repair to the anatomical footprint. 59 shoulders (89%) were reviewed at a mean follow-up of 52.4 weeks (SD: 27.6 weeks, range: 20.3-175.1 weeks). Patients were radiologically assessed with a magnetic resonance imaging (MRI) at 6 months after the procedure. Pre-operative and Post-operative range of motion, cuff strength, VAS, Constant, ASES, and UCLA scores were assessed. Pre-operative radiologic assessment with an MRI included Patte (modified by Boileau) classification of tendon retraction, and Goutallier classification of fatty degeneration. Cuff healing and integrity of repair was assessed using the Sugaya classification, wherein, Sugaya 4 and 5 were considered as re-tears. Results & Discussion Advanced fatty degeneration (Goutallier 3 and 4) was present in 44% of supraspinatus and 20% of infraspinatus muscle bellies, respectively; while moderate degeneration (Goutallier 2) was present in 42% of supraspinatus and 22% of the infraspinatus muscle bellies, respectively. Tendon retraction was to the level of the glenoid (Patte-Boileau III-2) or medial to the glenoid (Patte-Boileau IV) in 22%, and just lateral to the glenoid (Patte-Boileau III-1) in 66%. About half of the tears (51%) extended into the teres minor. The subscapularis was partially torn (Lafosse 1-3) in 46% of cases and completely torn (Lafosse 4-5) in 20%. At follow up, there was a statistically significant increase in the mean range of motion (Table 1). Relative cuff strength improved from 57% to 90%, when compared to contralateral side (Table 2). VAS improved statistically from 4.2+2.5 to 1±1.7 (p<0.001). There was a statistically significant improvement in all scores from preoperative to postoperative evaluations; Constant from 50±17.8 to 74±13.0 (p<0.001), ASES from 52±17.5 to 87±14.9 (p<0.001), and UCLA from 16±4.9 to 30±4.9 (p<0.001). There were 6 re-tears (10%) with Sugaya 4 and 5 grades noted, one failure was due to P. acnes infection. 65% of patients were Sugaya 2. Stiffness occurred in 6 cases (10%) with 4 requiring arthrolysis. 93% returned to pre-injury work, and 89% of cases returned to pre-injury sport. The satisfaction rate was 96%. Primary repair of massive posterior-superior cuff tears using the muscle advancement technique coupled with double-layer lasso loop repair leads to restoration of range of motion, symmetrical strength, and excellent functional outcomes.

Category: Shoulder - Rotator Cuff

Simulator VR Rotator Double Row Cuff Repair Training Improves the Overall Ease of the Procedure: A Randomized, Controlled and Multicentric Transverse Validity Study

Abstract ID# 21536

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Summary:
This prospective, controlled and multi-centric study about the transfer validity between VR simulator and real condition demonstrate that the simulator is not sufficient to learn a complex and sequential procedure like double row repair.

Data:
Purpose To investigate the transfer validity of an arthroscopic cuff repair from virtual reality simulation to real conditions. Methods Thirty orthopedic residents and first year orthopedic fellows were enrolled in our study from six French university hospitals. At baseline, they were asked to answer a survey about the number of arthroscopic procedures they performed as an operating assistant or main surgeon. The attendees were also asked about their confidence in performing an arthroscopic cuff repair. Following this survey, they were randomized in two different groups: virtual reality training (VR+) or no virtual reality training (VR-). At the beginning of our study, both groups received one session of training on the simulator ArthroSR® (VirtaMed AG, Zurich, Switzerland) and a theoretical course on cuff repair. Thereafter the VR+ group underwent a monthly based training program with increasingly difficult procedures. The training sessions were standardized, lasted 1 hour, and were performed under the supervision of the same assessor. After 6 months, all the attendees were asked to perform an arthroscopic double row supraspinatus repair on a 3D printed shoulder model using real anchors. Two independent and blinded shoulder specialists graded the attendees using the Arthroscopic Surgical Skill Evaluation Tool (ASSET) score. Statistical analysis was performed with a non-parametric t-test Mann-Whitney was used. The results are expressed with median and standard deviation. Results Both groups were initially comparable. There is no significant difference between the two group with the total ASSET score (63+/−4.7 versus 58+/−8.3, p=0.11). The VR+ group presented a better ASSET Global rating scale than the VR- group (35+/−3.1 versus 32+/−5.7, p=0.046). The task specific checklist for the procedure did not differ between VR+ and VR- (26.8+/−2 versus 25.6+/−2.8, p=0.24). The VR+ group was faster than the VR- group (1705+/−215 seconds versus 1890+/−247 p=0.0063). Conclusion A monthly based VR program of 6 months improves the arthroscopic performance of orthopedic surgeons in formation but is not sufficient to master a procedure.

Category: Shoulder - Rotator Cuff

Risk Factors for Early Failure of Non-operative Management of Degenerative Rotator Cuff Tears

Abstract ID# 21676

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Summary:
A retrospective cohort study designed to identify risk factors that increase likelihood of surgery within 3 months of initial presentation after failure of non-operative management for degenerative rotator cuff tears.

Data:
Background: A number of risk factors for the general failure of non-operative management in the treatment of atraumatic, degenerative rotator cuff tears (RCT) have been identified. However, to date, there is a paucity of research investigating how these risk factors are related to the timing of the failure of non-operative management. A study incorporating this temporal factor would assist physicians and patients to determine when an individual patient is likely to need surgical intervention. The aim of this study was to determine risk factors, including duration of symptoms from initial date of onset to presentation, for early surgical intervention. Methods: A retrospective cohort study was performed of patients with degenerative, atraumatic RCT who underwent surgery by two fellowship-trained shoulder surgeons and had at least 12 months of postoperative follow-up. These patients were divided into two cohorts based on duration of time between index presentation to the surgeon and intervention: early (fewer than 3 months) and delayed (greater than 3 months). Patient characteristics such as demographics, comorbidities, individually and combined via the Functional Comorbidity Index and Charlson Comorbidity Index, clinical findings and shoulder/rotator cuff tear characteristics were collected and data analysis was performed. Results: 144 patients met inclusion criteria, which was failure of at least 6 weeks of physical therapy +/- a glucocorticoid injection. One hundred seven patients (74%) underwent surgery within 3 months of presentation, and 37 (26%) underwent surgery after at least 3 months. Analysis revealed duration of symptoms prior to presentation is a prognostic factor for early versus late surgery (p<0.001). Among other factors, patients with an external rotation strength less than 5 (14%) early group, 39 (36%) late group, 4-10 months: 11 (30%) early, 27 (25%) late, 11-25 months: 16 (43%) early, 28 (26%) late, >25 months: 5 (14%) early, 12 (11%) late; p-value 0.05). Additionally, no current tobacco use increased likelihood of undergoing surgery early (early: 96/106 (90%), delayed: 28/37 (76%); p-value 0.04). Age was also a predictive factor with older patients, on average, being more likely to require surgery earlier (mean age: early: 56+/−9, delayed: 61+/−11; p-value 0.02). Patients who experienced night pain were more likely to fail non-operative treatment earlier (early: 89/94 (95%), delayed: 27/34 (79%); p-value 0.02). Patients with an external rotation strength less than 5/5 were more likely to undergo surgery within 3 months of presentation (early: 58/107 (54%), delayed: 12/36 (33%); p-value 0.03). Conclusions: This study found that the major risk factors for failure of non-operative management within 3 months of index presentation are shorter length of time from symptom onset to presentation, older age, presence of night pain, and an external strength less than full strength. This information may help guide informed decision making.

Category: Shoulder - Rotator Cuff

Assessment of the Tendon Retraction Classification Systems for Predicting Reparability and Rotator Cuff Integrity in Arthroscopic Rotator Cuff Repair

Abstract ID# 21771

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Summary:
Among 4 classification systems of SSP tendon retraction, Lhee classification was most valuable in predicting reparable and RCI after ARCR.

Data:
Purpose: This study aimed to determine which classification system of the supraspinatus tendon retraction is most valuable for predicting the reparability and rotator cuff integrity (RCI) after arthroscopic rotator cuff repair (ARCR).
Methods: This retrospective study was performed on 463 consecutive patients who underwent ARCR for full-thickness tear. The inclusion criteria were patients who had full-thickness supraspinatus (SSP) tear and a minimum of 12 months follow-up. Patients with partial-thickness tear, osteoarthritis, instability, or a history of previous shoulder surgery were excluded. The degree of tendon retraction was assessed by the position of the retracted tendon in the coronal view of MRI by two shoulder surgeons who were not aware of the patient’s information, and tendon retraction was evaluated according to 4 types of classification systems (Patte, French Arthroscopy Society (SFA), Kim, Lhee). Retear after ARCR was defined as Sugaya type IV and V. Using the receiver operating characteristic (ROC) curve and the area under the curve (AUC), the ability of each classification system to predict reparable and retear after ARCR was evaluated. The cut-off point of each classification system was determined according to Youden index. Results: 403 patients met our inclusion criteria for reparability and 370 patients for RCI with retear rate of19.2%. For the prediction of reparability, the AUC of Patte, SFA, Kim, and Lhee were 0.685, 0.784, 0.738, and 0.823, respectively. The AUC of Patte was significantly smaller than that of SFA and Lhee (p<0.015, p<0.001, respectively). For the prediction of RCI, the AUC of Patte, SFA, Kim, and Lhee were 0.581, 0.642, 0.723, and 0.751, respectively. The AUC of Patte was significantly smaller than the other three classifications (p=0.01, p<0.001, p<0.001, respectively), and Kim and Lhee was significantly greater than that of SFA. The cut-off points of Kim and Lhee were at the center and the medial one-third of the humeral head. Those of SFA and Patte were at the lower edge of the anatomical neck and the glenoid rim. Conclusion: Among 4 classification systems of SSP tendon retraction, Lhee classification was most valuable in predicting reparability and RCI after ARCR.

Category: Shoulder - Rotator Cuff

Differentiating Partial from Complete Rotator Cuff Tears Using Thermal Imaging in Patients Scheduled for Arthroscopic Repair

Abstract ID# 21969
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Summary:
In this study we present clinical evidence showing that thermal imaging may be a useful, simple, low-cost adjunct imaging tool for evaluation of rotator-cuff tears and may provide additional capability for identiﬁcation of complete versus partial tears before surgery.

Data:
Objective: This study evaluates the usefulness of smartphone-based thermal imaging for diagnosis of rotator-cuff tears (RCT) and whether this imaging modality can discriminate between partial and complete tears. Methods: Forty-ﬁve patients (age 55±8 years old; male:female=27:18; complete:partial=24:21) with moderate-to-severe limitation in range of motion (ROM), and scheduled to undergo primary rotator-cuff arthroscopic repair, participated (ethics-approval #HFH-219-2020). FLIR thermal images were captured and skin temperature (ST) measured over the rotator cuff tear (RCT) and over the trapezius away from the tear from the superior and posterior aspects respectively using a FLIR-One Pro thermal camera (FLIR Systems, Wilsonville, OR, USA) attached to a smartphone incorporating FLIRtools software. The primary outcomes were (1) the difference between the ST over the RCT and that of similar sites of the contralateral, unaffected shoulder (?ST-RCT), and (2) the difference between the ST over the uninjured trapezius on the side of the RCT and that of the unaffected side (?ST-trapezius). Tear status (complete/ partial) was determined from the surgical records. Results: When considering all patients together, the ST over the RCT, posterolateral to the acromioclavicular (AC) joint, was signiﬁcantly warmer on the affected vs the unaffected side (mean±SD[n=45]: ?ST-RCT=0.34±0.14, p=0.008 by paired t-test). No diﬀerence in ST was detected over the area of the trapezius between affected and unaffected sides. However, patients with complete tear, had a greater (warmer) ?ST-RCT than those with partial tear (?ST-RCT, complete [n=24] vs partial [n=21]: 0.45±0.17 -vs- 0.22±0.22, p=0.008 -vs- p=0.162). Conclusions: These studies provide evidence that thermal imaging may be a useful, simple, low-cost adjunct imaging tool for evaluation of rotator-cuff tears and may provide additional capability for identiﬁcation of complete versus partial tears and the determination of the need for surgical intervention. Further studies involving advanced thermal properties are in progress.

Category: Shoulder - Rotator Cuff

The Validity and Interrater Reliability of a New Non-Invasive Model for Objective Measurements of Scapular Kinematics

Abstract ID# 22021
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Summary:
The presentation of a promising model for quantitative measurements and objective assessment of scapular kinematics for clinical use.

Data:
Background: Primary or secondary scapular dyskinesia is characterized by abnormal scapular rotations. It can be painful and impair the shoulder function. A skin marker-based motion capture model providing quantitative measures of the rotations of the scapula was recently developed and can potentially be used to diagnose and monitor scapular dyskinesia. Aim: To investigate the concurrent validity and the interrater reliability of a new model for analysis of scapular kinematics. Materials and Methods: Twelve infrared cameras were used to track reflections from moving skin markers in the motion capture model. A strict protocol for placement of the skin markers was followed. Shoulder range of motion (ROM) and activities of daily living (ADL) were tested in healthy volunteers. To investigate the validity, the skin marker-based model was compared to a gold standard through simultaneous data collection from markers fitted to an intracortical pin in the scapula. Interrater reliability was tested in a different group of healthy volunteers by comparing the skin marker-based protocol performed by two investigators blinded to each other’s results. The mean Root Mean Square Error (RMSE) was calculated for each tested motion to determine the validity. The interrater reliability was determined as Intraclass Correlation (ICC,2.1) for each tested motion. Results: Eight subjects were included in the validity test: female/male=2/6, mean (standard deviation) age 35.0 (3.0) and BMI 23.4 (3.3). The mean RMSE of all scapular rotations ranged 2.3-6.7 during shoulder ROM and 2.4-7.6 during ADL. The highest errors were seen for movements in front of the body: sagittal/scapular plane flexion, hair combing and eating. In 19 out of 24 measurements, the model showed larger range of rotation than the gold standard. In the reliability test, 20 subjects were included: female/male=8/12, mean (standard deviation) age 31.4 (9.1) and BMI 22.9 (1.7), ICC for measuring protraction ranged 0.07-0.60 during ROM and 0.27-0.69 for ADL. Correspondingly, ICC ranged 0.01-0.64 and 0.38-0.60 for upward rotation, and 0.25-0.83 and 0.25-0.62 for anterior tilt. Conclusion: Our results indicate that the model’s validity and reliability are task dependent and interpretation should be made with caution. The model provides quantitative measurements for objective assessment of the scapular movements and can be an important supplement to the clinical examination. Taking the inherent limitations of the method into consideration, the model is promising for clinical use.

Category: Shoulder - Rotator Cuff

Subacromial Platelet Rich Plasma Injections For Rotator Cuff Tendinopathy Are Partial Thickness Tears Associated With Poor Functional Outcomes?

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