between ultrasound-measured plate-tendon distances and plate prominence on radiographs. (Pearson correlation, $r = -0.61$, $p < 0.01$)

Conclusion: Although previous studies have shown the Soong classification to be reliable in assessing the degree of plate prominence, this study is the first to show that Soong gradings are representative of actual tendon-to-plate distances as measured on ultrasound. A careful evaluation of plate prominence on standard lateral X-rays could be one of the factors to take into consideration when deciding whether to remove hardware.

A-0486 Differences in psychological factors between patients treated operatively and patients treated conservatively for carpal instability

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Introduction: Carpal instability is commonly seen in the orthopedic outpatient clinic. Most patients are treated with a brace and referred for handtherapy to stabilize the wrist and reduce pain. However, a great number of patients has persistent pain after conservative therapy. These patients might be treated with an operation.

Health psychology shows that pain is influenced by the psychological factors mood, attention and cognition. We therefore hypothesized that psychological factors are part of the reason why treatment in these patients is insufficient. The aim of this study was therefore to determine the differences in psychological factors between patients treated operatively and conservatively.

Methods: A retrospective cohort study was performed between March 2019 and October 2019. All patients who visited the outpatient clinic in 2017 and the first half of 2018, who were diagnosed with carpal instability were approached to join the study. After signing the informed consent, patients completed the brief COPE, the Pain Catastrophizing Scale (PCS), the Hospital Anxiety and Depression Scale-Anxiety (HADS-A) and the Life Orientation Test-revised (LOT-R). As part of standard care, the QuickDash and the Patient Rated Wrist/Hand Evaluation (PRWHE) had already been completed on the day of the first outpatient visit.

A non-parametric Mann-Whitney U test was used to determine differences between groups regarding these psychological factors.

Results: A total of 89 patients were included. 21 patients were treated with an operation (24%). No differences in baseline QuickDash or PRWHE were observed. The PCS (CON-group, median = 17 (IQR16); OK-group, median = 25 (IQR9) and HADS-A (CON-group, median = 4.5 (IQR7); OK-group, median = 7.5 (IQR5)) questionnaires were significantly different between both groups ($p = 0.011$ and $p = 0.018$, respectively), as were the subscales active coping (CON-group, median = 2 (IQR1.4); OK-group, median = 3 (IQR1), denial CON-group, median = 0 (IQR0.5); OK-group, median = 1 (IQR1.5) and self-blame (CON-group, median = 1.0 (IQR1.5); OK-group, median = 1.5 (IQR1.5) of the brief COPE ($p = 0.032$, $p = 0.013$ and $p = 0.048$, respectively).

Conclusion: In conclusion, patients treated with an operation for carpal instability have higher scores on several psychological parameters when compared to patients treated conservatively, despite comparable baseline results on pain and function.

A-0488 The role of patient specific implants in complex 3D reconstructions of the distal forearm

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Introduction: Posttraumatic intraarticular malunion of the distal radius is a challenging problem for treating surgeons. Different techniques have been

described from open, arthroscopic to open with 3D reconstruction using 3D printing of cutting and sawing guides. Anyway, they are indicated only in cases with rather simple fracture lines. For multifragmentary situation, the shape of distal fragments, their size, and location may be a limiting factor for use of standard plates. So in symptomatic more complex malunions salvage procedures are still indicated.

The authors are presenting a group of six patients with complex multi fragmentary intraarticular malunions treated via 3D planning, 3D printing of cutting and sawing guides, and 3D printing of patient-specific plates. Five patients were originally indicated for salvage procedures like RSL fusion and Sauve-Kapandji.
Methods: Six consecutive patients were evaluated at an average of 10 months after osteotomy. Indications for corrective osteotomy were symptomatic malunions in the radiocarpal, ulnocarpal joint, and radioulnar length and axis irregularity. All patients had intra and extraarticular correction, in two cases concomitant procedure on the ulna was performed (one corrective osteotomy, one ulnar head replacement). The average interval to osteotomy was 9 months. Pre and postoperative X-rays, preoperative CT scans, PWRE, ROM, and VAS were collected.
Results: All osteotomies healed uneventfully. Shape, length, and rotation of the radius and ulna were corrected. No bone necrosis due to small fragmentation was observed. All patients were planned for plate removal (in two already performed). All patients have pain subsidence, motion, and stability of forearm and wrist improvement. Due to the complexity of preoperative deformity two patients are unable to return to their previous job.
Discussion: Using 3D planning and printing technology for corrective procedures in intraarticular malunions of distal radius becomes state of the art for more complex procedures. Using patient-specific implants allows surgeons to perform the reconstructive procedure even in cases where salvage would be indicated. It increases the precision of the procedure and decreases risks of iatrogenic injury to the patient.

A-0491 Long-term follow-up of patients treated with pyrocarbon disc implant for thumb carpometacarpal osteoarthritis: the effect of disc position on outcomes measurements

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Background: Pyrocarbon disc interposition arthroplasty can be used to treat thumb base osteoarthritis. As with all implant techniques for this condition, there is a risk of pyrocarbon disc (sub)luxation. However, the relationship between disc position, experienced pain and necessity for revision surgery is not known. This study evaluated the relation of radiographic pyrocarbon disc position with the Michigan Hand Questionnaire (MHQ) outcome measurement. In addition, the correlation between disc position and other factors, including pain intensity and thumb strength, was assessed.
Methods: This retrospective study included 136 patients with a mean follow-up of 6.7 years. Radiographs were scored on disc position and classified as 'well aligned' (Grade 1) up to 'severe displacement' (Grade 4). A database used for outcome measures included MHQ scores, pain intensity, satisfaction, thumb strength and range of motion. In bivariate analyses we used Spearman's rank to assess any association between disc position and outcome measurements.
Results: Eighty of the 136 implants (59%) were well aligned (not luxated) at follow-up. No relationship existed between the degree of disc luxation and MHQ scores. Furthermore, we could not detect any association between disc position and other outcome variables including pain intensity, patient satisfaction, thumb strength or range of motion.
Conclusion: Our study suggests that disc (sub)luxation has little clinical consequences on the different studied outcome measures. There seems to be no evidence for routine radiological monitoring of disc position during follow-up, especially if the patient is asymptomatic.

A-0495 Morbidity and function loss after resection of malignant peripheral nerve sheath tumors

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Background: Malignant peripheral nerve sheath tumors (MPNST) are aggressive soft tissue sarcomas, but their resection may lead to serious morbidity. Incidence of postoperative motor and sensory deficits is unknown and reconstruction aimed at restoring such deficits are infrequently carried out. This study aimed to identify the incidence and risk factors of postoperative morbidity in MPNST, as well as the use and outcomes of functional reconstructions in these patients.
Methods: Postoperative function and treatment of MPNSTs diagnosed from 1988–2019 in 10 cancer centers was obtained. Patients with and without function loss were compared, defined by
Results: Seven-hundred-fifty-six patients (33.4% neurofibromatosis type 1, NF1) were included. MPNSTs originated in 34.4% from a major nerve. Of 658 surgically treated patients, 27.2% had
Conclusions: Surgical resection of MPNSTs commonly results in major motor deficits and loss of critical sensation. Loss of function is more likely when resecting MPNSTs in NF1 patients, large, and deep-seated tumors, and those arising from major nerves. Whenever patients present with motor or sensory deficits, these will likely persist. Peripheral nerve surgeons are more commonly involved in high-risk patients, but not in the majority of cases. Functional reconstructions are infrequently performed, but may result in good regain of function regardless of the use of multimodal oncological treatment.

A-0496 Double nerve transfer for reconstruction of pinch in high ulnar nerve palsy

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Background: In direct repair of ulnar nerve injuries above the elbow, reinnervation of the ulnar intrinsic muscles of the hand does not occur reliably.

This is thought to be a result of the long regenerative distances following nerve repair which necessitate a long period of denervation during which muscles undergo irreversible denervation changes.

Distal nerve transfers, such as the anterior interosseous nerve to deep motor branch transfer, performed at the time of high ulnar nerve repair have gained popularity as a means of providing earlier reinnervation. This transfer, when placed as a reverse end to side or a hemi end to end transfer may work by prolonging the window for reinnervation by native axons. Published results vary and outcomes are inconsistently reported. In our experience pinch grip often remains poor even when intrinsic reinnervation does occur.
Methods: In this cadaveric study we propose an end to end nerve transfer of two individual motor branches from the median nerve in the hand to the two ulnar nerve motor branches supplying the first dorsal interosseous (FDI) and adductor pollicis (ADP). 8 cadaver hands were dissected using a standardised dissection protocol.

The branches to the FDI and ADP were mobilised after all other motor branches had been seen to arise. Some intrafascicular dissection was required to maximise the length of the two recipient nerve branches. The transfers were compared for size matching, axon count, and tension free coaptation.
Results: The mean length of the branches to FDI and ADP were 18 mm and 17 mm respectively.

We consistently found that transfer of the motor branch to flexor digitorum brevis (FPB) (mean length 15 mm) and opponens pollicis (OP) (mean length 20 mm) were able to reach the FDI and ADP branches to perform a tension free coaptation with a good size match. The motor branch to the index lumbrical always arose from the radial digital nerve. In 4 out of 8 hands, there was more than one motor branch to the index lumbrical, with the more proximal branch being longer (mean length 21 mm) and amenable to transfer to either recipient without tension.
Discussion: The nerve transfers proposed are technically feasible with good anatomical consistency among the small number of cadavers in this study.

We propose that these transfers could be used to reconstruct pinch function, at the same time as primary nerve repair, in high ulnar nerve injuries, in order to overcome the limitations incurred by the long regenerative distances in these injuries. Furthermore, these novel nerve transfers could be used alongside, or in place of the more standard anterior interosseous nerve to deep motor branch of ulnar nerve transfer.

A-0497 Novel nerve transfer to the sterno(cleido)-mastoid muscle: an experimental animal model for proprioceptive reinnervation

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Introduction: Trauma to the upper limb often results in drastic impairment of quality of life. In recent years, therapeutic concepts utilizing bionic reconstruction have advanced to an established option, enabling patients to regain motor control. Nevertheless, the recovery of sensory feedback in bionic reconstruction still presents a great obstacle, which is often reported by patients as a disturbing problem. The functional outcome and the prosthesis embodiment are often insufficient, leading to artificial movement patterns and prosthesis abandonment. Interestingly, the potential implementation of proprioceptive feedback in the bionic reconstruction of the upper extremity is still poorly explored.

To address these questions, we established a novel nerve transfer model to investigate alterations in a skeletal muscle with a high density of proprioceptive organs after reinnervation with a mixed nerve. The findings of this study may help to implement proprioceptive control in the sensory feedback of bionic reconstruction.

Materials and Methods: In a rat model, the ulnar nerve is transferred to the ipsilateral sternomastoid muscle. The ulnar nerve was transected distal to the dorsal branch and tunnelled under the ipsilateral major pectoral muscle to spare adjacent structures. Coaptation is done epimysial using two interrupted sutures at the motor entry point of the sternomastoid muscle. As a control, the ipsilateral buccal branch of the facial nerve is used for the pure motor reinnervation of the sternomastoid muscle in a similar manner. Functional assessment using ENG and EMG measurements was performed 12 weeks after the surgery. Axonal load of the donor and recipient nerves, as well as reinnervation of proprioceptive organs, was evaluated using novel VGLUT1 and Piezo2 immunohistochemical staining.

Results: Surgical feasibility of the novel nerve transfer has been proven. No adverse events related to the surgical procedure were observed, all animals tolerated the procedure well. We expect to see reinnervation of proprioceptive organs after reinnervation with the ulnar nerve compared to the reinnervation with the buccal branch of the facial nerve. The results of the immunofluorescent evaluation of proprioceptive reinnervation will be presented at the conference.

Conclusion: We demonstrated a nerve transfer for the investigation of reinnervated skeletal muscle via the ulnar nerve using novel immunohistochemical staining methods. The findings of this study may provide a better understanding of the neurobiological processes occurring in the reinnervated skeletal muscles as well as gain a deeper knowledge of the importance of proprioceptive control for sensory feedback in bionic prosthetics.

A-0499 Tenosuspension technique with suture-anchor in first carpo-metacarpal joint arthritis: long term follow-up results

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The thumb carpometacarpal (CMC) joint is the most common site of surgical reconstruction for osteoarthritis in the upper extremity. Numerous techniques have been described in the literature for the surgical management of CMC joint arthritis.

From 2007 to nowadays we have introduced a new tenosuspension technique that uses a suture anchor inserted in the trapezoid to lock the APL based neo-legament.

In a pivotal part of the study (from 2007 to 2010), we reviewed retrospectively 27 patients treated with the Ceruso modified Weilby's technique and we compared the results with 32 patients operated on with the suture anchor technique, recording a better outcome for the new tenosuspension technique.

From 2007 to 2019 we operated on 242 patients with the suture anchor technique. We evaluated these patients pre-op and at 90 days from the operation with VAS pinch and quick dash test.

All the patients were stadied according to the Eaton-Littler classification.

All the patients had the same immobilization time and rehabilitation protocol.

148/242 patients with a follow-up of at least 5 years have been re-evaluated by comparing the current data with those of the quick dash and VAS pinch test at 90 days post-op. To these patients a satisfaction questionnaire was administered.

Post op Quick Dash score has improved in the most of patients compared to the pre-op evaluation: the scores decreased significantly a 90 gg. VAS pinch tests were improved significantly at 90 gg post-op in 88% of patients. These results have been confirmed in the most of cases even five years after the surgical treatment. We had 6/242 cases of mild CRPS and 5/242 cases of flexor pollicis longus (FPL) tenosynovitis, in patients with metacarpophalangeal joint instability.

We didn't have any major complication. Over 82% of patients were satisfied with the procedures.

In our study we recorded a good outcome of this tenosuspension technique at 90 days post op in a high number of patients. The Suture Anchor technique has shown a fast recovery of the patients with poor postoperative pain, improvement of grip strength and return to most of the daily activities at 90 days. The results remain constant over time.

A-0500 A Safe Protocol for Intra-articular Steroid Injections to the Hand During COVID-19 Pandemic

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Introduction: The use of intra-articular, periarticular and soft tissue steroid injections are commonly used to ease pain from inflammatory and non-inflammatory musculoskeletal pain e.g. osteoarthritis, carpel tunnel syndrome and de Quervains. During the COVID-19 pandemic WHO guidance (1) advised against their use due to the associated increased risk of mortality in patients with influenza and delayed viral clearance in patients with MERS-COV and SARS-COV infection.(2,3,4) Evidence of the risk associated with the use of steroid injections in musculoskeletal conditions and the risk of COVID-19 is currently insufficient and we face the dilemma of offering patients treatment with potential risk or condemning them to ongoing debilitating pain. Guidance from BOA (8) and the Faculty of Pain Medicine (9) now recommends steroid injections based on a balance of risks and benefits for the individual patient. To our knowledge there is no study published examining whether steroid injections increases the susceptibility to COVID-19 infection or causes worse outcome in the event of contracting the virus. Our aim was to assess the impact of intra-articular steroid injections on COVID-19 related outcomes including susceptibility, morbidity and mortality.

Methods: Patients deemed in clinical need of steroid injections for symptomatic relief of hand/wrist conditions were provided with information leaflets regarding the possible associated risks of COVID-19 following steroid injections and underwent a formal risk assessment in the form of a patient questionnaire before steroid injections were considered. Informed consent was obtained and documented prior to proceeding with injection therapy. A follow-up questionnaire was undertaken at 4 weeks following injection therapy to assess for the development of COVID-19.

Results: 50 patients receiving steroid injections between September and December 2020 were followed-up with post-injection questionnaires. Overall, those who underwent steroid injections were low risk patients with none or few comorbidities. The duration of shielding post-injection varied between individuals (range 0 to >7 days). No patients in our cohort reported post-injection COVID-19 symptoms or confirmed COVID-19 infection.

Conclusion: Despite the limited evidence regarding the safety of steroid injections for the management of pain in hand/wrist conditions in the context of the COVID-19 pandemic our results suggest that it is safe in patient deemed low-risk following formal risk assessment. Larger studies are required to fully determine the risk of contracting COVID-19 following steroid injections.

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A-0503 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 3 cm up to 8 x 4 cm. In cases of post ORIF nerve iritation original approach was prolonged by only 4 cm. No additional procedure was required. All patients with nerve compression and scar iritation had improvement in EMG, subjective and scar dysestesias, 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 senzitivity, diminished perfusion and tendency to compression by scaring. 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-0504 MENTORSHIP IN HAND SURGERY: CROSS-SECTIONAL SURVEYS OF MENTORS AND MENTEES

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Aims: This study aims to determine the characteristics of mentors and mentees in Hand Surgery in the UK, how they form and maintain relationships and barriers they experience.
Methods: Two anonymous validated surveys were distributed to mentors and mentees, via the BSSH, BAPRAS, PLASTA and individual Orthopaedic and Plastic Surgery Units throughout the UK. There were 90 respondents (59 mentors, 31 mentees).
Results: Mentors were typically consultant, male, Trauma and Orthopaedic surgeons aged 40–60. Mentees were mostly trainee male Plastic surgeons aged 26–36. Further analysis showed female mentees had only male mentors. Mentors commonly had mentees assigned to them and 57% preferred this. Mentees commonly met their mentor in work and 89% preferred meeting them independently. Both groups preferred to communicate in person. Mentors favoured mentees who were willing to learn, whereas, mentees preferred mentors who had a genuine interest in their career and personal development. The benefits from these relationships included mentors experiencing improvement in their own knowledge and mentees learning through patient care. The most common barrier experienced by both respondent groups was lack of time. The most common suggestion for improving mentoring relationships was the implementation of a formalised mentoring scheme.
Conclusion: The results of this study highlighted issues within the current informal mentoring system namely its preference towards males and the lack of scheduled time to focus on it. In order to improve the mentoring process for females and minority groups within Hand Surgery in the UK, the results of this study could be used to inform the establishment of the BSSH mentorship programme that is currently being developed.

A-0511 Patient-reported outcome measures in management of paediatric traumatic fingertip injuries using skin glue or sutures: a comparative study before and during COVID

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Introduction: Soft tissue injuries of the hand are one the most common presentations of children to the emergency department. During the first national lockdown of the COVID-19 pandemic in the United Kingdom, we introduced a new trauma pathway for paediatric fingertip injuries. This was launched in anticipation of reduced workforce, limited operating capacity and strict health and safety measures.
Aims: To review the patient/parent-reported outcomes and satisfaction of paediatric patients who sustained simple fingertip injuries managed using our new pathway (Group 1 – washout and application of skin glue/steristrips in the emergency department) compared to a matched cohort (Group 2 – formal washout and closure with sutures in an operating theatre) treated prior to the COVID-19 outbreak.
Methods: Two matched cohorts of thirty patients were randomly selected over the course of two years. Parents were contacted at a minimum of three-months post-injury. They were asked to complete a 20-item survey consisting of patient/parent-reported experience, including a 10-item fingertip scar assessment questionnaire to assess the appearance of the finger and residual symptoms. Unpaired t-test was used for statistical analysis.
Results: In Group 1, 88.9% of patients reported normal appearance of the finger nail, 75% reported normal length of the finger, 67% reported that there is no noticeable deformity, 88.9% reported no visible scarring on the fingertip. Only one patient from Group 1 reported slight cold sensitivity in the fingertip. Average satisfaction score is 8 out of 10. In Group 2, 94.7% of patients reported normal appearance of the finger nail, 94.7% reported normal finger length, 89.5% reported that no noticeable fingertip deformity, 73% reported no visible scarring on the fingertip. Average satisfaction score is 9.2 out of 10. There was no statistical difference between the two groups for any of these measures.
Conclusion: Preliminary findings suggest that use of dermal glue for nail bed injuries is equivalent to traditional repair in theatre in terms of physical appearance of the finger and symptoms. To date there are no prospective studies comparing simple wound closure methods versus formal washout and closure in theatre for simple fingertip injuries. As fingertip injuries make up a significant volume of the trauma attending children's emergency departments, a safe and simple method for management of these injuries is desirable to reduce the burden on health services. We hope to maintain this new pathway in post-pandemic practice and reassess once a larger cohort is established.

A-0512 Should we stop elective surgery during a pandemic?

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Background: Birmingham has a 5.5 million population representing 8% of the UK population. The BAME group represented in Birmingham accounts for almost 40% while the UK average is 12%

Little was known during the SARS-CoV-2 pandemic on the safety of continuing elective surgeries.

Most hospital across the UK halted elective surgeries during the first national lockdown of 10 weeks.
Aim: We aim to assess the risk posed by continuing hand trauma surgery during the pandemic. Primary outcome being the mortality and secondary outcome being the morbidity on patients undergoing hand surgery.
Methods: This is a retrospective cohort study looking at electronic patient records on all patients who underwent hand surgery during the 10 week national lockdown from 23rd March 2020 to 30th May 2020.
Results: We saw a 45% reduction in number of presentations to Birmingham compared to the previous year similar time period.

30 day mortality was 0.005% and SARS-CoV-2 complication was 0.005%

Overall surgical complication remained at 6.75% in par with established literature
Conclusion: SARS-CoV-2 complication rate low in this cohort

No mortality from hand surgery

Urgent surgery should not be delayed for SARS-CoV-2 testing

A-0513 Pushing boundaries in using collagenase: two step technique for severe Dupuytren disease

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Objective: becoming more experienced with collagenase (CCH) injiections indications have been slowly widened and cases complexity increased:stage III and combinated cords, 2 joints in the same hand and multiple digits. We started to taste CCH as first step in stage III and IV Dupuytren disease (DD) and volar capsulotomy for chronic PIP contracture to restore the extension of the joint as second step.
Methods: From 2016 patients with Tubiana stage III or IV DD and severe PIPJ contracture (not just attributed to the cord but also from intrinsic joint contracture) were selected for enrolment in our Hand surgery Department. In the first step MP cords were injected with CCH in the outpatients department. 72 hours later, patients returned for an extension procedure, performed under regional anesthesia. After 3 months we performed a secondary surgery procedure for severe FFCs of PIP (collateral ligaments and volar plate release), with a mean of 45 minutes of surgical time. All patients were referred to our Department hand therapist after the I and the II step. At follow up we assessed fixed flexion contractures, adverse events, ROM, patient satisfaction and DASH.
Resuls: Thirteen fingers were treated in 10 patients with a mean age of 60,2 years. Eight little fingers and five ring fingers were treated. All fingers had metacarpophalangeal joint (MCPJ) contracture, and proximal interphalangeal joint (PIPJ) contracture. Mean pretreatment MCPJ contracture was 65.5 and the mean pretreatment PIPJ contracture was 70. Posttreatment contracture was 5.5 and 10 for the MCPJ and PIPJ, respectively. Patients satisfaction was extremely high for pain control and for quickness of functional recovery.
Conclusions: 2 step procedure with CCH and surgery is a safe and effective treatment for severe Dupuytren's contracture with PIPJ involvement. We recommend its use in patients who have more advanced stage of DD or patients that are unsuitable for more invasive surgical treatments. We really hope that CCH will be soon available again in Europe.

A-0515 Distinctive analysis of axonal components in the radial and ulnar nerve branches innervating human forearm

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Introduction: The dexterous movement of the hand is the one of fundamental features, which defines human's nature and provides them with a wide spectrum of abilities to interact with outer world. These motions are mostly generated in the central nervous system, which have to be conducted via peripheral nerve system to the target organ. Although the topography and the anatomy of peripheral nerves of forearm are comprehensively explored, there is only little known about quantity and distribution pattern of the axons within these nerves and their tiny branches. Moreover, despite the expanding indication spectrum for various nerve transfer procedures, there is still no distinguished axonal cartography of nerve branches innervating human forearm.
Methods: Nerve branches of the ulnar and radial nerves (FCU, FDP(IV-V), ECRB, ECRL, EDC, PIN, motor branches to the brachioradial, supinator muscles) were harvested from forearm of 9 heart-beating organ donors immediately after death. The exclusion criteria were any traumas of forearm or scars indicating possible altered anatomy of peripheral nerves. After fixation, dehydrating and cryofixation, the nerve samples were sectioned with a cryotome to prepare 10 μm-thick slices. The cross-sections of the nerve branches were stained using novel immunofluorescent staining using antibodies against choline acetyltransferase (ChAT) for efferent axons and against neurofilamet (NF) for all axon qualities. Axonal composition of each nerve cross section was evaluated using a fully integrated imaging system and subsequently quantified using automated software.
Results: A distinctive axonal map of the ulnar and radial nerve branches was established. Findings of these study indicated high amount of afferent axon fibers (approx. 60%) in every single motor branch of

the ulnar and radial nerves. Quantification analysis of the efferent fibres within motor branches of the peripheral nerves innervating human forearm showed axonal load correlation between potential donor and recipient nerves.
Conclusion: For the first time, a distinctive axonal cartography of the nerve's branches innervating human forearm was created. These findings elaborate the essential role of afferent fibers in dexterous hand movements. Moreover, the novel knowledge regarding the axonal composition in the peripheral nerve branches may be useful for surgery decision making selective nerve transfer surgery.

A-0517 Is Adaptive Proximal Scaphoid Implant (APSI) a valid option for SNAC wrist also in young patients? A case series

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Purpose: Adaptive proximal scaphoid implants (APSI) are an alternative treatment for patients with early scaphoid non-union advanced collapse (SNAC) wrist. The purpose of this retrospective study is to analyse clinical and functional outcomes of APSI in functionally demanding patients, mostly treated between the third and the fourth decade of life.
Methods: Twelve patients, under 53 years of age, who underwent an APSI procedure from January 2004 to June 2018 were included in the study. A clinical and radiographic assessment was performed using self-administered questionnaires and ranges of motion (ROM) and grip strength were measured. The mean follow-up was 77.3 ± 44.4 months, among them four patients with a follow-up greater than 9 years.
Results: No complications were reported. The average Vas score was 0.5 ± 0.9 at rest and 2.2 ± 2.7 at stress. The mean percentage value of T-Rom was $73.3\% \pm 8.2\%$ compared with the healthy wrist. The mean grip strength percentage increased compared with the contralateral grip and was 80.2% for dominant and 67.9% for the non-dominant hands. The mean Mayo wrist score was 73.7, the mean DASH score was 6.8.
Conclusion: This technique is an attractive, safe and valid treatment option for scaphoid proximal pole nonunion, also in young patients.

A-0520 Diagnostic arthroscopy in the surgical planning of wrist Osteo-arthritis

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Wrist osteoarthritis can be localised to different articular surfaces of radiocarpal or inter-carpal joints and develops according to predictive patterns. The most frequent causes of the degenerative disease are post-traumatic and related to long standing ligament injuries (SLAC wrist) or scaphoid non-union advanced collapse (SNAC) wrist that after many years lead to carpal collapse. The degenerative condition can be studied with plain radiographs and advanced diagnostic imaging techniques as CT scan and MRI scan. Wrist arthroscopy is an additional technique that allows the direct visualization of articular surfaces and identify precisely the damaged intra-carpal joints. Arthroscopy has a higher sensibility and specificity compared to MRI and is considered the gold standard in evaluating cartilage damage. The aim of this study is to use arthroscopy as a guide to surgical choice in order to preserve the intact joints and avoid progression of arthritis. Materials and Methods: One hundred and nine patients underwent wrist arthroscopy before the planned surgical procedure for wrist oateoarthritis. All patients had XRays and CT scan or MRI scan pre-operatively. 98 were males and 11 females, mean age 52 (20- 68). There were 29 SNAC, 66 SLAC, 1 SCAC, 3 radiocarpal arthritis, 2 midcarpal arthritis, 1 old perilunate, 1 Preiser Disease and 6 Kienbock Disease. Arthroscopy can be performed as a separate-first step procedure or at the same operating time. Radio-carpal joint and midcarpal joints are examined with standard portals 3–4, 6R, 1–2, MCR e MCU, additional portals were used if needed. The pre-operative planning was established before and after arthroscopy.r
Results: Arthroscopy has give important informations about cartilage status, relationship between the carpal bones, state of intrinsic and extrinsic ligaments and was important to improve the diagnosis. The surgical treatment was modified and improved in 34% of cases according to arthroscopic finding. Statistical analysis revealed that for the four bone fusion group the indications to treatment and the surgical treatment performed were statistically significantly different after arthroscopy ($p < 0,01$), while there were no statistically significant differences beween the OA stage before and after arthroscopy. The disadvantage of this procedure is the increase of

operating time or necessity of two procedures to be performed. Discussion: The treatment of advanced arthritis is mainly represented by salvage procedures as proximal row carpectomy, four corner fusion, partial or total fusion or partial or total prosthesis. With the use of arthroscopy the treatment can be tailored according to the residual intact cartilage surfaces and sometimes it is possible to post-pone salvage procedures and find more conservative solutions expecially in the early stages. Arthroscopy can be useful to identify cartilage damage and thus detect the intact carpal joints to be maintained and others to be fused and to define surgical planning in a more conservative way.

A-0522 Primary surgery for radial polydactyly: long-term follow up

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Radial polydactyly represents a diverse group of anatomical anomalies, including triphalangeal thumb. The complexity of anatomy may be underestimated resulting in poor results from primary surgery and late deformity. We have applied a systematic anatomical approach to primary surgery for more than 20 years.

Methods: A retrospective review of patient outcomes following primary surgery for radial polydactyly with a minimum of 10 years follow-up. Longitudinal alignment, stability, adequacy of the first web space, IPJt motion, composite flexion, cosmesis and need for revision surgery were assessed.

Results: 40 patients (33 unilateral, 7 bilateral) underwent primary surgery for radial polydactyly in the period 2002–2010. 47 hands were treated. Mean age at primary surgery was 20.5 months (Range: 1 month-10.5 years). Duration of follow-up was a minimum of 10 years.

Wassel classification of cases: Wassel II 6/47, Wassel III 5/47, Wassel IV 18/47, Wassel V 1/47, Wassel VI 1/47, Wassel VII 12/47, Unclassifiable 4/47.

Longitudinal alignment: 1/47 developed radial deviation of IPJt, revision surgery was declined; 1/47 demonstrated residual ulnar clindodactyly. Most thumbs were stable, 2/47 required revision joint surgery. 1st web tightness: 2/47 hands required surgery, 2/47 did not require surgery. Limited IPJt flexion was recorded in 11/47 hands, extensor lag in 3/47 hands. Limited IPJt flexion post-op reflected the pre-op range of motion and did not have a significant impact on activities of daily living or hobbies. Cosmesis: unsatisfactory scar and bulky skin envelope 1/47, nail ridge 1/47, residual nail spike 1/47. Patients did not request secondary surgery for cosmesis and reported good ability with activities of daily living.

Revision surgery was performed in 4/47 hands (8.5% revision rate) to treat 1st web tightness and joint instability.

1 Wassel IV – 1st web tightness
Surgery: 4 flap z-plasty

2 Wassel V – Residual 1st web tightness following 1st web release at primary surgery. Hypoplastic APB. Dominant radial duplicate.
Surgery: Further 1st web release with V-Y advancement of flaps from primary 4-flap z-plasty.

3 Wassel VII – Radial soft tissue tightness, attenuated ulnar collateral ligament, radial deviation of IPJ.
Surgery: Release of radial soft tissues, plication of ulnar collateral ligament, temporary k-wire.

4 Wassel VII – Hyperextensile MCPJt
Surgery: Reconstruction with palmaris longus graft, temporary K-wire.

Discussion: The majority of patients demonstrated stable joints with good longitudinal alignment, adequate first web space and functional composite flexion. Cosmesis was mainly favourable. 3 of 4 revisions were in thumbs with complex anatomical anomalies, an unfavourable starting point. We have previously reported more complex anatomical findings in the triphalangeal sub-group. The remaining revision, 1st web release (Case 1), had a favourable starting point but was in a high achieving piano-playing patient with a specific functional demand. Our long-term results demonstrate low rates of secondary surgery (8.5%) compared to reported rates of 12–26%.

We advocate a systematic anatomical approach to primary surgery to optimise primary surgical care, to provide a prognostic role, to reduce the risk of secondary deformity and guide management of late deformity.

A-0524 Recovery of Sensory and Motor Function after Median Nerve Reconstruction with Processed Nerve Allograft

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Introduction: The median nerve provides sensory and motor function critical to activities of daily living. Severe trauma to the forearm can result in functional deficits requiring nerve gap reconstruction. The RANGER® Registry is an ongoing study of processed nerve allografts (Avance® Nerve Graft, AxoGen Corp) in peripheral nerve injuries. Here we report on outcomes of median nerve injuries repaired with processed nerve allograft.
Methods: The database was queried for median nerve injuries distal to the elbow. Subjects with sufficient assessments to evaluate sensorimotor outcomes were included. Repairs older than one year from original injury were excluded from the analysis of motor function. Meaningful motor and sensory recovery were defined as $\geq$M3 or $\geq$S3 on the MRC scale and were assessed independently. Subgroup analysis were performed by gap length, mechanism of injury, smoking status, and level of injury. A p-value less than 0.05 was considered significant.
Results: There were 40 subjects included. The mean age was 40 ± 17 (17–77) years. Mechanisms of injury included lacerations, $n = 27$, complex trauma, $n = 9$, and neuroma resections, $n = 4$. The mean gaps were 33 ± 17 (15–70) and 34 ± 17 (13–70) for motor and sensory function respectively. Repairs in the analysis of motor function had a shorter time-to-repair and longer follow-up time, 15 ± 34 (0–125) days and 21 months, than repairs included sensory function, 62 ± 201 (0–1067) day and 19 months. Motor MR was observed in 78% of repairs, $n = 23$ and Sensory MR in 63% of repairs, $n = 35$; $p = 0.25$. These results were in line with expected outcomes for nerve autograft, MR 48–84%, reported in the literature. Further analysis showed no significant differences among the subgroups, $p > 0.05$. There were no related adverse events.
Conclusions: Processed nerve allografts were safe and provided both functional sensory and motor recovery. While MR rates were not significantly different, variances in group characteristics may have accounted for the differences in recovery rates. Subgroup analysis showed no differences among the groups. These outcomes compare favorably to historical controls in the literature for nerve autograft. Processed nerve allograft may be considered as an option when reconstructing major peripheral nerve injuries.

A-0526 Management of Palmer Type 1B TFCC Tears: A Systematic Review of Cadaver Studies

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Clinical studies often compare techniques of open and arthroscopic repair of the Triangular Fibrocartilage Complex (TFCC) without addressing the actual reattachment techniques themselves. The purpose of this systematic review of cadaver studies was to compare the biomechanical outcomes of the different surgical techniques used for Palmer 1B TFCC tears. Using PubMed and Embase databases, we identified 244 articles. Eight articles fulfilled the inclusion criteria. Seven different surgical techniques were identified. Stability was tested by evaluation of the amount of dorsopalmar translation and strength by amount of load causing failure. The different reinsertion techniques seemed to restore distal radioulnar joint stability to various extents, regardless of surgical technique (open or arthroscopic). Overall, the transosseous repair provided the most stable

reconstruction and the suture anchor repair was the strongest on load-bearing. Based on this review, we can conclude that studies comparing different reinsertion techniques should not only evaluate the approach (open versus arthroscopic) but should also evaluate the effect of different techniques of reattachment on short- and long-term clinical outcomes.

Level of evidence, 3a

A-0528 Measurement properties of the Michigan Hand Outcomes Questionnaire: Rasch analysis of responses from a traumatic hand injury population

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Purpose: This study aimed to use Rasch analysis to test the content, scoring, and measurement properties of the Michigan Hand Outcomes Questionnaire (MHQ).

Methods: MHQ scores from 196 patients with hand and wrist conditions were collected in an outpatient hand rehabilitation facility. Rasch analysis was conducted to assess the fit statistics of MHQ to confirm the scaling structure of disability subscales, and to identify differential item functioning.

Results: The MHQ did not fit with the Rasch model ($\chi 2 = 2376.78$, $df = 74$, $p < 0.001$), and most thresholds of item responses were disordered. The original scoring algorithm derived from 5-point Likert response options was adjusted to 3-point Likert (10 items) and 4-point Likert (11 items) based on the visual inspection of the thresholds map. Differential item functioning was present in the revised scale based on the age, sex, and dominant hand. Only 3 revised subscales of the MHQ including activities daily living (one hand), aesthetics, and satisfaction showed acceptable fit to the Rasch model. Unidimensionality was achieved in all revised subscales.

Conclusions: The overall MHQ had a substantial misfit from the Rasch model. Despite efforts of item reduction and rescoring, we did not reach a satisfactory solution. This calls into question the validity of the statistical evaluations performed on this scale using the traditional scoring.

A-0540 The Utility of Prophylactic Antibiotics in Preventing Infection After Internal Fixation of Closed Fractures of the Hand

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Backgroud: Prophylactic antibiotics (PA) have been shown to be ineffective in reducing surgical site infection (SSI) in clean, elective surgery of the hand. The routine administration of PA for internal fixation of fractures of the hand is a subject that has been scarcely studied. We hypothesized that prophylactic antibiotics do not reduce SSI incidence in fixation of closed fractures of the hand.

Methods: We present a retrospective comparative study in patients who underwent open or closed reduction and internal fixation of a fracture of the hand and carpus. Patients demographics, past medical history, fracture characteristics and type of internal fixation used were extracted from our electronic archive. Follow-up period lasted for one year, in which documentation of any form of clinically evident SSI, such as pus formation, dehiscence of wound and positive bacterial culture, was made. Exclusion criteria included: age under 18 years, open fractures and immunosuppressive illness, such as diabetes mellitus.

Results: A total of 107 patients met the inclusion criteria, 63 in the control group and 44 in the tested group. The total infection rate was 6.5%. All infections (3 in the control group and 4 in the tested group) were pin-tract infections that resolved completely after pin extraction. Our study did not find significant differences between the tested groups ($P = 0.442$). No specific fracture pattern was associated with increased total infection rate ($p = 0.898$).

Conclusion: In this study, we found no support for routine administration of PA prior to internal fixation of closed fractures of the hand and carpus. PA should still be administered in selected patients, such as those with decreased immunity or open fractures. Further large-scale research is needed to establish proper guidelines, to reduce the adverse effects of antibiotic treatment.

A-0543 Median Nerve Injury in Wistar Rats Treated with GM1: Functional Evaluation

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The sole use of microsurgical techniques for treating peripheral nerve injuries is not sufficient to promote an axonal regeneration that will lead to complete recovery of the functions of the injured nerves. Many studies are being conducted that use pharmacological agents as associated therapy. In this study, the action of monosialoganglioside (GM1) as a neuroprotector, antIneurotoxic and anti-inflammatory agent is evaluated, as well as an enhancer of the neurotrophic factors in peripheral nerve injuries. Thirty-two male Wistar rats were used, of which ten rats were randomly selected to determine the mean grasping strength of normal rats (group 0). There were three groups; the first was the control group whose animals were submitted to a 5 mm lesion and received no treatment (group I). In the other two groups, a complete section of the median nerve was performed by microsurgical technique. One group was submitted to external epineural microneurorrhaphy (group II) and the other group was treated with epineural microneurorraphy associated with intraperitoneal administration of GM1 (group III). The microsurgical technique of neurorrhaphy was the end- to- end suture type, performed immediately after the lesion. Functional analysis was performed weekly through the use of the grasping test assessing the flexor muscles of the fingers; this test is specific for the median nerve evaluation. In this experimental model, the animal is lifted by the tail and stimulated to grasp with its paw a bar at the top of a pyramid connected to a conventional digital balance. While the animal is grasping the bar, it continues to be lifted by the tail until it loosens its grip. Then, the value shown in the balance is registered. The test shows not only the day that recovery began but also the improvement with time. The mean values in rats of group 0 were compared to the values of the animals of groups II and III through the analysis of variance (ANOVA one way). For comparison of the mean values of the strength sustained by rats of the groups II and III, the Wilkoxon test was applied. We can conclude, stating with error inferior to 5%, that from the functional perspective, the group that received the association of epineural microneurorrhaphy and administration of GM1 (group III) presented better performance, by doing the grasping test in less time and applying a higher mean strength.

A-0551 Pyrocardan implant arthroplasty for trapeziometacarpal osteoarthritis with a minimum follow-up of 5 years

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Purpose: Treatment of trapeziometacarpal osteoarthritis (TMOA) remains controversial and many different concepts for surgical treatment may be proposed. Pyrocarbon interposition sparing ligaments and bone stock with a biconcave implant called Pyrocardan® is indicated in early and moderate stage of TMOA.

The aim of this study was to evaluate the results the Pyrocardan® interposition implant with a minimum follow-up of 5 years.

Methods: 103 arthroplasties in 96 patients were included prospectively and continuously. The median age was 59 years (range 20 to 73 years). 16% of patients were 50 years old or younger. 80% were women. According to the Eaton and Littler classification TMOA was stage 2 in 78% (n = 80), stage 3 in 21% (n = 22) and stage 1 in 1% (n = 1). The evaluation focused on bilateral objective criteria of mobility and strength, pain evaluation on VAS, questionnaires of Quick-dash, PRWE and satisfaction. Radiographic evaluation was made on standard radiographs looking for implant subsidence by measuring trapezial and metacarpal specific indices.

Results: The median follow-up was 67 months (range 60 to 120 months). Two patients were reoperated on for changing the size of the implant. In 2 cases the procedure failed and was converted with trapeziectomy. Median values of PRWE and Quick-dash scores were 58 and 5 preoperatively and 4 and 9 after 5 years, respectively. The mean VAS was 7 preoperatively and 0.6 after 5 years. Strength of tip pinch, key pinch and grip were preoperatively 5 kg, 5 kg, 18 kg respectively and 7 kg, 8 kg, 27 kg after 5 years. No mobility deterioration was observed. Metacarpophalangeal (MP) joint hyperextension did not occur over the time. The median immobilization period was 2 weeks (range 2 to 4 weeks). Median

return to normal activities was 12 weeks (range 2–28 weeks). Overall clinical and functional results continue to improve between 1 year and 5 years after the operation. Radiologically, there was no significant implant subsidence at the trapezium or metacarpal level except in 1 case at the trapezium level, with no clinical repercussions. No implant instability or migration was found. The overall satisfaction rate was 96%.

Discussion: This pyrocarbon interposition with the Pyrocardan® implant provides reliable clinical and radiological mid-term results that do not deteriorate over the time. Results after 5 years are at least comparable if not better than those of other partial pyrocarbon implants, total TM prosthesis or TM arthrodesis especially in terms of complications. Our results on thumb strength, MP-joint-hyperextension and immobilization time occurring are better than those of the trapeziectomy procedures.

Conclusion: Pyrocardan® implant arthroplasty is a minimally invasive and effective medium-term solution for the treatment of TMOA in the early and moderate stages that is interesting in young and active patients. In case of failure this arthroplasty is easily convertible in other kind of procedure. Long-term follow-up is now required.

A-0557 Complications in congenital thumb hypoplasia treatment

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The goal: to determine the advisability of reconstruction with thumb preservation in thumb hypoplasia grades III–IV Blauth.

Materials and methods: By the end of 2020, the authors had accomplished 258 cases of congenital thumb hypoplasia grades III–IV, 146 reconstructions of them were hypoplastic thumb preservation and 112 were pollicizations. In this review, w e will not discuss the results of 34 reconstructions in Blauth II thumb hypoplasia and 112 pollicizations in Blauth IV–V thumb hypoplasia, since these patients had common complications only, like minor skin necrosis (1.2%), which had no further influence on treatment outcomes.

112 reconstructions in children with Grade III (48 patients) and Grade IV hypoplasia (64 patients) were analyzed. The complications were rated according to the treatment stage.

In 64 cases the 1st stage was local flap plastics round the hypoplasic thumb base. The goal was to enlarge the thumb base for further reconstruction. None had either impaired circulation or impaired wound healing in postoperative period.

Reconstruction with the 1st metacarpal bone formation was performed in 112 cases.

The following complications were noted:

- resorption of 2nd metacarpal bone fragment used for reconstruction (11 cases, 9.9%);
- bone growth plate disruption of the 2nd metacarpal bone diaphysis which fragment was used for transplantation (4 cases, 3.4%);
- synostosis of the 1st newly constructed bone and the 2nd metacarpal ones (8 cases, 7.1%).

Tendon of the superficial digital flexor of the 4th finger was transferred in 86 cases. The flexion contracture of the 4th finger in the proximal interphalangeal joint was a long-term complication (7 patients, 8.2%). In 8 cases the 5th finger muscle abductor was utilized for thumb function with no complications.

Discussion: Data analysis shows quite a high number of complications after hypoplastic thumb reconstruction. We had no goal to compare with the pollicization results, since this requires for a separate study.

Our data shows that thumb reconstruction is a rather challenging intervention nesessitating an experienced surgeon and a full implementation of all surgery stages. Moreover, the results satisfy patients and their parents if no complications take place.

Conclusion: Thumb preservation in congenital hypoplasia grades III–IV is reasonable for reconstruction, since desired cosmetic and functional results could be achieved.

A-0560 Lacertus syndrome: Is it underdiagnosed? Does it exist?

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Introduction: Proximal compression of the median nerve art the level of the elbow (PCMNE) under the lacertus fibrosus is a commonly missed diagnosis, albeit being quite common. Below we present our experience regarding the incidence and management of this problem

Materials and Methods: Since December 1st 2020 we reviewed 104 patients with peripheral neuropathy of the upper limb. All were referred for electrodiagnostic studies. 35 of those patients were diagnosed as having PCMNE. These patients presented with vague pain radiating from the elbow down to the palm, shoulder pain, neck pain, sleep disturbance as well as weakness of grip.

Clinical signs that we used to identify clinically the compression were tenderness at the medial antecubital fossa, pain in resisted supination, weakness in FPL and FCR as well as the presence of a Tinel sign. Patients that were due to have surgery, completed the Quick Disability of the Arm, Shoulder and Hand (QDASH) questionnaire prior to surgery.

Twenty one of those patients proceeded to have surgery under Wide Awake Local Anaesthesia No Tourniquet which consisted of release of the lacertus fibrosus using a curved incision in the radial border of the pronator teres. Patients were followed up and proceeded to complete the QDASH approximately two months after surgery.

Results: The average QDASH prior to surgery (19 patients) was 59,74. The average QDASH post surgery (10 patients) was 19,86. 8/21 patients had a previous carpal tunnel decompression in the same hand. 2/21 patients had a simultaneous carpal tunnel decompression with the lacertus release. All the patients mentioned improvement in their symptoms in the first 48 hours post surgery

Of the patients that we operated on, 12 patients had negative electrodiagnostic studies for peripheral neuropathy and the rest were described as having very mild PCMNE. This was identified when the neurophysiologist was identifying fibrillations in the FCR. It is worth mentioning that many patients did not attend for follow up because of the COVID-19 pandemic.

Conclusions: PCMNE is a common pathology (35/104 peripheral neuropathies seen in our department) and surgery can improve symptoms greatly. Many patients can have shoulder, c-spine or nerve operations with little improvement because the underlying pathology has not been properly assessed and managed. This is predominantly a clinical diagnosis and the surgeon should have high suspicion of it in patients with sleep disturbance, pain in the antecubital fossa and weakness in the FPL and FCR.

A-0561 Lunate fragmentation in Kienbock's disease – 29 cases

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Lunate fragmentation in plain x rays was mentioned in 2006 by Tatebe et al. as a sign of advanced Kienbock's disease; and extensor tendon ruptures (rarely flexors) in those cases have been described. In 2010 Lichtman stated that in Kienbock's stage IIIC (coronal lunate fracture) radial shortening osteotomy was not indicated.

In our 54 cases of shortening osteotomies of the radius, 26 had lunate fragmentation on plain x rays of the wrist – 8 in stage IIIA, 15 in IIIB and 3 already with some signs of osteoarthritis (Lichtman stage IV), more advanced cases that in the whole series. There were 12 man and 18 ulna minus, with a medium age of 37 years, a distribution similar to the complete series

Overall, the modified Mayo Wrist Score (excluding the laboral status – max. 75 points) went from a medium 31,5 pre-op to 57,7 in the last review. Excluding the stage IV cases, that score went from 36 to 63 in cases without fragmentation and from 31 to 56 in cases with fragmentation.

In those 26 cases, lunate fragmentation in plain x rays was classified as coronal in 11, palmar in 5, dorsal in 2 and ''total'' (seen in AP and lateral x rays) in 8 cases.

In those 26 cases only 2, both with a coronal fracture, had a bad result, one early and the other 20 years after surgery. So, a coronal fracture of the lunate bone is not exactly a bad prognosis sign, although perhaps worse than other types of lunate fragmentation in Kienbock's disease.

We would like to add to these 26 cases of radial shortening osteotomy two patients with a coronal fracture with mild complaints that refused surgery and one with a dorsal fragmentation of the lunate bone and a dorsal tenosynovitis that was operated – tenosynovectomy with excision of dorsal bone fragments.

A-0563 Acute injuries to the ulnar collateral ligament of the thumb: a systematic literature review of diagnostic studies

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Introduction and Aims: Ulnar collateral ligament (UCL) injuries to the metacarpophalangeal joint of the thumb are common and may cause significant morbidity if not diagnosed and managed in a timely manner. Despite their frequency, it remains uncertain how to best diagnose an unstable thumb with either a complete UCL tear or dislocated ligament. We therefore carried out a systematic literature review to determine the accuracy of diagnosing acute UCL injuries with current clinical and imaging techniques.
Methods: A systematic review was carried out following the PRISMA guidelines. We searched the Cochrane Central Register of Controlled Trials (CENTRAL), MEDLINE via Pubmed and EMBASE via Ovid using a predefined search strategy. All trials in the English language relating to the diagnosis of acute UCL injuries in any age or gender were considered, excluding review articles, case reports and non-diagnostic trials. Data was recorded on a predefined form and analysed and assessed for bias using the QUADAS-2 tool by two authors. Any disagreements were settled after discussion with the senior author.
Results: 24 studies were identified for inclusion after screening. Five trials assessed clinical examination, 10 ultrasound, five MRI, two arthrography, one both clinical and ultrasound assessment and one both ultrasound and MRI. In total, there were two level I evidence studies, six level II studies and 16 level III studies. The average age of participants was 33.0 (95% CI 29.2 to 36.8)

For the six clinical examination trials, two studies with a total of 53 participants gave sensitivities of 0.94 and 0.92 and specificities of 0.57 and 0.41 respectively for the detection of dislocated ligaments by clinical stress testing. One study reported a sensitivity of 0.91 and specificity of 0.75 for the diagnosis of a complete rupture.

In the 12 ultrasound trials, four studies with a total of 96 participants stated sensitivities between 0.4 and 1.0 and specificities between 0.78 and 1.0 for the detection of a dislocated UCL. From the six MRI trials, one stated a sensitivity of 1.0 and specificity of 1.0 for the diagnosis of UCL displacement. The two trials reviewing stress arthrography did not report statistical outcomes.

All but one of the 24 studies had unclear or high risk of bias in one or more domains when assessed using the QUADAS-2 tool. The evidence was judged to be of low to moderate quality and there was a significant degree of heterogeneity amongst trial design for each index test.
Conclusion: Our review shows that there is a paucity of evidence for the use of currently available modalities in diagnosing acute UCL injuries of the thumb. An absence of general agreement amongst hand surgeons as to the key aspects of diagnosis and indications for surgical intervention may be a contributing factor. We recommend consensus amongst hand surgery societies for UCL injury management and the promotion of large multi-centre trials in the future.

A-0566 Passive mobilisation with place-and-hold versus active motion therapy after flexor tendon repair – a randomised trial

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Mobilisation after flexor tendon repair in fingers has been the subject of debate for several years. Many hand surgery clinics have turned to early active mobilisation. However, there is no strong scientific support suggesting that early active mobilisation will produce better range of motion than the Kleinert regimen when place-and-hold is added.

This prospective, randomised trial compares active mobilisation with passive mobilisation including place-and-hold. Sixty-four patients with a flexor tendon injury in zones I or II were included in this trial. Randomisation to either active mobilisation or passive mobilisation with place-and-hold was made after surgery. The patients were followed for 12 months with the outcome measurements range of motion, stength, rupture frequency, DASH, Abilhand and Purdue Pegboard.

We were unable to find any significant difference between the two groups for any of the outcome measurements. Passive mobilisation with place-and-hold is still a good method for rehabilitating flexor tendons after repair.

A-0567 Biomechanical study of wrist pain and instability in Ehlers-Danlos Syndrome

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The aim of the study was to assess biomechanical and clinical examination of Ehlers-Danlos Syndrome patients with wrist pain and instability.

Background: Ehlers-Danlos Syndrome (EDS) is a genetic mutation which is responsible for protein coding which provides to changes in soft tissues structure. Nowadays it is divided into 13 different types which are connected with joints, ligaments, tendons, cardiac and skin symptoms. Patients are suffering because of high developed pain, deformities, congenital anomalies of the circulatory and digestive systems and more others. One of the greatest problems is high muscle fatigue and imbalance which leads to the joint instability.

Materials and methods: 108 patients [76W, 32M] with clinical EDS diagnosis (74 confirmed with genetic testing) underwent wrist clinical and biomechanical testing. 47 patients [35W, 12M] present wrist pain during clinical examination and instability. To assess patients wrist condition the DASH and PRWE questionnaire was taken. All patients underwent wrist isotonic examination on Biodex System 4 Pro examination with wrist dorsal and palmar flexion movements. Global grip strength examination was conducted with Biometric Hand Kit device. As control group we examined 46 healthy volunteers [34W, 12M] without any previous wrist or upper limb trauma.

Results: The examination revealed significant difference between forearm muscles during active wrist motion. The wrist extensors muscles average peak velocity was significantly decreased ($p < 0{,}0001$) with result $198{,}6 \pm 14{,}3$ deg/sec in comparison with wrist flexors average peak velocity $323{,}7 \pm 23{,}4$ deg/sec. There was significant decrease of muscle balance presented as agonist/antagonist ratio in EDS group with average result 44%, the result for control group was 69%. There were significant decrease observed in nearly all examined biomechanical parameters such as: total work, average power, muscle fatigue. There was mild correlation ($r > 0{,}4$) between muscles biomechanical parameters and clinical wrist instability.

Conclusions: The biomechanical proofs that wrist pain and instability in EDS cases is connected with muscle imbalance and decrease of muscles biomechanical parameters. Knowledge of causes and muscles capabilities gives the opportunity to reshape way of thinking of wrist pain and instability in hypermobile cases.

Keywords: Ehlers-Danlos Syndrome, wrist instability, Biodex

A-0568 Radiological and functional correlation following scapholunate and intercarpal ligamentoplasty ''SLIC procedure" at minimum follow-up of 12 months

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Methods: We report the outcomes of scapholunate and intercarpal ligamentoplasty technique ''SLIC procedure'' performed in 22 patients (mean age of 39.7 years at surgery), for the management of reducible static scapholunate instabilities without repairable stumps.

Reconstruction of the dorsal part of the scapholunate interosseous ligament and the dorsal intercarpal ligament was obtained by a free palmaris longus graft according to the technique described by Dautel and Pauchard, and following its modifications made by the author.

These patients were evaluated for pain and active wrist range of motion, grip strength, functionals scores (QuickDASH and PRWE) and radiological appearance (diastasis, SLA, RLA, CLA) preoperatively and after a mean follow- up of 28.3 months (range 12–65) after surgery.

A CT scan without injection was performed at the revision to measure the posterior radioscaphoid angle (PRSA). The objective was to find a radiological and functional correlation in our population, after a ''SLIC" ligamentoplasty and to analyze the correction of the PRSA postoperatively. The hypothesis was that correcting the PRSA would improve clinical and functional outcomes.

Results: Pain (VAS) was significantly improved, from 2.7 to 0.7 at rest and from 7 to 3.2 during hand use. The average wrist flexion was 46.4° and the extension was 59.1°. Grip strength reached 82.8% of the contralateral side. The functional scores were significantly improved postoperatively. The mean scapholunate angle significantly decreased from

81.1° to 73.5°, and the static scapholunate diastasis decreased from 4.7 mm to 3.6 mm. Scaphoid subluxation was fully corrected in 15 cases (68%).

The PRSA angle was significantly corrected, going from 112.7° on average preoperatively to 104.2° postoperatively.

Patients for whom the PRSA was corrected exhibited a tendency for improved clinical and subjective outcomes.

We deplore 1 case of scaphoid necrosis, 7 recurrences of static instabilities including 3 early as 4 months postoperatively, 3 scapho-capital osteoarthritis and 5 carpal collapse with ''SLAC" wrist.

Conclusion: Our study did not show any significant statistical correlation between clinical and radiological results in the medium term after scapholunate ligamentoplasty by ''SLIC procedure".

Our results are quite good in the medium term and seem to show the importance of the correction of the rotatory subluxation of the scaphoid, revealed by the PRSA, more than the correction of the scapholunate diastasis.

A review after more than 10 years will be necessary to ensure prevention of the risk of osteoarthritis induced by this correction.

Keywords: Wrist instability, scapholunate dissociation, scapholunate ligament, ligamentoplasty

A-0570 Biomechanical comparison of modified Adams-Berger and DX technique in DRUJ reconstruction

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Background: Adams-Berger ligamentoplasty is a widely accepted reconstruction for unrepairable TFCC injuries with instability. Failure of the reconstruction and recurrent instability is still a clinical problem. Internal brace augmentation of tendon grafts is gaining more popularity, but use in the DRUJ is not yet published.

Questions/purposes: The purpose of this study was to compare a novel anatomical DRUJ reconstruction with a modified Adams-Berger reconstruction to answer which technique stabilize better the DRUJ and which has enough stabilizing effect to allow early mobilization.

Methods: Nine matched pairs of cadaveric upper extremities were used. The dorso-palmar translations in the DRUJ that occurred with 50 N load were measured before and after detachment of the TFCC from the ulna and after ligament reconstruction with either modified Adams-Berger procedure or DX Swivelock technique. Internal brace augmented palmaris longus tendon grafts were used in all reconstruction.

Results: In the Adams-Berger group the injured and the reconstructed displacements were significantly higher than the native, while in the DX group both the native and the reconstructed displacements were significantly lower than the injured. The mean (SD) change of translations were 0.46 (1.94) mm after Adams-Berger and 2.51 (1.31) mm after DX reconstruction, implying significant better stabilizing effect of the latter.

Conclusions: DX Swivelock reconstruction showed better time zero stabilizing effect compared with Adams-Berger procedure, regaining almost normal stability of the DRUJ.

Clinical relevance

DX Swivelock technique using internal brace augmentation could allow earlier mobilization. This method could be also performed with arthroscopic assistance, without larger surgical approach.

A-0572 Elbow joint formation in children with congenital humeroradial synostosis

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Relevance: Longitudinal reduction of the upper limb with ulnar deficiency is a group of severe and rare congenital diseases, the total frequency of which does not exceed 1–1.4% of all upper limb anomalies. Congenital humeroradial synostosis is a variant of upper limb reduction with ulnar deficiency and is characterized by the absence of an elbow joint, deformation and shortening of the forearm combined with hand pathology. Absence of mobility between humerus and radius, often with a functionally unfavorable position of the forearm, determines the importance of elbow joint formation research.

Material and methods: From 1973 to 2020 we observed 98 children aged 1 to 17 years with congenital humeroradial synostosis. Surgical treatment was used in 74.6% of patients, 182 operations were performed. All surgical interventions were divided into 3 groups: operations aimed at eliminating

deformities of the shoulder and forearm (corrective osteotomies, lengthening limb segments), hand reconstruction (pollicization, elimination of syndactyly and clinodactyly, reconstruction of metacarpal bones), interventions for creation an elbow joint and ensure mobility in it. Elbow joint formation was performed in 21 patients (21.4%). We used arthroplasty, microsurgical autotransplantation of the first metatarsal-phalangeal joint, resection of the synostosis area in the presence of hypoplastic humeroelbow joint, individual endoprosthetics of the elbow joint.

Results and discussion: The synostosis zone resection was performed in two patients with preserved hypoplastic humeroelbow joint. Synostosis zone resection and arthroplasty was performed in three next patients aged 5–6 years. Microsurgical autotransplantation of the first metatarsal-phalangeal joint of the foot to the elbow joint position was performed in 14 patients aged 5–17 years. Two patients aged 9 and 13 years received individual endoprosthetics of the elbow joint, and not only the size, but also the design features of prosthesis were adapted for each patient.

In patients after resection of synostosis zone, including arthroplasty, the passive training of movements began in 3–4 days after surgery. In both cases, we marked a new synostosis 1–3 months after the intervention. In 2 out of 3 cases of arthroplasty we marked a certain mobility in the joint area. With the use of microsurgical technology, the passive training of movements we started after the removal of the needles or Ilizarov frame in a month after the operation. In all cases, we received a complete graft implantation and a passive mobility in the elbow joint. In 12 cases 3–6 months later intervention we marked active mobility, in two cases, due to lack of active mobility we performed joint kinematization. After the endoprosthesis of the elbow joint the passive movements training began in 3 days, active motions up to 15 degrees was detected in one patient on the 7th day after the intervention.

Conclusion: Microsurgical autotransplantation of the first metatarsal-phalangeal joint and individual elbow joint endoprosthesis are methods of choice of the elbow joint formation. The advantage of endoprosthetics is the elimination of risks of necrosis of the moved tissue complex, the absence of foot injury, the possibility of the earliest possible training of movements.

A-0578 Two Headless Compression Screw or Angular Stable Plate fixation in Scaphoid Nonunions

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Introduction: Scaphoid nonunion treatment remains challenging and stabilization techniques range from K-wire to headless compression screw (HCS) or volar angular stable plate stabilization. Rotational stability of the different techniques was brought into interest in the last years with the intention to increase stability and union rates.

Purpose of this study was to compare radiological and clinical outcome of two HCS and plate fixation in scaphoid nonunions.

Methods: 38 patients with scaphoid nonunions were treated by nonvascularized bone graft from the iliac crest and stabilization with either two HCS or volar angular stable scaphoid plate. Clinically assessment included range of motion (ROM), pain, grip strength, DASH Score, PRWE, Michigan Hand Outcomes Questionnaire and modified Green O'Brien Wrist Score. Union was confirmed by using CT scans of the wrist.

Results: 29 out of the 32 patients (91%), who returned for clinical and radiological examination, showed bony union at the CT scans at a mean follow-up interval of 34 months. No significant differences cloud be found in union rate, ROM, pain, grip strength and patient reported outcome measurements between the two HCS and plate group. High to length ratio and capitolunate angle improved significantly in both groups compared to before surgery.

Conclusions: Scaphoid nonunion stabilization by using two HCS or angular stable volar plate fixation results in comparable high union rates and functional outcome. Two HCS should be considered as first line treatment and scaphoid plate in recalcitrant scaphoid nonunions with substantial bone loss, humpback deformity or failed prior surgical intervention.

A-0581 Easy flow with a MiniFlo? An external distraction device to overcome joint contractions

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Introduction: Flexion contractures of the proximal interphalangeal (PIP) or metacarpophalangeal (MCP) joints are common in Dupuytren disease or may occur after complex trauma. Several techniques and devices were developed to stretch contracted tissue. With the MiniFlo external fixator continuous traction is applied to the involved joint, enabling a self-determined and gradual increase in extension controlled by the patient's resilience.
Methods: Nine patients with Dupuytren disease or post-traumatic flexion contractures were treated between 2019/10 and 2020/08. A MiniFlo distraction fixator was implemented and adjusted to the relevant PIP or MCP finger joint. The degree of traction acting on the joint is chosen by the patient starting from the first postoperative day. This study assess (1) the nature of contracture, (2) the duration of distraction, (3) the degree of improved extension deficit, (4) potential complications and (5) the postoperative management.
Results: In the 11-month period, nine patients were identified with PIP or MCP joint flexion contractures between 50 and 95 degrees. In two cases, the contracture was caused by Dupuytren's disease and in seven cases after complex trauma. 77% of the patients were male, the median age was 51 years (IQR 28–69). The PIP joint was affected in all of the nine cases and the MCP joint once. In two patients, two fixators were applied simultaneously on different joints. Consequently, a total of 11 fixators were installed. During 14 to 49 days, the patients controlled the gradual increase of the distraction themselves. After dismantling of the fixator, the median improvement of flexion-contracture was 50.2° (IQR 15°-90°). A total of five patients (55%) developed one or more complications (range 1–3). 33% showed an over-distraction of the PIP joint, because the center of the fixator ace did not match the rotation center or the telescopic unit was not open. In one case, a bended k-wire was observed, caused by too much angulation of the placed k-wires. 44% of the patients did not show a maximum extension when the fixator was at the distraction limit. In the latter cases, a fixator replacement and correction of the angulation enabled a continuation of the distraction.

Once 0° extension has been achieved, the fixator was left for another 1–3 weeks in place. Finally, an extension splint was fitted or further necessary surgery performed, e.g. pully-reconstruction or variants of aponeurotomy. However, it was difficult in certain cases to maintain the achieved extension.
Conclusion: Using a MiniFlo fixator reduced the flexion contracture under a gentle stretching of the tissue in 100% of the evaluated cases. The use of the fixator proved to be a good preparation for potential subsequent surgery. Among other advantages of the presented technique, no skin grafting was needed. Most of the complications were caused by misalignment of the k-wires and could be corrected afterwards with minor effort. After recognizing the pitfalls a quick learning curve of the surgeons and a significant reduction of the complications was achieved. However, it is important to have a strategy after removal of the fixator to maintain the gained extension.

A-0582 Surgical treatment of chronic (misdiagnosed) perilunate fracture dislocations

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Perilunate dislocations represent approximately 10% of all wrist injuries and are not early diagnosing in up to 25% of cases. Perilunate dislocations in combination of carpal bones fracture are associated with a high incidence of posttraumatic wrist osteoarthritis.

The aim of the study is to evaluate the outcomes of treatment in patients with chronic perilunate dislocation that were operated by two different operative methodic.
Materials: Clinical group consisted of 33 patients with chronic perilunate dislocations (isolated perilunate dissociations were excluded from our study): 21 patients (63.6%) – transcaphoid-perilunate dislocations, 7 patients (21.2%) – transradial-styloid-transscaphoid perilunate dislocation, 5 patients (15.2%) – transcaphoid-trans-capitate-perilunate dislocation. All patients, depending on the treatment, were divided into two groups: group I – 26 patients (78.8%) have open reduction and internal fixation with K-wire and fractures fixation with Herbert screws and group II – 7 patients (21.2%) have proximal row carpectomy (PRC). The mean age was 29.8 ± 6.2 years in group I and 29.7 ± 6.8 years in group II ($p = 0{,}983$). The mean average time period until surgery was 39.4 ± 6.4 days in group I and 41.4 ± 5.8 days in group II ($p = 0.448$). In addition, there were no significant differences between the two groups in terms of sex, dominant arm, injury mechanism, time from injury to surgery, or follow-up period (respectively, $p > 0.05$). The clinical outcomes were evaluated using the Mayo wrist score, the range of motion, grip strength. Final clinical assessments were performed at a mean follow-up period of 12.9 ± 1.8 months in group I and 12.9 ± 1.7 months in group II ($p = 0.930$). Statistical analysis was

performed using STATISTICA 12.0, P values of < 0.05 were considered significant.

Result: The mean Mayo wrist score at the final follow-up were 54.6 ± 7.7 and 68.6 ± 5.6 in groups I and II, respectively, which were significantly different ($p < 0,05$). The mean flexion-extension wrist motion was 69.3 ± 13.5 and 91.9 ± 3.9 degrees in groups I and II, which were significantly different ($p < 0,05$). The mean radial-ulnar deviation wrist motion was 36.4 ± 6.3 and 31.4 ± 6.3 degrees in groups I and II, which were significantly different ($p < 0,05$). The mean grip strength was 38.3 ± 7.2 kg and 16.6 ± 4.9 kg in groups I and II, which were significantly different ($p < 0,05$). Pain was persistent in 14 patients of I group and in 1 patient from II group for heavy manual work. 17 patients (65%) of I group developed post-traumatic midcarpal arthritis, all patients have post-traumatic stiffness and contracture. 4 patients of group I have second operation – total wrist fusion. In II group was 3 patients with hematoma in p/o period.

Conclusion: Both – the wrist reconstruction and the PRC procedure lead to comparable long-term treatment and trauma consequences, while rehabilitation and recovery in case of PRC is easier and earlier, has fewer complications. On the other hand, this procedure is associated with the irrecoverable loss of substantial anatomic structures. This can be perceived indistinctly by the patient, especially in relations of the consequences of a missed diagnosis and litigation.

A-0585 Corrective osteotomy for diaphyseal forearm malunions using 3D planning and patient-specific surgical guides: clinical and radiographical outcome in 30 patients with a minimum follow-up of 1 year

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Background: Diaphyseal forearm malunions can cause significant pain and lead to an important deficit. When correction is indicated, anatomical correction of these deformities can be difficult to achieve using standard surgical techniques. The use of 3D-planning and patient-specific guides is gaining popularity to perform osteotomies in a reliable and reproducible way while simultaneously shortening radiation exposure and operating time.

Objectives: This prospective case series evaluates the clinical and radiographical outcome of 3D planned osteotomies using patient-specific guides in patients suffering from diaphyseal malunions with an important secondary functional deficit.

Designs and Methods: 30 patients were prospectively enrolled consisting of 22 both-bone diaphyseal malunions, 2 Galeazzi fractures, 1 Monteggia fracture and 5 isolated diaphyseal radius fractures requiring osteotomy. For all patients, bilateral CT scans were obtained using a specific protocol. Surgical correction was virtually planned, and patient specific guides were designed, 3D printed and sterilized for intraoperative use. 21 patients had a corrective osteotomy of both radius and ulna, 7 were isolated radius corrections and 1 had an ulnar osteotomy. All procedures were performed by a single handsurgeon. An independent physiotherapist performed clinical evaluation at least one year postoperatively. PROM's included VAS pain, DASH and PRWE. Osteotomy consolidation and correction were assessed on plain radiographs at standard intervals. 2D projections were computed from the planned 3D model to determine correction error.

Results: The mean age of all included patients was 15 years (4–45). Average delay from injury to correction was 4,8 years (0,4-23,7). Mean follow-up was 39 months (12–78). VAS, DASH and PRWE improved significantly. 96% of patients would undergo surgery again. The mean planned angular corrections of radius and ulna were 9,6 and 9,7 degrees, respectively. Average postoperative corrections were 9,8 and 10,1 degrees with corresponding errors of 1,8 (range 0,0-3,3) for the radius and 1,6 (range 0,1-3,1) degrees for the ulna. Mean forearm supination improved from 49,3 (range 0–90) to 82,3 (range 50–90) degrees ($p < 0,001$)

Mean forearm pronation corrected from 62,6 (range 10–90) to 73,6 (range 50–90) degrees ($p = 0,129$). Grip Strength altered significantly from 22,9 (range 1–49) kg to 32,7 (1–55) kg ($p < 0,001$). 87% returned to their previous work after an average of 12 weeks. Mean operating time was 100 (range 45–150) minutes. We encountered no important complications.

Conclusion: 3D planned osteotomy with patient specific guides is a safe and reliable technique to achieve accurate correction of complex diaphyseal forearm malunions, with significant improvement of pain and function.

A-0591 Assessment of ulnar elongation by distraction osteogenesis in radial longitudinal deficiency

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Introduction: Based on the analysis of the literature on limited material and the resulting statistical studies of small scientific value, we have decided to look at the problem of ulna lengthening in radial longitudinal deficiency.

Previous publications evaluating the results of ulna lengthening in radial longitudinal deficiency are based only on small groups of patients.

Previously published results do not provide unambiguous conclusions whether the limbs among which lengthening of the ulna was performed, together with other corrective operational procedures, eventually reaching a greater length of the ulna, than the limbs among which the elongation procedure was not performed.

Aim: The aim was to assess the ulna lengthening in radial longitudinal deficiency, which consists of:

1. examining the effectiveness of ulna lengthening in radial longitudinal deficiency
2. determining the number and quality of complications encountered during lengthening
3. comparing the impact of ulna lengthening or not on the length of the ulna

Materials and Methods: The material consists of 62 upper limbs, diagnosed with type III and IV of radial longitudinal deficiency according to Bayne's and Klug's classification. Patients between 3 and 18 years of age were assessed.

The study group includes 31 upper limbs (28 patients, 12 women, and 16 men), in which lengthening procedure were performed at the age of between 3 and 16 years.

The control group was selected from a population of 46 limbs with radial longitudinal deficiency type III and IV who underwent X-rays falling in the age of study group, it is between 3 and 18 years, with no ulna lengthening. Of this population were drawn 31 cases (1 X-ray for 1 limb), which were analyzed in our study.

Evaluation of the study group, in which the ulna lengthening procedure was performed once was conducted based on the following parameters known from the literature as the initial length, final length, elongation, latency period, % increase in length, the total period of stabilization and the coefficient of healing.

The difficulties occurring during the total period of stabilization in the case of lengthening limbs were classified according to the classification proposed by Paley to the problems, obstacles, and complications.

Results: There was a statistically significant difference in average ulnas length before and after the lengthening within the study group.

There was no statistically significant correlation between percentage increase in ulna length and the age of study group.

There was a statistically significant positive correlation between total period of stabilization and the age of study group.

Complications occurring during the elongation revealed in 55% of elongated limbs, and there were difficulties in 18%, 47% the obstacles, and complications in 35% according to Paley's classification.

Found that there is a statistical difference between the average lengths of the ulnas in the study group after lengthening, and the average length of the ulnas in the control group.

Conclusions:

1. There are differences between the lengths of the ulnas in the radial longitudinal deficiency type III and IV, in which the procedure of lengthening was performed or not
2. Older kids require a longer period of stabilization to achieve a similar percentage of ulnar growth than younger.
3. Complications occur in 55% of the elongated ulnas

A-0596 Dual-mobility touch prosthesis: A functional alternative in surgical treatment of painful thumb osteoarthritis: A prospective analysis with 41 prostheses

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Introduction: Painful osteoarthritis of the thumb carpometacarpal (CMC) joint is a common disease and a disabling condition. The implantation of a thumb CMC joint prosthesis is an effective trapezium-preserving

procedure to relieve pain and improve strength and motion. We sought to examine the early functional results of a patient cohort treated with a dual- mobility touch thumb CMC joint prosthesis.

Methods: A bicentric prospective study was performed to assess functional results of 38 patients including 41 dual-mobility touch prostheses. Inclusion criteria have been advanced osteoarthritis (Eaton and Littler stage 2 or 3) with complaints unamenable to further non-operative therapy, and a trapezium height above 8 mm. Preoperative and postoperative assessments included pain according to the visual analogue scale (VAS), the range of motion (ROM), the opposition in the Kapandji index, the pinch and grip strength as well as functional scores (MHQ, DASH).

Results: The average follow-up time was 12 months. The mean pain score measured by a VAS was 7 ± 0.9 preoperatively and 0.8 ± 1.3 postoperatively. Thumb opposition according to the Kapandji index significantly increased after surgery (6 ± 1.5 to 9 ± 1.4). The mean grip- (13 ± 7.1 kg versus 18.2 ± 9.5 kg) and mean pinch strength (3.9 ± 1.2 kg versus 5.3 ± 1.8 kg) significantly improved, and the results were comparable to the contra-lateral side. Both radial and palmar abduction showed a significant increase in the ROM ($31.8° \pm 3.7°$ versus $36.1° \pm 3.8°$ and $33.1° \pm 4.8°$ versus $37.6° \pm 4.6°$). Before surgery a total of 15 patients presented a metacarpophalangeal (MCP) hyperextension $> 15°$ (range 15° to 28°). All of these patients showed postoperatively a significant normalization in the position of the MCP joint. The mean DASH score (13.8 ± 5.2), and the mean Michigan Hand Outcomes score (81.1%) showed overall good functional results. There were no complications such as infection, loosening, material breakage or osteolysis, and no indication for surgical revision.

Conclusion: We conclude that in a short-term follow-up the dual-mobility touch prosthesis is reliable to improve motion, strength, and pain relief. In addition, a significant improvement of pre-existing MCP joint hyperextension can be achieved.

A-0598 Carpal Tunnel Syndrome: live with pain or live without pain?

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Carpal Tunnel Syndrome (CTS) is a tunnel syndrome characterized by pain and paresthesias caused by compression of the median nerve along the canal. The risk of acquiring this syndrome during life is up to 10%; overall prevalence – up to 3% of the total population (Irenio Gomes et al., 2004; Keir PJ, Rempel DM., 2016; Wipperman J, Goerl K., 2016).

Aim of the research: to substantiate the need for surgical treatment of patients with carpal tunnel stenosis/compression neuropathy of the median nerve.

Material and methods: From 2014 to 2019, 486 patients with clinically established compression neuropathy of the median nerve at the level of the carpal tunnel were observed at the Center for Hand Surgery in Dnipro. The average age of patients: $43 + 13$ years; by gender – were dominated women (394 (81.07%)) under the age of 45 years. In 392 (80.66%) patients, the diagnoses were confirmed by electromyography studies.

There are 2 observation groups:

- I (178 patients) – were treated without surgery (anti-inflammatory non-steroidal drugs, hormonal blockades, neuro-stimulants and physiotherapy, correction of comorbidities (18 cases));
- II (308 patients) – were treated with surgery.

It was performed the ligamentotomy in 79 (25.7%) cases and ligamentectomy of the palmar carpal ligament in 229 (74.3%) cases: in 89 cases of them it was combined with synovectomy of the flexor tendons, in 9 cases – with flexors tenolysis + median nerve neurolysis, in 3 cases – with the removal of soft tissue neoplasms, in 3 cases – with the removal of osteophytes. Patients in both groups received a course of neuro stimulating drug therapy ("Nucleo C.M.P. Forte", B vitamins – "Vitacertin", e.t.c.) and underwent physiotherapy rehabilitation.

Results and discussion: Long-term results were observed in 78 patients of group I and in 122 patients of group II in the period from 1 month to 5 years. In group I, improvement (reduction of the pain and paresthesias, but without significant changes according to electromyography studies) for 3,6,12 months noted in 33 (42.31%) patients, 45 (57.69%) patients had no visible changes or was determined deterioration (so they were forced to agree to surgery).

In group II significant improvement and complete recovery (confirmed by electromyography studies at 3, 6, 12 months) were observed in 108 (88.52%) patients, in 10 (8.2%) patients – there was a temporary improvement (up to 1 year after surgery), in 3 (2.46%) patients – without visible changes and in 1 (0.82%) patient – with deterioration after surgery.

Conclusion: Thus, the analysis of the treatment of patients with carpal tunnel stenosis (compression neuropathy of the median nerve) conducted based on a specialized department indicates the

indisputable advantages and the need for surgical treatment of this pathology of the hand.
Keywords: tunnel syndrome, carpal canal, median nerve, surgery, treatment

A-0605 Clinical and biomechanical evaluation of STT arthrodesis

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The aim of the study was to performed biomechanical and clinical evaluation of the wrist after STT arthrodesis.
Background: Scaphotrapeziotrapezoid (STT) arthrodesis is useful technique for surgical treatment in advanced Kienböck disease, scapholunate advanced collapse (SLAC) and STT joint arthrosis. Stable and free of pain wrist allows normal function of the hand. The biomechanics of the wrist are essentially altered by arthrodesis but patients treatment satisfaction is high.
Materials and methods: 29 patients [6W, 23M] after unilateral STT arthrodesis surgery underwent precise clinical and biomechanical examination. The average duration time after surgery was 7 ± 4 years. To assess patient condition the DASH and PRWE questionnaire was taken. To assess wrist muscles biomechanical parameters during active workout patients underwent isotonic examination with 12 repetitive wrist extension and flexion movements. To assess wrist muscles strength capabilities isometric wrist examination was provided with continuous wrist flexion and extension contraction in three wrist positions: 30 deg of extension, 0 position, 30 deg of flexion. Both examinations were conducted with Biodex System 4 Pro electronic dynamometer. To assess global grip strength and key pinch strength Biometric Hand Kit device was used.
Results: The biomechanical examination revealed significant differences ($p < 0{,}05$) between examined muscles biomechanical parameters of involved (operated) and uninvolved limb. Wrist extensors average peak velocity during isotonic testing was significantly decreased ($p = 0{,}000179$) for involved limb 211,1 deg/sec and for uninvolved limb 250,4 deg/sec. Wrist flexors average peak velocity during isotonic testing was also significantly decreased ($p = 0{,}000013$) for involved limb 341,2 deg/sec and for uninvolved limb 403 deg/sec. The isometric testing also reveled significant difference between involved and uninvolved limb. Wrist extensors peak torque in 0 position was 7,9 Nm for involved and 9 Nm for uninvolved limb, wrist flexors peak torque in 0 position was 12,3 Nm for involved and 14,4 for uninvolved limb. Despite the significant reduction of forearm muscles biomechanical capabilities 93% of examined patients evaluate positively STT surgery and would perform the surgery again if needed.
Conclusions: Salvage procedure such as STT arthrodesis helps patients to maintain a functional range of motions, decreased the pain. Although biomechanical parameters are substantially unfavorably changed most of the patients claim significant improvement.
Keywords: STT, arthrodesis, biomechanics, Kienböck disease, SLAC, osteoarthrosis

A-0606 Vein conduits used to improve the reliability of arterial suture repair by microsurgery. Randomised comparative study on rats

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Sleeving microsurgical sutures with a vein conduit is a well described procedure for microsurgical nerve repair. Although it has rarely been described in the context of vascular repair, this technique could improve the reliability of microsurgical suturing of small vessels as in hand surgery. As part of a university degree in microsurgery, 29 novice surgeons conducted a comparative study of 58 microsurgical arterial microsurgical sutures on rats with and without venous cuffs.

The comparative sutures were performed on the same rat, using the first carotid to perform a standard suture and the second carotid to perform a sleeved suture, the sleeve was performed with an external jugular vein segment. The data analysed were suture time with arterial clamping time, number of stitches used, complications as well as vascular leakage and permeability of the repair at 0 and 5 minutes assessed with a patency test.

The average body weight of the rats was 263 g. The mean suture time was greater in group A (standard repair) 52.4 minutes compared to group B (sleeve repair) of 37.7 minutes. Similarly, the number of stitches was significantly different between the 2 groups, with 5.4 stitches in group A and 4.7 stitches

in group B ($p = 0.003$). The permeability of the suture was not different between the 2 groups $p = 0.19$, but there was a difference in anastomotic leakage when the clamp was released, with 69% of the suture being hermetic in group A and 83% in group B ($p = 0.035$).

The addition of a venous sleeve around an arterial suture seems to improve its reliability by limiting leaks and therefore the risk of the suture being repeated, despite the fact that these were novice practitioners. It could be interesting to transpose this technique to microsurgical suturing of digital arteries and to carry out a comparative study with ultrasound control of the permeability to remote clinical control.

A-0608 Sensitivity and specificity of clinical examination in open injuries of the hand

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Introduction and Aims: Clinical examination of upper limb injuries is an important skill in the armamentarium of teams involved in the treatment of hand trauma. The findings dictate the decision regarding surgical intervention and influence choice of anaesthetic. However, few studies report the diagnostic accuracy of physical examination in traumatic hand injuries. The aim of this project was to evaluate the accuracy of clinical examination for trauma in our unit.

Methods: Consecutive patients presenting to the authors with open hand injuries in a Regional Hand Unit trauma clinic between 3rd August 2020 and 24th November 2020 were studied. All patients were assessed clinically for damage to deeper structures indicating surgery. Intra-operative findings and interventions were reviewed and compared to earlier physical assessment. Data regarding patient and surgeon demographics, type of anaesthetic used and details of injury were collected.

Results: A total of 48 patients were identified. The average patient age was 37.6 years (range 8–77 years). Left and right hands were injured with equal frequency (Left:Right = 24:24). The most common type of injuries were incision injuries (22), followed by lacerations (11) and penetrating injuries (7). Two patients were assessed by a consultant, six by a core surgical trainee, and the remainder by a specialist registrar.

On clinical examination, there was suspicion of the following: 17 digital nerve injuries in 15 patients, 33 flexor tendon injuries in 18 patients, and 15 extensor tendon injuries in 13 patients. Following surgical exploration, there were 9 confirmed digital nerve injuries in 9 patients, 26 flexor tendon injuries in 14 patients, and 14 extensor injuries in 11 patients. False negative assessments were made for zero digital nerve and flexor tendon injuries, and two extensor tendon injuries. 27 patients were operated on with local anaesthetic, 19 patients required general anaesthetic or regional block, and anaesthetic data was unavailable for two patients.

Overall sensitivity and specificity for clinical examination was 0.94 and 0.79, respectively. Clinical examination was most sensitive in identifying flexor tendon injuries (1.0) and nerve injuries (1.0), compared with extensor tendon injuries (0.86). However, clinical examination had greater specificity in identifying nerve injuries (0.83), compared with flexor (0.72) and extensor (0.7) tendon injuries. Negative predictive values were considerably better than positive predictive values from both nerve and flexor tendon injuries, whereas these values were almost equal for extensor tendon injuries.

Discussion: Our findings suggest an over-diagnosis of injuries on clinical assessment. The sensitivity, specificity, and positive and negative predictive values have the potential for optimisation. Several factors could have influenced these findings: the presence of neuropraxia, clinician experience, patient compliance, delays in clinical presentation and the presence of other injuries. Whereas over-diagnosis is consistent with avoiding missing significant injuries, it can result in unnecessary surgery. The potential to reduce this with assessment by senior clinicians and imaging should be explored.

A-0609 Work-related risk factors for ulnar nerve entrapment in the Northern Finland Birth Cohort of 1966

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Ulnar nerve entrapment (UNE) is the second most common entrapment neuropathy in the upper extremity. The etiology of UNE is multifactorial and is still

not fully understood. The aim of the study was to identify occupational risk factors for UNE and to determine whether smoking modifies the effects of work-related factors on UNE.

The study population consisted of the Northern Finland Birth Cohort of 1966 (NFBC1966). In total 6325 individuals active in working life attended a 31-year follow-up study in 1997. Occupational risk factors were evaluated by a questionnaire at the baseline in 1997. The data on hospitalizations due to UNE were obtained from the Care Register for Health Care between 1997 and 2018.

The incidence rate of hospitalization due to UNE was 47.6 cases per 100 000 person-years. After adjusting for confounders, entrepreneurs (Hazard ratio (HR) = 3.68, 95% CI 1.20–11.27), smokers (HR = 2.51, 95% CI 1.43–4.41), participants with thyroid disease (HR = 4.14, 95% CI 1.50–11.44), workers exposed to temperature changes (HR = 1.72, 95% CI 1.00–2.93), workers with physically demanding jobs (HR = 3.02, 95% CI 1.39–6.58) and workers exposed to hand vibration (HR = 1.94, 95% CI 1.00–3.77) were at increased risk of hospitalization for UNE. Exposure to work requiring arm elevation increased the risk of hospitalization due to UNE in smokers (HR = 2.62, 95% CI 1.13–6.07), but not in non-smokers.

Work-related exposure to vibration and temperature changes, and physically demanding work increase the risk of hospitalization for UNE. Smoking may potentiate the adverse effects of work-related factors on UNE.

Keyword: cohort study; occupational risk factor; ulnar nerve; entrapment neuropathy; smoking

A-0613 Spontaneous autonomic reinnervation of neuromuscular junctions after surgical deefferentation: experimental animal model

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Introduction: Muscles in the human body are innervated not only by efferent fibers but also show a complex innervation pattern of afferent and autonomic fibers. The impact of afferent and autonomic fibers on muscular function is scarcely explored. Surgical restoration of muscular motor function is focused almost exclusively on efferent reinnervation of neuromuscular junctions (NMJ). The current scientific literature suggests that only efferent axons reinnervate NMJ, as there is no evidence of any other fiber types innervating skeletal muscles.

Due to the mixed nature of most motor branches of peripheral nerves, the selective investigation assessing the relevance of various fiber qualities in the neuromuscular regeneration is limited. The separate innervation of dermato-muscular complex via the trigeminal and facial nerves represents a feasible model for research on this matter. In this study, we demonstrate for the first time autonomic reinnervation of facial muscles after total deprivation of efferent input.

Materials and Methods: The facial nerve of 20 rats was resected distally from the stylomastoid foramen creating a 5 mm nerve gap. Following surgery, the whisker pad movement was assessed every 3rd week using video recordings. 12 weeks after the surgery, double retrograde labeling of facial muscles was performed. Subsequently, facial muscles were harvested for novel immunofluorescent staining for specific visualization of fiber qualities.

Results: 18 of 20 rats showed restored whisker pad movement 12 weeks after facial nerve lesion. Five of five rats showed intraoperative whisker pad movement by stimulating the ipsilateral infraorbital nerve (ION) and lost the ability to whisk postoperatively right after transection of the ION. Reinnervated facial muscles showed an abundance of cholinergic nonmyelinated axons innervating NMJs, indicating their parasympathetic nature. The central representation of these fibers was identified in the ipsilateral cranial parasympathetic ganglion.

Discussion: In this study we delivered comprehensive evidence for the spontaneous autonomic reinnervation of facial muscles without involvement of the facial nerve. These findings may not only help to interpret discrepancies in experimental models for neuromuscular research, but also raise the question, whether a similar phenomenon takes place in striated muscle of extremities following other forms of neuropathy. Moreover, autonomic innervation may elaborate the underlying mechanism of so-called ''sensory protection'' implemented in preventing atrophy of a denervated muscle.

A-0616 Distribution of sensory nerve endings in the interosseous membrane of the forearm

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Background: The role of proprioception in understanding the dynamic stability and neuromuscular control of the forearm is important for the treatment of forerarm injuries involving bone, ligaments and joint capsules. Therefore the aim of the study was to investigate types and distribution of sensory nerve endings in the different parts of the human interosseous membrane of the forearm.
Material & Methods The distal oblique bundle (DOB), the distal accessory bundle (DAB), the central band (CB), the proximal accessory bundle (PAB), the dorsal oblique accessory cord (DOAC), and the proximal oblique cord (POC) were dissected from twelve human fresh frozen cadaver forearms. Sensory nerve endings were analysed in two levels per specimen as total cell amount/mm2 after immunofluorescence staining with low-affinity neurotrophin receptor p75, protein gene product 9.5, S-100 protein and 4′,6-Diamidin-2-phenylindol (DAPI) on an Apotome microscope (Carl Zeiss Microscopy, Jena, Germany) according to Freeman and Wyke's classification.
Results: Free nerve endings were the predominant receptor in all six ligaments with greatest density in the DOB followed by POC. The second most sensory nerve endings were unclassifiable corpuscles, followed by Pacini corpuscles. The DOB had the highest amount of Pacini corpuscles followed by the PAB and POC. The DOAC only contained free nerve endings and unclassifiable corpuscles.
Conclusions: The DOB, PAB and POC had the highest density of sensory nerve endings, which indicates, that control of the dynamic stability of the forearm is pronounced at the distal and proximal radioulnar joint due to the closed proximity of the DOB and POC, respectively.

A-0618 Clinical dilemma: Should we operate patients with scaphoid nonunion and good preoperative PRWHE scores to prevent progressive osteoarthritis?

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Introduction: rnMost patients with a scaphoid nonunion will develop wrist osteoarthritis after 10 years. Surgery could prevent progressive osteoarthritis by achieving union. To prevent progressive osteoarthritis, even patients with good PRWHE scores are generally surgically treated. However, postoperative union and preventing progressive osteoarthritis are not achieved in all these patients. To enhance patient-centered care, we aim to report patient-reported outcomes in patients with good preoperative PRWHE scores.rnrnMethods: rnWe performed a cohort study at the Xpert Clinic in the Netherlands. Data were prospectively collected as part of usual care. Adult patients with scaphoid nonunion who underwent non-salvage surgery were included if the preoperative and minimally one year postoperative Patient Rated Wrist/Hand evaluation (PRWHE) were available. Based on the preoperative PRWHE, we divided patients into 2 groups; (1) patients with PRWHE score ≤ 30 and (2) patients with PRWHE score >30. We used the PRWHE score as our primary outcome to report on physical functioning and pain. The minimally clinically important difference (MCID) for the PRWHE is 11.5. As secondary outcomes, we assessed patient satisfaction and postoperative complications. rnrnResults: rnOf the 118 included patients, 35 patients had a preoperative PRWHE score ≤ 30 and 83 patients had a PRWHE score > 30. The median PRWHE score improved from 19 [interquartile range 11–26] preoperative to 9 [3–17] postoperative in patients with a score ≤ 30 ($p = 0.002$) and from 57 [45–66] to 12 [8–28] in patients with a score >30 ($p < 0.001$). A worse postoperative score of minimally 11.5 points (difference between the preoperative and postoperative PRWHE score) was reported by 9% of the patients in the ≤ 30 group and by 2% of the patients in the >30 group. rnPatient satisfaction and complications were evaluated in the ≤ 30 group. We found an improvement in satisfaction with the hand ($p < 0.001$) from preoperative to postoperative. Excellent or good postoperative satisfaction with the treatment results was reported by 66%, and 77% would undergo the treatment again. Complications were found in 4 patients (Quervain

syndrome, screw removal, revision surgery, salvage procedure).rnrnConclusion rnPhysical functioning, pain, and satisfaction with the hand improve in patients with preoperative good PRWHE scores ($\leq$30) after scaphoid nonunion surgery. However, more patients with preoperative scores $\leq$ 30 reported a clinically important worse postoperative PRWHE score (9%) than patients with preoperative scores $>$30 (2%). Postoperative complications were found in 9% of the patients with preoperative good PRWHE scores.rnOur results can be used to inform patients with a scaphoid nonunion and good preoperative PRWHE scores about postoperative outcomes. This will enhance patient-centered care, and surgeon and patient could make the decision about performing scaphoid nonunion surgery to prevent progressive osteoarthritis, also based on patient-reported outcomes. rn

A-0619 Reconstruction of finger defects with free mini-flaps

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The reconstruction of fingers with skin and soft tissue defects remains challenging. The optimal reconstructive treatment should be simple, reliable, cost effective, and provide pliable, sensitive, and cosmetically similar tissue that will allow adequate function. A free flap of appropriate size may provide an ideal surgical solution, since it is associated with a shorter time of returning to work and satisfactory function and aesthetic appearance. The purpose of the study was to compare the outcomes of fingersâ€™ reconstruction using free arterialized venous flap (AVF), superficial palmar branch of the radial artery (SUPBRA) flap, dorsal radial perforator flap (DRAP), and dorsal ulnar artery perforator (DUAP) flap harvested from the ipsilateral extremity.

Materials and Methods = During 6 months were performed 4 types of free flaps from the ipsilateral extremity in the reconstruction of fingersâ€™ defects, with small/moderate skin defects, including: 1 AVFs, 3 SUPBRA flaps, 1 DRAPs, and 1 DUAP flaps. Standardized assessment of outcomes was performed, including duration of operation, objective sensory recovery, cold intolerance, time of returning to work, active total range of motion (ROM) of the injured fingers, and the cosmetic appearance of the donor/recipient sites.

Results = All flaps survived completely, and the follow-up duration was 12 months. The mean duration of the complete surgical procedure for AVFs was distinctly shorter than that of the other flaps. The SUPBPRA were employed to reconstruct skin defects and extensor tendon defects using a vascularized palmaris longus graft in 1 finger. Optimal sensory recovery was better with AVFs and SUPBRA flaps as compared with DUAPs and DRAP flaps. No significant differences were noted in ROM or cold intolerance between the 4 types of flaps. Optimal cosmetic satisfaction was noted for the recipient sites of AVFs and the donor sites of SUPBRA flaps.

Conclusions = All 4 types of free flaps from the ipsilateral extremity are a practical choice in finger reconstruction for small/moderate-sized skin defects. The SUBPRAs play an important role in such operations due to the wider indications, and better sensory recovery and cosmetic appearance associated with this method.

A-0627 Improved preservation of the pinch strength by the PyroDisk CMC thumb arthroplasty compared to trapeziectomy with interposition arthroplasty

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Background/Introduction: Different surgical techniques have been proven equally effective in pain reduction of CMC thumb joint osteoarthritis. Much less is known how well the strength is preserved after surgery. The PyroDisk CMC thumb arthroplasty has been introduced with the idea that the interposition and the hardness of the pyrolytic carbon disc contribute to preservation of thumb length. After performing a hemitrapeziectomy, the disc is secured in the joint space with a tendon strip, contributing to thumb alignment with preservation of function and strength. In this study, we wanted to compare the PyroDisk arthroplasty (PDA) with trapeziectomy plus tendon interposition (TTI). Primary, we tested whether the PyroDisk arthroplasty resulted in a higher pinch strength. Secondarily, we compared the range of motion (ROM), patient reported outcomes, satisfaction and complications.

Methods: We performed an observational cohort study of patients operated between 2006 and 2011, after approval of the Institutional Review Board and written informed consent of all participants. Inclusion criteria were CMC thumb joint osteoarthritis Eaton and Glickel stage two or three and non-responsiveness to non-operative treatment for at least three months. Patients were treated with PDA or TTI depending on patient- and surgeon preference. The following outcomes were determined: strength of pinch; key- and tippinch; palmar abduction and opposition; the Michigan Hand Outcome Questionnaire (MHQ), satisfaction and complications. Due to scarcity of preoperative hand measurements, we used cross-sectional data gathered at one time point for both groups (after at least 5 years of follow up). Demographic data and perioperative complications were collected by review of medical records. Depending on distribution of data means and standard deviations or median and interquartile score were used for analysis. Propensity score matching was used to match both study groups on demographic variables. A ratio of 2:1 was used resulting in inclusion of 62 (of 188) PDA and 31 TTI patients. The two groups were analysed using independent t-test (normal distributed) or Mann-Whitney U test (non-normal distributed). A p-value ≤ 0.03 (Bonferroni correction) for primary and 0.05 for secondary outcomes was considered statistically significant. All analyses were performed in R.

Results: The PDA-group patients showed more preservation of pinch strength than those of the TTI group regarding key pinch ($p = 0.028$) and tip ($p = 0.01$.) No differences were found for ROM. Patients of both groups reported comparable MHQ scores (median[IQR] for PDA: 74 [59,90] and TTI 73 [56,90]) and were equally satisfied. Complication rates were comparable between both groups. The survival rate of the PDA was 91%. Removal of disc was mainly based on progression to scaphotrapeziotrapezoidal joint arthritis which was treated with disc removal and completing trapeziectomy.

Conclusion/discussion: This study confirmed our hypothesis that the pinch strength is better preserved by the interposition of the pyrodisc after performing a hemitrapeziectomy compared to trapeziectomy combined with tendon interposition arthroplasty for CMC thumb osetoarthritis. Both techniques have comparable outcomes considering patient reported outcome (MHQ), satisfaction, ROM and complications.

A-0633 A systematic review of health utilities and their derivation methods for hand conditions

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Introduction: Determining the cost-effectiveness of interventions is essential for value-based care. Cost-effectiveness is commonly reported in terms of cost per quality-adjusted life year (QALY). Health state utility is required to calculate QALYs. Utility represents the desirability of a health state scored on a scale from 0 (equivalent to death) to 1 (equivalent to full health). Negative values describe health states deemed worse than death.

Utilities can be obtained through direct preference elicitation techniques such as time trade off (TTO) and standard gamble (SG), as well as indirect elicitation techniques using visual analogue scales (VAS) and preference-based measures of health (PBMs). A PBM is a patient reported outcome measure (PROM) that describes health states that have been valued by members of a population using direct preference elicitation techniques. The EuroQol- Five Dimension (EQ-5D) is an example of a generic preference-based measure. PBMs have a standardised health state classification system and a preference-based scoring algorithm for estimating health state utility from a specific population's perspective.

Utility values are dependent on health states, derivation techniques and the population in which values are obtained. 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 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. The methodological quality and relevance of included studies was assessed in line with established criteria for health utility studies (Papaioannou et al., 2019).

Results: Collectively, 31 studies were identified. Utility values were reported for a range of hand conditions including carpal tunnel syndrome, hand transplantation, base of thumb arthritis, cubital tunnel syndrome, trigger finger, Dupuytren's disease, rheumatoid arthritis, carpal fractures and digital replantation. Included studies reported the use of TTO, SG, VAS, discrete choice models and generic preference-based measures. No condition specific preference-based measures were identified. Surveyed populations included clinicians, patients and members of the general public. Utility estimates were predominantly derived in American/Canadian populations. Utility values ranged from 0.27 after failed intervention following radial nerve palsy to 0.99 after successful anterior subcutaneous transposition to treat cubital tunnel syndrome.
Conclusions: This systematic review provides a dataset of utility values for hand conditions. Utility values for similar health states varied markedly with a range of valuation methods and populations reported. There are few methodologically robust utilities values that can be used in cost-utility analysis for hand conditions. There is future scope to develop utility values through expanded collection of generic PBMs, mapping onto condition-specific measures and developing value sets for condition specific measures.

A-0641 Gunshot injuries of the hand: fractures of the metacarpal bones with defects along the diaphysis and their treatment in a specialized center

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The presence of military conflicts in the world determines the urgency of the problem of providing specialized care to the wounded with gunshot injuries of the hand, which account for up to 25% of the structure of combat injuries of the upper extremity (Zarutsky J. et al., 2014, Strafun S. et al., 2017).
Aim: To substantiate the appropriateness of staged treatment of gunshot fractures of the metacarpal bones with their defects along the diaphysis in a specialized center.
Materials and methods: In 2014–2019, 49 (82 metacarpal bones) patients with gunshot fractures with diaphysis defects up to 5 cm (12 cases – with bullet wounds, 37 cases – mine injuries) were treated. Initially were performed the surgical debridement of wounds, stabilization/reosteosynthesis of fractures of the metacarpal bones in the external fixation devices or by using k-wires/pins for restoring of damaged structures; distraction of fragments of bones in external fixation devices (10 cases). The bone defects were repaired with autografts and next fixation with K -wires or AO structures.

Results and discussion. It was achieved consolidation of graft fragments in all patients by 7 to 12 weeks. Subsequently, physiofunctional and occupational therapy were performed in the Center, military hospitals or sanatoriums. Treatment outcomes assessed in 18 patients over a period of 6 to 18 months on the DASH scale. A good result obtained in 12 (66.67%) patients, satisfactory – in 6 (33.33%).
Conclusions: Thus, our experience in the treatment of gunshot fractures of the metacarpal bones of the hand indicates the need and appropriateness of the staged restoration of their integrity in specialized conditions
Keywords: hand, metacarpal bones, gunshot fractures, surgical treatment

A-0644 Patient Reported Outcome Measure in Hand Trauma Surgery During a Pandemic

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Background: During the First peak of the Covid-19 pandemic almost all hospitals in the UK had to stop elective services and cancer services. They had to reconfigure staff and services to deliver emergency Trauma services.

This study aims to study the patient experience at a tertiary trauma centre in the UK during this challenging period when most patients were anxious to attend hospital for their emergency care. At our tertiary referral center we performed minor and intermediate procedures in a procedure room.
Methods: Patient reported experience questionnaires were conducted by independent reviewers

during the 10-week period of the UK's first lockdown.

All patients, who underwent upper limb surgery in the procedure room were included in this study
Results: A total of 204 patients were treated in the procedure room. 105 patients responded to the telephone consultation.

Over 95% felt the procedure room pathway was appropriate for their treatment.

All patients felt comfortable during their surgery and would recommend this service to their friends and family

Conclusion: This study is an important service evaluation exercise to measure the positive experience the patients had when they underwent their surgery in the procedure room during a challenging time. This highlights the work all healthcare workers have done across the NHS in making patients feel comfortable during their journey.

It also highlights the fact the importance of maintaining essential services during a pandemic.

A-0647 Hand Trauma injury pattern during the Pandemic

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Background: Birmingham Hand Centre caters for a population of 5.5 million in the West Midlands UK. During the Covid-19 first national lockdown we encountered different challenges within the NHS. The hand trauma services needed reconfiguration to maintain acute trauma service. The injury pattern we came across was different during the national lockdown compared to previous years.

Methods: We analysed data from Electronic Patient Records during the first lockdown from 23.3.2020 to 30.05.2020

We included all patients who presented to Birmingham Hand Centre for Upper limb Surgery.

Results: 547 patients attended during this lockdown period. This is a 45% reduction in the workload compared to the same 10 week period from the previous year. Out of these 384 patients required surgery. Majority of the injury was related to domestic injuries 213 or 55%. Work related injuries were 20 or 5%, sports and leisure was 35 or 9% while road traffic accidents were 8 or 2%.

Discussion: Our data suggests that there was a paradigm shift in injury pattern during the first national lockdown. At the beginning of the lockdown people were more compliant while towards the end of the lockdown with easing of restrictions and more and more key workers starting to return to work we noticed increase in work related injuries. We also noticed a high rate of knife crime during the lockdown which can be attributed to rise in interpersonal violence.

A-0651 Endoscopic Trigger Finger Release: Outcomes of a Novel Minimally Invasive Technique for the Treatment of Stenosing Tenosynovitis

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Introduction: The purpose of this study is to introduce a novel endoscopic technique for treating patients with stenosing tenosynovitis of the fingers. We present the short term functional and objective outcomes of patients treated with this technique.

Methods: 45 patients (64 fingers) who failed conservative treatment for trigger finger were admitted to an outpatient surgery center for surgical treatment. For this endoscopic technique a 1 cm transverse incision is made at the distal palmar crease proximal to the A1 pulley of the affected finger. Release of the A1 pulley is performed with the scope mounted blade and a 2.7 mm, 0 degree arthroscope. Patients returned for follow up and outcomes were assessed via grip strength, finger range of motion, DASH questionnaires, and VAS pain scale.

Results: Outcomes are reported for 45 patients, 26 male and 19 female. Mean age was 70.1 years. Of the 64 fingers operated on, 10 were index, 22 were middle, 27 were ring, and 5 were little fingers. No thumbs were operated on. Compared to the contralateral side, gross grasp, lateral pin, three-jaw chuck, and precision pinch recovered 87%, 96%, 83%, and 95% respectively. At final follow up, average extension/flexion for the MP, PIP, and DIP joints were 1/83, 4/96, and 1/72 respectively. Mean VAS scores decreased from 5.7 preoperatively to 1.7 postoperatively (p-value < 0.05). There were no instances of a severed A2 pulley.

Conclusions: This novel technique is less invasive than other surgical techniques available for the treatment of trigger finger. Endoscopic visualization provided by this technique decreases the likelihood of complication. All patients returned to normal functionality of the hand within a month and pain subsided significantly.

A-0654 Endoscopic Treatment of Lateral Epicondylitis: A Cadaveric Study

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Introduction: Lateral epicondylitis (LE) is a common cause of chronic pain of the elbow and a leading cause of wrist extensor dysfunction. The purpose of this study is to create a minimally invasive, novel approach to Extensor Carpi Radialis Brevis (ECRB) release for LE treatment and increase awareness of surrounding vulnerable anatomy. We hypothesize that our novel approach will produce effective and reproducible release of ECRB without compromising vulnerable adjacent anatomy, namely the radial nerve and radial collateral ligament.
Methods: We attempted endoscopic ECRB release in 42 cadaver specimens. After portal entry and exit sites were made, we utilized an endoscopic release system for attempted ECRB origin release. Following attempted release, our group openly dissected each specimen, taking measurements and noting proximity to surrounding vulnerable anatomy. Percentage of ECRB release was estimated and accidental damage to any relevant anatomical structures was noted for future approach modification.
Results: We recommend taking a posterior approach which provides easier access to the ECRB origin and easier entry based on how the patient will be positioned in the operating room: supine with the extremity pronated. The first reference line is drawn from the third metacarpal to the lateral epicondyle. The second reference line is drawn 1.5 cm distal from the lateral epicondyle. Our entry portal is created 0.5 cm anterior from the midline and our exit portal is created 3.5 cm anterior from midline. Proper ECRB location can be confirmed through visualization of two tandem tendon sheaths and boundaries demarcated by white/yellow lines at the edges of the clear cannula. This approach led to a mean ECRB release of 63%. Utilization of this approach in combination with visualization keys did not compromise adjacent anatomy. Average distance from the radial nerve was 2.7 cm.
Conclusion: Using an endoscopic release system in combination with our novel approach allows for the partial release of ECRB without damaging adjacent vulnerable anatomy. In the future, this minimally invasive technique may lead to less post-operative pain, a lower risk of infection, and earlier return to activity compared with open release. Additional trials may serve beneficial to bolster the reproducibility of the approach for live case demonstration.

A-0656 MODERN: a prospective multicenter study on outcome-monitoring of trunk nerve lesions of the upper extremity

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Background: Injuries of the upper extremity trunk nerves usually have serious consequences for patients' participation in all areas of life. Their healing processes are long, often delayed and very cost consuming. Thus a precise diagnosis that allows for correct therapeutical decision as early and precise as possible is crucial for optimal outcome. The complimentary clinical application of high resolution imaging methods for therapeutic monitoring appears most promising. The aim of the present study is therefore to further develop and review the clinical application of MR neurography for the early and precise diagnosis of complex nerve lesions as well as their healing course.
Methods: In this prospective study, patients (N = 60) from two hand trauma centers with complete lesions of the trunk nerves of the upper extremities are included and examined at four measurement times (acute, 4, 12 and 18 months after surgery). In addition to a detailed clinical examination, high-resolution imaging for therapeutic monitoring and a sensory-motor function test (WEST test, hand strength) are performed. In addition, questionnaires assess everyday function (DASH) and quality of life (SF-36), psychological well-being (DASS, IES) and pain (PainDetect). A correlation of the clinical findings with high-resolution imaging data is planned.
Results: First interim results are available from N = 21 patients. Mean age of patients was 36 yrs (SD = 13), mostly male (76%). Multiple nerves were affected in 71%, single nerve lesions were present in 29% of patients. The median and ulnar nerves are most commonly affected. Characteristic MR-morphology of an acute nerve lesion was documented in acute (post-op) state. During healing course consistent changes were observed corresponding to the clinical findings. Everyday functions (DASH) were significantly reduced immediately after trauma (mean = 59, SD = 30), as well as 4 months (mean = 46, SD = 23) and increased after 12 months

(mean = 38, SD = 29). Hand strength on the affected side was significantly reduced compared to the healthy opposite side (MW = 44 kg, SD = 9), but improved significantly over the course from an average of 10 kg (SD = 9) 4 months after trauma to 19 kg (SD = 11) 12 months after trauma (affected side regardless of handedness). The health-related physical quality of life was also limited immediately after the accident, but recovered after 4 and 12 months. The health-related psychological quality of life was reduced early after trauma compared to the normal population. The majority of patients complained of pain 4 months after injury (93.3%), being reduced 12 months after injury to 40%.

Conclusion: With implementation of standardized high resolution imaging methods, a precise diagnosis can be achieved leading to the right treatment decision as early as possible. The initially reduced objective and subjective functions can therewith be improved to a best possible outcome. In our current experience, high-resolution imaging can beneficially be implemented for monitoring of nerve continuity and potential neuromatous changes of nerve fascicles as well as therapeutic success due to the presence and dynamics of T2-w hyperintense denervation edema of the target muscles.

A-0657 Paediatric composite fingertip grafts: 7-year experience from a tertiary plastic surgery unit and a proposed management algorithm

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Background: Even though paediatric fingertip injuries are one of the most common presentations to the Emergency Department, complete amputations of the digital tip are relatively rare. In such cases, replacement of the amputated tip as a composite graft is a well-established technique, but the timing of surgery relevant to graft survival remains controversial. Many units, in the United Kingdom (UK) and elsewhere, follow the dogma established by Moiemen and Elliott in a widely cited publication from 1997, where it was advocated that all composite grafts should be performed within 5 hours of injury, to ensure any increased likelihood of success. A number of subsequent publications have challenged this, pointing out both the arbitrary nature of the 5-hour window, and the lack of any proposed biophysiological mechanism to support it. In this study, we present our experience with paediatric composite fingertip grafts in our unit, which is a tertiary paediatric plastic surgery centre in the UK, and propose an algorithm for the management of these injuries in a safe way.

Method: All paediatric patients (<16 years old) who underwent composite fingertip grafts over 7.5 years, between January 2013 and June 2020, were identified from our database. Only complete amputations were included. A retrospective analysis of these patient's medical records was performed. Demographic, aetiological, injury extent using the modified Ishikawa model, and procedural data was collected. Outcome data such as such as infection, wound issues, hook nail or secondary intervention were recorded, in addition to whether the graft was full, partial or failed take. These were compared to the injury-replant time. Statistical analysis, where relevant, was performed using SPSS for Mac (version 27.0, Chicago, IL).

Results: Forty children underwent composite fingertip grafts for complete amputation, with 21 males and 19 females. Patients were aged between 0 and 11 years (median 3 years). Almost all (39/40) amputations were caused by crush injuries. Mean time to theatre was 12.46 hours (range 3.7–26.8 hours). Twenty patients (50%) had no graft take, 9 patients (22.5%) had partial take, and 11 patients (27.5%) had complete graft take. There was no significant difference in outcomes with respect to graft take for those who had surgery within vs out with 5-hours from injury. Four patients (10%) developed post-operative infections, and there were no revision procedures performed.

Conclusion: One half of the patients who underwent composite grafting to fingertip injuries had at least partial take. There was no statistically significant difference in graft take beyond the previously suggested 5-hour timeframe to re-implantation or the time beyond this. Good surgical outcomes were demonstrated, with few incidences of post-operative complications. As a result, we proposed an algorithm to our tertiary centre for on-going safe treatment of paediatric digital tip amputations.

A-0658 Using elastic vessel loops to determine the passive tension at which tendon transfers are set for radial nerve palsy

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Introduction: Radial nerve injuries with paralysis are devasting and lead to significant functional impairment. Fortunately, tendon transfer surgery is highly successful in the upper limb and restores function. In low-to-middle income countries like South Africa, trauma-related injuries constitute a large burden of disease that includes nerve injuries. While these injuries are relatively scarce worldwide, we manage them regularly and often at delayed presentation. When performing tendon transfer procedures, much emphasis is placed on the amount of passive tension at which the tendon transfer is set. There is, however, little published regarding the ideal passive tension for tendon transfer or the measurement thereof. This study aimed to introduce an innovative technique to measure the passive tension at which tendon transfers for radial nerve palsy are set using elastic vessel loops.
Method: This study was conducted in two stages: the first consisted of a laboratory study, and in the second stage we applied the findings clinically. Laboratory studies were used to determine that elastic vessel loops obey Hook's law. Elastic vessel loops stretched to respective lengths were used to determine the tension in Newton at respective lengths in centimetres after calibration. This technique was applied in 16 consecutive cases over 18 months in a prospective study and the outcomes were evaluated. The study was approved by the Health Research Ethics Committee of the Faculty of Health Sciences, University of the Free State [UFS-HSD2019/0015/2506].
Results: We found that the mean passive tension at the wrist was set at 12.93 N (SD 0.77), the fingers at 13 N (SD 0.72), and the thumb was set at 7.62 N (SD 0.5). This achieved 81.25% satisfactory results as rated by the surgeon at six weeks and a median QuickDASH score of 11.36 (IQR 6.82–36.36) at six months postoperatively.
Discussion: The QuickDASH is a validated and excellent tool for measuring disability in the upper limb with scores ranging from 0 (no disability) to 100 (most severe disability). Patient measured outcomes are an important means of evaluating the success of an intervention and our achieved QuickDASH median score of 11.36 is pleasing in this regard. Our technique is affordable, reproducible, and carries a low learning curve, making it ideal for inexperienced surgeons and resource-constrained environments.
Conclusion: We recommend this innovative and inexpensive method for measuring the passive tension at which tendon transfers are set. This study also provides practical guidelines with numerical values, regarding the ideal passive tension at which tendon transfers for radial nerve palsy are to be set for satisfactory and consistent results. Surgeons at all levels of experience can implement this technique to produce a reliable result while developing an understanding of tensions intraoperatively. Future studies are encouraged to evaluate and define long term clinical outcomes.

A-0665 Diagnostic accuracy of MRI and MR Arthrography in Scapholunate Interosseous Ligament Injury: A Systematic Review and Meta-Analysis

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Title: Diagnostic accuracy of MRI and MR Arthrography in Scapholunate Interosseous Ligament Injury: A Systematic Review and Meta-Analysis
Rationale: The diagnosis of scapholunate interosseous ligament (SLIL) injury can be challenging. No consensus exists on which radiological modality takes precedence in case of inconclusive X-rays and their accuracy remains an open question.
Objective: To systematically review and perform a meta-analysis for determination of the accuracy of 1.5T, 3T magnetic resonance (MR) imaging and direct and indirect MR arthrography in comparison to arthroscopy, considered the gold standard, for the diagnosis of SLIL injury in patients with chronic wrist pain or clinically suspected SLIL injury and inconclusive X-rays.
Methods: A systematic search was carried out in EMBASE, PubMed, Cochrane and CINAHL for studies reporting diagnostic accuracy of MRI and MRA for SLIL injury, irrespective of language. Exclusion criteria included: cadaver studies, diagnostic case control and case reports; no specifications of technical features; impossible reconstruction of 2x2 table. The studies were classified either MRI 1.5T, MRI 3T or MRA studies. The presence of SLIL was dichotomised to either torn or intact ligament. The risk of bias in individual studies was assessed using the QUADAS-2 tool. Statistical analysis was performed by using a mixed-effects bivariate model, resulting in pooled data and a summary receiver operator characteristic (sROC) for each group. Meta regression was employed to assess the effect of MRI field strength and the addition of an arthrogram on diagnostic performance in a multivariate model.
Results: Of the 1634 records, 43 articles were screened and full text was assessed. 823 participants in 15 studies, most retrospective, were included in

the meta-analysis. The mean patients' age of the included studies was 35.1 years. Mean time between MRI/MRA and arthroscopy was 2.1 months. QUADAS-2 showed poor internal validity, but better external validity. Pooled sensitivity and specificity for MRI-1.5T were 55.4% [95% CI, 44.1%-66.1%] and 93.7% [95% CI, 74.6%-98.7%], for MRI-3T 73.5% [95% CI, 62.7% – 82.0%] and 92% [95% CI, 38.2% – 99.5%] and for MRA 80.9% [95% CI, 74.5% – 86.0%] and 92.1% [95% CI, 86.7% – 95.4%]. Regarding the heterogeneity in the pooled sensitivities and specificities an I2 of 0.00% was found for MRI 1.5T, 33.8% for MRI 3T and 65.6% for MRA. Bivariate mixed effects meta-regression on all included studies showed a significant effect of higher field strength and the use of direct arthrogram on sensitivity, but not on specificity. The use of indirect arthrogram had no significant impact on either sensitivity or specificity.

Conclusions: Overall quality of reporting was poor, with small sample sizes and a large attendant risk of bias. This also complicated the analysis of the results as partial injury was poorly reported. Our pooled results suggest MRA is more sensitive than non-MRA MRI in the diagnosis of SLIL injury, with comparable specificity.

Keywords: Key WordsMR, scapholunate, sensitivity, specificity, diagnostic accuracy

A-0667 Arthroscopy Capsuloplasty and Temporary Screw augmentation in S-L tears grade IIIC & IV of the EWAS Classification. Medium term follow Up

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Introduction: Scapholunate instability is the most frequent of the carpus and there are multiple classifications according to arthroscopic and radiological findings. Depending on the radiological findings, it can be classify as dynamic, pre-dynamic and static injuries. Many surgical techniques have been proposed for the treatment of this entity, from traditional open to more recently by arthroscopy approach. As everybody know, none technique have been demonstrated the gold standard in term of results. Lately, dorsal and/or volar arthroscopic capsuloplasty of the SL ligament tears has been and alternative of treatment in selected patients, been more effective in cases, without a big gap of the S-L joint.

Purpose: The purpose of this study was to evaluate the clinical and functional outcomes of a series of consecutive patients with acute and subacute scapholunate injuries, which were treated with the association of arthroscopic capsuloligamentous suture of the S-L ligament and plasty augmentation by temporary screw through the scapho-lunate joint.

Materials and Methods: A retrospective study was carried out on 24 patients who underwet association of temporary scapholunate screw and capsuloligamentous suture at our institution between the period of 2007 and 2019. The inclusion criteria were patients with S-L tears IIIC & IV of the EWAS's classification with reducible acute and subacute scapholunate injuries, with a minimum follow-up of one year. The exclusion criteria were, irreducible and chronic tears, or with associated fractures. Clinical and functional outcomes were assessed with VAS, Quick Dash and the modified Mayo Clinic Score, in the preoperatory and at three, six, and twelve months postoperative. The gap of the S-L joint and the scapholunate angle were measurement by pre and post standard & dynamic X-rays of the wrist and also by reconstruction helical CT-scan

Results: The mean VAS score was 8.7 preoperatively against 0.2 at year. At year of follow – up, the mean Quick DASH score and Mayo wrist score were 0.78% and 93 points respectively. The intercarpal screws were removed an average of 3.5 years after the initial procedure. No case of carpal collapse was reported.

Discussion: There are few studies in which more than one surgical technique is associated for the treatment of scapholunate instabilities. Good results had been reported in the short term, with osteoarthritis or carpal collapse in the long term follow-up. In our series we obtained a follow-up with a very good and excellent results, in the short & medium term; with preservation of the carpal alignment. No patient presented carpal collapse. Two patient have been developed radiological osteoarthritis buy without clinical symptoms.

Conclusion: The association of the temporary scapholunate screw with the capsuloligamentous suture for the repair of reducible acute and subacute scapholunate injuries is a good alternative with excellent results that allow extent the indication of the arthroscopic capsuloplasty specially in advance stages with anormal S-L angle and big gap. The precise placement of the screw in the trajectory of the center of the scapho-lunate joint is the key stone of this technique.

Key words: Scapholunate injury, arthroscopic repair, temporary scapholunate screw

A-0670 What benefits can be expected from the improvement of surgeon-patient relationships? A literature review

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Introduction: There is a growing evidence that effective surgeon-patient relationship is an important factor of surgery outcome. To date, only one literature review focused on surgeon-patient communication was published 7 years ago (Levinson 2013). The present systematic literature review reports on the observed effects of the surgeon-patient relationship.
Method: All the publications containing ''patient–surgeon-relation/relationship/communication'' in the title were used to search Pubmed, Google scholar and Mendeley database as well as Youtube. Titles containing ''physician'', ''doctors'' but not ''surgeon'' were not included. Only documents in English or French were included. Searches were performed without any time restriction.

A data extraction form was developed including document's details (article, video,language, year of publication, number of citations), authors nationality and area of expertise (surgeon speciality, psychologist, scientist, politician, epidemiologist), study characteristics and design. When the effect of the relation on surgical outcome was mentioned, from the patient or surgeon perspectives, it was included in the data extraction form (qualitative or quantitative observation, outcomes measures, level of evidence).
Results: The literature search resulted in a total 46 publications, 3 of which were inaccessible. Thus, 43 publications were analyzed, 39 articles and 4 videos. American authors were 60%, European 26% and 14% from elsewhere in the world. Articles were quoted 0 to 147 times (average 23).

We observed a huge increase in the number of publications during the last decade: we counted 2 publications in the eighties, 5 in the nineties, 7 between 2001 and 2010, 29 between 2011 and 2020.

18 publications (42%) only described the importance or quality of the relationship and on its evaluation methods. 25 publications described the benefits that can be expected from a good relationship. Among these 25, 44% scientifically evaluate the benefits of a good relationship. Only 3 publications used scientifically validated tools to evaluate the quality of the patient-surgeon relationship (CARE and Q-PASREL).

This review also demonstrates that in addition to oral communication, videos, emails and even social media offer considerable opportunities to enhance surgeon-patient relationships.

The reported benefits of a good Surgeon-patient relationship are: improvement of shared decision making, greater patient and/or surgeon satisfaction, less surgical complications or better coping, less litigations, shorter consultations,

better patient treatment acceptance, improvement of surgeons reputation, shorter recovery time, better meeting of patients expectations, less surgeon Burn-Out, less psychological co-morbidities, public health financial saving.
Conclusion: Patient-surgeon relationship is potentially a major factor of the outcome of surgery. Improving the relationship could result in tremendous benefit for patients, surgeons and the community. Too little effort has been devoted to this issue so far.

A-0671 ScaphoTrapezioTrapezoidal Joint Arthritis Arthroscopic Treatment with Tendon allograft Double Interposition

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Introduction: Scaphotrapeziotrapezoidal (STT) joint arthritis is the second most common carpus arthritis. Its prevalence varies from 2–16%, mostly affecting older women. It is commonly associated with the first carpo-metacarpal (CMC) joint arthritis. Involvement of both STT and first CMC is known as pan-trapezial arthritis with a combined prevalence of 8%. In fact, STT arthritis may be a cause of residual pain after successful trapeziectomy for first CMC arthritis. Conservative treatment is recommended for mildly symptomatic cases: splinting, oral antiinflamatory medication and intraarticular steroid injections. However, the ideal surgical treatment is still controversial. There is a wide range of surgical options reflecting the lack of consensus as to the gold standard. Our goal is to describe our results with arthroscopic treatment with tendon allograft double interposition in simultaneous STT and first CMC arthritis.
Methods: We report 10 cases of simultaneous STT and first CMC joint arthritis treated arthroscopically with tendon allograft double interposition in our center, from 2016 to 2019.

The senior author's surgical choice is an arthroscopic approach of the CMC and STT joint, partial

resection of the trapezium and distal scaphoid (1–2 mm) and tendon allograft double interposition between scapho-trapezio-trapezoid and trapezial-metacarpal joint with tendon allograft (semimembranous, semitendinous or tiabialis) from our bone and tissue bank, and temporary fixation with k wire.

Postoperative protocol includes thumb splinting for five weeks, and then partially during night time until two months post-op. Rehabilitation with physical therapy was performed for three to five weeks.

Results: Mean age was 63.7 ± 8 years, and 57% were women.

Baseline preoperative Visual Analogue Scale (VAS) was 8.1, Kapandji score was 7,5 ± 0,5. After a median follow-up time of 3 years all scores improved: mean VAS is 2,35, mean QuickDash test is 7,4 ± 6,5 and Kapandji score is 9 ± 1.

Formal significance statistical tests were not performed due to the small sample size.

Pain, grip strength, and ROM were excellent at median follow-up of 3 years.

All patients were extremely satisfied with the procedure. We report two complication: one case of protrusion of the tendon allograft at 1 year post-op and one of dorsal thumb dysesthesia.

Discussion: Much has been discussed in the literature about the most effective treatment for isolated STT joint arthritis and combined STT and first CMC. The use of arthroscopic treatment for both conditions simultaneously is rare and with this report we show the successful results of such procedure with double tendon allograft interposition, avoiding total trapeziectomy, maintaining radial column height and thus minimizing carpal instability. The reduced surgical time by using allograft instead of classic autograft, showed excellent outcomes with minimal complications.

Conclusion: In our experience, this type of arthroscopic procedure offers excellent results with minimal complications. Our cases prove that it be a valuable alternative in surgical treatment of simultaneous STT and CMC joint arthritis.

A-0673 A prospective comparative study between Monocryl, Vicryl Rapide and Ethilon for skin closure in open carpal tunnel decompression

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Background: Open carpal tunnel decompression is a common operation with approximately 5000 of them performed in Scotland in 2015 [1]. To date there remains no consensus regarding which suture material is the best to use for skin closure. This study aims to assess the effects that Monocryl (absorbable monofilament), Vicryl Rapide (absorbable polyfilament) and Ethilon (non-absorbable monofilament) have on wound closure following elective open carpal tunnel decompression surgery.

Method: We identified 109 patients who underwent open carpal tunnel decompression from June to December 2020. All patients were followed up via a face to face or telephone consultation at day 14 post-operative. The primary outcome was to compare the incidence of wound issues including dehiscence, erythema, stitch abscess and infection in each group. The secondary outcomes were to determine the requirement for antibiotic prescription for wound infections, the number of postoperative hospital admissions and the number of reoperations.

Results: Of the 55 patients whose wounds were closed with Monocryl, 5 of them had a post-operative complication including 2 dehiscence's, 2 with erythema and 1 with a dehiscence and infection. For the patient with an infection, this was diagnosed and treated with antibiotic therapy by their own General Practitioner. One patient required re-admission for a washout of a non-suture related haematoma. For the 31 patients whose wounds were closed using Vicryl Rapide, 3 of them had a post-operative complication including 1 dehiscence, 1 infection and 1 with a dehiscence and infection. Both patients with infections were diagnosed and treated with antibiotic therapy by their own General Practitioner. Of the 23 patients whose wounds were closed using Ethilon, 2 of them had a post-operative complication including 1 dehiscence and 1 with erythema. No patients in either the Vicryl Rapide or Ethilon groups required further hospital admission or re-operation. All wound complications which may have been related to the suture material were managed conservatively with no surgical intervention required.

Conclusion: It is difficult to confer from the results of this study if one suture material offers superiority over another with regards to wound closure following an open carpal tunnel decompression. However, given that the absorbable suture material does not require an appointment for removal of sutures and therefore is less time and potentially cost intensive, it could be argued that this may be the more ideal suture material to use.

Reference

https://online.boneandjoint.org.uk/doi/abs/10.1302/1358-992X.2017.19.007.

A-0679 Antegrade intramedullary nailing in comminuted, open metacarpal bone fracture

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Purpose: The purpose of this study was to evaluate the radiological and clinical outcomes of treatment of comminuted open fractures of the metacarpal with associated injuries to soft tissues, tendons, and neurovascular structures using antegrade intramedullary nailing at least 2 years postoperatively.
Methods: Between January 2008 and December 2017, 27 patients who met the inclusion/exclusion criteria were enrolled in this study. The inclusion criterion was open and comminuted fracture (with/without segmental bone defects). We evaluated simple radiograph and computed tomography (CT) findings and clinical conditions (visual analog scale [VAS] pain score and Disabilities of the Arm, Shoulder, and Hand [DASH] score), including active range of motion (ROM) and grip strength at final follow-up.
Results: The mean preoperative dorsal angulation was $29.63 \pm 7.59^{\circ}$ and the mean shortening was 9.30 ± 2.38 mm. Union was achieved at mean 12.3 weeks postoperatively, without any complications due to operative treatment. The angulation measured on the CT scans, shortening on simple radiographs significant improved ($10.26 \pm 3.19^{\circ}$, 0.52 ± 1.05 mm, respectively). The final VAS and DASH scores were 0.41 ± 0.64 and 3.6 ± 2.47, respectively, indicating satisfactory outcomes. The final ROM were $85.0 \pm 3.67^{\circ}$. The mean final grip strength was $89.56 \pm 5.69\%$ relative to the normal side. A mean extension lag at the MP joint of 12° was noted in three patients; however, it was resolved by additional tenolysis.
Conclusions: AIN is a simple method for fixation of open comminuted metacarpal fractures accompanied by soft tissue injury. The simplicity of the method is beneficial for repairing associated injured structures and healing soft tissue. Minimized additional damage around the MCB during surgery and good stability resulted in satisfactory bony union with minimal angulation, shortening, and rotation.

A-0681 Reconstructive operations of the thumb after traumatic deformities in children

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Background: Post-traumatic skin defect of the thumb and its reconstruction represents a problem in order to restore function and good aesthetic appearance. The thumb bears 50% of the hand function. Together with the second finger, their function is 70% of the entire hand function. A good reconstructive procedure should achieve both cosmetic and functional results and should be customized for a specific defect.
Materials and Methods: From 2007 to 2016, we did 210 microsurgical toes to hand transfer (306 transplants). And 267 (87.3%) of these, in patients with congenital pathology and 39 (12.7%) with posttraumatic deformities of the hand. In total, 352 fingers were reconstructed.
Results: According to our study, the blood supply disturbance of the toes transplants was in 19 (6.2%) cases of 306. Most of them caused in the early postoperative period (73.7%). The main cause of microcirculatory disorders was thrombosis of the venous or arterial trunks (8 cases). In 6 patients, the blood supply disturbance occurred as a result of thrombosis of autovenous insertions. Two patients had necrectomy at 7 and 18 days because conservative and operative treatment was not successful.
Conclusion: The method of choice for the appearance of the first signs of the blood supply disturbance in transfer toe is conservative therapy, which includes disaggregants, anticoagulants and hirudotherapy.

The effect of conservative therapy should be performed in 3 hours from the beginning of ischemia, if it is absent, the patient must be operated.

The operation includes soft tissue decompression, the mechanical pumping across of vascular anastomoses, and if it necessary, excision of abnormal part of the vessel with subsequent autoplasty.

A-0685 The Effects of Kinesio Tape® and No Tape for Muscle Facilitation and Inhibition, for Collegiate Athletes with Self-Reported Shoulder Pain

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Kinesio Tape® reports to target receptors within the somatosensory system to relieve pain (KTAI, 2013a) and inhibit overused and painful muscles (Kase, Wallis, & Kase, 2013). Despite the popularity of kinesiology taping, there is a lack of understanding of how this method improves muscle function and pain control. To have a better physiological understanding of Kinesio Tape®, surface EMGs (sEMG) to record motor output while measuring pain was used. The research question was: Does Kinesio Tape® cause a difference in muscle facilitation, inhibition, and pain, between Kinesio Tape® and no tape for collegiate athletes with self-reported shoulder pain? This quantitative non-randomized design used a convenience sampling method. Eleven participants with self-reported shoulder pain, who were collegiate athletes on the men's and women's lacrosse and tennis teams were recruited. Each participant received all three taping conditions (no tape, Kinesio Tape® inhibition, and Kinesio Tape® facilitation) during the session. All participants were unaware if they were receiving facilitation or inhibition taping methods. After being taped, sEMG electrodes were placed on the skin surface of the participant's affected extremity to the designated muscle bellies: (a) anterior deltoid, (b) supraspinatus, and (c) lower trapezius to measure muscle facilitation and inhibition. Participants performed four repetitions with maximum voluntary contractions (MVCs) which was repeated for each taping method. Each participant completed the visual analogue scale (VAS) before and after each trial to measure pain. The following descriptive statistics for average MVCs were: Anterior deltoid; no tape ($M = 13.78$, $SD = 5.42$), inhibition ($M = 13.50$, $SD = 5.30$), and facilitation ($M = 13.57$, $SD = 5.03$). Supraspinatus; no tape ($M = 7.52$, $SD = 2.50$), inhibition ($M = 7.52$, $SD = 2.77$), and facilitation ($M = 7.60$, $SD = 2.88$) and lower trapezius; no tape ($M = 163.54$, $SD = 90.02$), inhibition ($M = 158.52$, $SD = 76.64$), and facilitation ($M = 148.90$, $SD = 79.24$). A one-way ANOVA was utilized with a Tukey post-hoc comparison to compare the percentage of muscle function in each taping method. The results revealed no statistical significance between the taping methods for each muscle: Anterior deltoid ($p = .993$), supraspinatus ($p = .997$), and lower trapezius ($p = .922$). Pain was recorded using the VAS before and after each taping intervention with the difference being found between the two. The average mean score for the change in pain levels were as follows for participants; No tape ($M = 0.11$, $SD = 0.43$), inhibition ($M = -0.43$, $SD = 0.71$), and facilitation ($M = -0.32$, $SD = 0.59$). A one-way analysis of variance (ANOVA) with a Tukey post-hoc comparison showed no significant difference between the taping methods with ($p = .118$). A Pearson product-moment correlation was calculated for the relationship between pain and percentage of muscle function. No significant direct or indirect relationships between any taping method and pain were found. In conclusion, Kinesio Tape® for facilitation or inhibition does not significantly increase or decrease the percentage of muscle function or have a significant influence on pain.

A-0686 The influence of illness perception and mental health on return to work after carpal tunnel release

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Purpose: Although multiple factors influencing return to work after a carpal tunnel release(CTR) have been identified, little is known about the influence of psychological patient factors on return to work. Therefore, this study aims to identify which psychological factors play a role in the return to work after a CTR.
Methods: Patients planned for a CTR were asked to fill out the Brief Illness Perception Questionnaire(Brief IPQ) and the Patient Health Questionnaire (PHQ-4) preoperatively to measure illness perception and mental health status subsequently. Return to work was defined as the time until returning to work for 50% of the original contract hours and was measured using a questionnaire at six weeks, three months, and six months. To identify associations between non-psychological- and psychological patient factors and the return to work after a CTR, a Cox proportional hazards model was constructed.
Results: In total, 615 patients were included in our study. Six months postoperatively, 91% of the patients returned to work. For the psychological patient factors, we found that an increase of one point on the item worrying about CTS and on the item having faith preoperatively in a beneficial effect of the CTR was associated with a hazard ratio (HR) of 0.92 95%CI[0.88–0.96] and 1.10 95%CI[1.02–1.19] for returning to work in the first six months postoperatively respectively. An increase of one point on the depression subscale of the PHQ-4 was associated with an HR of 0.88 95%CI[0.78–0.99] for

returning to work in the first six months postoperatively.
Conclusions: Our study showed that multiple psychological patient factors are associated with the return to work after a CTR. Addressing these psychological factors preoperatively might be low-cost interventions to improve return to work after carpal tunnel release.

A-0687 Arthroscopic Recession of the ECRB for Surgery of Tennis Elbow

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Background: The aim of this study was to assess the functional outcomes and time to improve after arthroscopic recession of the extensor carpi radialis brevis (ECRB) tendon in patients with recalcitrant tennis elbow by sharply cutting the tendon arthroscopically.
Methods: In a prospective study, we included 14 consecutive patients including 3 (21%) men and 11 (79%) women with a mean age of 41 years (standard deviation = 6.8). All but one surgery was on the right elbow while all 14 patients were right-handed. During arthroscopy after shaving the synovium, a no. 11 blade was used to cut the ECRB tendon at the level of radiocapitellar articulation while avoiding the lateral collateral ligament, which is considered a tendon recession as is done in spastic muscles. Patients were followed up for 1, 3, 6, and 12 month intervals and were asked to fill the Mayo Elbow Performance Index (MEPI), Quick Disabilities of the Arm Shoulder Hand (QuickDASH), and Patient-Rated Tennis Elbow Evaluation (PRTEE).
Results: The mean PRTEE, QuickDASH, and MEPI scores showed significant improvement over time ($P < 0.001$). There were 5 excellent, 6 good, 1 fair and 2 poor results based on MEPI. Improvement progress took more than 6 months after surgery. Arthroscopic tendon suturing was done in 3 patients all of whom were categorized as fair or poor. One of the 3, required radial nerve neurolysis and the radial nerve was entrapped in the scar tissue. We could not find any relationship between improvement and other factors including the number of corticosteroid injections, symptom duration, dexterity, age, and sex.
Conclusion: Arthroscopic tennis elbow surgery is a safe and effective way in managing recalcitrant conditions although patients should be informed of the expected time to improve. A simple release and tendon recession without using any suture works effectively and is comparable in results with the other arthroscopic techniques.
Level of Evidence: Level V Prognostic
Keywords: Elbow, Arthroscopy, ECRB, Tennis Elbow, Enthesopathy of ECRB, eECRB

A-0691 Mid-Term Results of Patient-Specific Polymethylmethacrylate Radial Head Prosthesis in Complex Radial Head Fractures: Report of 8 Patients

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Purpose: In this prospective case report, we used the antibiotic-impregnated polymethylmethacrylate (PMMA) bone cement to make a patient-specific radial head prosthesis (RHP) by applying the 3-dimensional (3D) designing technique.
Methods: We used a computed tomography (CT) scan of both elbows to reconstruct the bones in Mimics software and used the contralateral uninjured radial head to mirror and reconstruct the fractured head and the stem by considering stem offset and tilt relative to the head. A mold was made respective to the design, and the RHP was made intraoperatively by pouring the PMMA bone cement inside the mold. To cut an adequate length of bone equal to the prosthetic neck length, a customized cutting guide was designed and 3D printed by referencing from the intact capitellum. RHP was fit loose in the canal. The lateral collateral ligament was repaired in all patients, while the medial collateral ligament was not approached in any. We followed the patients for a mean of 18 months (13–20 months).

Results: We treated the radial head fracture with a patient-specific PMMA RHP in 8 patients. Mean grip strength was 86% of the unaffected side. The mean arc of extension-flexion and supination-pronation of the operated side was 86% and 96% of the unaffected side, respectively. One patient complained of proximal forearm pain that appeared one year after surgery. She was the only patient with signs of loosening on the radiographic exam. Based on the Mayo Elbow Performance Index (MEPI), there were 4 excellent, 3 good, and 1 fair results. Moreover, the mean DASH score was 8 out of 100 (0–22), showing minimal disability while the patient can cope with most living activities. No patient ever complained of ulnar nerve symptoms requiring intervention.
Conclusion: When resources are limited or not available, PMMA RHP can be used safely as an alternative to metal prostheses to restore the forearm's valgus and axial stability. The use of 3D printing optimized the radial head arthroplasty's design and surgical technique, and we need further studies to assess the long-term follow-ups.

Type of Study/Level of Evidence: Therapeutic IV.
Keywords: Radial Head Prosthesis, Polymethylmethacrylate, 3-Dimensional, Patient-Specific

A-0692 Ultrasound-guided, ultra-minimally-invasive carpal tunnel release – literature review of a novel trend in hand surgery and discussion of own preliminary results

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Introduction: A trend towards ultrasound-guided, ultra-minimally invasive procedures has emerged in consequence of the overall tendency towards minimal-invasive or even "scarless" surgery and the availability of high-frequency linear probes with improved quality displays. Our aim was to review the current state of knowledge of this innovative trend in carpal tunnel release (CTR), and to present preliminary results of our own study in 35 patients.

Material and Methods: We performed a literature analysis of all clinical (excluding cadaver) studies on ultrasound-guided, ultra-minimally-invasive CTR published since its original description by Nakamichi et al. in 1997. Furthermore, we used clinical parameters and patient-based outcome measures (Boston CTS-Q, Levine-Katz and DASH scores) to conduct a retrospective analysis of data from 35 patients that had undergone ultrasound-guided, ultra-minimally-invasive CTR performed by the first author in our own department.
Results: The literature analysis identified 16 studies (5 prospective, 4 comparative, 7 clinical), including in total 1030 (mean 64, range 3–350) patients. In all but two studies, a single incision ranging from 1–10 mm was used; in the remaining two studies, the procedure was performed with a biportal approach. Under guidance of probes with frequencies ranging from 5–20 MHz, the flexor retinaculum was transected in a retrograde fashion in 11 and in an anterograde way in five studies. Most commonly, a small arthroscopic hook knife was used (n = 8), less frequently special anterograde cutting devices, needles, scalpel blades, or a thread (gigli saw principle). The procedure was mostly performed in the operation theatre (n = 12), but also in out-patient offices or intervention room settings (n = 4). An equal number of procedures was performed by (either hand, plastic, or orthopaedic) surgeons and by non-surgeons (physiatrists, rheumatologists, or radiologists). In all but one study, the procedure was performed under local anaesthesia, two groups took a WALANT approach. None of the 16 studies reported of major complications, e.g. neuro-vascular injury, on follow-up (range 3–24 months)

Our own results revealed that the patients could return to full activities of daily life 1 to 6 days after the ultrasound-guided, ultra-minimally-invasive CTR. All patients rated their results as highly satisfactory. Three early patients underwent secondary open completion of the procedure. Otherwise no complications occurred.

Discussion and conclusion: Ultrasound-guided, ultra-minimally-invasive CTR seems to be a reliable and safe procedure with important benefits when compared to classic open, mini-open, or endoscopic techniques. Advantages include significantly smaller incisions or puncture wounds (1–3 mm) that do not require sutures, improved safety due to direct visualization of anatomic structures (including anatomic variations), and feasibility under local anesthesia. Minimized postoperative morbidity and scarring may allow for timely return to daily activities and work. This innovative approach, despite a considerable learning curve, potentially offers important medical, economic, and aesthetic advantages, and should therefore be considered by hand surgeons.

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