visualizing the dorsolateral ulnoulneral joint space Intraoperatively

Data:

Introduction: The correct implantation of radial head arthroplasty to avoid over-lengthening is essential for the prognosis of the elbow joint. Frank et al. showed that an overlengthening above 2 mm is visible due to widening of the anterolateral ulnoulneral joint space but intraoperatively, this particular joint space is difficult to visualize. Whereas the commonly used Kocher approach allows visualization of the dorsolateral joint space without additional instruments or further surgical release of the already unstable elbow. Taking this into consideration the aim of our study was to investigate whether the easier visualization of the dorsolateral joint space is also a reliable method to indicate overlengthening in radial head arthroplasty.

Material and Methods: Radial head arthroplasty was performed in 5 human cadaver specimens with the forearm, wrist, and hand intact. The lateral ligament complex was detached and an isometric transverse rellaxis was performed. 6 stages of implantation heights were documented for the radial head arthroplasty: native joint with LCL repair (1), perfect height (2), + 2mm (3), + 4mm (4), + 6mm (5) and -2mm (6). Clinical measurement and image analysis of the dorsolateral and anterolateral ulnoulneral joint space was performed. Results: The dorsal and anterior lateral ulnoulneral joint space width was negligible in the native joint with LCL repair (1) and the radial head arthroplasty implanted at correct height (2) as well as implantation with -2mm (6). There was a significant increase in joint space width at all stages of overlengthening (+ 2, + 4 and + 6 mm) compared to stage 1, 2 and 6. Overlengthening of + 2mm showed a mean gap of 1,9 ± 0,97 mm anterior (p.0.0081) and 1,59 ± 0,61 mm anterior (p.0.0482). The mean gap size dorsal in + 4 mm was 3,52 ± 1,51 mm and 5,20 ± 1,63 mm at + 6 mm implantation height. Anterior an overlengthening of + 4 mm showed a mean ulnoulneral joint space width of 3,06 ± 0,43 mm and 5,07 ± 0,40 mm at + 6 mm implantation height. The intraclass correlation coefficient was 0.997 and the 95% confidence interval was 0.9673 to 0.9996 between the dorsal and anterior ulnoulneral joint space. Conclusion: Visualization of the dorsolateral aspect of the ulnoulneral joint space is a reliable indicator for overlengthening in radial head arthroplasty without further compromising an already unstable elbow. The method from Frank et al. regarding the anterolateral joint space could further be adapted to an alternative radial head arthroplasty system than described in the original paper. Merging the findings of the anterolateral ulnoulneral joint space in different implants leads to the assumption that visualization either of the ulnoulneral joint space dorsally or anteriorly is universally applicable to determine overlengthening in radial head arthroplasty, regardless of the type of the radial head implant.

Category: Elbow/Wrist/Hand

Augmented Ulnar Collateral Ligament Repair With Structural Bioinductive Scaffold: A Biomechanical Study

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Summary:

Augmentation with a bioinductive, biomechanically absorbing structural scaffold imparts additional time zero biomechanical strength to ulnar collateral ligament repair alone, and restores valgus stability without over constraint. Data:

Background: Ulnar collateral ligament (UCL) repair with suture brace augmentation has been shown to have good time-zero biomechanical strength and short-term outcomes with more rapid return to play than traditional reconstruction techniques. However, there are concerns of intraarticular biocompatibility, and over-constraint or stress shielding with the use of nonabsorbable suture tape. Recently, an off-the-shelf bioinductive structural scaffold, that absorbs at 2 years and has more physiologic mechanical properties, has been FDA approved for augmentation of soft tissue repair. The purpose of this study is to assess the feasibility of the biomechanical performance of UCL repair augmented with this structural scaffold. Materials and Methods: Seven cadaveric elbow specimens, from mid-forearm to mid-humerus were utilized. Sample size of 4 was determined, through power analysis using expected effect size from the literature, to yield a power of 0.8. The forearm was potted in neutral rotation. The surgical approach was performed, down to the level of the intact capsule and UCL (Figure 1A). The elbow then underwent valgus stress testing at 30, 60, and 90 degrees flexion, with a cyclical valgus rotational torque of 2-5 Nm, as described in prior studies of UCL repair, to establish the native state. Testing was then performed in 3 additional stages (Figure 1B-D): UCL-transected, augmented UCL repair with scaffold, and repair alone with scaffold not fixed. The order of testing in relation to repair with scaffold, and repair alone without scaffold, was alternated for specimens to account for any possible elastic deformation through testing. The repair technique was based on the previously described Internal Brace-Augmented repair, but with scaffold instead of suture tape (Figure 2). Valgus opening, measured in degrees, was compared among the 4 states, as repeated measures for statistical analysis. Results: There was a significant difference between each of the 4 UCL repair states, at all flexion angles (P<0.001, <0.0001, and <0.0001 at 30, 60, and 90 degrees flexion, respectively by repeated measures ANOVA; Figure 3). Valgus opening was significantly improved with scaffold-augmented repair compared to repair alone (P=0.003 for all flexion angles). Valgus opening was similar between UCL-transacted state and repair alone (P=0.4, 0.2, and 0.1 for 30, 60, and 90 degrees). The scaffold-augmented repair did not decrease valgus opening beyond that of the native state. Conclusion: Augmentation with a bioinductive, biomechanical absorbable structural scaffold imparts additional biomechanical strength to UCL repair alone, and restores valgus opening close to but not tighter than the native state. Use of this absorbable structural scaffold imparts time zero strength in the setting of ligament repair. Return to play timelines may still be longer than suture tape augmentation, but use of a bioabsorbable scaffold with more physiologic mechanical properties alleviates the risk for stress shielding, over-constraint, and biocompatibility concerns.

Category: Elbow/Wrist/Hand

Do Pyrocarbon Radial Head Replacements Offer Satisfactory Clinical and Radiological Outcomes? A Systematic Review

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Summary:

Theoretically pyrocarbon promises to be a superior material for radial head arthroplasty due to its high biocompatibility with the bone. The primary objective of this systematic review was to evaluate clinical and radiological outcomes of Pyrocarbon radial head replacements. Data:

Background: Pyrocarbon promises to be a superior material for radial head arthroplasty due to an elastic modulus comparable to the native bone and thus providing higher biocompatibility. The primary objective of this systematic review was to synthesize available literature investigating the clinical and radiological outcomes of Pyrocarbon radial head replacements while the secondary objective was to determine the complications and revision rates related to the usage of these prostheses. Methods: Three electronic databases (PubMed, Medline, EMBASE) were used to search for studies published on outcomes and complications of the radial head arthroplasties using Pyrocarbon radial head prostheses. The systematic review was designed in accordance with the PRISMA guidelines and the review was registered prospectively in the PROSPERO database. The studies were appraised and scored using the Methodological Index for Non-Randomized Studies (MINORS) tool. To ensure repeatable results, the database searches were performed independently by two authors on two separate occasions. Functional outcomes were assessed objectively using different PROMs like MEPS, DASH and BMS (Broberg-Morrey Score). Range of motion was measured using goniometer and grip-strength was measured using the dynamometer. Post-operative radiological outcomes were reported using radiographs. Results: A total of 13 studies cumulatively reporting 330 patients who underwent Pyrocarbon radial head arthroplasty were included in the review. The mean age of patients ranged from 47 years to 54 years of which 51.1% were males. The majority of radial head replacements were done for acute trauma (86.6% 297/343) with the remainder done for arthritis (1.5%) and trauma sequelae (11.9%).
Mean follow-up period in the selected studies ranged from 18 months to 110 months with minimum follow-up across all studies being 12 months. MoPyC (Modular Pyrocarbon, Tornier™, Montbonnot-Saint Martin France) was the implant of choice in twelve studies while one study used the Ascension Pyrocarbon radial head (Ascension Orthopaedics™, Austin, TX). Nine studies demonstrated mean Mayo Elbow Performance Score (MEPS) ranging from 79.5 to 96. Mean extension deficit across twelve selected studies ranged from 6 to 19 degrees while mean flexion ranged from 120 degrees to 140 degrees. Mean pronation and supination ranged from 71 degrees to 87 degrees and 63 degrees to 85 degrees respectively. Seven studies reported grip strength, ranging from 68.9% to 96% of the grip strength in the contralateral limb. Overall implant-related revision rate due to intra-prosthetic dissociation, prosthetic fracture, peri-prosthetic loosening, radio-carpal subluxation and under-stuffed/over-stuffed elbow was seen on radiographs in 6% to 100% of patients across different studies but symptomatic implant loosening leading to revision remained rare (1.5%, 5/330). Radiological radio-capitellar congruence was reported in 81% to 100% cases across different studies while capitellar erosion ranged from 0% to 89%. Pyrocarbon implants specific complications included implant fracture in 1.5% cases and intra-prosthetic dislocation in 1.2% cases. Conclusion: Mid-term to long-term clinical and radiological outcomes and revision rates of pyrocarbon radial head replacements are satisfactory, but implant specific complications like intra-prosthetic dissociations of modular implants and pyrocarbon fractures must be kept in mind when choosing for these implants.

Category: Elbow/Wrist/Hand

Clinical Results Of Internal Bracing In Postero-Lateral Instability Of The Elbow

Abstract ID# 21943

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Summary:
Internal Bracing in posttraumatic instability of the elbow led to good subjective and objective score results.

Data:
Introduction: A tear of the lateral ulnar collateral ligament (LUCL) with/without tear of the medial collateral ligament (MCL) leads to PLRI or bilateral elbow instability. The majority of these injuries can be treated conservatively. Indications for surgery are persisting instability, osseous lesions or extensive soft tissue damage. The aim of this study is to evaluate clinical results of internal bracing in postero-lateral Instability (PLRI) of the elbow with or without medial elbow instability. The hypothesis is that internal bracing allows early post-operative mobilization and thereby avoids stiffness without endanger stability.

Methods: Between 2013-2019 43 patients with a mean age of 38,8 years (18-67), were treated with internal bracing and included in this study. After diagnostic arthroscopy and treatment of accompanying lesions reposition and internal bracing of the LUCL complex was performed with an absorbable tape and knotless anchors. In cases with significant medial instability, reposition and internal bracing of the MCL was performed in the same session. All patients were treated without a splint and immediately mobilized. The Mayo Elbow Performance Score (MEPS), Oxford Elbow Score (OES), Visual Analogue Scale (VAS), and subjective evaluation of the postoperative result were evaluated. Clinical stability of the elbow was evaluated with the Push-up Test, the Pivot-shift test, Stand-up test and the pincer grip. Results: The mean follow-up was 3.5 ± 1.6 years (2-8). Postoperative ROM improved significantly (extension/flexion) mean: 0/6/144 (range: 0/0-70/130-150) in comparison to Pre-OP mean: 0/21/122 (range: 0/0-70/60-150) p<0.05. At FU the mean score results were: OES: 39.2 ± 9 (11-48) points, MEPS: 85.2 ± 18.6 (30-100) and the VAS was 1.5 (0-8±2.1). Patients evaluated the operation postoperatively by school marks (1-6) by a mean of 1.9. There were no clinical signs of persistent instability in clinical testing in any patient. Conclusion: Internal Bracing in posttraumatic instability of the elbow led to good subjective and objective score results. Early mobilization allowed to regain almost full ROM without persistent instability.

Influence of a Blood Flow Restriction on the Joint Position Sensation in the Upper Limb

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Summary:
The study on healthy recreational athletes divided into interventional and placebo, and control groups determined that the inflated blood flow restriction band on the arm impairs the sense of wrist joint position.

Data:
The literature confirms that compared with low-load training, low-load blood flow restriction (BFR) training is more effective and tolerable; therefore, the potential usage of BFR in sports medicine has been recently highlighted. With a sensation of joint motion, the joint position sense (JPS) constitutes proprioception, being crucial in joint stability, coordination, and protection against injurious movements. To date, the safety issues of using BFR haven’t been raised; therefore, the study determined the effect of a worn arm BFR band on the wrist JPS. The prospective randomized, double-blind placebo-control study was conducted in a medical university laboratory. Sixty healthy right-handed young recreational athletes (30 females, 30 males) were randomly assigned to three groups, equal in size and gender rate; Group I, the interventional group; Group II, the placebo group; and Group III, the controls. The participants, examiner, and statistician were blinded. In all groups, the active wrist joint position reproduction was measured using the isokinetic dynamometer (Biodex System 4 Pro) on two separate occasions at a 90-minute-long interval. The examination was performed bilaterally, and the participants in each group were randomly assigned to start with the right (RL) or left (LL) limb. During measurements, the participants were wearing masks covering their eyes. The starting position was 0°, and the target position was 30° of wrist flexion. During the first session, the measurements were performed with no bands. During the second session, the wireless BFR cuff (AirBands, Vald Performance) was worn in Group I and Group II on a standardized level of the arm of the examined limb. In Group I, a standardized pressure was applied, while in Group II, the bands stayed uninflated. The collected parameter was the absolute difference between the target and actively replicated position, defined as an absolute angular error, AAE (degrees). The studied group arithmetic mean (x) and the standard deviation (σ) were calculated for AAE for each limb during the two sessions. The variables were normally distributed. The results obtained during the first session were compared to those in the second session separately in each group using a parametric t-test for dependent samples. The same test was used for the between-lims comparative analysis. A minimal sample was calculated before the study. In Group I, the AAE was statistically significantly higher (p = 0.002-0.004) in the second session (RL, x = 12.81±8.23°; LL, x = 13.17±6.99°) than in the first session (RL, x = 8.29±7.38°; LL, x = 7.40±5.22°). Contrarily, the mean AAE obtained in the two other groups during the second session was smaller than during the first session, and the differences were not statistically significant. The analysis of the results obtained in both sessions didn’t detect any differences between the right and left limbs in any of the groups. It can be concluded that even in healthy athletes, wearing an arm BFR band adversely affects the JPS of the wrist; therefore, special care should be taken during BFR training.