Published in final edited form as:

J Shoulder Elbow Surg. 2010 September ; 19(6): . doi:10.1016/j.jse.2010.03.004.

Outcomes of Type II Superior Labrum, Anterior to Posterior (SLAP) Repair: Prospective Evaluation at a minimum 2-year follow-up

Nicole A. Friel, MS, Vasili Karas, BS, Mark A. Slabaugh, MD, and Brian J. Cole, MD MBA
Rush University Medical Center, Chicago, IL

Abstract

Hypothesis—Patients with type II superior labrum, anterior to posterior (SLAP) lesions will have improved function and decrease pain at a minimum two years after arthroscopic SLAP repair using bioabsorbable suture anchor fixation.

Materials and Methods—The study population consisted of 48 patients who underwent arthroscopic SLAP repair. Subjective shoulder scores, range of motion, and strength (post-operative only) were assessed pre-operatively and at a minimum of two years post-operatively.

Results—At an average of 3.4 years following surgery, statistically significant improvement was seen in ASES, UCLA, SST, CADL, VAS, and SF-12 physical outcome scores. Improvements were made in forward flexion, abduction, external rotation, and internal rotation. Subgroup analysis of non-athletes, non-overhead athletes, recreational overhead athletes, and collegiate overhead athletes showed pre- to post-operative improvements in subjective outcomes scores. Overhead laborers and non-laborers subgroups also showed pre- to post-operative improvements in subjective shoulder scores.

Discussion—On the basis of this data, arthroscopic SLAP repair of type II lesions with bioabsorbable suture anchors provides a significant improvement in functional capacity and pain relief. No differences were seen between the outcomes of non-athletes, non-overhead athletes, recreational overhead athletes, and collegiate overhead athletes, suggesting that SLAP type II repair is successful independent of the patient's vocation or sport.

Level of Evidence—IV, Case Series, Treatment Study

Keywords

Labrum; SLAP lesion; shoulder arthroscopy; superior labrum anterior to posterior

Introduction

Superior labral, anterior to posterior (SLAP) lesions, originally classified by Snyder et al¹⁷ have been commonly associated with trauma and overhead athletics. Typical mechanisms

© 2010 Journal of Shoulder and Elbow Surgery Board of Trustees. Published by Mosby, Inc. All rights reserved.

Corresponding author: Brian J. Cole, MD, MBA, Professor, Departments of Orthopedics & Anatomy and Cell Biology, Division of Sports Medicine, Section Head, Cartilage Restoration Center at Rush, Rush University Medical Center, 1725 W Harrison Ave, Suite 1063, Chicago, IL 60612, (T) 312-432-2381 (Michelle-Administrative Assistant), (F) 312-942-1517, bcole@rushortho.com.

Publisher's Disclaimer: This is a PDF file of an unedited manuscript that has been accepted for publication. As a service to our customers we are providing this early version of the manuscript. The manuscript will undergo copyediting, typesetting, and review of the resulting proof before it is published in its final citable form. Please note that during the production process errors may be discovered which could affect the content, and all legal disclaimers that apply to the journal pertain.

that produce SLAP lesions include traction, compression of the labrum from a fall onto an outstretched arm, and chronic acceleration/deceleration of the shoulder that often occurs in overhead throwing athletes and laborers who constantly use their arm above shoulder level.¹⁴

Historically, SLAP lesions have been treated with a variety of methods including debridement, tenotomy, and labral reattachment. Labral reattachment has been performed with a variety of different constructs including sutures, staples, tacks as well as bioabsorbable anchors.^{9,10,16}

Multiple authors have reported successful outcomes after SLAP repair, and reattachment of the labrum to the glenoid with bioabsorbable suture anchors for treatment of type II lesions is considered the current standard of care.⁵ Recently, however, the outcomes of SLAP repair have been reported as less than ideal, especially in overhead athletes, and biceps tenodesis¹ and tenotomy⁸ have been suggested as options for better outcome. The purpose of this study was to subjectively and objectively evaluate the outcomes of SLAP type II repairs. We hypothesize that patients with type II SLAP lesions will have improved function and decreased pain at a minimum two years after arthroscopic SLAP repair using bioabsorbable suture anchor fixation.

Materials and Methods

Study Design (Patient Selection)

The study was approved by the Institutional Review Board at the Rush University Medical Center (ORA #08042903).

Between December 2002 and April 2007, 136 consecutive patients who underwent arthroscopic SLAP treatment were enrolled in our prospective database. Lesions included type I, II, III, and IV SLAP tears, as well as associated pathologies including Bankart lesions and rotator cuff tears. Upon review of the patient charts, 60 of the 136 patients had type II SLAP tears treated with labral repair and were included for analysis. Exclusion criteria included (1) patient undergoing rotator cuff repair, (2) SLAP type I, III, or IV lesions, (3) prior surgical procedures on the ipsilateral shoulder, and (4) patient undergoing concomitant tenodesis or tenotomy. Patients with Bankart tears were included in the study population as well as patients undergoing subacromial decompression, distal clavicle excision, and intra-articular debridement.

Patients with the above diagnoses were included in this study (not just isolated SLAP tears) when the preoperative examination and history indicated the main pathology to be the SLAP tear. For example in patients with instability and SLAP tears, these patients had pain from their SLAP lesions not associated spatially with their dislocation events. Even though instability was a component of the patients' complaints and physical examination, their physical examination and history indicated pathology from their SLAP could not be attributed to instability; pain was a main component of the patients' complaints. Kim et al¹² have shown that nearly 89% of SLAP tears are associated with other pathology, specifically type II lesions are associated with Bankart lesions. The inclusion of these patients with concomitant pathology was permitted to be consistent with the varied pathology that surgeons encounter in patients with SLAP lesions.

Preoperative Examination

Patients were clinically diagnosed with a SLAP tear by the senior author (BJC) based upon the presence of a consistent history, positive O'Brien's test, and positive pain with abduction/ external rotation. Both subjective data (UCLA) shoulder test, American Shoulder

and Elbow Surgeons (ASES) shoulder score, Simple Shoulder Test (SST), cumulative Activities of Daily Living (CADL) score, Visual acuity pain scale (VAS), Short Form- 12 (SF-12) and range of motion (ROM) were recorded pre-operatively and at post operative follow-up visits. All surveys were completed by the patient.

Operative Technique / Surgical Procedure and Perioperative Management

All patients who had a type II SLAP repair underwent an exam under anesthesia and diagnostic arthroscopy first to confirm the diagnosis of a SLAP tear (using criteria based upon Synder et al¹⁷) and to exclude other pathology such as rotator cuff tears and biceps tendinopathy. SLAP repair was performed in the beach chair position under general anesthesia and local interscalene nerve block. All operations were performed by the senior surgeon (BJC). SLAP lesions were confirmed by the presence of separation of the cartilage/labrum junction with a tear extending medial to the glenoid in which a peel back of the biceps complex was exhibited with abduction and external rotation. Additional degenerative changes of the cartilage adjacent to the biceps insertion confirmed the presence of a SLAP tear. One anterior portal using an 8.25mm cannula inserted in the anterior/superior rotator interval was used. The superior glenoid was prepared with an arthroscopic elevator and then burr to expose bleeding cancellous bone as the repair bed. Most commonly, two single loaded 3.0 mm BioSuture tacks (Arthrex, Naples, FL) anchors were then placed percutaneously just off the anterior/lateral edge of the acromion penetrating the rotator cuff at the musculotendinous junction. The first anchor was placed directly under the biceps insertion and the second was placed at the 11 o'clock position (right shoulder). Each anchor had one suture limb passed through the labrum with a 45 degree curved spectrum (ConMed Linvatec, Largo, FL) and knots were tied behind the biceps and medial to the labral tissue to avoid prominence of the knot adjacent to articular cartilage. Double loaded anchors with one limb anterior and one posterior to the biceps were avoided to prevent strangulation of the biceps.

Post-operative Management

Post-operatively patients were kept in a shoulder immobilizer for four weeks and initiated physical therapy after their first postoperative visit. Initially, passive range of motion and active assisted motion including closed chain scapular strengthening were implemented. At four weeks active motion was begun and strengthening was allowed at 8 weeks post-operatively. At three months patients were allowed to initiate a sport specific regimen of strengthening and conditioning. Return to overhead activities was allowed at 5-6 months.

Post-operative testing

Forty-eight patients were evaluated using the same pre-operative questionnaire, with the addition of questions regarding return to sport and work. A thorough physical exam was also completed at follow-up, which included range of motion as well as strength testing using a dynamometer (Isobex from Medical Device Solutions, Oberburg, Switzerland). In addition, patients were asked if they would repeat the surgery again based upon the current state of their shoulder.

Statistical Analyses

Statistical analysis was performed using paired t-tests to compare pre- and post-operative scores. Patients were further categorized as non-athletes, non-overhead athletes, recreational overhead athletes, and collegiate overhead athletes for sports-related subgroup analysis, and overhead laborers versus non-laborer for work-related subgroup analysis. Sport subgroup analysis compared post-operative outcomes using Kruskal-Wallis with Dunn's Multiple Comparison Test for nonparametric data, and also evaluated the degree of improvement

from pre- to post-operative scores using one-way ANOVA and post-hoc Newman-Keuls Multiple Comparison Test. Work subgroup analysis compared post-operative outcomes using independent sample t-tests. Significance level was set at 0.05. Statistical analysis was performed using GraphPad Prism 5.0 (La Jolla, CA).

Results

Patient Demographics

Completed survey data was available for 48 of the 60 patients (80%) that met the inclusion criteria. The average patient age was 33.1 years (range, 16.1 to 58.9 years) at the time of surgery, with a mean time period between injury and SLAP repair of 11.2 months (range, 1.1 to 47.1 months). Patients were followed up at a mean of 3.4 years (range, 2.0 to 5.7 years) following surgery. The population consisted of 39 males and 9 females. Forty-two were right handed, and 60% had surgery on their dominant shoulder. Thirteen patients (27%) were receiving worker's compensation at the time of surgery. Twenty-nine patients (60%) reported a single traumatic incident while nineteen (40%) noted symptoms after chronic over-use. Ten patients were non-athletes, 15 were non-overhead athletes, (i.e. gymnastics, wrestling, etc), 10 were overhead athletes (i.e. baseball, volleyball, tennis) at a recreational level, and 13 were overhead athletes at a collegiate level. Thirteen were overhead laborers, and 35 describe non-laboring work.

Patients indicated for surgery had failed conservative treatment consisting of rest, anti-inflammatory medications, and activity modifications. Twenty-four patients (48%) previously had an injection, and 28 patients (56%) had at least four weeks of physical therapy prior to surgery.

Concomitant procedures at the time of SLAP repair included Bankart repair (10), subacromial decompression (5), distal clavicle excision (2), labral cyst decompression (2), microfracture of the humeral head (1), capsular release (1), and acromioplasty (1). (Table 1)

Outcomes Assessment

Four patients underwent subsequent surgery on the index shoulder. Two patients had a revision SLAP repair and were included in outcome analysis; two patients underwent subsequent surgery (biceps tenodesis and biceps tenotomy, respectively), and although their failures are reported, these patients were not included in the outcomes analysis.

At an average of 3.4 years (range, 2.0 to 5.7 years) following surgery, statistically significant improvement was seen in ASES, UCLA, SST, CADL, VAS, and SF-12 physical outcome scores. No significant improvement was seen in the SF-12 mental component. (Table 2) Improvements in range of motion were found in forward flexion, abduction, external rotation, and internal rotation. (Table 3) Pre-operative strength scores were not available for all patients. Post-operative strength of the operated shoulder did not reach that of the contralateral shoulder at a minimum of 2 years post-op. (Table 4) UCLA scores averaged 30.9, corresponding to 10 (23%) excellent, 25 (57%) good, 8 (18%) fair, and 1 (2%) poor outcomes. (Figure 1) Forty-one of forty-six patients (89%) responded that they would have the surgery again.

Subgroup analysis of non-athletes, non-overhead athletes, recreational overhead athletes, and collegiate overhead athletes showed pre- to post-operative improvements in subjective outcomes scores. (Table 5) Range of motion improved significantly for non-athletes, whereas the other three groups generally had good range of motion pre-operatively, so large improvements were not seen. Comparison of post-operative subjective scores, range of motion, and strength did not reveal any significant differences between groups. However,

statistically significant differences were seen when comparing the degree of improvement from pre- to post-op subjective outcome scores and range of motion. (Table 5)

The collegiate overhead athletes had 54% (7 of 13) return to previously level of sport, with shoulder injury cited as the reason for not returning to their previous level in 5 of 6 athletes. Interestingly, 6 of 7 baseball players returned to their previous level of sport, while only 1 in 4 tennis players returned to their previous level. (Table 6)

Subgroup analysis of overhead laborers versus non-laborers showed pre- to post-operative improvements in subjective outcomes scores, with significant improvements in range of motion only for the overhead laborers, primarily due to the good range of motion pre-operatively for the non-laborers. Comparison of post-operative subjective scores showed better results in the overhead laborers group in SST, ASES, and CADL scores, whereas post-operative pain was lower in the non-laborer group. The post-op range of motion and strength did not reveal any significant differences between groups. However, statistically significant differences were seen when comparing the degree of improvement from pre- to post-op range of motion. (Table 7)

Re-operations

Four patients needed additional procedures after their SLAP repair. One patient, an overhead athlete, reported a popping sound and sudden onset of pain during physical therapy 8 weeks post-operatively. Revision SLAP repair was performed 7 months after the index procedure. The second patient, also an overhead athlete, had repair of both SLAP and Bankart lesions at the index procedure. He recovered well for 7 months before a traumatic event that lead to a dislocation. At one year following the initial SLAP procedure, the patient underwent revision anteroinferior stabilization. Of note, the superior labral repair remained intact. The third patient, an overhead laborer, described an aching pain in his shoulder following surgery. One year following the index procedure, arthroscopy showed an intact labrum but biceps tenodesis and subacromial bursectomy were performed secondary to recalcitrant biceps tendonitis. The fourth patient, a non-athlete, had pain out of proportion to her clinical symptoms after reporting a fall onto an outstretched arm. At surgery almost three years after the index SLAP repair, a loose body and labral fraying was found along with an intact superior labrum. The patient underwent biceps tenotomy and bursectomy. The third and fourth re-operations mentioned above were not included in outcome analysis since they underwent biceps tenodesis and tenotomy, respectively.

Discussion

This study evaluated the outcomes of arthroscopic type II SLAP repair with suture anchor fixation. Our results showed that arthroscopic treatment of type II SLAP tears resulted in good to excellent results in 79% of patients with 89% of patients reporting that they would repeat the surgery again. Subjective shoulder outcomes improved and patients had improved range of motion at a minimum two-years post-operatively.

Outcomes of repair for type II lesions are successful, with good to excellent results ranging from 65% to 97%.^{3-6,11,13-16,18,19} Inclusion criteria for each of these studies has a wide range, from isolated type II SLAP repairs to mixed combinations of pathologies associated with the SLAP tear. Field and Savoie⁷ first described outcomes of arthroscopic type II and IV SLAP repairs, with improvement in all 20 patients involved in the study, including 10 athletes. Voos et al¹⁸ assessed concomitant RCR plus a labral repair procedure, in which 16 patients had Bankart and 14 patients had SLAP lesions. Ninety percent of patients reported good to excellent results, and 77% returned to their pre-injury athletic status. The authors concluded that combined treatment for rotator cuff and labrum pathology yields good

outcomes, restoration of range of motion, and a high degree of patient satisfaction. Coleman et al⁴ reported on the outcomes of patients undergoing type II SLAP repair, with or without concomitant acromioplasty. The authors noted 65% and 81% good to excellent results in SLAP only and SLAP plus acromioplasty, respectively. They recommended that acromioplasty may be added to SLAP repair to improve outcomes and to decrease the incidence of impingement following surgery. Further, Enad et al,⁵ in a mixed population of isolated type II SLAP repairs and SLAP repairs with concomitant procedures, found 89% good to excellent UCLA scores and 77% return to their pre-injury level of sport. The results of these studies are comparable to our results with patients attaining good to excellent results 79% of the time when undergoing SLAP repairs and concomitant procedures and 62% returning to their pre-injury level of sport.

Isolated SLAP repair has also been associated with good results. Rhee et al¹⁵ in a study including Types II, III, and IV SLAP lesions, noted 86% good to excellent results. Cohen et al³ found only 69% good to excellent results in 39 patients with isolated type II SLAP at 3.7 years post-op. The authors note that poorer outcomes may be contributed to the high expectations and demands of over-head athletes (74% of the study population), but overall, type II SLAP is difficult to treat. Most recently, Yung et al¹⁹ evaluated the outcomes of isolated type II SLAP repairs with bioknotless suture anchors. Patients had improvements in UCLA (18.1 to 31.3) and all returned to pre-injury sport level.

The effectiveness of SLAP repair in athletes has been questioned due to the low percentage of athletes returning to their pre-injury level of sport, which is particularly important given that a large percentage of the tears are found in athletes. Kim et al¹¹ found that 22% of overhead athletes returned to their pre-injury sport level compared to 63% in non-overhead and non-athletes. Cohen et al,³ in a study of isolated type II SLAP repairs, found only 38% good to excellent outcomes in throwing athletes (n=8) compared to 71% in non-throwing group (n=21) (p<0.04). Yung et al¹⁹ reported on 16 patients with SLAP lesions, 13 of which participated in overhead sports. 87.5% of patients reported good to excellent results. The authors pointed out that elite throwing athletes, although able to return to their pre-injury level, had a longer rehabilitation period before return to sport. Interestingly, Rhee et al¹⁵ noted that athletes had higher outcomes scores than non-athletes (UCLA 32.7 versus 31.3), and even more surprising, throwing athletes did significantly better than non-throwing athletes (UCLA 33.9 versus 31.7, p<0.011). The authors note that the low outcome scores of the non-throwers may be contributed to gymnasts, who have a higher rate of repetitive injuries, comprising more than half of the non-throwing athlete group. This study is confounded by the fact that not all lesions were type II (21 type II; 9 type III; 4 type IV). Most recently, Brockmeier et al² noted that 74% of athletes that underwent arthroscopic SLAP repair, including 71% of overhead athletes, were able to return to their previous level of sport. Our results show that overall athletes had good to excellent results in 83%; overhead athletes even had 86% good to excellent outcomes, indicating that satisfactory results can be obtained in athletes treated with SLAP repair. Further, 62% of all athletes and 59% of overhead athletes (67% recreational and 54% collegiate) returned to their pre-injury level of sport. Interestingly, of the collegiate overhead athletes, 6 of 7 baseball players returned to their previous level, compared to only 1 of 4 who played tennis. Brockmeier et al² also showed that although 71% of all athletes returned to their previous level, only 4 of 8 tennis players returned to preinjury level of sport.

Recently, Boileau et al¹ suggested that biceps tenodesis may be superior to SLAP repair for the treatment of type II SLAP tears, especially in an athletic population. The authors noted that although both groups had improvements in the Constant shoulder score (SLAP: 63 to 83; biceps: 59 to 89), 60% of the patients in the SLAP group were disappointed and only 20% returned to the previous sport. This was compared to the biceps tenodesis group, in

which 93% were satisfied or very satisfied and 87% returned to their previous level of sport. This study, however, focused on overhead athletes (9 collegiate and 11 professional), and the patient age was statistically different between each of the groups (SLAP: 37, range 19-59; tenodesis: 52, range 28-64). Therefore, although tenodesis may be beneficial in this small population of throwing athletes, it is questionable whether these outcomes can be applied to the general population.

The present study shows significant improvements from pre- to post-operative scores in the population as a whole as well as for each of the sport and work subgroups. No differences are evident when comparing post-operative scores for each of the four sports subgroups. Generally, non-athletes showed larger pre- to post-operative improvement scores especially in range of motion; however, this was likely due to lower pre-operative scores rather than better post-operative outcomes. Subgroup analysis of overhead laborer versus non-laborer shows improvements from pre- to post-operatively in both groups, with overhead laborers achieving better functional outcomes and non-laborers achieving greater reduction in pain.

Weaknesses of the current study include the lack of pre-operative strength scores, making pre- to post-operative strength comparisons difficult. Although patients showed good strength following surgery, the operated shoulder was less than the contralateral shoulder. As 60% of the patients had surgery on their dominant hand, the operated versus contralateral shoulder strength measurements may be confounded by baseline variations in dominant versus non-dominant hand strength. Further, this study is limited by the subgroup analysis, in which the small sample size for each group may confound interpretation of results. Additionally, re-operations on the ipsilateral shoulder were not included in the outcomes analysis for one patient undergoing biceps tenodesis and another undergoing biceps tenotomy.

Conclusions

On the basis of this data, arthroscopic SLAP repair of type II lesions with bioabsorbable suture anchors provides a significant improvement in functional capacity and pain relief. No differences were seen between the outcomes of non-athletes, non-overhead athletes, recreational overhead athletes, and collegiate overhead athletes, suggesting that SLAP type II repair is successful independent of the patient's activity level. Additionally, while overhead laborers and non-laborers both show improvements from pre- to post-operatively, overhead laborers achieved better functional outcomes and non-laborers achieved greater reduction in pain.

Acknowledgments

This study was supported by NIH grant T32 AR052272.

Approved by the Institutional Review Board at Rush University Medical Center (ORA #08042903)

References

1. Boileau P, Parratte S, Chuinard C, Roussanne Y, Shia D, Bicknell R. Arthroscopic treatment of isolated type II SLAP lesions: biceps tenodesis as an alternative to reinsertion. *Am J Sports Med.* 2009; 37:929–936.10.1177/0363546508330127 [PubMed: 19229046]
2. Brockmeier SF, Voos JE, Williams RJ 3rd, Altchek DW, Cordasco FA, Allen AA, et al. Outcomes after arthroscopic repair of type-II SLAP lesions. *J Bone Joint Surg Am.* 2009; 91:1595–1603. [PubMed: 19571081]

3. Cohen DB, Coleman S, Drakos MC, Allen AA, O'Brien SJ, Altchek DW, et al. Outcomes of isolated type II SLAP lesions treated with arthroscopic fixation using a bioabsorbable tack. *Arthroscopy*. 2006; 22:136–142.10.1016/j.arthro.2005.11.002 [PubMed: 16458798]
4. Coleman SH, Cohen DB, Drakos MC, Allen AA, Williams RJ, O'Brien SJ, et al. Arthroscopic repair of type II superior labral anterior posterior lesions with and without acromioplasty: a clinical analysis of 50 patients. *Am J Sports Med*. 2007; 35:749–753.10.1177/0363546506296735 [PubMed: 17267765]
5. Enad JG, Gaines RJ, White SM, Kurtz CA. Arthroscopic superior labrum anterior-posterior repair in military patients. *J Shoulder Elbow Surg*. 2007; 16:300–305.10.1016/j.jse.2006.05.015 [PubMed: 17363292]
6. Enad JG, Kurtz CA. Isolated and combined Type II SLAP repairs in a military population. *Knee Surg Sport Tr A*. 2007; 15:1382–1389.10.1007/s00167-007-0334-8
7. Field LD, Savoie FH 3rd. Arthroscopic suture repair of superior labral detachment lesions of the shoulder. *Am J Sports Med*. 1993; 21:783–90.10.1177/036354659302100605 [PubMed: 8291627]
8. Franceschi F, Longo UG, Ruzzini L, Rizzello G, Maffulli N, Denaro V. No advantages in repairing a type II superior labrum anterior and posterior (SLAP) lesion when associated with rotator cuff repair in patients over age 50: a randomized controlled trial. *Am J Sports Med*. 2008; 36:247–253.10.1177/0363546507308194 [PubMed: 17940144]
9. Garofalo R, Mocci A, Moretti B, Callari E, Di Giacomo G, Theumann N, et al. Arthroscopic treatment of anterior shoulder instability using knotless suture anchors. *Arthroscopy*. 2005; 21:1283–1289.10.1016/j.arthro.2005.08.033 [PubMed: 16325077]
10. Kartus J, Perko M. Arthroscopic repair of a type II SLAP lesion using a single corkscrew anchor. *Arthroscopy*. 2002; 18:E10.10.1053/jars.2002.31664 [PubMed: 11877628]
11. Kim SH, Ha KI, Kim SH, Choi HJ. Results of arthroscopic treatment of superior labral lesions. *J Bone Joint Surg Am*. 2002; 84-A:981–985. [PubMed: 12063332]
12. Kim TK, Queale WS, Cosgarea AJ, McFarland EG. Clinical features of the different types of SLAP lesions: an analysis of one hundred and thirty-nine cases. *J Bone Joint Surg Am*. 2003; 85-A:66–71. [PubMed: 12533574]
13. Morgan CD, Burkhart SS, Palmeri M, Gillespie M. Type II SLAP lesions: three subtypes and their relationships to superior instability and rotator cuff tears. *Arthroscopy*. 1998; 14:553–565.10.1016/S0749-8063(98)70049-0 [PubMed: 9754471]
14. Park JH, Lee YS, Wang JH, Noh HK, Kim JG. Outcome of the isolated SLAP lesions and analysis of the results according to the injury mechanisms. *Knee Surg Sport Tr A*. 2008; 16:511–515.10.1007/s00167-007-0482-x
15. Rhee YG, Lee DH, Lim CT. Unstable isolated SLAP lesion: clinical presentation and outcome of arthroscopic fixation. *Arthroscopy*. 2005; 21:1099.10.1016/j.arthro.2005.05.016 [PubMed: 16171635]
16. Samani JE, Marston SB, Buss DD. Arthroscopic stabilization of type II SLAP lesions using an absorbable tack. *Arthroscopy*. 2001; 17:19–24.10.1053/jars.2001.19652 [PubMed: 11154362]
17. Snyder SJ, Karzel RP, Del Pizzo W, Ferkel RD, Friedman MJ. SLAP lesions of the shoulder. *Arthroscopy*. 1990; 6:274–279.10.1016/0749-8063(90)90056-J [PubMed: 2264894]
18. Voos JE, Pearle AD, Mattern CJ, Cordasco FA, Allen AA, Warren RF. Outcomes of combined arthroscopic rotator cuff and labral repair. *Am J Sports Med*. 2007; 35:1174–1179.10.1177/0363546507300062 [PubMed: 17387217]
19. Yung PS, Fong DT, Kong MF, Lo CK, Fung KY, Ho EP, et al. Arthroscopic repair of isolated type II superior labrum anterior-posterior lesion. *Knee Surg Sport Tr A*. 2008; 16:1151–1157.10.1007/s00167-008-0629-4

Figure 1. Post-operative UCLA Shoulder scores. Excellent (34-35), Good (28-33), Fair (21-27), Poor (0-20)

Table 1

Demographic data of the 48 patients that met the inclusion criteria.

Demographics	
Number of patients, n	48
Age (years), mean $\pm$ s.d. (range)	33.1 $\pm$ 12.1 (16.1 to 58.9)
Gender, n (%)	
Male	39 (80)
Female	9 (20)
Dominant hand, n (%)	
Right	42 (88)
Left	6 (12)
Injured side, n (%)	
Right	23 (48)
Left	25 (52)
Injured on dominant hand (%)	60.4
Worker's compensation, n (%)	13 (27)
Pre-injury activity level, n (%)	
Overhead Athletes	11 (23)
Non-Overhead Athletes	16 (33)
Non-Athletes/Non-laborers	17 (35)
Overhead Laborers	4 (8)
Mechanism of injury, n (%)	
Traumatic	24 (50)
Chronic	24 (50)
Duration of symptoms before repair (months)	11.2 $\pm$ 10.0
Number of anchors, mean $\pm$ s.d. (range)	1.9 $\pm$ 0.51 (1 to 3)
Concomitant Procedures, n	
Bankart repair	10
Subacromial decompression	5
Distal clavicle excision	2
Cystic decompression	2
Microfracture of the humeral head	1
Capsular release	1
Acromioplasty	1

Table 2

Subjective Shoulder surveys, both pre- and post-operatively.

	Pre-op	Post-op	t-test
SST	7.28	10.20	p<0.0001
ASES	59.49	83.37	p<0.0001
VAS	3.98	1.52	p<0.0001
CADL	11.85	17.52	p<0.0001
SF-P	41.09	45.72	0.0035
SF-M	53.28	54.22	0.6296

SST (Simple Shoulder Test), maximum 12; ASES (American Shoulder and Elbow Surgeons), maximum 100; VAS (Visual Analog Pain), maximum 10; CADL (Constant Activities of Daily Living), maximum 20; SF12-P (Short Form 12 – Physical); SF12-M (Short Form 12 – Mental).

Table 3

Range of motion. Forward flexion, abduction, and external rotation in degrees. Internal rotation values correspond to the level of internal rotation: Dorsum of hand to interscapular region (T7) or higher (10); Dorsum of hand to 12th dorsal vertebrae (8); Dorsum of hand to waist (L3) (6); Dorsum of hand to lumbrosacral junction (4); Dorsum of hand to buttock (2); Dorsum of hand to lateral thigh or less (0).

	Pre-op	Post-op	t-test
Forward flexion	160	180	0.0008
Abduction	156	179	0.0003
External Rotation	67	73	0.0487
Internal Rotation	7.9	9.6	0.0002

Table 4

Post-operative strength scores using a dynamometer (Isobex) in kg. Both forward flexion and external rotation was stronger in the contraateral (unoperated) shoulder compared to the operated shoulder at a minimum 2 years post-op. Pre-operative strength scores were not available.

	Operated	Contraateral	t-test
Forward flexion	8.3	9.0	0.0267
External Rotation	8.8	9.4	0.0152

Table 5

Subjective outcome scores, range of motion, strength testing, and UCLA results for each subgroup (non-athlete, non-overhead athlete, recreational overhead athlete, collegiate overhead athlete).

	Non-Athletes	Non-Overhead Athletes	Overhead Athletes (Recreational)	Overhead Athletes (Collegiate)	Comparisons Across Subgroups		
					Comparison of Pre-op Scores	Comparison of Post-op Scores	Comparison of Degree of Improvement in Pre- to Post-op Scores
Number of patients	9	15	9	13			
Age (at DOS)	41.8	33.7	36.1	23.5	0.0027		
DOS-DOI	0.6	1.2	0.6	1.0	0.0602		
Follow-up (years)	3.0	3.6	3.5	3.5	0.4963		
Would repeat the surgery	6	14	9	12			
Returned to Pre-injury level	N/A	10 (67%)	6 (67%)	7 (54%)			
Simple Shoulder Test							
Pre-	3.1	9.0	7.7	7.9	0.0024 ^{*,^}	0.5677	0.0383 [*]
Post-	9.0	10.4	10.0	10.9			
Improvement	5.9	1.6	2.4	3.0			
p-value	0.0012	0.0537	0.0430	0.0043			
ASES Shoulder Score							
Pre-	35.9	66.1	62.8	65.9	0.0022 ^{*,^}	0.5237	0.0758
Post-	78.3	85.2	78.0	88.5			
Improvement	42.4	19.1	15.2	22.6			
p-value	0.0021	0.0081	0.0712	0.0045			
Visual Analog Pain Scale							

	Non-Athletes	Non-Overhead Athletes	Overhead Athletes (Recreational)	Overhead Athletes (Collegiate)	Comparisons Across Subgroups		
					Comparison of Pre-op Scores	Comparison of Post-op Scores	Comparison of Degree of Improvement in Pre- to Post-op Scores
Pre-	6.0	3.7	3.6	3.2	0.032 [^]		
Post-	2.3	1.4	1.8	1.0		0.6892	
Improvement	-3.7	-2.6	-1.4	-2.2			0.4243
p-value	0.0137	0.0028	0.1806	0.0158			
Constant ADL Score							
Pre-	7.7	15.1	11.4	11.3	0.011 [*]		
Post-	16.8	18.1	16.3	18.2		0.6101	
Improvement	9.1	3.4	5.1	6.9			0.0880
p-value	0.0005	0.0034	0.0310	0.0011			
Forward Flexion							
Pre-	124	160	171	179	0.0012 ^{##}	0.5446	0.001 ^{##}
Post-	180	179	179	180			
Improvement	6	19	8	1			
p-value	0.0034	0.1050	0.1930	0.3409			
Abduction							
Pre-	124	155	159	179	0.0132 [^]		0.0082 [^]
Post-	180	179	180	179		0.7215	
Improvement	56	24	21	-1			
p-value	0.0034	0.0633	0.0878	0.6761			
External Rotation							
Pre-	53	67	69	78	0.0003 [^]	0.0563	0.0005 ^{##}
Post-	78	74	67	72			
Improvement	24	7	-3	-6			
p-value	0.0021	0.0449	0.4161	0.1422			

	Non-Athletes	Non-Overhead Athletes	Overhead Athletes (Recreational)	Overhead Athletes (Collegiate)	Comparisons Across Subgroups		
					Comparison of Pre-op Scores	Comparison of Post-op Scores	Comparison of Degree of Improvement in Pre- to Post-op Scores
Internal Rotation							
Pre-	4.9	8.6	7.9	9.5	0.0024 ^{*,^}		
Post-	9.8	9.6	8.9	9.8		0.3401	
Improvement	4.9	1.0	1.0	0.4			
p-value	0.0003	0.0682	0.3198	0.3409			0.0005 ^{*,#}
Strength in Forward Flexion							
Operated	7.9	8.8	7.3	8.8	0.7978		
Contralateral	7.9	10.1	7.8	9.2		0.5644	
p-value	0.9773	0.0393	0.4072	0.1996			
Strength in External Rotation							
Operated	8.2	9.7	7.8	8.7	0.6342		
Contralateral	8.8	11.0	7.7	9.2		0.1357	
p-value	0.4498	0.0254	0.6331	0.1979			
UCLA							
Post-	28.9	31.6	32.0	30.9			0.6166
Excellent	22%	29%	38%	8%			
Good	44%	50%	63%	69%			
Fair	22%	21%	0%	23%			
Poor	11%	0%	0%	0%			

* Statistical difference between Non-athlete vs non-overhead athlete;

Non-athlete vs recreation overhead athlete;

[^] Non-athlete vs collegiate overhead athlete.

Table 6

Table showing which of the collegiate overhead athletes returned to their previous level of sports and if not whether this was due to their shoulder. (n=13)

	Sport(s)	Level of Participation	Return to pre-injury level of sport?	If no, was this due to your affected shoulder?
1	Baseball, Raquetball	Collegiate	Yes	-
2	Baseball	Collegiate	Yes	-
3	Softball, Volleyball	Collegiate	No	Yes
4	Tennis	Collegiate	No	Yes
5	Baseball	Collegiate	Yes	-
6	Softball	Collegiate	No	Yes
7	Tennis	Collegiate	No	Yes
8	Baseball	Collegiate	Yes	-
9	Baseball	Collegiate	Yes	-
10	Tennis	Collegiate	No	No
11	Baseball, Football	Collegiate	No	Yes
12	Baseball, Basketball, Football	Collegiate	Yes	-
13	Tennis	Collegiate	Yes	-

Table 7

Subjective outcome scores, range of motion, strength testing, and UCLA results for the work subgroups (overhead laborer, non-laborer)

	Overhead Laborer	Non-Laborer	Comparison of Post-op Scores
Number of patients	12	34	
Age (at DOS)	40.40	30.22	0.0124
DOS-DOI	0.62	1.04	0.1407
Follow-up (years)	3.08	3.56	0.1543
% Traumatic	0.67	0.62	
Returned to work			0.0138
Yes	0.67	0.83	
No	0.33	0.17	
If no, was this due to your shoulder?			<0.0001
Yes	1.00	0.25	
No	0.00	0.75	
Simple Shoulder Test			
Pre-	3.5	8.6	
Post-	8.5	10.8	0.0018
p-value	0.0004	0.0001	
ASES Shoulder Score			
Pre-	38.1	67.1	
Post-	71.7	87.5	0.0070
p-value	0.0009	<0.0001	
Visual Analog Pain Scale			
Pre-	5.6	3.4	
Post-	2.6	1.2	0.0166
p-value	0.0090	<0.0001	
Constant ADL Score			
Pre-	6.7	13.7	
Post-	15.8	18.1	0.0381
p-value	<0.0001	<0.0001	
Forward Flexion			
Pre-	133	170	
Post-	179	180	0.4423
p-value	0.0024	0.0723	
Abduction			

	Overhead Laborer	Non-Laborer	Comparison of Post-op Scores
Pre-	123	168	N/A
Post-	180	179	
p-value	0.0001	0.0776	
External Rotation			0.3318
Pre-	57	72	
Post-	75	72	
p-value	0.0063	0.9462	
Internal Rotation			0.8157
Pre-	4.9	9.0	
Post-	9.5	9.6	
p-value	<0.0001	0.0882	
Strength in Forward Flexion			0.2729
Operated	7.0	8.8	
Contralateral	7.9	9.4	
p-value	0.1768	0.0892	
Strength in External Rotation			0.4508
Operated	8.1	9.0	
Contralateral	8.8	9.7	
p-value	0.3496	0.0144	
UCLA			0.0186
Post-	28.6	31.7	
Excellent	18%	24%	
Good	46%	61%	
Fair	27%	15%	
Poor	9%	0%	