[Orthopaedic Surgery]

Early Results of Concurrent Arthroscopic Repair of Rotator Cuff and Type II Superior Labral Anterior Posterior Tears

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Background: Recent reports on concurrent arthroscopic rotator cuff and type II superior labral anterior posterior (SLAP) repair have raised concerns over postoperative stiffness and patient satisfaction. However, it is unclear if the observed stiffness relates to the repair of degenerative SLAP tears in older adults, the surgical technique, the postoperative rehabilitation, or to a combination of these factors.

Purpose: The purpose of this study was to evaluate the outcome and repair integrity of concurrent arthroscopic rotator cuff and type II SLAP repair.

Study Design: Case series.

Methods: Of 11 patients identified, 7 had a full-thickness rotator cuff tear and 4 had a high-grade partial thickness tear that was completed. A cannula placed through the rotator cuff tear improved the trajectory for posterior suture anchor placement during SLAP repair. Postoperative rehabilitation employed continuous passive motion to prevent stiffness.

Results: At minimum of 1-year follow-up, mean *yes* responses on the Simple Shoulder Test improved from 5.4 to 10.7 (out of 12; $P < .01$), and mean American Shoulder and Elbow Surgeons scores improved from 40 to 87 (out of 100; $P < .01$). Mean forward elevation improved from 148° to 161° ($P < .01$) and external rotation from 58° to 67° ($P < .01$). Magnetic resonance imaging, obtained at most recent follow-up in 10 patients, demonstrated a healed SLAP tear in all patients and a persistent rotator cuff defect in 1 patient.

Conclusions: Arthroscopic rotator cuff repair can be successfully combined with type II SLAP repair in relatively young patients who have sustained traumatic injury to their shoulders. Allowing early passive motion may help prevent postoperative stiffness without compromising rotator cuff healing.

Keywords: type II superior labral anterior posterior repair; rotator cuff repair; concurrent repair; outcome; magnetic resonance imaging; continuous passive motion

All-arthroscopic rotator cuff repair has grown in popularity because the technique allows enhanced visualization, preserves the deltoid attachment, and typically elicits less postoperative pain.[12] Tears of the superior labrum, termed *SLAP* (superior labrum anterior posterior) tears, were first identified arthroscopically and have been repaired in that manner for nearly 20 years.[22] Despite the prevalence of reports describing the results of arthroscopic rotator cuff repair and the results of SLAP repair, only a few studies have described the treatment of both rotator cuff and labrum pathology,[7,17,20-22] and even fewer studies have described the results of concurrent arthroscopic rotator cuff and SLAP repair.[1,9,23]

Some studies have noted a high incidence of postoperative stiffness following combined arthroscopic rotator cuff and

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SLAP repair,[1,9,17] and at least a couple have recommended debridement of the SLAP lesion[1] or biceps tenotomy[9] as alternatives to SLAP repair. However, it is unclear if the stiffness observed in these studies relates to the repair of predominately degenerative, or type I, SLAP tears in older adults, the surgical technique, the postoperative rehabilitation, or a combination of these factors.

The principal objective of this study is to report on the subjective and objective outcomes, including isokinetic strength testing and magnetic resonance imaging (MRI) at minimum of 1-year follow-up, in a small group of patients who underwent combined arthroscopic rotator cuff and SLAP repair and a standardized rehabilitation program emphasizing early recovery of passive motion. We also describe a trans–rotator cuff tear portal that facilitates anchor placement during SLAP repair.

METHODS

We retrospectively reviewed all rotator cuff repairs performed by the senior author (S.S.H.) from January 2005 to January 2007 and identified 11 patients (11 shoulders) who underwent concurrent arthroscopic repair of type II SLAP tears and rotator cuff tears. During this period, a total of 173 arthroscopic rotator cuff repairs were performed; of those, 11 SLAP tears (6.4%) were concurrently repaired. The 11 patients had a mean age of 47 years (range, 35 to 56 years). All 11 patients reported a discrete traumatic injury to their arms that triggered the onset of pain and weakness with overhead activities. Of 11 patients, 8 reported injuring their arm during sport or work or while lifting a heavy object, such as a riding lawn mower. Eight patients were men, and 3 patients sustained compensable injuries at work. The procedure was performed on the dominant extremity in 9 patients. An independent institutional review board approved this study, and all patients signed a written consent for participation.

At their initial office encounter, all patients underwent thorough standardized physical and radiographic examination, and shoulder-specific self-assessment was carried out with the Simple Shoulder Test (SST) and American Shoulder and Elbow Surgeons (ASES) questionnaires. MRI scans were available preoperatively for all patients, but most of these were obtained before initial presentation; that is, imaging technique was not standardized, and only 1 MRI was performed with intra-articular gadolinium. The MRI studies routinely identified a supraspinatus tendon tear but not the SLAP lesion. Eight patients underwent initial nonoperative treatment, 5 with subacromial corticosteroid injection.

The surgical technique was standardized. Patients underwent surgery on an outpatient basis; after receiving an interscalene block, each assumed the sitting position in a beach chair positioner (TENET, Calgary, Alberta, Canada), with the forearm secured in a hydraulic arm holder (Spider, TENET). Superior labrum lesions were suitable for repair if they were type II SLAP tears, according to the classification of Snyder.[22] Specifically, the biceps origin was detached from the superior glenoid, and the detachment was accentuated by traction on the biceps tendon. The defects extended 5 mm or more from the glenoid articular margin and demonstrated either granulation tissue beneath the superior labrum or debris on the superior glenoid rim. Meniscoid variants or degenerative type I SLAP lesions were not repaired.[5,16,21] Partial articular-sided rotator cuff tears were debrided to a stable margin with a motorized shaver and marked with a No. 1 monofilament suture for later evaluation in the subacromial space. Partial-thickness tears involving greater than 5- to 6-mm tendon detachment, or 50% of tendon thickness, were considered high grade[8,13] and were completed to a full-thickness tear.

Following subacromial bursoscopy and rotator cuff tear inspection or completion, the arthroscope was replaced into the glenohumeral joint for SLAP repair. First, the superior glenoid was gently abraded; then, in all but 2 patients, 2 bioabsorbable suture anchors were inserted (BioFastak, Arthrex, Naples, Florida)—one anterior to the biceps origin, the other posterior, each loaded with a single No. 2 nonabsorbable braided suture (Fiberwire, Arthrex). All suture anchors were placed between the 11 o'clock and 1 o'clock positions on the glenoid clock face. The posterior suture anchor was routinely inserted through the rotator cuff tear defect (Figure 1), either through the lateral portal or through a separate anterosuperior portal. This trans–rotator cuff defect portal improved the trajectory of the posterior anchor. Sutures were passed through the labrum in retrograde fashion using a suture shuttle system, with care taken to avoid incorporating adjacent capsular tissue into the repair. Standard arthroscopic knot-tying techniques were employed to complete the SLAP repair.[15,18]

The arthroscope was then replaced into the subacromial space for rotator cuff repair. All rotator cuff tears in this series were single-tendon tears confined to the supraspinatus. Seven were full-thickness rotator cuff tears, and 4 were high-grade partial-thickness tears involving greater than 50% of tendon thickness, which were converted to full-thickness tears. One rotator cuff tear was a longitudinal split that underwent side-to-side repair. The remaining repairs employed bioabsorbable suture anchors (BioCorkscrew, Arthrex) double-loaded with No. 2 nonabsorbable braided suture. The number of suture anchors depended on tear size: Smaller tears were repaired with 1 anchor and simple stitches, whereas larger tears were repaired with 2 anchors in a single-row configuration or 3 anchors in a double-row configuration employing both simple and horizontal mattress stitches. Three patients also underwent distal clavicle excision for associated symptomatic acromioclavicular joint arthrosis.

Postoperatively, all patients were enrolled in a standardized rehabilitation protocol that encourages early recovery of passive motion for repair of small- and medium-sized rotator cuff tears. Patients were instructed to use a continuous passive motion (CPM) device (Kinex, Waukesha, Wisconsin) at home for 30 to 60 minutes at a time, 4 times daily for 2

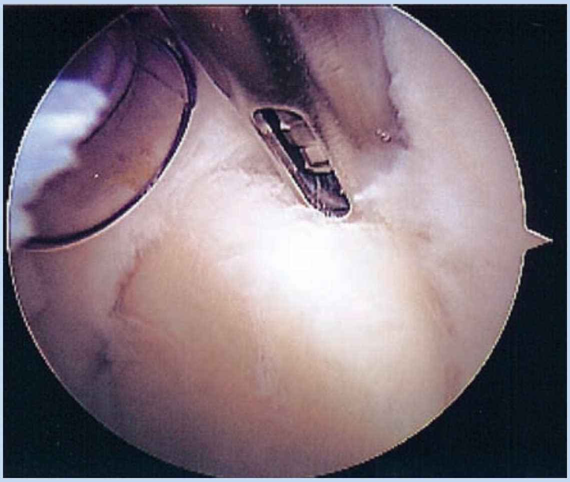

Figure 1. Intra-articular arthroscopic view from a standard posterior portal demonstrating placement of a cannulated guide through the rotator cuff tear in addition to a second cannula placed conventionally within the rotator interval. The trans–rotator cuff defect portal affords excellent access to the posterosuperior glenoid rim.

weeks, beginning the evening following surgery, to prevent subacromial and subdeltoid adhesions. The CPM device was programmed to permit forward elevation and external rotation to 90° and 20°, respectively. All patients reported regular CPM use with no reported problems. They did not keep CPM logs detailing use, so compliance with the CPM protocol could not be ensured. To protect the SLAP repair, each patient was instructed to keep his or her arm in a padded soft brace when not using the CPM and refrain from active elbow flexion and forearm supination for 3 weeks following surgery. Patients also initiated active-assistive range of motion exercises supervised by a physical therapist. These exercises were initially in forward elevation and external rotation at the side, followed by internal rotation at 4 weeks. At 6 weeks, active range of motion was permitted; posterior capsule stretches were introduced; and brace use was discontinued. Periscapular strengthening exercises were initiated immediately, beginning with shrugs and side-lying scapular clocks, followed by prone periscapular strengthening exercises at 4 to 6 weeks postoperatively. Closed chain exercises and advanced scapular training, including plyometrics and rhythmic stabilization, were initiated and advanced after 8 weeks postoperatively. At 8 weeks, rotator cuff strengthening was initiated and gradually advanced until a transition to a home-based strength and conditioning program between 3 and 4 months postoperatively.

All patients were examined postoperatively at 1 week, 3 weeks, 6 weeks, 3 months, and 6 months. Of 11 patients, 10 returned to the clinic after a minimum of 1 year from surgery (mean, 19 months; range, 14 to 27 months) for examination by 2 independent evaluators. One evaluator was an orthopaedic sports medicine fellow (J.S.); the other evaluator was an athletic trainer (A.D.) with greater than 10 years of clinical experience. Measurements for both shoulders were recorded and averaged between the 2 evaluators. In addition, patients underwent quantitative isokinetic strength testing (Biodex, Shirley, New York) of both shoulders. Internal and external rotation strength were measured at 60° per second and 180° per second, reported as a percentage of torque to body weight, and compared with the unaffected, opposite side.

All patients completed SST and ASES questionnaires at a minimum of 1-year follow-up. In addition, a Single Assessment Numeric Evaluation (SANE)[24] was obtained, and patients were asked if they would undergo surgery again if faced with identical shoulder symptoms. Of 11 patients, 10 also underwent a non-contrast-enhanced MRI study on a high-field (1.5 T) scanner. The MRI studies underwent independent review by an experienced musculoskeletal radiologist to assess healing of SLAP lesion and rotator cuff (Figure 2).

RESULTS

At a mean follow-up of 19 months (range, 14 to 27 months), mean ASES score improved from 40 (range, 18 to 68) to 87 (range, 53 to 100; $P < .01$). The mean number of *yes* responses on the SST improved from 5.4 (range, 1 to 12) to 10.7 (range, 5 to 12; $P < .01$). All patients reported that they would undergo the surgery again, and the mean postoperative SANE was 90.2 (range, 80 to 100). Excluding the 3 patients with a work-related claim, the mean number of *yes* responses on the SST was 11.9 (range, 11 to 12); the mean ASES score was 91.8 (range, 83 to 100), and the mean SANE was 91.6 (range, 80 to 100). Overall, 7 of 11 patients returned to work at a mean of 12 weeks postoperatively (range, 5 to 20 weeks), including 6 of 8 patients without a work-related claim.

Independent range of motion measurement revealed that mean forward elevation and external rotation at the side improved significantly from 148° to 161° ($P < .01$) and from 58° to 67° ($P < .01$), respectively, but internal rotation (from T10 to T9) did not improve. Isokinetic strength testing demonstrated slightly greater external rotation strength for the repaired shoulder (7% greater at 60° per second, 4% at 180° per second), but this was not statistically significant ($P > .30$ and $P > .60$, respectively). Postoperative MRI demonstrated a healed SLAP tear in all 10 patients and a persistent rotator cuff defect in 1 patient (Figure 3).

A postoperative complication requiring further treatment occurred in a patient with a work-related claim who developed stiffness that did not respond to oral corticosteroids and dedicated physical therapy. At 8 weeks following surgery, he underwent a manipulation under anesthesia followed by an arthroscopic lysis of adhesions and capsular release. Second-look arthroscopy revealed healed SLAP and rotator cuff repairs. Residual deficits in internal rotation prompted an arthroscopic release of the rotator interval and posterior

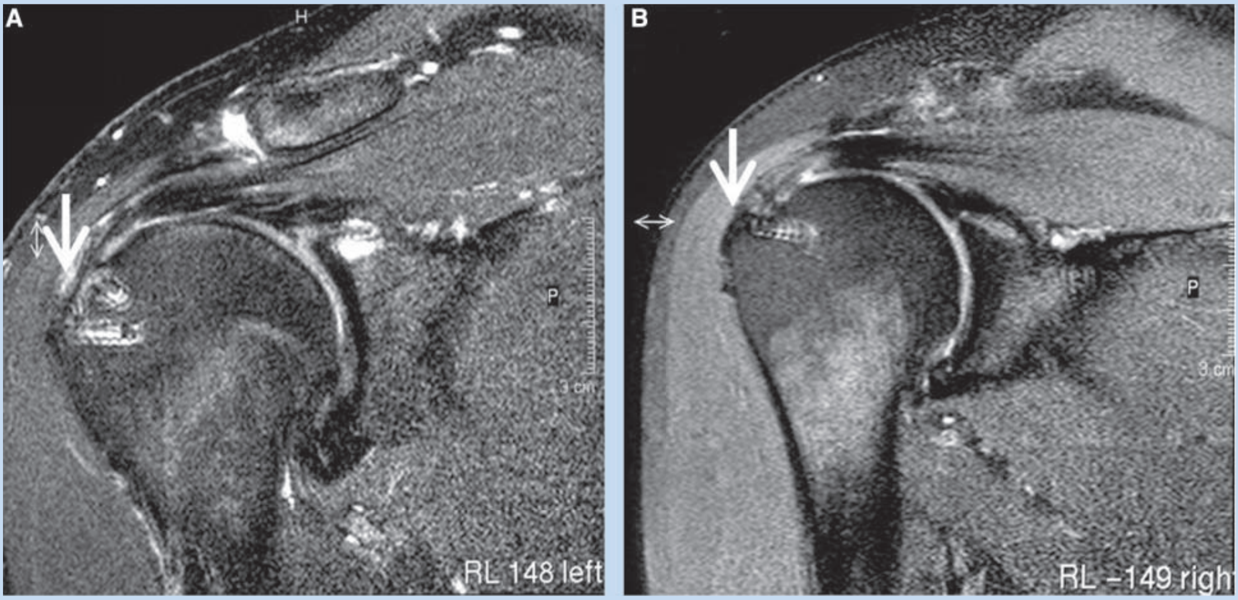

Figure 2. Representative postoperative oblique coronal MRI demonstrating healed rotator cuff and SLAP tears: A, patient 11; B, patient 10. Note the bioabsorbable suture anchors (white arrows).

capsule with a hook-tipped radiofrequency probe. A vigorous stretching program and home CPM[19] were immediately initiated postoperatively. At most recent follow-up, the patient demonstrated forward elevation to 168°, external rotation at the side to 58°, and final SST and ASES scores of 12 and 84, respectively (Table 1).

DISCUSSION

Arthroscopic rotator cuff repair and arthroscopic repair of type II SLAP tears are commonly performed procedures. Beginning with Snyder's initial report[22] on SLAP lesions in 1990, many reports on the treatment of SLAP tears have mentioned concomitant lesions, including partial- and full-thickness rotator cuff tears.[10,17,20,21] Snyder et al[21] reported on 140 SLAP lesions: 77 were type II tears and 7 of these were associated with full-thickness rotator cuff tears. Conversely, some reports on the results of arthroscopic rotator cuff repair included patients who also underwent SLAP repair.[14] Until recently there has been a dearth of information on the outcome of concurrent rotator cuff and SLAP repair.

In 2001, Savoie et al reported on 40 patients with a SLAC (superior labrum anterior cuff) lesion,[20] specifically referring to an articular-sided supraspinatus tear combined with a tear of the anterior portion of the biceps anchor (type IIA SLAP tear).[4] They repaired the superior labrum in all patients with a bioabsorbable tack, suture anchor, or suture punch technique and recommended transtendon rotator cuff repair for tears involving greater than 50% of tendon thickness. Of 40 patients, 39 were satisfied with the procedure, but no data were given regarding the number of patients who underwent concurrent rotator cuff repair as opposed to debridement.[20]

In 2001, Conway reported on the arthroscopic repair of partial-thickness rotator cuff tears and SLAP lesions in professional baseball players.[7] All 14 players underwent arthroscopic repair of deep intratendinous rotator cuff tears based on mattress stitches without suture anchors. In addition, associated labral tears were treated with either debridement or suture anchor repair, and associated instability was treated with thermal capsulorrhaphy. The number of patients who underwent SLAP repair as opposed to debridement was not mentioned, nor was the outcome of concurrent repair discussed. Of 9 players with greater than 12 months of follow-up, 8 returned to play at the same or higher level.

Voos et al recently reported on a group of 30 patients who had combined repair of rotator cuff and labral lesions[23]: 16 patients had Bankart tears and 14 had SLAP tears, although there were no outcome differences between the 2 groups. In particular, patients who underwent SLAP repair did not demonstrate any motion deficits. Overall, 90% of patients reported good to excellent satisfaction. The mean ASES score at final follow-up was 94—similar to the 92 observed in this study for the 8 patients without a work-related claim. Two patients with persistent rotator cuff tears were identified by clinical examination, but neither postoperative MRI nor objective strength testing results were reported.

Franceschi et al recently reported on a prospective randomized controlled trial comparing the outcomes of combined rotator cuff repair and SLAP repair with combined rotator cuff repair and biceps tenotomy in patients older than

Figure 3. Representative postoperative oblique coronal MRI demonstrating a persistent rotator cuff tear (patient 6).

50 years.[9] The tenotomy group demonstrated greater range of motion and higher UCLA scores than did the SLAP repair group. Abbot et al recently reported on the arthroscopic treatment of concurrent SLAP and rotator cuff tears in patients older than 45 years.[1] Patients who underwent debridement of their SLAP lesion demonstrated significantly better UCLA scores and improved function and pain relief at 2 years of follow-up than did patients who underwent SLAP repair. Patients who underwent debridement of their SLAP lesions demonstrated significantly better range of motion, particularly internal and external rotation, than did those who underwent repair.

The differences between the results of this study and those of Abbot et al may relate to postoperative rehabilitation. Unfortunately, Abbot et al did not report the details of the rehabilitation program they employed, except to note that it was the same for the SLAP repair and debridement groups.[1] In this study, 1 of 11 patients developed postoperative stiffness that interfered with activities of daily living, was nonresponsive to physical therapy and exercise, and ultimately required reoperation. Postoperative stiffness is a recognized complication following concurrent SLAP and rotator cuff repair. Morgan et al reported on 102 patients undergoing arthroscopic suture anchor repair of type II SLAP tears.[17] Thirty-two repaired shoulders had rotator cuff tears, including 12 full-thickness tears. All 17 patients who did not achieve an excellent result had associated rotator cuff pathology. Three patients who were judged to have fair results had undergone concurrent rotator cuff repair, complicated by postsurgical stiffness requiring a second arthroscopy to release subacromial adhesions. The reoperation rate was 25% for stiffness following repair of both type II SLAP and rotator cuff tears.

Table 1. Patient outcomes.[a]

Patient	FE	ERS	IRB	SST	ASES	SANE	RTW, Weeks	Follow-up, Months	Complication
1	168	79	T9	12	83.3	90	Yes, 5	27	Yes[b]
2	176	55	T11	12	86.6	80	Yes, 8	16	No
3	170	60	N/A	12	88.3	80	Retired	26[c]	No
4	168	58	T11	12	84.1	100	Yes, 12	22	Yes[d]
5	167	68	T10	12	100.0	98	No	19	No
6	159	68	T9	12	93.3	100	Yes, 20	17	No
7	150	69	T9	5	70.0	80	No	17	No
8	135	67	T12	7	53.3	80	No	16	No
9	152	62	T12	11	98.3	90	Yes, 10	15	No
10	162	77	T10	11	96.6	99	Yes, 16	15	No
11	163	62	T5	12	100.0	95	Yes, 12	14	No

[a]FE, forward elevation; ERS, external rotation at the side; IRB, internal rotation to the back; SST, Simple Shoulder Test; ASES, American Shoulder and Elbow Surgeons; SANE, single assessment numeric evaluation; RTW, return to work.
[b]Superficial radial sensory neurapraxia.
[c]Patient completed self-assessment at 26 months postoperatively but did not return for final clinical follow-up.
[d]Postsurgical stiffness requiring arthroscopic lysis of adhesions and manipulation.

Franceschi et al also observed postoperative stiffness following combined SLAP and rotator cuff repair.[10] Their patients were, on average, 16 years older than the patients in this study (63 versus 47 years).

This study has several strengths: A single surgeon performed all procedures, employing a standardized arthroscopic technique and postoperative rehabilitation program. In addition, all patients underwent independent evaluation by 2 examiners at most recent follow-up. All but 1 patient underwent postoperative MRI to evaluate repair integrity, as well as a quantitative strength measurement. Recent studies on arthroscopic repair of small- and medium-sized tears[2,6] and in patients younger than 65 years[3] used MRI or computed tomography arthrography to document persistent rotator cuff tears in approximately 10% to 15% of patients, which is comparable with the 10% (1 of 10) reported in this small series.

This study has several limitations that relate to lack of treatment consensus regarding the type II SLAP tear.[11] Specifically, it is difficult to differentiate the type II SLAP tear that warrants repair from the senescent or degenerative SLAP tear. Although the type II SLAP tears repaired in this study were identified according to strict and established arthroscopic criteria,[22] other surgeons may not have repaired some of these tears in the absence of an associated rotator cuff tear. The non-contrast-enhanced MRIs obtained postoperatively may have missed residual defects or retears of both rotator cuff and superior labrum. Finally, the duration of follow-up was short such that additional follow-up is needed to assess long-term durability and effectiveness of concurrent arthroscopic type II SLAP and rotator cuff repair. The study also had a small sample size and lacked a control group undergoing debridement or tenotomy for the SLAP tear. A suitable control group with similar demographics and clinical findings was not available.

Concurrent arthroscopic repair of rotator cuff and type II SLAP tears can lead to an improved outcome in carefully selected patients. However, we cannot conclude that arthroscopic SLAP repair is superior to debridement or to biceps tenotomy when combined with arthroscopic rotator cuff repair, nor can we confirm that SLAP repair was necessary in these patients.

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