

Abstracts provided by authors in alphabetical order.

## **VALIDITY OF INERTIAL SENSOR-BASED MEASUREMENT WITH A ROBOT ARM**

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### **Introduction**

Inertial motion analysis systems are increasingly used in medical diagnostics due to their low cost and lack of laboratory space limitations. Contrary to optometric motion analysis systems, angles are measured indirectly using accelerometer, magnetometer, and gyroscope readings. The accuracy of the angle measurement largely depends on the software provided by the manufacturer and is not the same for all sensor axes.

### **Aim**

To validate the measurements of the RSQ Motion sensor in the roll and yaw axes in relation to the KUKA KR3 R540 AGILUS industrial robot. To analyse the effectiveness of the algorithm correcting the readings in the yaw axis.

### **Material and methods**

One RSQ Motion sensor was placed on the robot arm. Eight different angular positions were tested, each in the continuous sensor measurement mode. 9 repetitions were performed for each of the angular positions in 11 series. The accuracy of sensor measurement was calculated as the difference between the angle on the robot and the averaged sensor reading for the fixed position.

### **Results**

The mean measurement error (mean±SD) for all tested angles was  $0.04 \pm 0.03^\circ$  (roll axis). For the yaw axis without the correction algorithm, it increased with the given angle from  $0.64 \pm 0.41^\circ$  to  $5.72 \pm 2.71^\circ$ . The correction algorithm applied to the yaw axis eliminated the error increase with the given angle, and the mean measurement error was  $0.12 \pm 0.12^\circ$ .

### **Conclusions**

The measurement taken on the roll axis of the RSQ motion sensor is a very accurate measurement, suitable for medical diagnosis. The correction algorithm applied to the yaw axis turned out to be very effective.

**Keywords:** inertial sensors, motion capture, validation.

## **ISOKINETIC PERFORMANCE AND RECOVERY AFTER ARTHROSCOPIC BANKART REPAIR- PROSPECTIVE STUDY**

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### **Introduction**

Restoring shoulder instability by arthroscopic labral repair proved its efficacy. However, another issue is to restore shoulder strength.

### **Aim**

The aim of the study was to evaluate shoulder isokinetic profile in recovery after arthroscopic Bankart repair.

### **Material and methods**

61 patients who were evaluated 4 and 6 after arthroscopic Bankart repair. The Biodex System 3 station was used for examination of the shoulder's concentric muscles' strength according to standard isokinetic protocol. Selected parameters were used for evaluation and comparison between involved to uninvolved shoulder and the progress of individual parameters.

### **Results**

All analyzed parameters progressed in short term observation by 14.6-66.3% ( $p < 0.0001$ ). The deficits between the operated and non-operated limbs were significant after 4 m (10.7–39.1%) and slightly or completely eliminated after 6 m (-9.8–26.8%,  $p < 0.0001$ ). There was no correlation between limb dominance and the effectiveness of rehabilitation. Only the results of the strength parameters are gender-dependent – men are objectively stronger (peak torque to bodyweight  $p < 0.0001$ , progress and deficits of other parameters  $p > 0.0001$ ). The greatest differences between the operated and non-operated upper limb are in the angular velocity of  $360^\circ/s$  – almost 39% of the deficit after 4 months and over 26% after 6 months ( $p > 0.005$ ).

### **Conclusions**

Complete or nearly complete recovery of isokinetic shoulder profile after arthroscopic Bankart repair takes at least 6 months. There was a significant deficiency in all parameters at 4 months and, however, also significant progress after another 2 months of rehabilitation. Limb dominance is not a factor for the ability of the shoulder to recover, as same as gender.

**Keywords:** isokinetic assessment, shoulder instability, arthroscopy.

## **REVERSE SHOULDER ARTHROPLASTY IN MANAGEMENT OF PROXIMAL FRACTURE OF THE HUMERUS**

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Reverse shoulder arthroplasty (RSA) is becoming the preferred treatment for displaced proximal humerus fractures in elderly patients.

Questions that need to be addressed:

1. In the most recent literature, there is no real definition for «elderly patients. Most of the time, this population has around 80 years at the time of proximal humerus fracture, patients who underwent RSA treatment had a high survival rate (94% at 1 year, 73% at 5 years), which is better than the survivorship reported after surgical treatment of femoral neck fractures (81–87% at 1 year, 38% at 5 years). The presence of comorbidities (ASA > 3–4) and/or cognitive disorders are risk factors for early mortality. Those parameters have to be taken into account in the surgical decision process (Maugendre *et al.*, 2019).
2. Why is an RSA indicated in 4-parts fracture of the proximal humerus (Bonnevialle *et al.*, 2016)?

Complex 4-part fractures of the proximal humerus are one of the most difficult fractures to manage, and we know that in this specific population, this has to be considered a one-shot procedure. RSA has been proposed as an alternative to hemiarthroplasty (HA) when internal fixation is insufficient. We have learned from our experience and a prospective cohort study that at short and intermediate-term, clinical outcomes are better with RSA than with HA (absolute Constant score, the quick-DASH, or the SSV scores). The complication rate is higher with HA (24% vs. 10%,  $P = 0.01$ ). The radiological rate of the union of the greater tuberosity was similar in both groups (70%) if a specific designed for fracture prosthesis is implanted. In addition, we know that clinical results in terms of mobility are more reproducible and predictable in the RSA group, especially in elevation and internal rotation ( $130^\circ$  vs.  $112^\circ$ ,  $P = 0.01$ ; sacrum vs. L3,  $P = 0.03$ ).

Nevertheless, scapular notching occurred in more than 20% of patients with RSA, suggesting that care should be taken when using this prosthesis in the youngest and still active patients.

3-The surgical technique matters – especially in terms of tuberosity fixation (Boileau *et al.*, 2019).

Despite the advanced age of the patients or osteoporosis level, tuberosity reattachment is mandatory. This lead to a high rate of tuberosity healing (84% in our prospective study). Tuberosity reconstruction and healing in reverse shoulder arthroplasty for fractures improve active forward elevation, external rotation, and patient satisfaction. For patients without healing of their tuberosities, results were significantly lower subjective results (Subjective Shoulder Value of 65% vs. 83%,  $P = .029$ ) and lowered active mobility in forward elevation ( $115^\circ \pm 26^\circ$  vs.  $141^\circ \pm 25^\circ$ ,  $P = .023$ ) and external rotation ( $11^\circ \pm 12^\circ$  vs.  $27^\circ \pm 12^\circ$ ,  $P = .010$ ). The main radiographic complications for those patients were tuberosities migrations and or tuberosities resorption. This indicates that the surgical technique of tuberosities reattachment is mandatory, and bone grafting is necessary.

In conclusion, it seems that Reverse Shoulder Arthroplasty is indicated in displaced proximal humerus fractures in elderly patients. Moreover, tuberosity fixation and healing around the prosthesis would result in better outcomes and patient satisfaction.

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## **NERVE TRANSFERS IN BRACHIAL PLEXUS INJURY – ANALYSIS OF 12 PATIENTS**

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### **Introduction**

Brachial plexus injury causes significant limitation of upper limb functions. In some cases, nerve transfer techniques should be considered, mainly to restore shoulder function and elbow flexion.

### **Aim**

The study aimed to evaluate the shoulder and/or elbow function after nerve transfers in patients with brachial plexus injury – own experiences.

### **Material and methods**

Twelve patients were operated on with partial brachial plexus injury in the years 2013–2020, with indications and the possibility of nerve transfers. In ten, we performed transfers to improve shoulder function, and seven had transfers to improve elbow flexion. The follow-up was at least nine months. At that time, patients used electrostimulation and were rehabilitated under the physiotherapist's supervision. We evaluated the improvement in limb function by assessing the range of active motion and strength according to the Lovett scale.

### **Results**

Shoulder transfers caused stabilization of the humeral head in the glenoid in all patients. Nine allowed for active movement within a varied range of flexion, abduction, and internal rotation. Elbow transfers in four patients resulted in fully flexing the joint with M4+/M5 force, two patients with flexion of 0–90° with M3 force, and one with lack of active flexion. There was no muscle function loss after the median and ulnar nerve bundles were collected, while one patient caused a transient decrease of sensation in the ulnar nerve's area. We performed additional secondary procedures in 7 patients.

### **Conclusion**

The technique of nerve transfers, in selected situations, may be effective and give a clinical and functional improvement in patients after brachial plexus injury.

**Keywords:** brachial plexus injury, nerve transfers, shoulder dysfunction, elbow dysfunction.

## **A BRACHIAL ARTERY PSEUDOANEURYSM AS A RARE COMPLICATION OF A PROXIMAL HUMERUS EXOSTOSIS**

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### **Introduction**

Osteochondromas are benign bone tumors. Mostly they are asymptomatic. Sometimes, they cause painful skin pressure during limb movement or irritate vessels or nerves.

### **Aim**

We present two cases of brachial artery pseudoaneurysm as a rare complication of humerus exostosis, treated surgically by orthopedists with vascular surgeons.

### **Material and methods**

First case: A 24-year-old male patient with arm acute pain, swelling, and hematoma on the medial side and III-V finger numbness – no traumatic history. In childhood was diagnosed with osteochondroma. The lesion was palpable under the skin, hard, painless, moves with the arm's movement with positive Tinel sign. Good blood supply to the upper limb. Ultrasonography revealed a pseudoaneurysm of the brachial artery.

Second case: A 19-year-old male patient with acute pain in the arm. Earlier diagnosed with multiple osteochondromas. Examination – palpable, non-painful tumor of the axilla's area and the posterior part of the arm. MRI demonstrated three osteochondromas in humerus with nodular structure – chondrosarcoma was suspected.

### **Results**

First case: We operated with vascular surgeons. The pseudoaneurysm and osteochondroma were identified and removed, and the brachial artery was patched with a continuous suture. Second case: We took samples for histopathology. Another day increased pulsations were observed around the operative area. Ultrasonography revealed a fibrotic pseudoaneurysm of the brachial artery. Histopathological examination showed only deposits of hemosiderin. Another operation was performed. The artery was reconstructed using a saphenous vein, and the osteochondroma was removed.

### **Conclusion**

Artery pseudoaneurysms are rare complications of osteochondromas in the upper extremities. It should be suspected, especially in the close location of large vessels.

**Keywords:** brachial artery pseudoaneurysm, osteochondroma, Exostosis, rare complication.

## **ARTHROSCOPIC TREATMENT OF POSTERIOR SHOULDER INSTABILITY – EVALUATION OF OUTCOMES AND RECOVERY**

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### **Introduction**

Posterior shoulder instability (PSI) is a relatively uncommon type, usually results from repetitive trauma related to sports. In cases of labral tears and clinical deficiency, the arthroscopic repair is commonly recommended.

### **Aim**

The study aimed to assess functional outcomes and biomechanical recovery of the patients with PSI treated with arthroscopic posterior labral repair with anchor fixation.

### **Material and methods**

37 patients were evaluated before the procedure, then follow-up continued after 2, 4, 6, and 12 months. Evaluated data involved Range of Motion (ROM) – flexion, abduction, and external rotation – along with shoulder function measured by UCLA and WOSI scales. Furthermore, the isokinetic profile of the shoulder was tested in external and internal rotation.

### **Results**

2 months after the arthroscopic treatment, a significant decrease was noticed in ROM by 19.5–38% ( $p < 0.001$ ). In the 4th month, ROM increased by 22.5–31.2% ( $p < 0.014$ ) and didn't change in the next time intervals. UCLA improved in the 4th month by 20.7% ( $p < 0.0001$ ), while WOSI was comparable with preoperative data. In 6m results of both scales rose further by 10.9–30% ( $p < 0.0042$ ). No significant difference was observed after 12 m. The improvement of isokinetic profile ranged from 14.6% to 161.7% ( $p < 0.013$ ).

### **Conclusions**

Treatment of PSI is linked with substantial restriction of shoulder function and mobility in the first 2 months after the operation. 4 months after the procedure is enough to regain complete shoulder function and mobility. Nearly complete recovery was achieved at 6 months, although also at 4 months deficits range at around 20%.

**Keywords:** range of motion, shoulder instability, posterior shoulder instability, biomechanics.

## **THE INFLUENCE OF SHOULDER ARTHRODESIS ON THE FUNCTION OF THE UPPER LIMB IN ADULT PATIENTS AFTER A BRACHIAL PLEXUS INJURY – A SYSTEMATIC LITERATURE REVIEW WITH ELEMENTS OF THE META-ANALYSIS**

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### **Introduction**

Indications for shoulder arthrodesis have decreased due to shoulder arthroplasty. It is often performed in the brachial plexus palsy, where there is no indication for neurosurgical treatment, or it is ineffective.

### **Aim**

This study aimed to evaluate the functioning of the upper limb after glenohumeral arthrodesis in adult patients with brachial plexus palsy, based on the literature.

### **Material and methods**

Databases were searched until April 2021 to identify studies describing shoulder arthrodesis outcomes in adult patients with brachial plexus paralysis. The data included: number of arthrodeses, gender, age, follow-up, mechanism of injury, pain before and after the operation, type of fixation, the position of the arthrodesis, complications, functional outcomes, and subjective patient satisfaction.

### **Results**

294 shoulder arthrodeses were assessed with a mean follow-up of 5.5 years. The most common cause of injury was a motorcycle accident. Arthrodesis position was ranged from 15–40 degrees of flexion, 15–60 of abduction, and 0–50 of internal rotation. Plates, screws, and external fixation were used for stabilization. The complication rate was at the level of 28%. Active flexion and abduction averaged 61 and 56 degrees, respectively; reaching the hand to the mouth, front pocket, and buttock was feasible for 69%, 71%, and 38%, respectively, after surgery. Shoulder pain was present in 77% of patients, and 28% experienced no relevant pain reduction after surgery. The subjective satisfaction rate was 82%.

### **Conclusions**

Shoulder arthrodesis in brachial plexus palsy, reducing shoulder pain, increases stability, and improves active function. This increases the possibility of carrying out everyday activities and gives high patient satisfaction.

**Keywords:** shoulder arthrodesis, shoulder fusion, brachial plexus injury.

## **EVALUATION OF SURGICAL TREATMENT OF SCAPULAR BODY AND GLENOID FRACTURES IN 23 PATIENTS**

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### **Introduction**

Scapular fractures represent only 0.7% of all fractures and are associated with high energy injury. The majority of fractures can be treated nonoperatively, however, patients with substantial glenoid or neck displacement benefit from surgical treatment.

### **Aim**

The aim of the study was to evaluate clinical outcomes of open reduction and internal fixation of scapular fractures, involving not only glenoid but also scapular body, treated in our institution.

### **Material and methods**

23 patients that underwent surgical treatment from 2013 to 2020 were included in the retrospective study. Clinical outcome was assessed by evaluating shoulder range of motion and pain on a numeric rating scale (NRS).

### **Results**

18 out of 23 patients were included in the analysis, as 5 patients were lost-to-follow-up. Patients were predominantly males (66.7%), with an average age of 46 years (25–67). The mean follow-up of the patients was 54 weeks (6–149). Most common fracture type (57%) was 14F0 (AO classification – extraarticular glenoid neck fracture). The deltopectoral approach was performed in 3 cases, the Judet approach in 5 and the mini-open in 15. The most common type of scapula fixation was 2 plates (57% of patients). 43% of patients had multiple fractures involving clavicle, radius, metacarpals, spine, pelvis, or ribs. Postoperative range of motion was: mean flexion 140° (60°–180°), abduction 133° (40°–180°) and external rotation 48 (-10°–80°). Mean pain in NRS was 1 (0–3). One patient reported poor results due to concomitant partial brachial plexus palsy.

### **Conclusion**

This study shows that patients eligible for surgical treatment present good clinical outcomes, however, the indications for surgery are still not clear.

**Keywords:** scapula fractures, scapula osteosynthesis.



## **SHOULDER CLINICAL AND BIOMECHANICAL ASSESSMENT OF HEDS AND HSD PATIENTS**

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### **Introduction**

Ehlers Danlos Syndrome (EDS) is a genetic mutation responsible for protein coding, which further leads to changes in soft tissue construction. One of the most common types of EDS is the hypermobile type. It is very often mixed by mistake with HSD – Hypermobility Spectrum Disorders. The biggest issue is not only the genetic but also clinical diagnose, which will lead to the most appropriate treatment arrangement.

### **Aim**

Clinical and biomechanical assessment of hEDS and HSD patients.

### **Material and methods**

144 patients were examined, after the preliminary test, 37 patients with hEDS and 32 patients with HSD were qualified for the study. Patients underwent shoulder clinical examination and rotator cuff biomechanical examination on Biodex System 4 Pro with the isokinetic protocol. Additionally, we decided to examine patients' shoulder muscles bioelectric activation during shoulder movement with Noraxon Telemetry GT2000. Patients were also assessed with ASES and DASH questionnaires and hEDS questionnaire developed by EDS Society.

### **Results**

We observed a significant decrease in both examined groups of external rotator cuff biomechanical parameters ( $p < 0.005$ ) in comparison to the internal rotators. The average muscle balance ratio was 46% in all examined trials in both groups. We observed a significant increase of deltoideus bioelectric activation, especially the middle part, during abduction movement and resisted abduction. The activation of supraspinatus was diminished at the same time.

### **Conclusions**

Lack of shoulder stability and its dislocations in hEDS and HSD cases may be connected with a lack of shoulder muscles balance and abnormal activation during shoulder movement. Biomechanical and bioelectric testing may be a useful tool for hypermobile patients assessment.

**Keywords:** Ehlers Danlos Syndrome, HSD, proprioception.

## **SHOULDER CLINICAL AND BIOMECHANICAL ASSESSMENT OF PROFESSIONAL STANDARD DANCERS**

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### **Introduction**

Professional dancers, due to their training and activity, are constantly exposed to overloads which may lead to soft tissue damage and microtrauma. A lot of scientific research is concerned with biomechanical testing of contemporary, classical, or hip-hop dancers. Despite the fact that more and more research with advanced biomechanical devices is conducted, there are only a few papers that are concerned with the assessment of professional standard dancers. Nevertheless, nearly none of them is trying to assess the upper limb and its biomechanical parameters.

### **Aim**

Biomechanical parameters and most common upper limb complaints among professional standard dancers assessment.

### **Material and methods**

20 professional standard couples were qualified for this study. The average time of couple practice was 12 years. To assess shoulder muscles, we used an electronic dynamometer and isometric protocol for flexion, extension, abduction, adduction, and rotations movement. Shoulder clinical examination consists of the basic rotator cuff, shoulder impingement, and instability tests. We used the Beighton scale to assess generalized joint hypermobility and the DASH questionnaire to assess dancers' upper limb condition.

### **Results**

The most common complaint of female dancers was cervical neck and shoulder pain after training and competitions. For male dancers, the most common complaints were concerned with shoulder and elbow. Isometric testing revealed a significant difference ( $p < 0.05$ ) between rotator cuff biomechanical parameters. Beighton scale was significantly higher in the female dancers' group in comparison with male dancers.

### **Conclusions**

Standard dancers are exposed to continuous shoulder girdle muscles overload due to repetitive shoulder elevation, which leads to rotator cuff muscles imbalance. This preliminary study indicates further research for more precise dancers' assessment.

**Keywords:** dancers, biomechanics, Biodex.

## VALIDITY AND RELIABILITY OF SHOULDER RANGE OF MOTION MEASUREMENT USING INERTIAL MOTION UNITS

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### Introduction

Assessment of range of motion (ROM) is an essential part of the orthopedic examination. The development of new technologies gives clinicians the possibility to use devices other than a goniometer for measuring ROM.

### Aim

The aim of this study was to inter- and intra-rater reliability in measuring ROM of the shoulder with two different Inertial Motion Units (IMU) (RSQMotion- RSQTechnologies, Poland) and Propriometer (Progres, Poland) and validate both against standard electronic goniometer.

### Material and methods

15 healthy volunteers (30 shoulders) were included in the study (mean age =  $24.7 \pm 3.2$ , all of the volunteers right-handed, BMI =  $22.4 \pm 3.2$ ). Maximal (max), active ROM were tested in flexion, abduction, internal and external rotation. Additionally, at the fixed angle of 90°, flexion and abduction and 45° rotations were set passively with a goniometer to confront the results shown in other devices. W-Shapiro-Wilk test, Intra Class Correlation ((2,k), (3,1), (3,k)), Wilcoxon test, and Bland-Altman test with 95% Limits of Agreement (LOA) were used for data analysis.

### Results

Fair to excellent correlation (JK: ICC 0.6–0.98, LOA >  $\pm 5$ ; CB: ICC 0.63–0.99, LOA >  $\pm 5$ ) between IMU and goniometer in max ROM; the better correlation between IMU on Propriometer and goniometer (JK: ICC 0.73–0.96; CB: 0.77–0.98). For both IMU sensors: good to the excellent correlation between raters JK and CB (ICC 0.74–0.97; LOA >  $\pm 5$ ) in max ROM; poor to excellent correlation (ICC 0.2–0.88; LOA <  $\pm 5$ ) in 90° and 45°. Fair to excellent intra-rater reliability for both IMU sensors (day1 vs. day2) (ICC 0.7–0.88, LOA >  $\pm 5$ ).

### Conclusion

The study provides essential, preliminary evidence for the reliability of the measurement of shoulder ROM with IMU sensors.

**Keywords:** inertial motion units, range of motion, shoulder, IMU, goniometer.

## **PROXIMAL HUMERUS FRACTURE NAILING, POSTERIOR APPROACH – TECHNIQUE DESCRIPTION AND PRELIMINARY RESULTS**

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### **Introduction**

Common Proximal Humerus Fracture (PHF) nailing complications are stiffness and persistent pain. One of the reasons for that is iatrogenic rotator cuff damage at nail introduction.

### **Aim**

Is there a safe and efficient way to introduce a nail into the humeral head without any harm to the rotator cuff?

### **Material and methods**

In this study, we present a technique to nail the PHF with a straight nail via a posterior approach, sparing rotator cuff tendons, reporting the final outcome and the complications of the method.

### **Results**

20 patients have been operated on for displaced proximal humerus fracture. 5 of them, due to technical difficulties, had to be converted to an anterolateral approach. 8 of them were 3-part fractures and 12 2-part fractures. Follow-up was superior to 12 months. The mean Constant score after surgery was 91.875 (pain 14.125; ROM 36; function 19.25; strength 22.5). Mean VAS 0.2. No suprascapular nerve and long head of the biceps injury have been reported.

### **Conclusions**

The posterior approach to PHF nailing via extended Neviaser portal is a very good alternative to the standard approaches. It requires only a small muscle belly spread, respecting rotator cuff tendons, which prevents all consequences of tendon scarification after PHF nailing. The risk of noble structures damage (in particular suprascapular bundle) is slender if proceeded according to a technique described.

**Keywords:** PHF, shoulder, fracture, intramedullary nailing.

## **ARTHROSCOPY TECHNIQUES IN THE TREATMENT OF THE GLENOID FRACTURE. OWN CASES, RESULTS, AND CONCLUSIONS**

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### **Introduction**

Isolated fracture of the glenoid is rare, which does not mean that it can be treated effectively and minimally invasively.

### **Aim**

Presentation of our own cases of the 10 patients post-traumatic fractures of the antero-inferior glenoid. Presentation of the arthroscopic stabilization of the acetabular fractures using the S&N RoundButton implant. The biggest problems. Tips and tricks.

### **Material and methods**

Own cases of the trauma patients. Pre and post-operative X-rays, CT scans. Function and stability of operated shoulders assessed on the basis of various scales- self-assessment by the patients.

### **Results**

In each case, the fracture was healed. No infection was observed. Full Range Of Motion was achieved in every patient. There has been no dislocation since the operation.

### **Conclusions**

Arthroscopic technique with the use of a dynamic implant for the treatment of the anterior-inferior glenoid fracture is a difficult but very effective and minimally invasive method.

**Keywords:** round button, glenoid fractures, złamanie panewki łopatki, arthroscopy techniques, own cases, Boileau method.

## **STEMLESS SHOULDER ARTHROPLASTY – EARLY RESULTS AND COMPLICATIONS IN FIRST 69 PATIENTS**

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### **Introduction**

Shoulder arthroplasty remains the final option for end-stage arthritis. Due to the important risk of implants exchange in the future, some new bone-sparing prostheses were introduced.

### **Aim**

The goal of this study was to evaluate the first stemless arthroplasties implanted in our institution.

### **Material and methods**

From 2015 to 2021, sixty-nine shoulder stemless arthroplasties were implanted. Patients' results were analyzed based on retrospective data: pain (numeric rating score – NRS), function (simple shoulder value score – SSV), and range of motion.

### **Results**

In this period, 25 reverse shoulder arthroplasties (Verso group) and 44 anatomic arthroplasties (Eclipse group) were implanted. In the Verso group, patients' average age was 72.6. 9 patients were evaluated after a minimum of 12 months of follow-up (mean 16 months). Mean postoperative results were: NRS 1, SSV 74%, flexion 139°, abduction 123°, external rotation 27°. 3 complications were reported: 1 patient had an intraoperative conversion to the stemmed humeral implant, 1 had small glenoid stable infraction healed without complications, and 1 reported periprosthetic proximal humerus fracture after fall 2 months after surgery. In the Eclipse group, patients' average age was 64. 19 patients were evaluated after 12 months (mean follow-up 36 months). Mean postoperative results were: NRS 1, SSV 70%, flexion 141°, abduction 131°, external rotation 41°. 2 complications were reported: 1 patient had loosened the bone graft fixation screw, and 1 had radiological signs of glenoid component loosening.

### **Conclusions**

In short-term evaluation, the results of stemless shoulder arthroplasty are satisfactory. The complications are also reported and should be evaluated in longer follow-up.

**Keywords:** stemless shoulder arthroplasty.

### **OPERATIVE APPROACH TO FIRST-TIME SHOULDER DISLOCATION**

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### **Introduction**

Orthopedic surgeons operate on acute ligament injuries of the knee and ankle but rarely on the shoulder.

### **Aim**

The aim of this presentation is to discuss clinical situations when an operative treatment should be done or should be considered.

### **Material and methods**

There are many publications relating to the first-time dislocation in PubMed, but we still do not have clear pieces of evidence on how we should treat this kind of patient. This present analysis is focused on indications for surgery after first-time shoulder dislocation.

### **Results**

Indications for surgery after a first-time shoulder dislocation is symptomatic instability, recurrence, pain, failed rehabilitation, high demand-thrower and worker, glenoid displacement fracture, large Hill-Sachs lesion, humeral avulsion of glenohumeral ligament.

### **Conclusions**

There are circumstances where surgical repair is indicated following primary traumatic anterior shoulder dislocation, and we should precisely analyze every patient individually.

**Keywords:** first-time shoulder dislocation, operative treatment.

### **GOUTALLIER CLASSIFICATION RELIABILITY MAY BE IMPACTED BY THE SIZE OF THE ROTATOR CUFF TEAR**

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### **Introduction**

Goutallier classification is widely used to describe fatty infiltration within a rotator cuff muscle belly. Goutallier classification based on MRI is widespread, but no one has yet studied if its reliability can be deteriorated by the size of the cuff retraction.

### **Aim**

The aim of our study was to evaluate whether the Goutallier grading system should be adjusted to the cuff tear size or if it is reliable regardless of the amount of retraction.

### **Material and methods**

MRIs of 81 patients with different tear sizes were compiled, and 3 cuts from each series were extracted in the same manner (total 243 images). The tear size was assessed according to Cofield classification. Nine clinicians assigned Goutallier classifications to each of the four RC muscles. A threshold of Krippendorff's alpha of 0.8 was set, and only reviewers who reached that were included in further analysis.

### **Results**

Five of 9 clinicians achieved a level of 0.8 or higher, reflecting high intra-rater reliability. Based on only the raters with high intra-rater reliability, there was a significant difference in Goutallier grade between slices in supraspinatus ( $p = 0.007$ ), infraspinatus ( $p < 0.001$ ), and subscapularis ( $p = 0.0193$ ), but not teres major ( $p = 0.4227$ ). The tendency was to give the lower grade for the same muscles in more medial MRI cuts.

### **Conclusion**

Goutallier classification is influenced by the slice reviewed, the size of the tear, and the muscle being evaluated. Choosing the right MRI image can be crucial for accurate diagnosis and treatment planning, especially as torn rotator cuff tendons tend to retract over time.

**Keywords:** rotators cuff, Goutallier classification, shoulder, arthroscopy.

## **INFRASPINATUS OR TERES MINOR FATTY INFILTRATION DOES NOT INFLUENCE PATIENT OUTCOMES AFTER REVERSE SHOULDER ARTHROPLASTY WITH A LATERALIZED GLENOID**

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### **Introduction**

Previous studies show that reverse shoulder arthroplasty (RSA) may improve forward elevation (FE) but, external rotation may remain impaired with substantial teres minor (TM) fatty infiltration.

### **Aim**

The purpose of this study was to examine the influence of fatty infiltration on a postoperative range of motion (ROM) and patient-reported outcomes (PROs) after RSA with a more lateralized center of rotation.

### **Material and methods**

About 69 patients (average age 69 years; 44 women, 25 men) with preoperative MRI, 1-year postoperative ROM, 2-year Veteran's Rand Survey, American Shoulder and Elbow Surgeons subjective form, and Single Alpha-Numeric Evaluation scores who underwent RSA with a lateralized glenoid component between 2010 and 2014 were identified. Patients with Fuchs stage 3 fatty degeneration were compared with patients with stage  $\leq 2$  using a one-way ANOVA.

### **Results**

Eleven patients had Fuchs stage 3 in the teres minor and 28 with stage 3 in the infraspinatus. Charlson comorbidity indices, Veteran's Rand Survey scores, age, and BMI were not different between groups. There were no differences after one year (follow-up =  $15 \pm 14$  months) in FE (FE =  $128 \pm 29$ ) or external rotation ( $33 \pm 13$ ) between groups. There were no differences in two-year minimum (follow-up =  $42.9 \pm 17.9$  months) American Shoulder and Elbow Surgeons scores between degenerated teres minor ( $76.4 \pm 20$ ) or infraspinatus ( $69.1 \pm 24$ ) groups.

### **Conclusion**

This is the first study to report that in a more lateralized RSA, neither teres minor nor infraspinatus fatty infiltration appear to influence ROM or PROs negatively.

**Keywords:** reverse shoulder arthroplasty, Goutallier classification, Fuchs classifications, lateralization.

## **TOTAL ELBOW ARTHROPLASTY AFTER LOOSENING OF INTERNAL FIXATION IN DISTAL HUMERUS FRACTURE: A CASE REPORT**

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### **Introduction**

Displaced distal humerus fractures may be treated surgically with open reduction and internal fixation. In selected cases, total elbow arthroplasty (TEA) is advised. This case represents the treatment of rare severe multifragmentary distal humerus fracture after loosening the internal fixation and TEA implantation.

### **Material and methods**

Case Presentation: A 74-year-old healthy female patient was presented with a multifragmentary displaced fracture of the right humerus. Open reduction with internal fixation with the use of Herbert screw and locking plate was performed as a matter of urgency. Olecranon fracture was stabilized with tension band wiring. Post-operative physiotherapy protocol and the sling were applied. After a year, the patient suffered from severe pain, elbow joint instability, and "crunching" in the affected joint. The patient was diagnosed with loosening of fixation, resulting in a major elbow dysfunction. Therefore, hardware removal and total elbow arthroplasty were performed. Two years after the TEA procedure, the patient presented asymptomatic, with full joint stability and satisfying ROM (flexion =  $130^\circ$ , extension = lack  $20^\circ$ , supination =  $90^\circ$ , pronation =  $80^\circ$ ), SANE = 75%, and GROC = 80% of operated joint, no complications were observed.



### **Conclusions**

In selected trauma cases, TEA is a successful way to restore the function of the elbow joint. Such way of treatment is a feasible method for particular cases of complex elbow joint trauma management.

**Keywords:** total elbow arthroplasty, elbow trauma.

### **FUNCTIONAL OUTCOME AND RETURN TO SPORT AFTER ARTHROSCOPIC LATARJET PROCEDURE IN ATHLETES AND PHYSICALLY ACTIVE PATIENTS**

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### **Introduction**

Arthroscopic Latarjet procedure for anterior shoulder instability results in excellent long-term results in the general population. This study evaluates outcome, return to sport (RTS), and complication rate in athletes.

### **Aim**

The aim of this study is to evaluate the clinical outcome, return to sport, and complication rate after the arthroscopic Latarjet procedure in athletes and physically active patients.

### **Material and methods**

Physically active patients treated by arthroscopic Latarjet were eligible for inclusion in the retrospective study. According to the risk of dislocation, patients were divided into 3 groups. Sport assessment tools consisted of KJOC Score (0–100 pts), SPORTS Score (0–10 pts), and RTS time. To evaluate clinical results, a range of external/internal rotation (ER/IR), Constant, and the Walch-Duplay Scores were used. Statistical significance was estimated at 0.05.

### **Results**

Data for 46 patients (mean age 27.1 years, mean follow-up 51.7 months) was analyzed. The mean RTS time, KJOC Score, and SPORTS Score were 52.7 ( $\pm$  1.7) months, 94.8 ( $\pm$  5.7), and 9.4 ( $\pm$  1.2), respectively. There was no correlation between RTS, KJOC, SPORTS, and patients' groups ( $p = 0.623$ ). At the final assessment, 42 patients (91.3%) had a positive outcome, and 4 (8.7%) patients failed after major trauma. Complications occurred in 8 patients (17.4%) with revisions in 4(8.7%) cases. Constant and Walch-Duplay Scores were 87.7 ( $\pm$  8.2) / 88.2 ( $\pm$  10.7), respectively. There was no limitation of ER/IR ( $p < 0.05$ ).

### **Conclusion**

Arthroscopic Latarjet is an effective method to anterior shoulder instability in physically active patients, provides a high and fast RTS, but the complication rate is not insignificant.

**Keywords:** anterior instability, arthroscopic Latarjet, Latarjet, athletes, return to sport.

## **ARTHROSCOPIC DECOMPRESSION OF THE SUPRASCAPULAR NERVE AT THE SPINOGLENOID NOTCH IN VOLLEYBALL PLAYERS IMPROVES THE ARM FUNCTION BUT DOES NOT RESTORE STRENGTH OF EXTERNAL ROTATION. CASE SERIES OF ARTHROSCOPIC NERVE DECOMPRESSIONS AND LITERATURE REVIEW.**

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### **Introduction**

Suprascapular nerve (SSN) entrapment in volleyball players leads to infraspinatus muscle (ISP) atrophy and weakness of abduction and external rotation of the arm.

### **Aim**

The aim of this study is to answer the question of what results should be expected after decompression of SSN based on literature review and the group of operated volleyballers.

### **Material and methods**

Volleyballers who underwent SSN decompression were retrospectively analysed. Assessment tools consisted of a range of motion and external rotation (ER) strength in Lovett's scale and postoperative ER strength measured by a dynamometer, Constant score, and visual evaluation of infraspinatus muscle recovery. A systematic review of literature on PubMed and Embase was performed to query 'Suprascapular AND (entrapment OR neuropathy) AND (volleyball OR athletes) AND (surgical OR arthroscopic OR decompression)'.

### **Results**

Data of 8 patients (mean age 25.9 years, mean follow-up 95.5 months) was analysed. Mean preoperative/final ER range and strength were 44.4/58.6 and 2.57/4.14, respectively. The final ER Strength of the operated/contralateral arm was 4.5/7.2 Kg. The constant Score was mean 82.4. For 3/8 patients total and 2/8 partial recovery of ISP was observed. 9 studies were included after the literature review gives 44 cases of volleyball players treated surgically by decompression of the SSN. Among them, significant/partial improvement in ER strength was noticed in 40.9/59.1% cases, and complete/partial ISP recovery was noticed in 25/75%.

### **Conclusion**

This study proved that SSN decompression in volleyballers improves shoulder function, but results of ISP recovery and restoration of ER strength are unpredictable.

**Keywords:** suprascapular nerve entrapment, nerve release, volleyballers.

## **MASSIVE AND IRREPARABLE ROTATOR CUFF TEARS TREATED BY PARTIAL ARTHROSCOPIC REPAIR AND PARTIAL REPAIR WITH LONG HEAD OF THE BICEPS TENDON AUGMENTATION. COMPARISON OF CLINICAL AND RADIOLOGICAL FINDINGS**

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### **Introduction**

Management of massive rotator cuff tears (MRCT) is associated with high rates of failure. The long head of the biceps tendon augmentation (LHBTA) by reinforcement of the reconstruction may improve healing and provide a better outcome than partial repair only.

### **Aim**

Comparison of clinical and radiological outcomes after partial repair (PR) and PR with LHBTA to answer the question: does additional LHBTA improve the results.

### **Material and methods**

Patients with irreparable supraspinatus muscle (SSP) tear and complete infraspinatus muscle (ISP) tear were included in the retrospective study. Irreparability was defined as SSP  $\geq 3$  in Goutallier and 3 in Patte classifications. Assessment tools consisted of a range of motion (ROM), arm strength, Acromio-humeral index (AHI), Constant, SST, Hamada, and Sugaya scores. Goutallier classification for SSP and ISP and diameter of the teres minor muscle (TMn) was evaluated. Statistical significance was estimated at 0.05.

### **Results**

Data for 60 patients (30 in each group) with a mean age of 62.5 years and a mean follow-up of 34.5 months was analyzed. In the final comparison between PR and PR with LHBTA, there were no significant differences in ROM, arm strength, SST, and Goutallier ( $p > 0.05$ ). Constant was  $70.9(\pm 11.5)$  vs  $76.2(\pm 10.9)$ , Hamada was  $2.6(\pm 1)$  vs  $1.9(\pm 0.9)$ , Sugaya was  $4.1(\pm 0.9)$  vs  $3.5(\pm 1.1)$  and AHI was  $4.7(\pm 1.3)$ mm vs  $5.8(\pm 2)$  mm respectively ( $p < 0.05$ ). Overgrowth of TMn positively correlates with higher arm strength, higher Constant, and lower Sugaya scores.

### **Conclusions**

MRCT repaired by PR with LHBTA provides better radiological and partially functional results than PR only. Overgrowth of teres minor muscle favors better clinical and radiological outcomes.

**Keywords:** rotators cuff, rotators cuff tear, biceps augmentation, irreparable tears, massive cuff tears.

## **EARLY CLINICAL AND BIOMECHANICAL RECOVERY AFTER SURGICAL TREATMENT OF ANTERIOR SHOULDER INSTABILITY- PROSPECTIVE COMPARISON OF OPEN LATARJET, ARTHROSCOPIC LATARJET-BANKART AND ARTHROSCOPIC BANKART REPAIR**

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### **Introduction**

Both arthroscopic labral repair, as well as coracoid transfer, have been effective in restoring shoulder stability. The pace of recovery may be different between techniques and be another important factor in early prognosis for the patient.

### **Aim**

The aim of the study was to evaluate prospectively and compare clinical and biomechanical recovery after three surgical techniques for anterior shoulder instability- open Latarjet (oL), arthroscopic Latarjet-Bankart(@LB), and arthroscopic Bankart repair (@B).

### **Material and methods**

Three groups of oL (32), @LB (30), and @B (106) were evaluated at 8 w, 4 m, 6 m, and 12 m follow-up (FU) with ROM, functional scores (UCLA, WOSI), and isokinetic testing.

### **Results**

External rotation (ER) range was significantly lower for oL comparing to @LB and @B at all times, with no differences between @LB and @B. There was significant improvement of UCLA and WOSI for all techniques at all FU comparing to preoperative values, with no significant differences between groups. Isokinetic testing: ♦at 4m: internal rotation peak Torque-to-body-weight (PT/BW) at 90degree/s was significantly lower for both coracoid groups comparing to @B, ♦at 6m: oL showed inferior parameters then both @B and @L for a deficit of PT at ER 180degree/s and ER PT/BW at 90degree/sl; @B showed superior several parameters, then both coracoid groups.

### **Conclusion**

However, patients may expect faster and superior clinical and biomechanical recovery after arthroscopic Bankart repair. If the coracoid transfer is performed, the arthroscopic approach combined with labral repair provided better external rotation and had some advantage over the classic open technique.

**Keywords:** shoulder instability, Latarjet, arthroscopic Latarjet, recovery, biomechanics.

## **TWO-STAGE REVISIONS WITH ARTICULATING ANTIBIOTIC SPACERS AFTER FAILED AND INFECTED ELBOW SURGERY – TECHNICAL ISSUES, COMPLICATIONS AND OUTCOMES FROM TWO EUROPEAN CENTERS**

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### **Introduction**

Revision surgery after failed elbow arthroplasty is a technically demanding procedure. Although the management of deep infections can result in sufficient bacterial eradication with articulating spacers, the complication rate is high.

### **Aim**

We aimed to assess the effectiveness and the risks when using articulating spacers in two-stage elbow revision arthroplasty in two European centers for elbow surgery.

### **Material and methods**

Twenty consecutive patients (8 m, 12 f, 65.5,  $\pm$  12.3y) from two surgical centers were retrospectively analyzed after two-stage revision surgery for failed elbow arthroplasty and suspected deep infection. Demographics, microbiologic profile, functional/radiological outcomes, technical issues, and complications were analyzed. The mean FU was 5.2 ( $\pm$  2.8) years with a minimum FU of 2 years.

### **Results**

Ten patients (50%) had microbiologic and histologic evidence of a deep infection. One rheumatoid patient (5%) needed a second revision. The average time between the first step and the second step was 31 ( $\pm$  4) weeks. The average number of previous surgeries was 2.5 ( $\pm$  1.3). The mean DASH score at the latest FU was 51.2 ( $\pm$  18.3). In five patients (25%), peri- or postoperative complications occurred that needed surgical revision (3 spacer failures, 1 hematoma, 1 persistent nerve damage). Radiographic implant loosening was not observed at the latest FU.

### **Conclusions**

The use of articulating antibiotic spacers in two-stage elbow revision surgery reliably eradicates deep infections (95%). Functional and radiographic results are satisfying after a mean FU of 5 years. The complication rate is high (25%), with spacer failures being the most common (15%), while severe nerve damages were observed in 5%.

**Keywords:** Total elbow arthroplasty, Antibiotic-Loaded Cement Spacer.

## **PROXIMAL ULNA DORSAL ANGULATION MEASUREMENTS IN ADOLESCENTS 15–18 YEARS OLD**

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### **Introduction**

Malunion after proximal ulna fracture may result in dramatic elbow functionality deterioration. If a dorsal fixation plate is used, it should contour the dorsal margin of the ulna properly, enabling restoration of proximal ulna dorsal angulation (PUDA) and anatomical bone union. Due to the authors' knowledge, no PUDA measurements in adolescents 15–18 years old were reported up to date.

### **Aim**

The aim of the study was to measure PUDA in adolescents 15–18 years old, allowing to assess whether a modification in the adult's plates design or intraoperative plate bending is needed when used in adolescents 15–18 years old.

### **Material and methods**

The study was a retrospective review of charts of consecutive emergency room patients. 107 lateral elbow radiographs in patients 15–18 years old were identified. Excluded were patients with fractures around the elbow (40) and radiographs with invalid lateral projection (17). 50 patients (18 women, 32 men, mean age 16.32 years [SD = 1.08]) were included. PUDA was defined as the angle between lines placed on the "flat spot" of the olecranon and the dorsal edge of the ulnar shaft. Three evaluators performed measurements three times, independently and in varying order. Intra- and inter-reliability was calculated using Krippendorff alpha.

### **Results**

The mean PUDA value was  $5.18 \pm 1.55$  degrees, with no sex differences. The overall Krippendorff alpha value for PUDA measurements was 0.77, suggesting acceptable reliability.

### **Conclusions**

This is the first study to report PUDA measurements in adolescents 15–18 years old. The mean PUDA from this study is comparable to adults and, therefore, is useful information when treating proximal ulna fractures with dorsal plating in adolescents.

**Keywords:** proximal ulna, dorsal angulation, plates design, dorsal plate fixation.

## **CLINICAL AND BIOMECHANICAL RECOVERY OF SHOULDER FUNCTION AFTER ANTERIOR SHOULDER INSTABILITY TREATMENT WITH ARTHROSCOPIC LATARJET-BANKART TECHNIQUE**

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### **Introduction**

Arthroscopic Latarjet-Bankart (AL) is a method of combining coracoid transfer and labral repair. As a completely arthroscopic method, AL limits the invasiveness of the procedure and precipitates recovery, however, it is associated with greater performance difficulty.

### **Aim**

The aim of the study was to evaluate the recovery of the patients after the AL procedure.

### **Material and methods**

30 patients with anterior shoulder instability were operated on using the AL technique. Their Range of Motion (ROM) was examined for – flexion, abduction, and external rotation. Shoulder function was evaluated with UCLA and WOSI scales. Data was collected amid preoperative examination and during one-year follow-up – after 2, 4, 6, and 12 months after the operation. Shoulder isokinetic profile was measured using Biodex 3 station system 4 and 6 months after the procedure.

### **Results**

Between preoperative and 2 m examination ROM decreased by 14.5–50.9% ( $p < 0.001$ ). Then it increased by 25.4–75.7% ( $p < 0.001$ ) between 2 m and 4 m. After 4m, there was no significant improvement in ROM. UCLA and WOSI increased by 22.9–30.2% ( $p < 0.03$ ) between preoperative and 4m examination. UCLA increased between 4m and 12m ( $p < 0.0491$ ), while WOSI did not demonstrate any significant rise. Isokinetic parameters improved by 17.1%–154.8% ( $p < 0.02$ ) from 4th to 6th month after operation.

### **Conclusions**

AL repair is associated with deterioration of the function in 2m after operation, but further rehabilitation leads to significant progress after another 2 months. Full clinical recovery is observed 4m after the operation. Deficits in strength parameters improved significantly at 6 month, however, still remained even after that time.

**Keywords:** shoulder instability, arthroscopic Latarjet-Bankart, recovery, biomechanics.

## **SURGICAL TREATMENT OF ACUTE POSTERIOR STERNOCLAVICULAR JOINT DISLOCATION WITH FIBERTAPE®**

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### **Introduction**

The study is needed as the posterior sternoclavicular joint dislocation is a rare, serious, and difficult injury to diagnose and treat. There are only about 120 cases described in the literature, therefore there is no gold standard of fixation. A posteriorly dislocated clavicle may compress mediastinal structures making this injury an emergency.

### **Aim**

The aim of this retrospective study is to demonstrate our approach to the treatment of posterior sternoclavicular joint dislocation with modified figure-of-eight Fibertape® technique, its efficacy, and mid-term outcomes.

### **Material and methods**

For this retrospective study, we recruited five patients who were treated for acute traumatic posterior sternoclavicular joint dislocation. Attempts of close reduction were unsuccessful in all cases. Open reduction and surgical fixation were therefore performed with modified figure-of-eight technique using Fibertape®. Data concerning time from injury to surgical treatment, hospital stay time, pre-injury sport activity level were analysed. The median follow-up time was 12 months (range 10–26) which included clinical evaluations, the DASH and Oxford Shoulder score questionnaires.

### **Results**

Open reduction and sternoclavicular joint fixation were successful in all subjects with no complications. The functional treatment results were very good, with all patients regaining a full range of motion. DASH scores were 0.8 (n = 2), 1.7, 2.5 and 3.3 and Oxford Shoulder score 44, 44, 46, 46, 48. The durability of our fixation was confirmed when one of the patients had a subsequent bike accident 3 months after the procedure. The initial fixation was unaffected.

### **Conclusion**

The presented technique allowed safe, effective, and durable results of the posterior sternoclavicular joint dislocations management.

**Keywords:** sternoclavicular injury, acute posterior sternoclavicular joint dislocation, sternoclavicular reconstruction, open reduction and internal fixation, fibertape.



## **ARTHROSCOPIC ELBOW OSTEOCAPSULAR ARTHROPLASTY IN THE TREATMENT OF OSTEOARTHRITIS IN ACTIVE PATIENTS UNDER 60 YEARS OF AGE**

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### **Introduction**

Treatment of primary elbow osteoarthritis in young, active patients is challenging for the surgeon. Arthroscopic osteocapsular arthroplasty (AOA) is an excellent good option to restore elbow mobility if conservative treatment fails.

### **Aim**

The purpose of this prospective study was to evaluate the effectiveness of AOA of the elbow as a treatment of osteoarthritis in active patients under 60 years of age.

### **Material and methods**

This study involved 28 patients with symptomatic degenerative elbow disease who underwent AOA in 2013–2019 by a single surgeon. The effectiveness of treatment was assessed on the basis of the elbow's range of motion

(ROM) before the surgery, intraoperatively and on the 10th day, 6th,12th week, 6th,12th month postoperatively; and the Mayo Elbow Performance Score (MEPS) and Simple Outcome Determination (SOD) by O'Driscoll.

### **Results**

The mean arc of elbow motion increased from preoperatively  $79.7^\circ \pm 22^\circ$  to  $123.2^\circ \pm 10^\circ$  at the time of surgery; it then decreased at the 10th-day post-operation, and slowly improved to reach  $109.3^\circ \pm 16^\circ$  after 12 months. The elbow's ROM was better after one year than before the surgery ( $P < 0.001$ ), however worse than immediately after surgery ( $P < 0.001$ ). The MEPS improved from  $70 \pm 14$  preoperatively to  $94 \pm 8$  at the final examination. SOD – 24 patients rated the elbow function as normal, almost normal.

### **Conclusions**

Treatment of symptomatic elbow osteoarthritis in active patients with arthroscopic osteocapsular arthroplasty was effective regardless of the degree of contracture. After early deterioration, elbow mobility gradually improved, reaching the maximum ROM 6–12 months after the surgery.

**Keywords:** elbow, arthroscopy, elbow osteoarthritis, osteocapsular arthroplasty.

## **OUTCOMES AND RECOVERY OF ARTHROSCOPIC BANKART REPAIR FOR ANTERIOR SHOULDER INSTABILITY**

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### **Introduction**

Traumatic anterior shoulder dislocation is one of the most common shoulder injuries with a high risk of recurrence and shoulder instability. The Arthroscopic Bankart repair is indicated for stabilization of anterior labrum without critical glenoid bone loss.

### **Aim**

The aim of the study was to evaluate clinical and biomechanical recovery after the arthroscopic Bankart repair technique for anterior shoulder instability.

### **Material and methods**

88 patients with anterior shoulder instability were assessed preoperatively and in 2, 4, 6, and 12 months (m) follow-up (FU). Clinical evaluation included Range of Motion (ROM), functional questionnaires (UCLA, WOSI), and isokinetic testing.

### **Results**

After decrease of ROM in 2 m FU by 10.2–45.8% ( $p < 0.0001$ ), there was significant improvement after 4 m, and 6 m by 4.3–51.4% ( $p < 0.025$ ). The most relevant increase occurred in flexion and external rotation. UCLA was improving till 4 m whereas WOSI even after 6 m. No statistically significant difference was observed after 12 m FU. Isokinetic profile parameters progressed by 9.9–72% ( $p < 0.019$ ) between 4 m and 6 m FU.

### **Conclusions**

After arthroscopic Bankart repair, clinical and functional status improves up to 6 m FU. The crucial progression takes place between 4 m and 6 m. Later no significant recovery is observed.

**Keywords:** shoulder instability, range of motion, anterior shoulder instability, arthroscopic Bankart repair, Traumatic anterior shoulder dislocation.

## **TREATMENT OF THE HABITUAL DISLOCATION OF THE SHOULDER JOINT WITH AN AUTOGENIC BONE BLOCK FROM THE WING OF ILIUM TRANSPLANTATION USING THE ENDOBUTTON TECHNIQUE.**

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### **Introduction**

One of the causes of habitual dislocation of the shoulder joint is an acetabular bone defect. 20% loss is an indication of bone grafting. This commonly used Latarjet technique is associated with many complications. An alternative technique of free bone block fixed on the endobutton was presented by E. Taverna.

### **Aim**

The aim of this study is to present the technique of acetabular bone defect restoration in the treatment of habitual dislocation of the shoulder joint using an autogenic block from the wing of the ilium and stabilized by an Endobutton Latarjet Smith&Nephew implant.

### **Material and methods**

Use of arthroscopic technique. Use of autogenic graft from the wing of ilium filling a bone defect. Stabilization of the graft with a single pair of Endobutton S&N implants. Tendon sparing of the subscapularis muscle (without separation). Simultaneous capsule and labrum stabilization. A radiological assessment of the integration, graft remodeling rotational movement using one pair of implants. Since March 2021, we have performed two procedures using Taverna's method in our centre. In our modification, we use one pair of endobuttons, an autogenic and tricortical block from the wing of the ilium.

### **Results**

Comparing the results with the Latarjet technique performed in our centre, we observe a significant reduction of the hematoma of the shoulder joint, moderate pain in the hip, and operated shoulder: VAS 6/10 (two weeks) to VAS 3/10 (six weeks).

### **Conclusions**

The technique demands further observations. We are planning: a radiological evaluation – CT three months after the surgery and again one year after; a clinical evaluation – A/P ROM, and functional shoulder tests.

**Keywords:** The habitual dislocation of the shoulder joint, Bone block transplantation, Endobutton fixation.

## **PRINCIPLES AND PHILOSOPHY OF JPC – JOINT PRESERVATION CENTER**

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### **Introduction**

The task of JPC is to join two inseparable fields of orthopedic treatment: operational and non-operational, and to coordinate their work in order to optimize treatment.

### **Aim**

JPC assumes preserving and avoiding or delaying joint replacement, improving quality of life, delaying aging processes, improving and restoring joint function, returning to physical activity, reducing the pain and costs for the health care system.

### **Material and methods**

The basis of JPC philosophy is a combination of two trends in current medicine: Personalized Medicine and Evidence-Based Medicine. JPC focuses on a comprehensive and holistic approach to treating joint diseases so that the patient can avoid treatments irreversible in their nature for as long as possible. Treatment here is a process and not just a single event. It has 6 stages, and each of them is dependent on the other and at the same time creates a whole.

### **Results**

In JPC philosophy, it is inscribed to build your own EBM base and continuously develop treatment methods and improve them based on our own experience. In order to put the philosophy into practice, it is important to construct a functional organizational structure with constant communication of the whole team with real-time modification.

### **Conclusions**

The JPC is innovative in every aspect of its design and implementation, this may be evidenced by a small amount of scientific work supported by EBM. JPC principles allow for unique and comprehensive control of the diagnostic and therapeutic process and continuous communication within the therapeutic team and the patient.

**Keywords:** joint preservation, innovative technology, organization.

## **COMPLEX ELBOW FRACTURE-DISLOCATION**

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Complex Elbow Fracture-Dislocation is the condition resulting from both the injury and the resultant loss of function due to damage to the articular surface and the ligamentous structures that stabilize the elbow [1]. The reliable treatment of this injury is usually very complicated, and the outcome is not always satisfactory [2–6]. Every fracture or injury around the elbow joint can cause instability of the humero-ulnar or humero-radial joint.

The different types of complex elbow fracture-dislocation and its treatment [1–12].

1. Posterior dislocation of the elbow joint with olecranon fracture and posterior dislocation of the radial head – PRUJ injury (Monteggia variant), sometimes with radial head fracture. Fixation of olecranon fracture, radial head reduction with Kirschner wire fixation, usually with no need for Annular Ligament (AL) repairing. In the case of radial head fracture, its fixation or replacement. LUCL repair if necessary.
2. Hotchkiss terrible triad – elbow dislocation, comminuted radial head fracture, coronoid fracture. Open reduction of elbow dislocation, radial head fixation or replacement, possible coronoid fixation, possible repairing of LUCL and /or MCL (anterior bundle).
3. Postero-lateral rotatory instability (PLRI) – Injury to the lateral ulnar collateral ligament (LUCL). Repairing of LUCL.
4. Postero-medial rotatory instability (PMRI) – Coronoid fracture (posteromedial part), injury to the LUCL, possible injury to the anterior bundle of MCL. Fixation in II and III types of coronoid fracture, repairing of LUCL, possible repairing of the anterior bundle of MCL.
5. Anterior dislocation of the elbow joint with an olecranon fracture. Proximal radio-ulnar joint (PRUJ) intact, possible coronoid fracture and/or radial head fracture, very rare injury to the LUCL and/or MCL (anterior bundle intact). Fixation of olecranon fracture sometimes together with coronoid fracture. Radial head fixation or radial head replacement if necessary, very rare is need to LUCL repair.
6. Dislocation of the radial head – injury to the AL, very often as a Monteggia variant: extension, flexion, or lateral. Open reduction of the radial head. In the case of Monteggia lesion as a first step fixation of the ulna and later on close or open reduction of the radial head with Kirschner wire fixation. Repairing of AL usually is not necessary.
7. Medial elbow dislocation – very rare and difficult to treatment. In all cases mentioned above, after fracture fixation and ligaments repair, if the elbow is still unstable, the application of Morrey's Dynamic Joint Distractor II is recommended. In case of lack of this distractor, temporary fixation of articular surfaces by use of 1 or 2 Kirschner wires is recommended.

**Conclusions and aim of the treatment:**

- open reduction of the dislocation
- fixation of fractures or replacement of the part or whole joint
- repairing or reconstruction of the ligaments
- dynamic Joint Distractor ( DJD ) if needed.

**Keywords:** fracture-dislocation, instability, dynamic joint distractor.

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#### **CLINICAL AND BIOMECHANICAL RECOVERY AFTER ANTERIOR SHOULDER INSTABILITY TREATED WITH OPEN LATARJET PROCEDURE – A PROSPECTIVE STUDY**

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#### **Introduction**

In Open Latarjet (OL) surgical technique, the coracoid process is transferred to the front of the glenoid. The indication for this procedure is a critical glenoid bone loss.

#### **Aim**

The aim of this study was to evaluate the clinical and functional recovery of patients after the OL procedure.

#### **Material and methods**

The group of 22 patients, who underwent OL procedure, was evaluated by the range of motion (ROM) and shoulder function using scales: UCLA and WOSI. The isokinetic profile of the shoulder was tested in external and internal rotation in 4 months (m) and 6m after the procedure. Data was collected prior to the operation and in one-year follow-up (FU) in 2m, 4m, 6m, and 12m.

#### **Results**

The deterioration of ROM was observed between preoperative examination and 2 m FU by 14.34–64.55% ( $p < 0.001$ ). There was a significant improvement in ROM by 17.82–111.18% ( $p < 0.007$ ) between 2 m and 4 m FU and no further progress after 4 m. UCLA and WOSI scales presented gain between preoperative and 4 m by 29.27–47.48% ( $p < 0.021$ ), albeit there were no significant changes in further examinations. There was a significant improvement in isokinetic profile between 4 m and 6 m ( $p = 0.0125$ ) in ER peak Torque-to-body-weight (PT/BW) at 90°/s.

### **Conclusions**

After the OL procedure, patients present worsening of function in 2m after the operation. The crucial progression of ROM and function appears between 2m and 4m, without any following significant upgrade. The isokinetic progress was slow and partial. Significant strength deficit also remained after 6 m.

**Keywords:** Open Latarjet, anterior shoulder instability, glenoid bone loss.

### **EVALUATING SENSITIVITY AND SPECIFICITY OF CLINICAL SHOULDER TESTS IN RELATION TO ARTHROSCOPIC FINDINGS**

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### **Introduction**

Shoulder pain is one of the most common complaints of patients seeking orthopaedic help, and the result of clinical shoulder examination is often the basis for further diagnosis and treatment.

### **Aim**

The aim of the study was to evaluate the correlation of clinical shoulder tests with arthroscopic findings.

### **Material and methods**

We have analysed 60 patients who have undergone shoulder arthroscopy. Findings in arthroscopy were treated as the true state of rotator cuff tendons. In those patients, we have evaluated Jobe's, Neer's, and Hawkins'-Kennedy's test for specificity and sensitivity detecting rotator cuff tears as well as checking Speed's and Yergasson's test for long head of biceps tendon pathology. Secondly, we checked if any specific combination of the aforementioned tests would result in a significant increase or decrease of diagnostic value.

### **Results**

Clinical shoulder tests vary in both sensitivity and specificity. Jobe's test achieved the highest overall sensitivity of 86.5%, with the specificity of 52%. Other rotator cuff-specific tests seemed to offer more sensitivity (Lift off test 82.9%, Belly press test 93.6%) but at the cost of reduced specificity (22.3% and 15.3% respectively). No evaluated combination of tests showed an increase in either sensitivity or specificity.

### **Conclusions**

Clinical shoulder tests, despite being long established as a foundation of the orthopaedic diagnostic process, have their limitations. Low sensitivity of subscapularis muscle tests suggests their use as an affirmative rather than a screening test, while the opposite is true for Jobe's test. Due to the study's small sample size, more research is needed to draw definite conclusions.

**Keywords:** arthroscopy, shoulder tests.

## RELIABILITY OF MEASUREMENTS PERFORMED ON TWO DIMENSIONAL AND THREE DIMENSIONAL COMPUTED TOMOGRAPHY IN GLENOID ASSESSMENT FOR INSTABILITY

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### Introduction

Accurate assessment of glenoid bone loss is important in preoperative decision-making and planning. Significant glenoid defects lead to increased risk of recurrence following arthroscopic shoulder stabilisation techniques.

### Aim

The main purpose of this study is to establish which of the two methods (2D vs. 3D) is more reliable in glenoid assessment for instability in pre-operative planning.

### Material and methods

One hundred glenoids were measured with the use of 2D-CT and 3D-CT (in 3D orientation) by two independent observers (one experienced and one inexperienced). Measurements were repeated after one week for 30 randomly selected glenoids.

### Results

The intra-class correlation coefficient (ICC) for inter-observer reliability was significantly greater for 3D-CT (0.811 to 0.915) than for 2D-CT (0.523 to 0.925). All intra-observer reliability values for 3D-CT were near perfect (0.835 to 0.997), while those for 2D-CT were less reliable (0.704 to 0.960). A dependent t-test showed that, for both observers, almost all glenoid parameters differed significantly ( $p < 0.05$ ) between 2D and 3D measurement methods.

### Conclusions

Therefore, it can be concluded that 3D glenoid reconstructions are more reliable for glenoid bone loss assessment than 2D-CT. The results suggest that quantifying a glenoid defect with the use of a 2D image only – even if performed by an experienced orthopaedic surgeon – is prone to errors. Differences in measurements between and within observers can be explained by plane setting and identifying glenoid rim in 2D-CT. Accordingly, we recommend that glenoid measurements should be performed in 3D orientation using 3D reconstruction obtained from CT images for pre-operative assessments, which are crucial for surgical planning.

**Keywords:** glenoid defect, shoulder, shoulder instability, three-dimensional measurement, three-dimensional reconstruction.



## **RELIABILITY OF HUMERAL HEAD MEASUREMENTS PERFORMED USING TWO- AND THREE-DIMENSIONAL COMPUTED TOMOGRAPHY IN PATIENTS WITH SHOULDER INSTABILITY**

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### **Introduction**

Hill-Sachs defect is the common diagnosis in patients with recurrent shoulder instability. The presence of this defect may predispose to a conflict between the humeral head and glenoid and consequently to the dislocation of the shoulder joint. Proper radiological evaluation of shoulder bone defects is crucial in preoperative planning.

### **Aim**

The aim of the study was to compare two measurement methods of humeral head defects in patients with shoulder instability. Intra- and inter-observer reliability of humeral head parameters were performed with the use of 2D and 3D computed tomography.

### **Material and methods**

The study group was composed of one hundred humeral heads measured with the use of preoperative 2D, and 3D computed tomography by three independent observers (two experienced and one inexperienced). All observers repeated measurements after 1 week. The intra-class correlation coefficient (ICC) and the minimal detectable change with 95% confidence (MDC95%) were used for statistical analysis of the diagnostic agreement.

### **Results**

For 3D inter-observer reliability, ICC values were "excellent" for all parameters, and MDC95% values were "excellent" or "reasonable." All intra-observer ICC and MDC95% values for 3D were "excellent" for experienced and inexperienced observers. For 2D-CT, ICC values were usually "good" or "moderate," with MDC95% values higher than 10 or 30%.

### **Conclusions**

Three-dimensional CT measurements are more reliable than 2D for humeral head and Hill-Sachs lesion assessment. This study showed that 2D measurements, even performed by experienced observers (orthopaedic surgeons), are burdened with errors. The 3D reconstruction decreased the risk of error by eliminating inaccuracy in setting the plane of the measurements.

**Keywords:** shoulder instability, measurement reliability, bone defects, 2D-CT, 3D-CT.

## SHOULDER PROPRIOCEPTION AMONG PROFESSIONAL STRING PLAYERS

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### Introduction

Playing strings (e.g., violin, cello) necessitates a high degree of precision of the movement. Physical loads include long daily hours of practicing complex movement in an unnatural position, which may cause a number of problems within the musculoskeletal system.

### Aim

The aim of the study is to assess shoulder joint position sense (JPS) among professional string players and seek correlations with profession-related epidemiological and clinical data.

### Material and methods

43 professional string players were examined. The study protocol included a specially designed questionnaire. JPS was assessed with Propriometer and represented as error of reproduction of joint position (ERJP).

### Results

29 people reported pain complaints with an average intensity of 5.3 +/- 1.4 on the VAS scale. The results of the proprioception show a significantly better JPS among musicians for 90 degrees abduction in left shoulder (60° vs. 90°; 5.2 ± 2.9 vs. 3.0 ± 1.8, respectively; p < 0.05) and right shoulder (60° vs. 90°; 5.2 ± 3.1 vs. 2.9 ± 1.6, respectively; p < 0.05) and 90 degrees flexion in left shoulder (60° vs. 90°; 5.4 ± 2.7 vs. 3.5 ± 1.8, respectively; p < 0.05) and right shoulder (60° vs. 90°; 4.9 ± 2.1 vs. 3.1 ± 2.1, respectively; p < 0.05).

### Conclusions

There is a significant occurrence of shoulder pain in actively playing professional string. Better results in 90 degree flexion and 90 degrees abduction in the proprioception test may indicate adaptation changes in neuromuscular control resulting from the positions taken while playing the instrument.

**Keywords:** musicians, proprioception, shoulder.

## NON-OPERATIVE APPROACH TO FIRST-TIME SHOULDER DISLOCATION

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Shoulder dislocation is happening more frequently as a competitive sport, and active life becomes more popular. First-time traumatic anterior shoulder dislocation is usually managed non-operatively.

The shoulder should be immobilized in a sling after the first shoulder dislocation. The position of the arm is traditionally in shoulder adduction and internal rotation. Existing

studies have demonstrated conflicting results with regard to the position of immobilization and time of immobilization. It is generally believed that both positions: external rotation (ER) and internal rotation (IR), produce similar results (Whelan *et al.*, Itoi *et al.*). Liavaag *et al.* analyses showed that the recurrence shoulder dislocation rate was 24.7% (twenty-three of ninety-three) in the IR group and 30.8% (twenty-eight of ninety-one) in the ER group ( $p = 0.36$ ). Duration of sling immobilization is still debated, with studies advocating ranges from 1 to 6 weeks (Lin *et al.*, Gibbson *et al.*). It is recommended to start a physiotherapy program after 2 weeks from shoulder reduction (Gaballah *et al.*, Kearney *et al.*). The program contains a range of motion and glenohumeral and scapular stability exercises. There are different opinions on physiotherapy duration time from 6 weeks to 4 months (Gaballah *et al.*, Gibbson *et al.*).

To sum up, further research is required to outline the optimal approach to immobilization and rehabilitation and their role in secondary prevention of recurrence.

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## **SHOULDER ARTHROPATHY SECONDARY TO SYRINGOMYELIA – NEW X-RAY CLASSIFICATION OF SHOULDER DEGENERATION**

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### **Introduction**

Shoulder neuroarthropathy is a rare joint degeneration mostly related to syringomyelia. X-ray is a basic tool to stage the advancement of shoulder destruction. It may reflect clinical status. Radiographic staging might also help decide reconstructive procedures, mostly reverse shoulder arthroplasty, for which preservation of glenoid is crucial.

### **Aim**

To create and verify the reliability of our own radiographic classification of neuroarthropathic gleno-humeral degeneration and to correlate it with clinical features.

### **Material and Methods**

The material was based on 39 cases (45 shoulders with neuroarthropathy secondary to syringomyelia) collected from a systematic literature review and our own pooled series of 10 cases. We have found 34 papers, all being case reports or case series. Inclusion criteria would be an X-ray in two projections and clinical data. NGH classification (classification of neuroarthropathic gleno-humeral degeneration): for glenoid (G) and head (H) 3 stages are distinguished: G0/H0 – no X-ray changes, G1/H1 – partial degeneration, G2/H2 – total degeneration.

### **Results**

The statistical analysis showed an almost perfect agreement between the evaluators for both humeral head and glenoid in both measurements (inter-rater reliability) and also almost perfect compatibility (intra-rater reliability). The majority of patients had total head degeneration without correlation with shoulder range of motion. The condition of the glenoid was various and also had no statistical influence on shoulder function.

### **Conclusions**

This data indicates that our NGH classification is highly reliable for the staging of shoulder degeneration related to syringomyelia. It seems to correlate with a range of motion partly. Stage G0 and G1 can still be qualified to reverse shoulder arthroplasty.

**Keywords:** shoulder neuroarthropathy, syringomyelia, shoulder degeneration.

## **AC JOINT REPAIR AND RECONSTRUCTION. DESCRIPTION OF NEW ESSKA ESA RECOMMENDATION, BASED ON CASE SERIES**

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### **Introduction**

In 2020, ESSKA ESA published new recommendations regarding AC joint repair and reconstruction that included new injury subtypes (ROCKWOOD III A/B), diagnostic modalities, timing, and surgical elements necessary to obtain optimal results.

### **Aim**

Analysis and presentation of new recommendations in relation to the case series.

### **Material and methods**

Detailed five case reports.

### **Results**

Presentation of results alongside case series.

### **Conclusion**

New ESSKA ESA recommendation as a novel milestone in the treatment of AC joint injury.

**Keywords:** AC joint repair, AC joint reconstruction, recommendations ESSKA ESA.