Objectives: The instability severity index score (ISIS) was designed to predict the risk of recurrence after arthroscopic instability shoulder surgery and to better predict those who would benefit from an open or bone transfer operation. Although this score has been widely disseminated to predict recurrence, there are certain areas in which preoperative assessment is limited, especially in radiographic workup. The objective of this study was to examine the validity of ISIS based on its existing variables, as well as to evaluate additional imaging and patient history variables pertinent to the potential redevelopment of a new score to assess risk of recurrent anterior instability following an arthroscopic Bankart repair.

Methods: All consecutive patients were prospectively enrolled with recurrent anterior shoulder instability who subsequently underwent an arthroscopic stabilization with minimum 24 months follow-up. Exclusion criteria included, prior surgery on the shoulder, posterior or multidirectional instability, or a rotator cuff tear. All instability severity index score variables were recorded (age <20, degree and sport type, hyperlaxity, Hill Sachs on AP xray, glenoid loss of contour on AP xray), as well as additional variables: 1. Position of arm at dislocation; 2. Number of instability events; 3. Total time of instability; 4. Glenoid bone loss percent; 5. Amount of attritional glenoid bone loss; 6. Hill Sachs measures (H/W/D and volume), and outcomes (recurrent instability) and scores (WOSI, ASES and SANE). Regression analysis was utilized to determine preoperative variables that predicted outcomes and failures.

Results: There were 217 consecutive patients (209 male-96.5%, 8 female-3.5%) who met criteria and were all treated with a primary arthroscopic shoulder stabilization during a 3.5-year period (2007-2011), with mean follow-up of 42 (range, 26-58 mos). The mean age at first instability event was 23.9 (range, 16-48), with 55% right shoulder affected, 60% dominant shoulder. Outcomes were improved from mean scores preoperative (WOSI=1050/2100, ASES=61.0, SANE=52.5) to postoperative (WOSI=305/2100, ASES=93.5, SANE=95.5), and 11.5% (25/217) had evidence of recurrent instability or subluxation. A total of 51/217 were 20 years or under, hyperlaxity in 5, Hill Sachs on internal rotation XR in 77, glenoid contour on AP XR in 77, with an overall mean ISIS score of 3.6. Factors associated with failure were glenoid bone loss greater than 14.5%(p<0.001), total time of instability symptoms >11.5 months(p<0.03), Hill Sachs volume > 1.3cm³ with H>1.5cm, W>1.0cm and D>5 mm(p<0.01), contact sport (p<0.01) and age 20 or under (p<0.01). There was no correlation in outcomes with Hill Sachs on IR or glenoid contour on XR (p>0.45), sports participation, and Instability Severity Score (mean=3.4 success, vs 3.9 failure, p>0.44).
Conclusion: At nearly four years of follow-up, there was an 11.5% failure rate of scope stabilization surgery. However, there was no correlation between treatment outcome and the ISIS measure given a mean score of 3.4 with little difference identified in those that failed. However, several important parameters previously unidentified were detected including, glenoid bone loss >14.5%, Hill Sachs volume >1.3cm³, and time length of instability symptoms. Therefore, the ISIS measure may need to be redesigned in order to incorporate variables that more accurately portray the actual risk of failure following arthroscopic stabilization.
Paper 24
Arthroscopic Soft Tissue Stabilization for Traumatic Anterior Shoulder Instability in Elite Collision Athletes: Is it Sufficient?

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Objectives: Surgical options for shoulder instability in collision athletes remain controversial. Although arthroscopic soft tissue stabilization is widely accepted treatment for shoulder instability, many surgeons prefer coracoid transfer for collision athletes with or without glenoid defect due to potential high recurrence rate after arthroscopic soft tissue Bankart repair (ABR). In the meantime, Hill-Sacks remplissage (HSR) has been gaining popularity as an effective arthroscopic augmentation procedure. Since 2002, we performed rotator interval closure (RIC) as an augmentation in addition to ABR or arthroscopic bony Bankart repair (ABBR) for collision athletes and obtained satisfactory outcome. However, teen players demonstrated higher recurrence rate compared to twenties and thirties. Therefore, from 2012, we performed HSR as an additional augmentation for teen players besides ABR/ABBR and RIC. The purpose of this study was to assess the outcomes after arthroscopic stabilization in collision athletes who underwent shoulder stabilization under our treatment strategy.

Methods: Between 2012 through 2015, 95 consecutive collision athletes underwent shoulder stabilization. Among those, only 2 patients (2%) underwent arthroscopic bony procedure for poor capsular integrity. Among the remaining 93 patients who underwent soft tissue stabilization, 65 were available for minimum 2 year follow-up (70%). Therefore, subjects consisted of 65 players including 54 rugby and 11 American football players (Table 1). There were 13 national top league, 24 collegiate, 21 junior or senior high school, and 7 recreational players. The mean age at surgery was 20 years (range, 16-36). The mean follow-up was 37 months (range, 24-64). We retrospectively reviewed intraoperative findings and surgical procedures using patient records including surgical reports and videos. We also investigated the mean time for sports return, functional outcome and recurrence rate. Pre- and postoperative Rowe scores were compared using paired t test.

Results: Preoperative 3DCT of the glenoid demonstrated bony Bankart (fragment type) in 43 players (66 %), attritional type in 16 (25%), and normal glenoid in 6 (9 %). Mean glenoid bone loss was 15 % (range, 0-25) and all of the glenoid with more than 10% bone loss retained bony fragment (Table 2). All 65 players demonstrated Bankart lesion and 15 had concomitant SLAP lesion (23%) which required repair. In addition, 5 players demonstrated capsule tear (8%), which were also repaired. Twenty four players (36%) underwent ABR or ABBR with RIC and forty one players (64%) underwent ABR or ABBR combined with HSR (Table 1).The mean time for sports return was 7 months (range, 4-13) after surgery. The mean Rowe score significantly improved after surgery from 65 (range, 55-75) to 92 (range, 65-100) (P < .001). Recurrence appeared in 2 cases (3 %), both of which were junior or senior high school players who underwent ABR with HSR.
Conclusion: Soft tissue stabilization combined with selective augmentation procedures for shoulder instability in collision athletes demonstrated satisfactory outcomes with low recurrence rate. Since the incidence of having bony Bankart lesion in collision athletes was very high, arthroscopic bony Bankart repair worked in many patients even with significant glenoid bone loss. Further, HSR seemed to be effective additional augmentation especially in young collision athletes.

<table>
<thead>
<tr>
<th></th>
<th>Total</th>
<th>ABR/ABBR with RIC</th>
<th>ABR/ABBR with HSR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Players</td>
<td>65</td>
<td>24</td>
<td>41</td>
</tr>
<tr>
<td>National top league</td>
<td>13</td>
<td>10</td>
<td>3</td>
</tr>
<tr>
<td>College league</td>
<td>24</td>
<td>8</td>
<td>16</td>
</tr>
<tr>
<td>Junior or senior high school</td>
<td>21</td>
<td>3</td>
<td>18</td>
</tr>
<tr>
<td>Recreational Level</td>
<td>7</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>Age at surgery (tears)</td>
<td>20(16-36)</td>
<td>23(15-36)</td>
<td>19(15-28)</td>
</tr>
<tr>
<td>Mean Follow up(months)</td>
<td>37(24-64)</td>
<td>41(24-64)</td>
<td>35(24-60)</td>
</tr>
<tr>
<td>Revision surgery</td>
<td>5</td>
<td>1</td>
<td>4</td>
</tr>
</tbody>
</table>

Table 2

<table>
<thead>
<tr>
<th>Glenoid morphology</th>
<th>Total(n=65)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fragment type</td>
<td>43(66%)</td>
</tr>
<tr>
<td>Attritional type</td>
<td>16(25%)</td>
</tr>
<tr>
<td>Normal glenoid</td>
<td>6(9%)</td>
</tr>
<tr>
<td>Glenoid bone loss</td>
<td>15%(0-25)</td>
</tr>
</tbody>
</table>
Objectives: Despite a growing body of literature regarding optimal repair configurations, little is known about inferior suture anchor placement (6 o’clock position). Here, we determine the biomechanical strength of adding a 6 o’clock anchor to a “standard” Bankart repair in a normal glenoid and a 13% anterior bone loss model.

Methods: 12 cadaveric shoulders were tested on a six axis industrial robot to measure the peak resistance to translation force with anterior displacement (1 centimeter). The rotator cuff muscles were loaded during testing to simulate physiological conditions. Test conditions included intact shoulder, Bankart lesion, Bankart repair (3, 4, and 5 o’clock anchors), and Bankart repair with a 6 o’clock anchor. A 13% anterior bone defect was then created (based on pretest CT scan) and all conditions were repeated. Repeated measures ANOVA was used to test for significant differences among groups.

Results: In the no bone loss group, the addition of a 6 o’clock anchor yielded the highest peak resistance force (52.8N, SD: 4.5N) and was significantly stronger than the standard Bankart repair by 15.8% (7.2N, p = 0.003). With 13% bone loss from the anterior glenoid, both the standard Bankart repair (peak force 49.3N, SD: 6.1N, p = 0.02) and repair with the addition of the 6 o’clock anchor (peak force 52.6N, SD: 6.1N, p = 0.006) had a significantly higher peak resistance force compared to the bone loss with Bankart lesion group (35.2N, SD: 5.8N). While the 6 o’clock anchor did increase the strength of the standard repair by 6.7%, this was not statistically significant (p = 0.9) in the bone loss model.

Conclusion: The addition of a 6 o’clock suture anchor to a “standard” Bankart repair increases to the peak resistance to translation force (no bone loss), although this additional strength is lost with creation of a 13% anterior glenoid bone defect.
Paper 26
Postoperative Recovery Comparisons of Arthroscopic Bankart to Open Latarjet for the Treatment of Anterior Glenohumeral Instability

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Objectives: Recurrent anterior glenohumeral instability is a disabling pathology that can be successfully treated by arthroscopic Bankart repair or an open Latarjet procedure. Long-term outcomes have shown lower rates of apprehension, recurrent dislocation and operative revision following Latarjet when compared to Bankart repair. However, there is a paucity of studies comparing the short-term post-operative recovery of arthroscopic Bankart versus open Latarjet. The purpose of this study is to evaluate the post-operative recovery following Bankart and the open Latarjet procedure.

Methods: The surgical outcomes system (SOS) database (Arthrex Inc., Naples, FL) was used to compare the post-operative recovery outcomes after either a primary or revision arthroscopic Bankart and an open Latarjet procedure. Patients were included who had a minimum of 1 year follow-up. Preoperative and postoperative (2 weeks, 6 weeks, 3 months, 6 months, 1 year and 2 year) time points were evaluated. Outcomes measures included Visual Analog Pain Scale (VAS), American Shoulder and Elbow Surgeons (ASES) Shoulder Function Score, ASES Shoulder Index Score, and SANE Score. Overall, 787 patients underwent primary Bankart (518 male, 240 female, 4 not recorded), 36 underwent revision Bankart (24 male, 10 female, 2 not recorded) and 75 underwent an open Latarjet procedure (59 male, 12 female, 4 not recorded). The mean age for primary Bankart, revision Bankart, and open Latarjet was 40.8, 38.6 and 32.8 respectively. Additionally, the average BMI for primary Bankart, revision Bankart, and open Latarjet was 27.2, 28.13, and 25.6, respectively.

Results: The postoperative recovery curves are displayed in Figure 1. When compared to primary Bankart, open Latarjet demonstrated significantly lower VAS scores at six weeks (p=0.0272) and at three months (p=0.0094). Medium term outcomes for ASES Shoulder Index Score, ASES Shoulder Function Score, and SANE Score, at 1- and 2-years showed no difference between primary Bankart and Latarjet. For the revision Bankart and open Latarjet procedures, the open Latarjet cohort demonstrated significantly higher ASES Shoulder Index Scores at the 3-months (p= 0.0017), 1-year (p= 0.0021), and 2-years (p= 0.0006) timepoints. Open Latarjet patients also had significantly higher ASES Shoulder Function Scores than revision Bankart at 3-months (p= 0.0162), 1-year (p= 0.0083), and 2-years (p= 0.0013). Revision Bankart repair resulted in significantly higher VAS scores than open Latarjet at 2-weeks (p= 0.0025), 6-weeks (p=0.0114), 3-months (p= 0.0024), 1-year (p= 0.0039), and 2-years (p= 0.0007).

Conclusion: When compared to Bankart repair, open Latarjet provides improved pain and functional outcomes during the early recovery phase, 2-weeks, 6-weeks, 3-months, and 6-months, with equivalent medium-term outcomes at 1-2-years. Furthermore, when compared to revision Bankart reconstruction,
open Latarjet provides improved ASES Shoulder Index Scores, ASES Shoulder Function Scores and VAS Scores at nearly all timepoints. In the treatment of recurrent anterior glenohumeral instability, open Latarjet is a reasonable option in the primary setting and should be favored over Bankart repair for revision cases with improved pain relief and functional scores.
Paper 27
Comparison of Knotless Versus Traditional Glenoid Anchors in Early Outcomes Following Arthroscopic Shoulder Stabilization

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Objectives: To compare knotless versus traditional glenoid anchors as well as use of all-suture versus non-all suture anchor material in early outcomes after arthroscopic shoulder stabilization. We hypothesize there is no difference in outcomes between anchor type or material.

Methods: Patients who were prospectively enrolled in the Multicenter Orthopaedic Outcomes Network (MOON) Shoulder Group instability database completed a series of patient reported outcomes (PROs) pre and post-operatively at 2 years. At the time of surgery, physicians documented technique utilized and materials employed. The incidence of subsequent shoulder surgeries, re-dislocations or subluxations, and return to sport (RTS) were obtained. Patients were stratified by anchor type (knotless [KL] versus knotted [KT]) and then by anchor material (all-suture [AS] versus non-all suture [NS]). Bivariate analyses were performed to compare outcomes between groups, including the Wilcoxon signed-rank test and chi-square test.

Results: A total of 447 patients who underwent primary arthroscopic shoulder stabilization were evaluated, with 112 patients in the KL group (90.2% male) and 335 in the KT group (82.4% male; p > .05). Then there were 70 patients in the AS group (74.3% male) and 377 in the NS group (86.2% male; p = .01). The KT group (24.6 ± 8.9 years) was significantly older than the KL group (21.3 ± 7.8 years; p = .0003) while the AS group (26.8 ± 9.1 years) was significantly older than the NS group (23.2 ± 8.6 years; p = .003). Significantly more patients in the KL group (87.5%) underwent surgery in the beach chair (BC) position than the KT group (45.4%; p < .0001) and significantly more patients in the NS group (59.9%) underwent surgery in the BC position than the AS group (34.3%; p < .0001). The primary direction of instability was anterior, with 78.6% in the KL group, 71.3% in the KT group, 82.9% in the AS group and 71.4% in the NS group. The number of contact athletes was similar in each group, with 75.0% in the KL group, 66.0% in the KT group, 70.0% in the AS group, and 67.9% in the NS group. Significantly more anchors were used in the KL group (4.2 ± 1.6) compared to the KT group (3.9 ± 1.8; p = .003) and significantly more anchors were used in the AS group (5.3 ± 2.4) compared to the NS group (3.7 ± 1.4; p < .0001). Significantly more patients had a redislocation in the KL group (11.6%) compared to the KT group (5.7%; p = .03), and significantly more patients had a redislocation in the NS group (8.2%) compared to the AS group (1.4%; p = .04). There were no significant differences in improvement of any PROs, incidence of RTS, subsequent shoulder surgeries or subluxations between anchor type or material groups.
Conclusion: Compared to traditional knotted glenoid anchors, patients undergoing arthroscopic shoulder stabilization with knotless anchors can expect to experience similar clinical outcomes. However, use of knotless anchors may be a significant risk factor for subsequent dislocation 2 years after arthroscopic shoulder stabilization surgery, which may be related to patients’ age. Moreover, use of all-suture based anchors may be associated with lower rates of subsequent dislocation which may be attributed to the size of their footprint and the apparent inclination of surgeons using these to utilize more anchors per labral repair, thus increasing points of labral fixation. Continued investigation of potential confounding variables is necessary to identify the direct effect of anchor type and material on patient outcomes.
Paper 28
Is Return To Play At 6 Months After Latarjet Safe? A Multicenter Orthopaedic Outcomes Network (MOON) Shoulder Group Cohort Study

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Objectives: The Latarjet procedure is becoming increasingly popular for the treatment of young athletes with recurrent instability. Earlier return to play protocols have been trialed with the thought that one is primarily waiting on bone healing. However, the impact of post-operative range of motion (ROM) and strength must be considered as well. Return to play has traditionally been accepted at 6 months post-operatively, but it is unknown what percentage of athletes achieve full strength and range of motion at that point. The purpose of this study was to 1) To evaluate rates of return of full strength and range of motion at 6 months after Latarjet, and 2) determine whether rates of results vary by percent bone loss, subscapularis split versus tenotomy, or athlete status (contact or overhead).

Methods: Ten participating sites throughout the United States enrolled patients in a multicenter prospective cohort study. Sixty-five athletes met inclusion criteria (mean age 24.5 SD 8.2; 59 male, 6 female) and underwent Latarjet procedure for anterior instability (19/65 (29%) primary operation, 46/65 (71%) had a prior failed anterior stabilization). All participated in either contact sports (83%) and/or overhead sports (37%). Regarding anterior glenoid bone loss, 10% had <10% bone loss, 55% had 11-20%, and 35% had 21-30%. The Latarjet procedure was performed with either subscapularis tenotomy (64%) or split (36%). Strength and range of motion were assessed pre-operatively and at 6 months after surgery. Return to play (RTP) criteria were defined as full strength as well as less than 20 degrees side-to-side ROM deficits in all planes. The independent likelihood of strength and motion RTP criteria at 6 months for percent bone loss as well as subscapularis tenotomy vs split was assessed with multivariate logistic regression modeling with adjustment as needed for age, sex, preoperative strength/motion, number of prior dislocations, and participation in contact versus overhead sports.

Results: 45% of patients failed to meet one or more return to play criteria: 9% failed for persistent weakness and 39% for ≥ 20 degree side to side loss of motion. All patients with loss of motion had ≥ 20 degree external rotation (ER) deficits either with elbow at side (88%) or at 90 degrees abduction (44%). There was no difference in achieving RTP criteria at 6 months between subscapularis split versus tenotomy either for strength (p=0.89) or range of motion (p=0.53). Contact athletes had a 53% RTP rate while overhead athletes had a 67% passage rate (p=0.17). Pre-operative weakness was not significantly predictive of post-operative weakness (p=0.13), and pre-operative external rotation was not predictive of post-operative ER deficits (p=0.16). Percent bone loss was not predictive of side-to-side post-operative ROM deficits or weakness (p>0.20 all planes of motion). No other predictors for failure to meet RTP criteria at 6 months were identified.
Conclusion: A large percentage of athletes do not have full return of strength and range of motion at 6 months following Latarjet procedure. Further consideration may be warranted prior to releasing these athletes to contact sports.