Arthroscopic Circumferential Labral Repair for Patients With Multidirectional Instability

A Comparative Outcome Study

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Background: Circumferential tears of the glenohumeral labrum are an uncommon injury, comprising 2.4% of all labral lesions. Currently, the clinical outcomes of arthroscopic circumferential labral repair for patients with instability and combined anterior, posterior, and superior labral tears are not well-known.

Hypothesis: Patients treated with arthroscopic circumferential shoulder labral repairs will have inferior clinical outcomes and higher failure rates compared with patients who have isolated arthroscopic anterior labral repairs.

Study Design: Cohort study; Level of evidence, 3.

Methods: A retrospective cohort study was performed to identify patients aged 18 years and older who underwent circumferential arthroscopic stabilization for recurrent instability as compared with an age-matched control group of arthroscopic primary anterior labral repairs. Age at surgery, American Shoulder and Elbow Surgeons (ASES) Standardized Shoulder Assessment Form score, Simple Shoulder Test (SST) score, 12-Item Short Form Health Survey (SF-12) score (mental and physical), and overall patient satisfaction with surgery were assessed for each group.

Results: A total of 35 consecutive patients (36 shoulders) who underwent an arthroscopic 360° circumferential labral repair were compared with a matched group of 31 patients who underwent an isolated arthroscopic anterior labral repair. The mean follow-up period was 34.3 and 56.8 months, respectively. No significant difference was found between the 2 groups for overall satisfaction with the surgery or recurrent instability. At the time of the follow-up survey, 22% of the patients experienced pain and 25% of the patients experienced instability in the circumferential repair group, whereas 15% of the patients experienced some level of pain and 30% of patients experienced a subjective sense of subtle instability in the isolated repair group. The ASES scores were 87.3 in the combined labral repair group and 93.3 in the isolated anterior group ($P = .35$), SST scores were 10.7 and 11.3 ($P = .70$), SF-12 mental scores were 54.6 and 56.8 ($P = .80$), SF-12 physical scores were 53.2 and 54.2 ($P = .98$), and age at time of the surgery was 26.7 and 24.6 years ($P = .33$), respectively. There was no difference between the 2 groups in pre- and postoperative range of motion ($P > .05$).

Conclusion: There was no difference in shoulder stability and function in patients after 360° combined labral repairs versus anterior labral repair alone. With proper patient selection, patients can expect similar outcomes despite the more extensive surgical procedure and complex postoperative rehabilitation protocol for circumferential repairs.

Keywords: shoulder; instability; multidirectional; outcomes; repair

The labral complex provides stability to the glenohumeral joint. When injured, recurrent dislocation and instability can result. Anterior Bankart, posterior Bankart, and superior labrum anterior and posterior (SLAP) lesions are distinct and common shoulder injuries resulting from traumatic or repetitive microtraumatic mechanisms.[2] Much research has been done on isolated Bankart lesions. Bankart lesions of the glenoid labrum are most frequently repaired via an arthroscopic approach, as this approach is less invasive and has outcomes comparable with the more traditional open approach.[4,5,7,17,19,28,29,32] Arthroscopic posterior Bankart repairs, while not as successful as anterior Bankart repairs, also yield positive outcomes.[3,14,20,27] Arthroscopic treatment of SLAP repairs (Figure 1) have been reported to have been successfully treated, with 63% to 100% of the patients having good or excellent outcomes.‖

Circumferential tears of the glenohumeral labrum are an uncommon injury, comprising 2.4% of all labral lesions.[21] Powell et al[26] first classified the 360° labral tear as a type IX pan-labral SLAP lesion. There are a variety of surgical techniques for the repair of isolated structures

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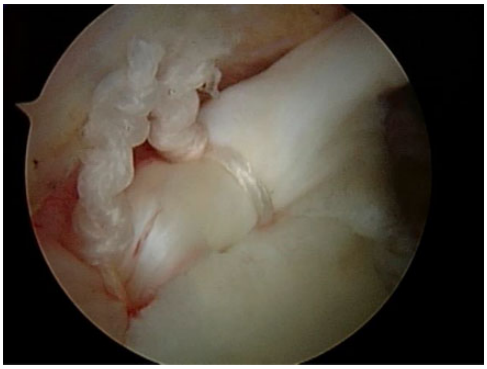

Figure 1. Superior labral repair.

in the shoulder joint, both open and arthroscopic.[32] To date, little research has been performed in patients with multidirectional labral detachment and instability and the arthroscopic treatment of circumferential labral tears (ie, anterior Bankart, posterior Bankart, and type II SLAP).[11,21,27] Repair of more than 1 labral section at the same time remains controversial because of increased complexity of the surgical repair, a larger surface area required to heal, and inferior capsular tissue quality.

The purpose of this study was to report the results after an arthroscopic circumferential labral repair for shoulder instability and compare these results with arthroscopic primary anterior Bankart repair. Arthroscopic primary anterior labral repair is the gold standard when considering the outcomes of arthroscopic stabilization. In essence, it was used as a "control" group against which the results of this study were compared. This can provide information to both the surgeon and the patient on what they can expect in the treatment of this complex pathology. Because patients with a circumferential lesion require multiple fixation points of the capsule and the labrum to the glenoid, we believed that this would cause increased tension and therefore decreased postoperative range of motion (ROM) compared with patients with an isolated anterior Bankart lesion. We also believed that inferior results would be seen on standardized outcome scores in patients with circumferential labral repairs because of the extensive nature of the surgery. Therefore, the hypothesis of this study was that patients who underwent circumferential shoulder labral repairs will have inferior clinical outcomes and higher failure rates compared with patients who underwent isolated arthroscopic primary anterior labral repairs.

METHODS

Approval was obtained by an institutional review board to identify all patients aged 18 years and older who had an arthroscopic repair of a circumferential glenohumeral labral tear performed by a single surgeon between January 2002 and July 2014. All patients initially had symptoms of shoulder pain and/or instability after traumatic injury. Labral tears were diagnosed by clinical examination and confirmed by magnetic resonance imaging. Treatment consisted of an initial period of nonoperative physical therapy for 6 months before the decision to proceed with surgery because of failure of nonoperative measures.

Surgical Technique

Circumferential Labral Repair. The patient was placed in the beach-chair position, and a careful physical examination under anesthesia was performed and directions of laxity and translation of the humeral head were recorded. A diagnostic arthroscopy was then performed, and the extent of labral tearing was examined. Both the glenoid and humeral head were inspected for evidence of bone loss. An arthroscopic load and shift test was performed to confirm both anterior and posterior instability.

Next, the arthroscope was repositioned laterally through a trans-rotator interval viewing portal. The posterior labral tear was mobilized using an arthroscopic elevator, and the glenoid rim was abraded using a motorized shaver. Instrumenting posteriorly through a portal placed in line with the posterolateral edge of the acromion, 2 double-loaded suture anchors were placed on the articular margin of the glenoid. Two anchors were used posteriorly because the posterior band of the inferior glenohumeral ligament and the central aspect of the posterior capsule were shifted. The superior aspect of the posterior capsule received stabilization from the posteriormost anchor of the superior labral repair. A suture-passing device was then used to place 2 vertical simple sutures for each anchor, shifting the capsule superiorly and laterally.

The arthroscope was then repositioned through a posterior-viewing portal. An accessory anteroinferior working portal was established just above the subscapularis near its humeral attachment site. An arthroscopic elevator was used to mobilize the anteroinferior capsule and labral complex. Soft tissue mobilization was performed until the labrum could "float" in the desired position above the glenoid rim to ensure that no undue tension was placed on the repair. Three double-loaded anchors were placed on the articular surface in the 5:30, 4:30, and 3:00 positions in the right shoulder. These locations were selected to specifically shift the axillary pouch (5:30) and reattach the anterior

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band of the inferior glenohumeral ligament (4:30) and the middle glenohumeral ligament (3:00). A suture-passing device was then used to shift the capsule and labrum superiorly and laterally. Simple sutures were used. An arthroscopic load and shift test was performed to confirm adequate stability anteriorly and posteriorly.

Last, the lateral trans-rotator interval portal was used for superior labral repairs.[12] The superior rim of the glenoid was abraded. Two double-loaded simple sutures were placed superiorly and posterosuperiorly. It is important to place both suture anchors posterior to the biceps attachment site in order to prevent postoperative loss of external rotation.

Anterior Bankart Repair. Patients were placed in the beach-chair position, and anesthesia was administered via an interscalene block. A careful examination under anesthesia was performed in each patient to confirm the diagnosis of isolated anterior glenohumeral instability. A diagnostic arthroscopy was then performed, and any associated pathology was inspected and treated as needed. In particular, the presence of glenoid bone loss or a large Hill-Sachs deformity was evaluated. Next, an arthroscopic elevator was used to mobilize the anteroinferior capsulolabral soft tissue complex. Mobilization was felt to be complete once the complex could "float" or remain above the level of the glenoid rim by itself. A motorized shaver was then used to abrade the glenoid rim. Typically, 3 double-loaded biologic suture anchors were placed in the 5:30, 4:30, and 3:00 positions in the right shoulder in order to stabilize and shift the axillary pouch, the anterior band of the inferior glenohumeral ligament complex, and the middle glenohumeral ligament, respectively. An arthroscopic load and shift test was performed after each repair to confirm stability.

Rehabilitation

After surgery, a standardized rehabilitation protocol was used for both the isolated Bankart repair and the circumferential repair groups. For the first 4 weeks, a sling was used to immobilize the shoulder in neutral rotation and 20° of abduction. During the first 2 weeks, patients were allowed to remove the sling for pendulum exercises and for early shoulder motion. During weeks 2 to 5, patients began isometric strengthening exercises with continued ROM restrictions. From weeks 5 to 8, patients focused on increased ROM in external rotation and began strengthening exercises. During weeks 8 to 12, the goal was for patients to regain full ROM and continue gradual strengthening. From weeks 12 to 24, patients were urged to continue strengthening and were allowed to gradually return to full activity. At 24 to 28 weeks, patients were encouraged to progress to functional activities, maintain full ROM, and continue progressive strengthening with the goal of returning to sporting activity (Table 1). To avoid injury to the repair, patients were advised to not do exercises with the barbell or dumbbell behind the head and neck. Posterior load exercises (ie, bench press, pushups) were restricted for 4 months. For shoulder safety when working with weights, patients were advised to always be able to see their hands if they were looking straight ahead. Return to contact sports was permitted at 6 months.

TABLE 1
Rehabilitation Protocol

Time, weeks	Activity
0-2	Control pain and swelling, protect the repair, and begin early shoulder motion.
3-5	Protect the repair, ensure wound healing, and prevent shoulder stiffness.
6-8	Protect the shoulder and avoid overstressing the repair, improve range of motion of the shoulder, and begin strengthening exercises.
9-12	Protect the shoulder repair, regain full range of motion, and continue gradual strengthening.
13-24	Protect the ligament repair, begin full range of motion, and continue strengthening and gradual return to full activity.
25-28	Progress to functional activities, maintain full range of motion, and continue progressive strengthening.

Patient Outcomes

Patients were evaluated in the office at standard intervals of 2 weeks, 6 weeks, 3 months, and 6 months. At each visit, ROM was checked and recorded. At 3 and 6 months postoperatively, strength and shoulder stability was assessed and recorded. Patients were contacted by mail and/or telephone after a minimum of 12 months and asked to fill out the American Shoulder and Elbow Surgeons (ASES) Standardized Shoulder Assessment Form score, Simple Shoulder Test (SST) score, and 12-Item Short Form Health Survey (SF-12) score (mental and physical). In addition, all patients were asked about any episodes of recurrent instability or dislocation events. Outcome measures were selected by the senior author (T.J.G.) before the initiation of the study.

Exclusion criteria included patients with significant glenoid bone loss (>20%), engaging Hill-Sachs lesions, capsular tears that required repair, or previous biceps tenodesis. For the circumferential labral repair group, a total of 43 shoulders in 42 patients met the inclusion criteria. Of the 42 patients, 7 were unable to be reached. Outcome data were collected for 36 shoulders in 35 patients. An age-matched group of 31 primary anterior arthroscopic Bankart repairs previously evaluated by the same fellowship-trained senior shoulder surgeon was identified. A total of 31 patients were used because a power study indicated that this number was sufficient for a control group.

RESULTS

The average follow-up time for the circumferential repair group was 34.3 months (range, 12-84 months), and the average follow-up time for the anterior Bankart repair group was 56.8 months (range, 23-91 months). There were 31 men (89%) and 4 women (11%) in the circumferential

TABLE 2
Mean Age and Sex of Participants

	Circumferential Group		Anterior Bankart Group	
Mean age	26.7 y		24.6 y	
Sex	31 (89%) men	4 (11%) women	20 (65%) men	11 (35%) women

labral repair group compared with 20 men (65%) and 11 women (35%) in the Bankart repair group. Age at the time of surgery was 26.7 years in the circumferential repair group and 24.6 years in the isolated anterior group; this difference was not statistically significant ($P = .33$) (Table 2). At the time of the follow-up survey, 22% of patients experienced pain and 25% of patients experienced instability in the circumferential repair group, whereas 15% of the patients experienced some level of pain and 30% of the patients experienced a subjective sense of subtle instability in the Bankart group. There were no significant differences between the 2 study groups regarding pain and instability, nor was there a difference in overall satisfaction with the surgery ($P > .05$ for all). There was no difference between the 2 groups in recurrent dislocations (1 patient from each group had a recurrent dislocation event). Both recurrences were traumatic redislocations while playing football.

The ASES score was 87.3 in the circumferential repair group and 93.3 in the isolated anterior group ($P = .35$). The SST score was 10.7 in the circumferential repair group and 11.3 in the isolated anterior group ($P = .70$). The SF-12 mental score was 54.6 in the circumferential repair group and 56.8 in the isolated anterior group ($P = .80$), and the SF-12 physical score was 53.2 in the circumferential repair group and 54.2 in the isolated anterior group ($P = .98$). There were no significant differences between the groups in any of the outcome scores (Figure 2).

In the anterior Bankart group, the preoperative mean ROM was 167° in forward flexion (FF) and 67° in external rotation (ER) compared with postoperative mean ROM at 6 months, which was 168° in FF and 60° in ER. In the circumferential group, there was a mean preoperative ROM of 160° in FF and 61° ER compared with a postoperative ROM at 6 months of 157° in FF and 55°in ER. There were no significant differences between the groups in pre- and postoperative ROM ($P > .05$).

DISCUSSION

In this study, arthroscopic circumferential labral repairs showed a high level of good and excellent functional outcomes. The overall redislocation rate was 3% in both the study groups. This is consistent with the previous literature[16,21,27,31] on circumferential and Bankart labral repairs.That said, 22% of the patients experienced pain and 25% of the patients experienced instability in the circumferential repair group, whereas 15% of the patients experienced pain and 30% of patients experienced instability in the isolated repair group. This finding suggests that redislocation rate, per se, may not be adequate when assessing outcomes after instability surgery.

Hantes et al[15,16] completed the first study to compare the repair of Bankart lesions with combined repair of anterior and superior labral tears.They found no significant difference in shoulder stability between the 2 groups and concluded that the restoration of the capsuloligamentous tissue prevented recurrent instability and restored function, similar to the results of the current study. Increased complexity of surgical procedure, inferior capsular tissue quality, and larger surface area required to heal did not appear to affect the outcome.

Tokish et al[36] described the outcomes of a patient cohort of 41 shoulders in 39 patients who were enrolled in a multicenter study and underwent a circumferential labral repair. The results of their study were similar to that of the current study in that the majority of patients showed a good or excellent mean pain score, mean instability score, mean ASES score, mean SF-12 score, and mean single assessment

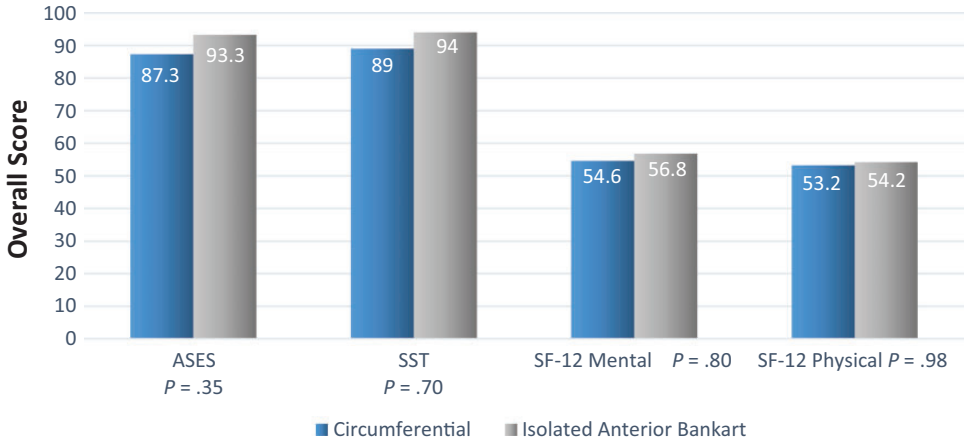

Figure 2. Scores of various outcome tests. ASES, American Shoulder and Elbow Surgeons Standardized Shoulder Assessment Form; SF-12, 12-Item Short Form Health Survey; SST, Simple Shoulder Test.

numerical evaluation score. However, the fact that the study was multicentered can lead to variability in the surgical approach/technique, postoperative rehabilitation protocols, and potential observer bias during physical examination.[36]

Lo and Burkhart[21] retrospectively reviewed 7 cases of recurrent instability and "triple labral lesions." Two of the 7 patients had a complete circumferential detachment of the labrum, whereas the other 5 had a small portion of the labrum still attached. They concluded that the circumferential repair procedure can restore normal stability to the glenohumeral joint, similar to the results of the current study. The Lo and Burkhart study did have a single surgeon perform all of the surgeries, but they only had 2 patients with a circumferential labral repair. These 2 studies, while producing positive outcomes, lacked an isolated Bankart repair group as a control against which to compare the outcomes of circumferential repair.

To our knowledge, this is the first study comparing the outcomes of arthroscopic circumferential labral repairs with isolated anterior Bankart repairs. Our findings indicated similar results between the circumferential repair group and the arthroscopic Bankart repair group. This information is important for surgeons when counseling patients in the perioperative time period on what reasonable expectations after circumferential labral repair may be in comparison with the much more commonly performed arthroscopic Bankart repair. In addition, this study adds to the relatively small amount of literature on the outcomes of these more complex injuries to help with the growing overall understanding of traumatic multidirectional instability.

There are several limitations to this study. First, this study was retrospective in nature, and as such, there were no preoperative shoulder function scores collected to compare pre- and postoperative function. The follow-up for the anterior Bankart group was longer than for the circumferential repair group, with an objective examination performed at 6 months. In addition, while the comparison group of anterior Bankart repairs was age matched, it was not sex matched, which potentially could have influenced the results. Another limitation was that the shoulder outcome scores used were for overall shoulder function and not specific to shoulder instability. More specific or additional outcome measures may have been better suited to find a difference in postoperative function between the 2 study groups. Furthermore, patients with global instability sometimes undergo surgery for pain and not necessarily frank dislocations. The indication for surgery in this cohort of patients — that is, pain versus instability — was not recorded. Finally, the ability to return to sport and at what level was not included as part of the outcome of the study for either arm of the study. This information may also have added important information relevant to surgeons performing this surgery.

CONCLUSION

There was no difference in shoulder stability and function in patients after circumferential labral repair when compared with anterior labral repair alone. With proper surgical technique and rehabilitation, properly selected patients treated with a circumferential labral repair for traumatic multidirectional instability and pain can expect outcomes similar to an isolated anterior Bankart repair despite the more extensive surgical procedure and complex postoperative rehabilitation protocol.

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