arm. To calculate the average of maximum internal rotation, we converted each internal rotation ROM to a scale of 0 to 12, where Buttock=0, Sacrum=1, L5=2, L4=3, L3=4, L2=5, L1=6, Th12=7, Th11=8, Th10=9, Th9=10, Th8=11, Th7=12. Wilcoxon signed-rank test were used for statistical analysis. P values of less than 0.05 were considered statistically significant.

Results: Before initial treatment, ROM (flexion, abduction, external rotation, and internal rotation) in group A (82.5°, 67.2°, 12.8° and Sacrum, respectively) and that in group N (95.6°, 77.2°, 18.3 and Sacrum, respectively) showed no significant difference (p=0.06, 0.07, 0.14, and 0.67, respectively). At 1 month after treatment, ROM in group A (155.3°, 133.3°, 41.9°, and L3, respectively) was significantly larger than that in group N (135.0°, 106.6°, 31.9°, and L5, respectively) (p=0.0004, 0.0032, 0.02 and 0.0093 respectively). However, there was no significant difference in ROM between the two groups at 3 or 5 months after treatment or at final follow-up. At final follow-up, ROM in group A was 159.4°, 146.7°, 48.3°, and L1, respectively, while that in group N was 156.3°, 145.9°, 40.6°, and L2, respectively (p=0.61, 0.85, 0.14 and 0.42 respectively). ROM in both group A and that in group N increased significantly: by 76.9°, 60.6°, respectively for flexion (P<0.0001, P<0.0001, respectively), by 79.4°, 68.8°, respectively for abduction (P<0.0001, P<0.0001, respectively), by 35.6°, 22.3°, respectively for external rotation (P<0.0001, P<0.0001, respectively), by 5 vertebral body levels, 3 vertebral body levels, respectively for internal rotation (P<0.0001, P=0.0012, respectively) at final follow-up. There were no intra-operative or post-operative complications in the thirty-four patients. Specifically, there was no recurrence requiring a release, axillary nerve dysfunction, infection, osteoarthritis, or shoulder instability.

Discussions: This study showed that the earlier improvement of passive ROM in group A than group N. At 1 month after treatment, ROM in group A was significantly larger than that in group N for all directions (flexion, abduction, external rotation, and internal rotation). On the other hand, there was no significant difference in ROM between the group A and group N at more than 3 months after treatment. Previous studies reported that shoulder stiffness responds well to nonsurgical treatment in 70% to 90% of patients and arthroscopic capsular release should be performed in patients unresponsive to conservative treatment. In this study, only 16 of 34 (47.1%) patients were treated non-surgically. We think this is because most of patients in this study were treated non-surgically before visiting our hospital. Average duration of the disorder before the first visit to our hospital was 8.4 months in this study set. Our results suggest that arthroscopic capsular release might be recommended to patients with persistent shoulder stiffness if they want early improvement of shoulder symptoms. The limitations of this study include its non- randomized study design, with a small sample size. The outcome of the group N might be overestimated because the patients underwent surgery after failing nonsurgical treatment were excluded from the analysis. The other issue that needs to be highlighted is that active ROM, muscle strength, and pain scale are not measured. Those can be subjects of further research.

Conclusions: Arthroscopic capsular release was useful for increasing shoulder ROM within 1 month after treatment in patients with shoulder stiffness. However, there was no significant difference in shoulder ROM between nonsurgical treatment and arthroscopic capsular release at more than 3 months after treatment. Early arthroscopic capsular release improves shoulder symptoms quickly.

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B0597

Elbow Valgus laxity after ulnar collateral ligament reconstruction in competitive athletes

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Background: Ulnar collateral ligament reconstruction (UCLR) has afforded overhead athletes high rate of return to previous level of play. Although biomechanical study using cadaveric elbows showed UCLR restored valgus laxity to the native state, no clinical study investigated if the restored valgus stability has been kept at the time to play competitively. The objective of this study was to evaluate elbow valgus laxity using stress ultrasound before and after UCLR, and after return to play at the previous level.

Materials and Methods: Eleven competitive athletes (mean age of 18.3 years; range, 15−22) who had undergone UCLR using the modified Jobe technique (figure-of-8 graft with a muscle-splitting approach) participated in this study. Of the 11 patients, there were 8 baseball players, 2 cheerleaders, and one wrestler. Physical examination, MRI, and stress ultrasound were performed before surgery and at 2 and 12 months after surgery. Outcomes were classified using a Conway scale. For the assessment of elbow valgus laxity, the width of the medial joint space was measured using ultrasound. The degree of elbow valgus laxity was defined as the difference in width of the medial joint space with and without valgus stress. Graft healing was assessed using ultrasound and MRI.

Results: Valgus laxity in affected elbow (1.7 ± 0.8mm) is significantly larger than that in unaffected elbow (0.4 ± 0.2mm) before surgery (p<0.001). After UCLR, valgus laxity in affected elbow significantly decreased to 0.1 ± 0.1mm and 0.2 ± 0.1mm, at 2 (p<0.001) and 12 months (p<0.001), respectively. Ultrasound and MRI showed no graft tear at 12 months after UCLR in all patients. Seven baseball players returned to competition at 11 months (8-12 months) after UCLR, 2 cheerleaders at 5 months, and a wrestler at 4 months. Ten patients (91%) had excellent outcome in Conway scale. One patient did not return to baseball for family reasons.

Conclusions: Elbow valgus laxity restored to the intact level after UCLR. The restored elbow valgus stability after UCLR has been kept until return to sports.

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B0599

A survival curve for arthroscopic double-row repair of the rotator cuff: Critical period analysis

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Background: The incidence of retear following rotator cuff repair remains a major concern and the cause and timing of retear remains unclear. Most serial imaging studies suggested that retears occur during the first 3 months, but they have short follow-up or limited numbers of serial images. The aim of this study was to prospectively investigate the timing of retears following arthroscopic double-row rotator cuff repair using a sizeable cohort at multiple time intervals. The hypothesis was that the 'critical period' extends to the first 6 post-operative months, during which the risk of retear is highest.

Material: The authors enrolled a consecutive series of 257 shoulders in 243 patients (14 bilateral) that underwent arthroscopic double-row suture anchor repair of full-thickness tears, between January 2007 and June 2010. The exclusion criteria were: partial-thickness tears (n=4), revision operations (n=9), shoulder joint stiffness (n=4), Hamada stage 2 or more (acromiohumeral distance <6 mm) on plain X-Rays (n=9), arthritis and rheumatologic disorders (n=6), severe musculoskeletal pathologies (n=8), gleno-humeral joint instability (n=4) or acromioclavicular joint dislocation (n=7). Therefore a total of 206 shoulders was included for the prospective outcome evaluation.

Method: Patients were recalled to three follow-up visits at the following post-operative time intervals: 3 months, 6 months, and 12 months or longer. Ultrasonography on the operated shoulder was performed by an independent radiologist at each visit and the Constant score was collected during the last visit.

Statistical analyses were performed using R version 3.1.3.1. Descriptive statistics were used to summarize the data. Data were not normally distributed. Between group differences were evaluated using Wilcoxon rank sum tests (Mann Whitney U test). When 3 or more groups were compared Kruskall-Wallis tests were used followed by Wilcoxon rank sum tests for pairwise comparisons (with Holm's correction for multiplicity). Categorical data were analyzed using Pearson chi-square tests or Fisher's exact tests. P-values < 0.05 were considered statistically significant.

Results: Of the initial 206 cases included, 1 died (0.5%) before the end of the follow-up period from unrelated causes, 3 cases (1.5%) had subsequent surgery on another joint that prevented them from attending the latest follow-up visit, and 26 cases (12.6%) missed one or more of the scheduled US examinations. Therefore, a total of 176 shoulders (85.4%) from 165 patients (84 men and 81 women) were available for all required follow-up visits with mean age 56.0 years. Ultrasonography revealed retears in 16 shoulders (9.1%) at 3 months, in 6 shoulders (3.4%) at 6 months, and in 5 others (2.8%) at last follow-up, while it confirmed intact cuffs in 149 shoulders (84.7%) at last follow-up (mean, 32.9 months). The incidence of retears was most significantly associated with tear size (p=0.001) and tendon degeneration (p=0.003). Retears were observed in 42.1% (8 of 19) of the three-tendon tears, but only in 17.4% (12 of 69) of the two-tendon tears and 8.0% (7 of 88) of the one-tendon tears (p=0.001). Likewise, the incidence of retears was significantly higher for retracted tendons (p=0.038) and if the infraspinatus had stage II or III fatty infiltration (p=0.002). The Constant scores at the last follow-up were lower for shoulders that had a retear during the first 6 months compared to shoulders that had a retear after the first six months (p=0.056) or to shoulders that had no retear (p<0.001). The incidence of retears was not related to other pre-operative tear characteristics (dominant side, bilateral procedures, or cause of pathology) or to concomitant patient conditions (smoking, diabetes, cardiovascular disease or hypertension).

Considering retear as the end-point, the six-month survival (and 95% Confidence Interval) for the complete series was 87.5% (82.7% − 92.5%). By contrast, the six-month survival was only 57.9% (CI, 39.5% − 85.0%) for three-tendon tears, compared to 88.4% (CI, 81.2 − 96.3) for two-tendon tears and 93.2% (CI, 88.1% − 98.6%) for one-tendon tears. In parallel, the six-month survival was merely 77.6% (CI, 68.2% − 88.3%) for degenerated tendons, compared to 93.6% (CI, 89.1% − 98.3%) for healthy tendons.

Discussion: Most retears occurred during the first three post-operative months (n=16), but some occurred between three and six post-operative months (n=6), and a few occurred after 6 months (n=5), considering the long follow-up period of the study. The results therefore confirm the hypothesis that the 'critical period' for healing and recovery following rotator cuff repair extends to the first 6 post-operative months, during which the incidence of retears is significantly higher (12.5%) than in the forthcoming months (2.8%). The findings corroborate the recent literature, which indicates that retears occur mostly during the first three post-operative months (9.1%). The observations suggest, however, that the so-called 'critical period' may extend until six post-operative months, particularly for patients with risk factors, most notably large tear size, degenerated tendons, tendon retraction and fatty infiltration. Our results suggest that the two factors most associated with early retears are pre-operative tear size and tendon degeneration, which corroborates the recent systematic review of Henry et al. Arthroscopy 2015 who reported a 'pooled retear rate' of 79% following repairs of chronic massive rotator cuff tears.

The main strengths of this study are its relatively large sample size and the acquisition of multiple serial images. The study has several limitations, typical of non-randomized studies, notably the variability of follow-up, the inclusion of patients with various sizes of subcapularis, the use of two different imaging modalities pre-operatively (CT and MRI) to assess muscle quality and fatty infiltration, the inability to analyze the inter- and intra-observer accuracy because US is a dynamic imaging modality and its interpretation must be done in the presence of the patient, and the portion of patients lost to follow-up (14.6%).