# Minimum 10-Year Clinical Outcomes After Arthroscopic 270° Labral Repair in Traumatic Shoulder Instability Involving Anterior, Inferior, and Posterior Labral Injury

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**Background:** Current literature reports highly satisfactory short- and midterm clinical outcomes in patients with arthroscopic 270° labral tear repairs. However, data remain limited on long-term clinical outcomes and complication and redislocation rates in patients with traumatic shoulder instability involving anterior, inferior, and posterior labral injury.

**Purpose:** To investigate, at a minimum follow-up of 10 years, the clinical outcomes, complications, and recurrent instability in patients with 270° labral tears involving the anterior, inferior, and posterior labrum treated with arthroscopic stabilization using suture anchors.

**Study Design:** Case series; Level of evidence, 4.

**Methods:** A retrospective outcomes study was completed for all patients with a minimum 10-year follow-up who underwent arthroscopic 270° labral tear repairs with suture anchors by a single surgeon. Outcome measures included pre- and postoperative Rowe score, American Shoulder and Elbow Surgeons (ASES) score, Simple Shoulder Test, visual analog scale for pain, and Single Assessment Numeric Evaluation (SANE). Western Ontario Shoulder Instability Index (WOSI) scores were collected postoperatively. Complication data were collected, including continued instability, subluxation or dislocation events, and revision surgery. Failure was defined as any cause of revision surgery.

**Results:** In total, 21 patients (mean ± SD age, 27.1 ± 9.6 years) with 270° labral repairs were contacted at a minimum 10-year follow-up. All outcome measures showed statistically significant improvements as compared with those preoperatively: Rowe (53.9 ± 11.4 to 88.7 ± 8.9; $P = .005$), ASES (72.9 ± 18.4 to 91.8 ± 10.8; $P = .004$), Simple Shoulder Test (8.7 ± 2.4 to 11.2 ± 1.0; $P = .013$), visual analog scale (2.5 ± 2.6 to 0.5 ± 1.1; $P = .037$), and SANE (24.0 ± 15.2 to 91.5 ± 8.3; $P = .043$). The mean postoperative WOSI score at minimum follow-up was 256.3 ± 220.6. Three patients had postoperative complications, including a traumatic subluxation, continued instability, and a traumatic dislocation, 2 of which required revision surgery (14.2% failure rate).

**Conclusion:** Arthroscopic repairs of 270° labral tears involving the anterior, inferior, and posterior labrum have highly satisfactory clinical outcomes at 10 years, with complication and redislocation rates similar to those reported at 2 years. This suggests that repairs of extensile labral tears are effective in restoring and maintaining mechanical stability of the glenohumeral joint in the long term.

**Keywords:** labrum; labral repair; shoulder; instability; dislocation

Traumatic 270° labral tears resulting in bi- or tridirectional instability are rare and complicated injuries, generally seen in competitive contact athletes.[14] This pathology typically involves tears to the anterior, inferior, and up to the midglenoid posteriorly with preservation of the superior labrum and biceps anchor (Figure 1).[14] In contrast, patients with triple labral lesions have arthroscopic findings demonstrating damage to the superior labrum and the proximal biceps complex.[12]

Panlabral tears account for only 2.4% of all labral tears, but they may be challenging for shoulder surgeons because of the extent of damage to the joint.[14,19,20] Additionally, preoperative clinical examination and diagnostic imaging

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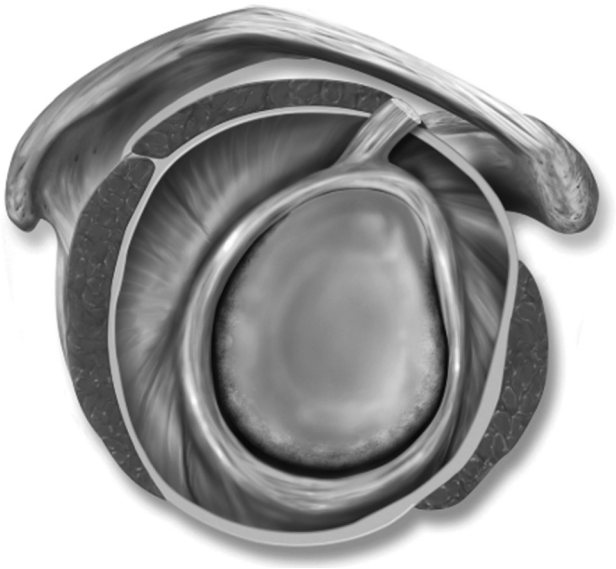

**Figure 1.** A 270° labral tear involves the anterior, inferior, and up to the midglenoid posteriorly with preservation of the superior labrum and biceps anchor. From Mazzocca et al.[14] Reprinted with permission.

frequently miss 270° labral tears, potentially complicating the treatment and subsequent clinical outcomes.[19]

Historically, surgical treatment of panlabral tears consisted of open inferior capsular shift or capsular plication to tighten the inferior capsule and reduce total joint volume.[2,7-9,15] Over the past 20 tears, a trend has emerged toward arthroscopic procedures resulting in less postoperative pain and less surgical morbidity.[1,3,11,14,18,20] As these labral lesions mostly cover 270° of the labrum, an arthroscopic approach allows complete visualization and repair of all labral pathology (Figure 2).[14] So far, only 4 studies have reported on arthroscopic treatment of traumatic anterior, inferior, and posterior labral injury and these were limited to short-term follow-up.[1,10,11,14]

Therefore, the purpose of this study was to investigate, at a minimum 10-year follow-up, the clinical outcomes, complications, and recurrent instability in patients with 270° labral tears involving the anterior, inferior, and posterior labrum treated with arthroscopic stabilization using suture anchors. We hypothesized that patients undergoing 270° arthroscopic stabilization would maintain significant improvement in clinical outcomes at a minimum 10-year follow-up.

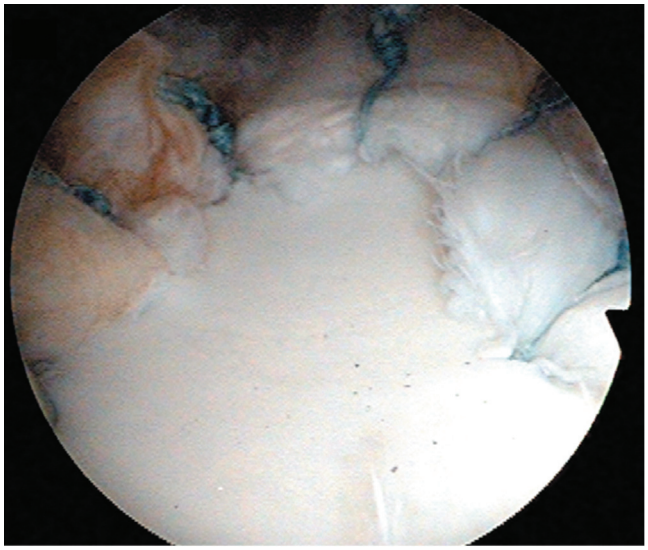

**Figure 2.** Arthroscopic view demonstrates extensile labral repair using 6 anchors in a 270° labral tear. From Mazzocca et al.[14] Reprinted with permission.

## METHODS

### Patient Selection

Institutional review board approval by the University of Connecticut was obtained before initiation of the study (17-066-3). A query of the institution's electronic medical record database using International Classification of Diseases, Ninth Revision, codes was made to identify all patients with glenohumeral instability from a single surgeon's practice. A limited chart review was conducted to identify all patients undergoing arthroscopic stabilization for 270° labral tears from the practice of a single fellowship-trained shoulder surgeon (A.D.M.) between January 1, 2003, and May 31, 2010. Patients were contacted via mail or phone call to collect outcome data. All patients provided oral consent before completing surveys over the phone.

### Inclusion and Exclusion Criteria

Inclusion criteria included arthroscopically confirmed 270° labral tears (anterior, posterior, inferior) treated with arthroscopic stabilization using suture anchors and having a minimum 10-year follow-up. Patients required a history of traumatic dislocation or subluxation that resulted in

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symptomatic anteroinferior or bidirectional instability.[14] Physical examination findings included 2+ or greater anteroinferior or posteroinferior load shift, symptomatic apprehension test, and positive relocation test.[14]

Exclusion criteria included history of atraumatic multidirectional instability or findings of hyperlaxity, fractures to the glenoid or humerus, revision procedures, concomitant procedures (eg, rotator cuff surgery, tenodesis of the long head of the biceps), superior labrum anterior to posterior (SLAP) lesions, significant glenoid and humeral head bone loss, and death.[14] Significant bone loss was defined as a Hill-Sachs lesion involving ≥20% of the humeral head articular surface or glenoid bone loss ≥20% on computed tomography imaging.[4,14]

## Clinical Examination

At the initial visit, a complete history was obtained consisting of a detailed description of the injury, including the degree of trauma, the number of dislocation and/or subluxation events since the initial instability event, history of shoulder instability symptoms and previous treatments, and whether reduction by a health care provider was required or the dislocation spontaneously reduced.[14] Physical examination included active and passive range of motion, anterior apprehension test, relocation test, and the presence of a sulcus sign. The load-and-shift test was performed anteriorly and posteriorly during surgery with the patient under sedation.[14]

## Radiologic Analysis

Preoperative radiographic analysis included plain anteroposterior, supraspinatus outlet, and axillary views. Magnetic resonance imaging (MRI) was used to assess the extent of the labral tear. Axial and sagittal images were helpful in identifying anterior and posterior labral tears. Patients with significant recurrent instability after the original traumatic dislocation had computed tomography scans to quantify the amount of bone loss at the glenoid and humeral head.[14]

## Surgical Technique

Surgery was performed according to Mazzocca et al[14] (Figure 2). After successful induction of general anesthesia and interscalene block, patients were placed on a beanbag in the lateral decubitus position. An examination under anesthesia was completed, measuring passive range of motion in forward flexion, external rotation, internal rotation, and abduction. Anterior and posterior load-shift tests were graded, and the presence of a sulcus sign was recorded. All patients had 2+ anterior and/or 2+ posterior load-shift tests during examination under anesthesia. The sulcus sign was present in 12 patients (57%).

The operative extremity was then prepared and sterilely draped. The arm was placed in an overhead traction device (Arthrex Inc), distracting the glenohumeral joint with 7 lbs (pounds) of overhead traction and 5 lbs (pounds) of longitudinal traction. A sterile blanket roll was placed under the axilla to improve visualization and passage of instruments inferiorly. The posterior viewing portal was established first. Using an outside-in technique with a spinal needle, an anterosuperior portal was established at the superior aspect of the rotator interval and anterior to the biceps tendon. Diagnostic arthroscopy was completed, confirming a 270° labral tear and integrity of the superior labrum and biceps anchor. Finally, an anteroinferior portal was established using a spinal needle superior to the subscapularis at a position midway between the glenoid and the humeral head.

Labral repairs were completed using solid suture anchors (3.0 PEEK Arthrex Inc) loaded with nonabsorbable high-strength No. 2 suture (FiberWire; Arthrex Inc). Anchors were placed every 10 to 12 mm, with the number of anchors, generally 6 or 7 in total, dependent on the individualized pathology. Arthroscopic repair began posteriorly. For the posteroinferior quadrant, 2 or 3 anchors were placed at the 7- and 8-o'clock positions. If indicated, an additional anchor was placed at the 9-o'clock position for right shoulders. The posteroinferior anchor was placed percutaneously through the infraspinatus at an angle perpendicular to the glenoid. A suture-passing instrument (Suture Lasso; Arthrex Inc) was used to grasp inferior tissue and pass the suture underneath the labrum, allowing posterosuperior capsulolabral shift with each anchor. After posterior labral repair, the inferior and anterior labral tears were repaired using percutaneously placed anchors through the subscapularis, starting inferiorly and moving superiorly. For a right shoulder, the anteroinferior quadrant was repaired with 3 or 4 anchors placed at the 5-, 4-, and 3-o'clock positions. If indicated, an additional anchor was placed at the 2-o'clock position. Labral repair was complete when the entire anterior, inferior, and posterior labrum was secured to the glenoid rim. Rotator interval closure was chosen and performed in patients with a sulcus sign that did not reduce with external rotation to improve stability.[14]

## Postoperative Rehabilitation

Postoperatively, the operative extremity was placed in a shoulder sling with an abduction pillow (Corflex) to be worn for 6 weeks. On days 7 to 10, formal physical therapy was initiated. Patients were limited to 30° of passive external rotation and permitted 180° of forward elevation in the first 4 weeks. At 4 to 12 weeks, active-assisted and active range of motion in all planes was initiated as well as scapular stabilization. At 12 weeks, rotator cuff strengthening and sport-specific training were begun. Return to full activities was generally permitted at 24 to 36 weeks.

## Clinical Outcomes

All patients were evaluated by the same examiner (A.D.M.) for physical examination and strength assessment. Postoperative physical examination findings were recorded from the most recent clinical visit. Shoulder function was evaluated with the Rowe score, American Shoulder and Elbow Surgeons (ASES) score, Simple Shoulder Test, visual analog scale for pain, Single Assessment Numeric Evaluation

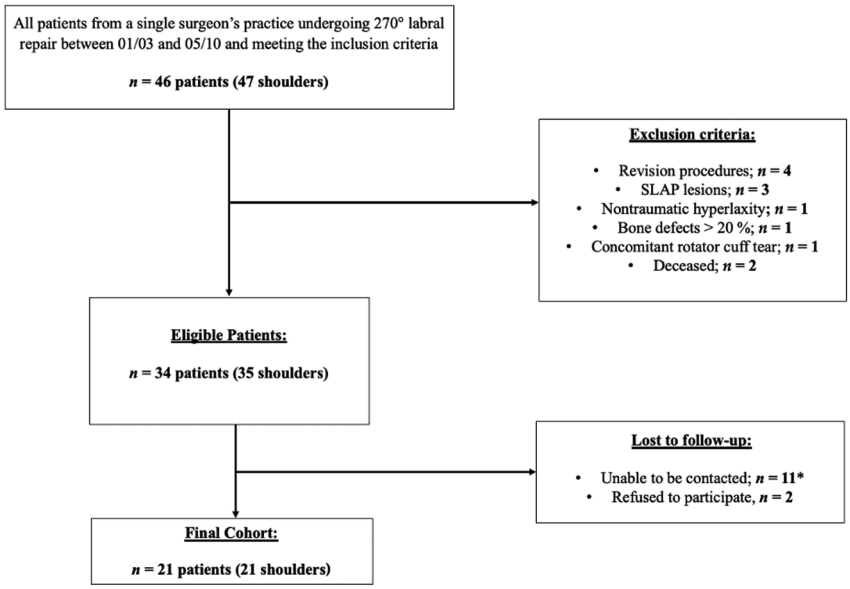


**Figure 3.** Flowchart of inclusion/exclusion criteria to form the final patient cohort. *One patient who was lost to follow-up had bilateral 270° labral repairs. SLAP, superior labrum anterior to posterior.

(SANE), and Western Ontario Shoulder Instability Index (WOSI). SANE and WOSI scores were collected to measure quality of life and satisfaction. The WOSI score, which was collected postoperatively, is a validated disease-specific self-assessment tool that rates the shoulder function of patients with glenohumeral instability based on 4 subdomains: physical, sports/recreation/work, lifestyle, and emotions. Interestingly, the WOSI score can be represented as a percentage of a normal healthy shoulder, improving clinical utility.[21] All postoperative 10-year outcome score data were collected via telephone or phone surveys.

Complication data were collected, including continued instability, subluxation or dislocation events, and revision surgery. Failure was defined as any cause of revision surgery.

### Statistical Analysis

For statistical analysis, continuous variables are presented as means and standard deviations and categorical variables as frequencies and proportions. To compare differences in pre- and postoperative outcome scores, the nonparametric Wilcoxon signed-rank test was used. $P < .05$ was considered statistically significant. All analyses were performed with Stata Statistical Software (Version 15; StataCorp LLC).

## RESULTS

### Patients

A total of 46 patients (47 shoulders) met the inclusion criteria for 270° labral tears with arthroscopic confirmation and stabilization during the study period between January 1, 2003, and May 31, 2010. Of these, 12 patients (12 shoulders) were excluded, and an additional 13 patients (14 shoulders) were lost to follow-up. The final cohort consisted of 21 patients (21 shoulders) who met the study criteria. The flowchart of the final cohort after inclusion and exclusion criteria is shown in Figure 3.

TABLE 1
Characteristic Data of the Patients (N = 21)

| | Mean ± SD or No. (%) |
|---|---|
| Age, y | 27.1 ± 9.6 |
| Body mass index | 27.3 ± 4.0 |
| Length of follow-up, y | 11.9 ± 1.3 |
| At latest clinical examination, mo | 22.7 ± 35.4 |
| No. of anchors | 6.3 ± 0.6 |
| Sex, male:female | 18:3 |
| Laterality, left:right | 15:6 |
| Operative side, dominant:nondominant | 7:14 |
| Rotator interval closure | 3 (14) |
| Glenoid bone loss <20%, anterior:inferior rim fracture | 2:1 |
| Hill-Sachs lesions <20% articular surface, standard:reverse | 4:2 |
| Comorbidity | |
| Diabetes or rheumatoid arthritis | 0 (0) |
| Smoking | 4 (19) |
| Alcohol | 2 (10) |
| Complication | |
| Subluxation | 1 (4.8) |
| Revision | 2 (9.5) |

The mean ± SD age of the patients was 27.1 ± 9.6 years (range, 16-48 years) at time of surgery. There were 18 male and 3 female patients. All patient data are delineated in Table 1. The average number of anchors used was 6 (range,

TABLE 2
Clinical Outcome Scores for 270° Labral Repair at Presurgery, 2 Years, and Minimum 10-Year Follow-up[a]

| | Presurgery | | 2 y | | | 10 y | | | 2 to 10 y |
|---|---|---|---|---|---|---|---|---|---|
| | Mean | SD | Mean | SD | *P* Value | Mean | SD | *P* Value | *P* Value |
| Rowe | 53.9 | 11.4 | 90.4 | 11.6 | **.018** | 88.7 | 8.9 | **.005** | .715 |
| ASES | 72.9 | 18.4 | 92.6 | 12.7 | **.018** | 91.8 | 10.8 | **.004** | .465 |
| SST | 8.7 | 2.4 | 10.9 | 1.9 | **.022** | 11.2 | 1.0 | **.013** | .462 |
| Pain | 2.5 | 2.6 | 0.0 | 0.0 | .317 | 0.5 | 1.1 | **.037** | .317 |
| SANE | 24.0 | 15.2 | 92.6 | 11.2 | | 91.5 | 8.3 | **.043** | .917 |
| WOSI | | | 308.0 | 356.9 | | 256.3 | 220.6 | | .499 |

[a]$P < .05$ was considered statistically significant (in bold). Empty cells indicate that *P* value was not calculated. ASES, American Shoulder and Elbow Surgeons; SANE, Single Assessment Numeric Evaluation; SST, Simple Shoulder Test; WOSI, Western Ontario Shoulder Instability Index.

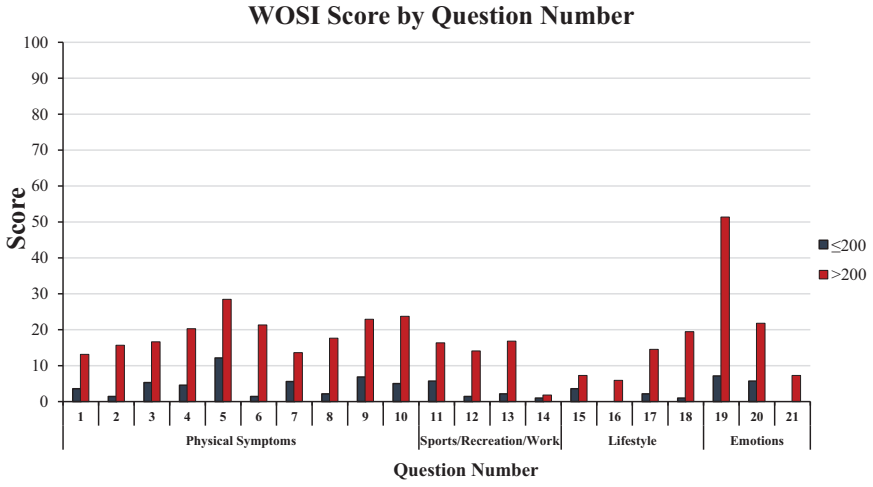


**Figure 4.** Analysis of WOSI scores stratified by all 21 items and by those with total scores ≤200 and >200. In those with worse 10-year WOSI scores, consciousness of the shoulder (No. 19), clicking/cracking/snapping (No. 5), compensation by other muscles (No. 9), and loss of range of motion (No. 10) scored the highest among the 21 items. WOSI, Western Ontario Shoulder Instability Index.

4-7). Only 1 patient had <6 anchors placed, all of which were double-loaded suture anchors. The average follow-up time was 11.9 ± 1.3 years (range, 10.1-15.4 years).

## Clinical Outcomes

Clinical outcome measures showed statistically significant improvements in all subjective and objective shoulder function after operative intervention at 10 years as compared with presurgery (Table 2). The mean postoperative WOSI score at 10 years was 256 (Figures 4 and 5). At 10 years, 7 shoulders (33%) had a WOSI score ≤200, corresponding to 90% of normal.[14] Detailed analysis of the WOSI outcomes by individual question and the 4 subdomains are shown in Figures 4 and 5, respectively. These measures indicate that for those with worse 10-year WOSI scores, consciousness of the shoulder (item 19), clicking/cracking/snapping (item 5), compensation by other muscles (item 9), and loss of range of motion (item 10) scored the highest/worst among the 21 items.

## Hand Dominance

Seven patients underwent 270° labral repair on the dominant arm (33%). Upon subgrouping by surgery on the dominant versus nondominant arm, no statistically significant differences were seen for any outcome measure.

## Complications

There were no intraoperative complications in this cohort. One patient had preoperative axillary nerve palsy that resolved spontaneously without long-term sequelae. Of 21 patients, 3 (14%) had postoperative complications. One patient experienced a subluxation event secondary to a throwing injury while playing handball 3 years after surgical stabilization. MRI revealed a slightly displaced

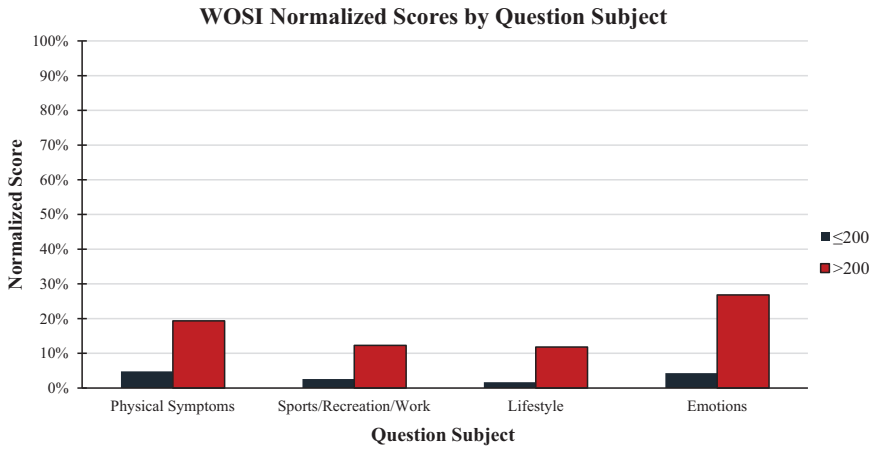


**Figure 5.** Analysis of WOSI scores organized by the 4 subdomains and stratified by those with total scores ≤200 and >200, presented as the normalized score in each subdomain. In those with worse 10-year WOSI scores, emotional and physical symptoms were experienced the most. WOSI, Western Ontario Shoulder Instability Index.

anteroinferior labral tear and a small Hill-Sachs lesion, but the patient was asymptomatic without pain or feelings of instability and opted for nonoperative management. Another patient had a traumatic dislocation 6 years after the initial stabilization, requiring revision labral repair. Intraoperative assessment revealed a large anteroinferior labral tear and a new superior labral tear. A third patient had recurrence of instability with insidious onset requiring revision surgery 1 year later. MRI and revision surgery revealed a retear of the posterior labrum.

## DISCUSSION

The most important finding of this study was that patients undergoing 270° arthroscopic labral repair using suture anchors maintained excellent clinical outcomes at a minimum follow-up of 10 years. Moreover, this challenging cohort experienced significant improvements in pain and shoulder function as compared with the preoperative state, with low rates of recurrent instability, complications, and revision surgery. Furthermore, the data from this study suggest the long-term efficacy of these extensive repairs to restore mechanical stability to the glenohumeral joint.

Extensive labral lesions, such as traumatic 270° labral tears, are a rare and surgically challenging pathology. Biomechanically, glenohumeral instability is a spectrum of disorder, in which extensive labral lesions are the result of acute traumatic events and/or long-standing repetitive microtrauma.[5] As such, traumatic 270° labral tears are characterized by labral tears to the anterior, inferior, and up to the midglenoid posteriorly with preservation of the superior labrum and biceps anchor.[14] The extent of these injuries is often underappreciated on advanced imaging studies and physical examination, with some patients exhibiting unidirectional instability.[14,16,20]

Of interest, labral tears can be typically classified into different categories based on location and extent of the lesions: anterior labral tears (Bankart lesions), posterior labral tears (reverse Bankart lesions), and SLAP tears.[13,14] First described by Lo and Burkhart[13] in 2005, triple labral lesions involve the anterior, superior, and posterior aspects of the glenoid, contrary to 270° labral tears, which present as an intact superior labral and biceps complex.

As shown by Mazzocca et al,[14] arthroscopic repair of 270° labral tears is seen as an effective treatment option in the management of bidirectional shoulder instability. Furthermore, as stated by the senior authors (D.P.B., A.D.M.), an arthroscopic approach permits complete visualization of the glenohumeral joint allowing the repair of any concomitant injuries. Of interest, Mazzocca et al reported on 19 patients (20 shoulders) with traumatic 270° labral tears at a minimum 2-year follow-up and identified significant improvements in Rowe (59 to 92), ASES (76 to 93), Simple Shoulder Test (9 to 11), and Constant-Murley (73 to 95) at final follow-up. Similarly, satisfactory mean postoperative SANE and WOSI scores of 95 and 302 were demonstrated, respectively. Of these patients, 6 were included in this 10-year follow-up study.

To date, there are limited studies investigating clinical outcomes of traumatic 270° labral tears. Alpert et al[1] examined the outcomes and satisfaction in 13 patients with frank 270° labral tears at a minimum 2-year follow-up and reported good clinical results with a success rate of 85% and no revision cases. However, the results were observed in patients with primary atraumatic multidirection instability.

Despite identifying satisfactory long-term outcomes, the current study did not investigate return to play. Pounder et al[18] identified a 76% rate of return to sport after arthroscopic 270° labral repair at a mean follow-up of 42.2 months in their 25-patient cohort, which included 19 (76%) collision athletes. Fifteen patients (60%) returned to the same or higher level of sport. Interestingly, 1 patient in the original cohort was a starting safety in the National Football League, indicating the success that these repairs may have. However, this patient was lost to follow-up.

At a final point, this study indicates that excellent long-term clinical outcomes can be expected in a challenging patient cohort. At a mean postoperative follow-up of 11.9 years, all outcome measures had significant improvements from baseline: Rowe, from 53.9 ± 11.4 to 88.7 ± 8.9 ($P$ = .005); ASES, 72.9 ± 18.4 to 91.8 ± 10.8 ($P$ = .004); Simple Shoulder Test, 8.7 ± 2.4 to 11.2 ± 1.0 ($P$ = .013); visual analog scale, 2.5 ± 2.6 to 0.5 ± 1.1 ($P$ = .037); and SANE, 24.0 ± 15.2 to 91.5 ± 8.3 ($P$ = .043). These scores are similar to the short- and midterm outcomes reported previously,[14] suggesting that arthroscopic repairs for extensile labral lesions are effective and satisfactory long term.[14,20,22] Ten-year WOSI scores in this cohort averaged 256.3 ± 220.6 as compared with 302 at 2 years.[14] Seven shoulders (33%) had a WOSI score ≤200, corresponding to 90% of normal. Of those with worse WOSI scores, consciousness of the shoulder had the highest mean response, which was the most consistently reported in the 2011 study from Mazzocca et al.[14] Overall, patients trended toward stable or improved WOSI scores from 2 to 10 years postoperatively, with only 1 patient having worsening scores. This patient had a subluxation event 3 years postoperatively while playing handball. Ultimately, this patient did not require revision surgery.

In the current literature, complication rates after 270° or 360° labral repairs range from 10% to 30%.[6] Tokish et al[22] reported 6 complications in 41 shoulders: 2 redislocations, 2 cases of postoperative stiffness, and 2 SLAP tears, for which all patients had a second operation. Ricchetti et al[20] identified 13 complications, including 6 episodes of shoulder stiffness; however, only 3 (7%) patients required additional or revision surgery. Pounder et al[18] identified only 1 recurrent subluxation with no dislocations or revision surgery in their 25-patient cohort of 270° labral tears. In the current study, 3 (14.2%) complications were identified. One patient had a recurrent subluxation after a handball injury. Another patient had continued instability and a third had a repeat traumatic dislocation, both of which required revision surgery (14.2% failure rate).

There are several limitations to this study. First, despite prospective collection of data, this study was retrospective. Second, there was no surgical or nonsurgical control group; therefore, the increased benefit of a surgical approach over a nonsurgical treatment in this patient cohort remains unclear. Third, there were a considerable number of patients lost to follow-up. Specifically, many of our patients were high school or college athletes, who were difficult to contact and/or examine after relocation. Fourth, there is a risk of recall bias. Also, the current study did not evaluate the extent of arthritic change over time. Plath et al[17] found that 69% of patients had some degree of arthropathy after arthroscopic Bankart repair for anterior instability at 10 years. As discussed by Pounder et al,[18] it is unclear if more extensive labral damage would correlate with increased rates of arthritic change. Finally, a considerable number of patients were not seen and examined after 10 years; that is, the purpose of the study was to reflect the subjective clinical outcomes after a minimum follow-up of 10 years.

## CONCLUSION

Arthroscopic repairs of 270° labral tears involving the anterior, inferior, and posterior labrum have high satisfactory clinical outcomes at 10 years, with complication and redislocation rates similar to those reported at 2 years. This suggests that repairs of extensile labral tears are effective in restoring and maintaining mechanical stability of the glenohumeral joint in the long term.

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