



Arthroscopic fixation of isolated type II SLAP lesions using a two-portal technique

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The purpose of this study was to assess the outcomes of twenty isolated type II SLAP lesions which were repaired arthroscopically using a two-portal technique.

Shoulder function was evaluated at a mean follow-up of 2 years using the modified Constant-Murley score. The average preoperative score was 65.2% ; it improved postoperatively to 86.4% ($p < 0.0001$). Pain improved from 6 points to 13 points ($p < 0.01$) and strength increased from 10 kg to 17 kg ($p < 0.01$). Seventeen of the 20 patients participated in athletic activity before the arthroscopic SLAP repair ; they were subdivided into two groups with regard to their age (< 40 years, and > 40 years). There were statistically significant differences between the groups, with 70% returning to the same level of competitiveness in the younger group versus 29% in the older age group. ($p < 0.0001$).

Arthroscopic repair of an isolated type II SLAP lesion using a two-portal technique, without using a trans rotator cuff portal, appeared as a reliable and effective procedure with respect to shoulder function and anatomy.

Keywords : isolated type II SLAP lesion ; two-portal technique ; arthroscopic repair.

INTRODUCTION

Lesions to the anterior superior labrum near the origin of the long head of the biceps were first described in 1985 by Andrews *et al* (1) in 73 overhead throwing athletes. In 1990, Snyder *et al* (20)

coined the term SLAP lesion (superior labrum anterior to posterior) when they described tearing of the intra articular origin of the biceps tendon. Snyder *et al* classified these lesions into 4 types (21) ; this classification is the most widely recognized. Other patterns of labral lesions that included the superior part of the labrum were described later by Maffet *et al* (14).

The typical mechanisms of injury in a SLAP lesion include traction, compression, avulsion, shear forces through the glenohumeral joint and degenerative changes of the superior labrum. Most are the result of traction injuries that occur in routine daily life or more often in overhead throwing athletes.

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The prevalence varies depending on the patient population studied. Snyder *et al* (20) in their study reported that, of 2375 arthroscopic procedures 140 (6%) revealed a SLAP lesion. Maffet *et al* (14) also reported that 84 (12%) of 712 patients examined arthroscopically had a SLAP lesion. Kim *et al* (13) found 139 SLAP lesions in 544 shoulder arthroscopy procedures (26%). Slap lesions in these studies were concomitant pathological findings in patients who were undergoing shoulder arthroscopy for a variety of diagnoses.

Patients with SLAP lesions complain of pain, especially with overhead activity. The pain is deep and aching and usually localized in the depth of the joint. Patients often report mechanical symptoms in the shoulder, such as “catching or clicking”, Type II SLAP lesion is often accompanied by other shoulder injuries such as impingement syndrome, rotator cuff tears, instability or glenohumeral joint arthritis but there are several cases in which this lesion is isolated and is the primary cause of shoulder pain.

Type II SLAP lesions are particularly unstable variants which, if they are symptomatic and fail to respond to non operative management are suitable for surgical intervention. Arthroscopic repair is now considered the standard treatment. A variety of arthroscopic repair techniques have been described with different suture passage devices, multiple working portals and a number of fixation devices.

The classic method in the arthroscopic labral repair technique is to make two working portals. Traditionally a posterior portal is used to visualize the labrum and an anterior- inferior portal and an anterior superior portal are used for fixation of the labrum. These conventional portals limit access to the more posterior superior aspect of the glenoid labrum and, as a result, the fixation of this part of the labrum is not always readily accomplished. In order to access the superior aspect of the labrum several authors have described other accessory portals through the rotator cuff (11,17,18). However, there have been concerns with regard to using portals through the cuff, as well as reports of unfavorable outcomes especially in overhead athletes. O'Brien *et al* (18) after a transrotator cuff labral repair technique documented a 26%

incidence of postoperative impingement symptoms, persisting 2 years postoperatively. Only 44% of these patients returned to their preinjury athletic activity level. Similarly, Kim *et al* (12) reported that only 4 (22%) of 18 overhead athletes treated, returned to the same level of sport activity after such a repair through the trans-rotator cuff portal. Our main concern with the use of the trans-rotator cuff portal was the potential risk of damaging the normal rotator cuff, especially in high-demand patients. We carried out the present study based on a hypothesis that arthroscopic repair of isolated type II SLAP lesions, could be achieved with only one anterior working portal, without causing an iatrogenic trauma in the normal rotator cuff. Our purposes were to evaluate the clinical outcome of patients as measured by the modified Constant-Murley score and to assess the return of patients to their previous level of sports participation.

PATIENTS AND METHODS

Patients Selection

Of the total of 63 patients who underwent an arthroscopic shoulder procedure, 20 patients (31.7%) had an isolated type II SLAP lesion and they were treated with arthroscopic fixation using a two-portal technique. All patients provided written informed consent before undergoing the procedure. The average age at surgical intervention was 35.7 years (range : 24-48). The mean follow-up period was 26 months (range : 24-29 months). There were 13 men and 7 women in this retrospective cohort study.

All patients were arthroscopically treated between January 2006 and May 2008 by the same surgeon.

Inclusion criteria included (1) pain in the shoulder aggravating with strenuous activities or sports participation, (2) at least 1 positive clinical test for SLAP lesion, (3) a type II SLAP lesion demonstrated in a non-contrast magnetic resonance imaging, (4) an isolated type II SLAP lesion confirmed by intraoperative arthroscopic assessment, and (5) a minimum of 2 years follow-up postoperatively.

Exclusion criteria included impingement syndrome, acromioclavicular joint arthritis, partial or full thickness tear of the rotator cuff, Hill Sachs lesion, frozen shoulder, Bankart lesion and age-related degenerative tears of the labrum.



Fig. 1. — Arthroscopic view of the shoulder showing the superior labral lesion.

Diagnosis

The diagnosis of SLAP lesions requires a high level of clinical suspicion. Physical findings are numerous. In this study the diagnosis was made using a combination of the history, physical examination and findings on imaging.

Preoperative physical examination included active compression test (O'Brien test), crank test, the Speed test, and the Yergason test. Preoperative and postoperative clinical function was evaluated with the use of the modified Constant-Murley score which was calculated as a percentage of the normal value relative to gender and age (9).

All patients underwent preoperative standard plain radiographs including anteroposterior, axillary and outlet view.

Furthermore, all patients underwent a high resolution non-contrast magnetic resonance imaging. A type II SLAP lesion was believed to be present on MRI when a line of high-intensity signal was seen coursing across the base of the hyperintense labrum to the periphery. All patients had documented evidence of a detached superior labrum. Final confirmation of the type II SLAP lesion was made at the time of arthroscopic surgery (Fig. 1). Type II lesions were confirmed by pathologic mobility of the biceps anchor including obvious discontinuity of the anchor and glenoid or an anchor that moved more than 5 mm when tension was applied to the long head of the biceps tendon.

Surgical Technique

Arthroscopic diagnosis and treatment were performed in the beach-chair position. Posterior and anterior portals

were created. The posterior portal was made approximately 2 cm medial and 1 cm inferior to the posterolateral corner of the acromion. Diagnostic arthroscopy was performed to confirm the diagnosis and to identify any concomitant pathology from articular surfaces, rotator cuff and anteroinferior portion of the labrum. The fibrous tissue between the superior portion of the labrum and the glenoid was debrided. Superior labrum and superior glenoid were roughened down to bleeding surfaces using an arthroscopic shaver.

All repairs were performed with knotless suture anchors (Labrafix® knotless anchor system, ArthroCare).

Suture anchors were inserted into the glenoid rim at an angle of approximately 45° and were impacted to the recommended depth into the predrilled holes. Although it is more technically demanding to insert an anchor at an angle of 45° through the standard anterior portal for fixation of the labrum posterior (dorsal) to the biceps anchor, we did not use any additional portal.

Three different suture anchor configurations were used to repair the type II SLAP lesion : 1) Two suture anchors placed posterior to the biceps tendon (5 patients, 25%), (Fig. 2) ; 2) One suture anchor placed at the posterior border of the biceps tendon at 11 o'clock position (3 patients, 15%), (Fig. 3) ; 3) Two suture anchors placed one anterior to the biceps tendon at 1 o'clock position and one posterior to the biceps tendon at 11 o'clock position (12 patients, 60%).

Statistical analysis

The independent t-test was performed to assess the difference between preoperative and postoperative modified Constant-Murley score. The t-test was also used to evaluate differences in time and ability to return to sport between groups. Statistical analysis was performed using SPSS software (version 12, Chicago, Illinois) and a value of $p < 0.05$ was considered statistically significant.

RESULTS

Of the twenty consecutive patients who demonstrated an isolated type II SLAP tear, and met the inclusion and exclusion criteria, there was 1 professional thrower, 3 high-school players, 13 recreational athletes and 3 patients had no participation in sports activities. Among the patients, no one demonstrated early glenohumeral degenerative changes on preoperative or postoperative radiographs.



Fig. 2. — Arthroscopic view from the posterior portal showing repair of the superior labral lesion. Use of 2 suture anchors placed posterior to the biceps tendon.



Fig. 3. — Arthroscopic view from the posterior portal showing repair of the superior labral lesion. Use of 1 suture anchor placed posterior to the biceps tendon.

The average preoperative Constant-Murley score (age and gender-matched), was 65.2% and improved significantly, postoperatively, to 86.4% ($p < 0.0001$). In addition, with regard to pain and strength there were statistically significant differences between preoperative and postoperative measurements. Pain improved from 6 points preoperatively to 13 points postoperatively ($p < 0.01$) and strength increased from 10 kgr to 17 kgr postoperatively ($p < 0.01$) (Table I).

Moreover the percentage of patients with good or excellent results in modified Constant score was 80% and only 5% of the patients mentioned a poor result (Fig. 4).

Return to sports

Patients were subdivided into two groups : those younger than 40 years and those older than 40 years old. A single traumatic incident caused the type II SLAP tear in 3 (37.5%) of the 7 patients who were more than 40 years old.

The ability to return to prior level of activity was statistically significant higher in those who were less than 40 years old compared with the older group of patients. Of the 10 patients who were less than 40 years old and participated in sports, 7 (70%) returned to the pre-injury level of activity. On the other hand of the 7 patients who were more than 40 years old and participated in sports activities

only 2 (28.5%) ($p < 0.0001$) were able to return to their original level of sports participation. Similarly, time to return to the original level of sports activity after the arthroscopic fixation, was significantly longer in patients who were more than 40 years old (group 1 in 6.5 months, group 2 in 9.5 months, $p < 0.0005$) (Table II).

DISCUSSION

The results of this study confirm our hypothesis that a two-portal technique, without using a transrotator cuff portal, is a reliable and effective method in arthroscopic repair of isolated type II SLAP lesions.

We found that 80% of the patients had excellent or good results according to the modified Constant score. Moreover, the arthroscopic repair of the isolated type II SLAP lesion provided statistically significant pain relief from 6 points preoperatively to 13 points postoperatively ($p < 0.01$).

We used one anterior working portal to repair the lesion and three different types of suture anchor configurations. Although this portal may limit access to the more posterior superior aspect of the glenoid labrum, we believed that lesions in this part of the labrum could be effectively treated by a single anterior working portal. Hence, in five patients (25%), we used two dorsal anchors for the fixation of this part of the labrum only through an anterior

Table I. — Comparison of preoperative and postoperative modified Constant-Murley score (age and gender adapted)

Variables	Pre op	Post op	P
Constant score	65.2%	86.4%	P < 0.0001
Pain	6p	13p	P < 0.01
Strength	10 kgr	17 kgr	P < 0.01

Table II. — Comparison of ability and time to return to prior level of activity based on the patient's age

Variables	< 40 years old	> 40 years old	P
Return to sport	7 (70%)	2 (28.5%)	P < 0.0001
Time to return	6.5 months	9.6 months	P < 0.0005

portal. The posterosuperior glenoid labrum sustains traction and compression forces during the throwing motion that include peel back mechanism and internal impingement (4). Suture anchor repair at the 11-o'clock position may be important for successful treatment of type II lesions. We decided not to use a trans-rotator cuff portal to avoid creating an iatrogenic trauma in the rotator cuff especially in high-demand patients and athletes. In our opinion, insertion of a cannula through the supraspinatus and penetration of the rotator cuff could lead to postoperative shoulder dysfunction. Several authors have described a trans-rotator cuff approach for the repair of type II SLAP lesions with variable results.

Cohen *et al* (6) mentioned that placing portals through the rotator cuff may be associated with

poorer surgical outcomes. Compared with those patients in whom only a rotator interval portal was used, those in whom the cuff was penetrated had a significantly poorer outcome, both in terms of functional scores and patient satisfaction. Furthermore, Boileau *et al* (3), in their patients with an isolated type II SLAP lesion, used biceps tenodesis as an alternative to reinsertion and they demonstrated that the subjective patient satisfaction and the rate of return to previous level of sports participation was significantly better after biceps tenodesis than after SLAP repair in which they used a trans rotator cuff portal as a working portal. Only 20% of the patients were able to return to their previous level of sports participation after SLAP repair. Oh *et al* (19) in a clinical and radiological analysis of 58 SLAP lesions

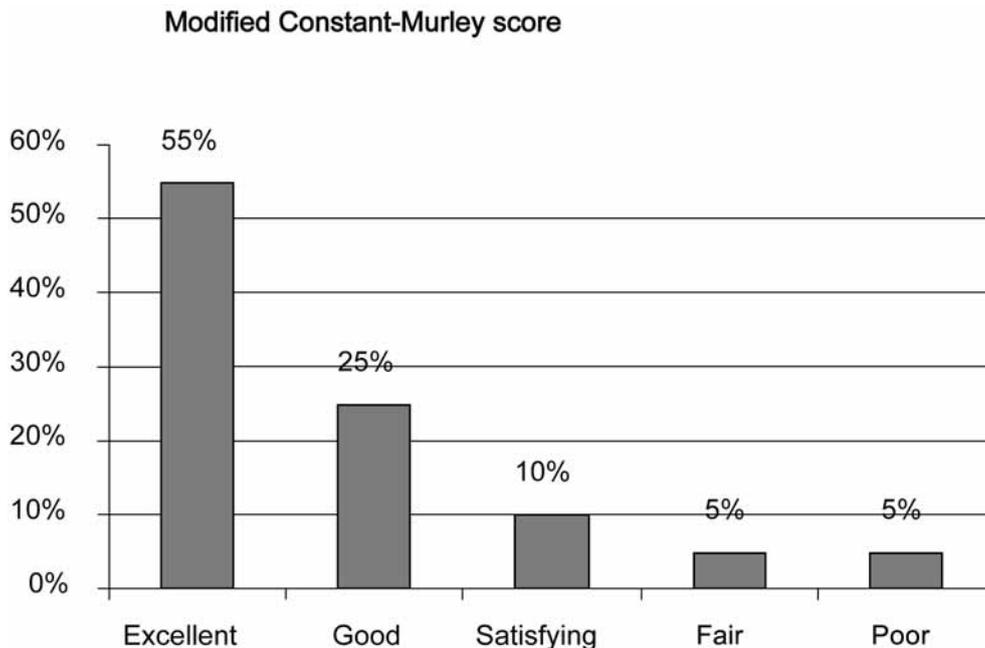


Fig. 4. — Patient's satisfaction according to modified Constant-Murley score (age and gender adapted)

stated that the trans rotator cuff portal is an efficient and safe portal for SLAP repair, although there are some valid concerns of damaging the cuff in patients with a SLAP lesion with concurrent cuff disorders, as well as in older patients. On the other hand, Coleman *et al* (7) conducted an outcome comparison, using a trans-rotator cuff portal and a rotator interval portal and concluded that there was no difference in clinical outcomes between the two groups.

Our series only includes patients with isolated type II SLAP lesions. All patients with additional associated shoulder lesions have been excluded. We included only this type of SLAP repairs, to remove any confounding variables that could arise as a result of including patients with impingement syndrome, rotator cuff tears or shoulder instability. By focusing on this isolated subset of labral injuries, we hoped to better elucidate the surgical outcomes both subjectively and objectively to more accurately guide patient and physician expectations when addressing this particular lesion. As mentioned by Kim *et al* (12) when a SLAP lesion coexists with other clinical syndromes it becomes difficult to differentiate if the result of a given treatment is due to the management of the SLAP lesion or to the management of the other pathological entities.

In our series, 17 of the 20 patients participated in athletic activities before the arthroscopic SLAP repair. There were 13 non professional players, 3 high school players and 1 professional player. We subdivided patients into two groups, with regard to their age, and we examined if there were any differences in ability and in time to return to sports between the two groups. Our results showed that there were statistically significant differences between the groups, with 70% returning to the same level of competitiveness in the younger group (< 40 years) and 29% ($p < 0.0001$) in the older group (> 40 years). The time to return to pre-injury level of activity was significantly longer in the older group (9.6 months versus 6.5 months, $p < 0.005$). Several previous studies have reported diverging findings regarding return to athletic activity in overhead sports after arthroscopic type II SLAP repair (Table III). Ide *et al* (11), after an arthroscopic repair of a type II SLAP lesion through a trans rotator cuff portal concluded that 30 (75%)

Table III. — Ability to return to sports activity

Boileau <i>et al</i>	20%
Neri <i>et al</i>	80% (< 40 y), 74% (> 40 y)
Ide <i>et al</i>	75%
Kim <i>et al</i>	22%
O'Brien <i>et al</i>	44%
Morgan <i>et al</i>	84%
Burkhart <i>et al</i>	84%

of 40 patients returned to their pre-injury level of sports participation. Neri *et al* (17) using the same portal, presented good or excellent results and high return to prior level of activity for the majority of patients regardless of age. However the time to return was prolonged for the patients who were more than 40 years old. Burkhart *et al* (5) demonstrated excellent or good results in overhead-throwing athletes, all of whom had an associated partial-thickness rotator cuff tear. Morgan *et al* (15) in their study reported that 7 (16%) of 44 baseball pitchers did not return to their pre-injury level of activity after an arthroscopic repair of a SLAP lesion through a lateral trans rotator cuff portal.

Type II SLAP lesions, which represent the most common type (55%), must be carefully distinguished from the normal biceps anchor with normal meniscal variant attachments. The meniscal variant, although mobile on probing, will reveal normal articular cartilage beneath the anchor that is contiguous with the smooth synovial lining of the biceps anchor (10,16). In the current study all patients underwent a high resolution non-contrast MRI for the diagnosis of type II SLAP tear. Connell *et al* (8) reported that high-field non contrast MRI had a sensitivity of 98% and a specificity of 89.5% for detection of superior labral lesions. On the other hand Kim *et al* (12) showed that high-field non contrast MRI had 54.5% true positive and 45% false negative results. When they performed an MR arthrography, they had 96% true positive and only 4% false negative results. MR arthrography is now considered to be the gold standard in assessing superior labral pathology (2,22).

There are some limitations to the present study. Although our data was prospectively collected and the evaluator was blinded, we had no control group for arthroscopic debridement or nonoperative

treatment. Another limitation is that we used only a single outcome score, the modified Constant-Murley score. Also, due to the number of patients we were unable to match patients according to level of sports participation. A disadvantage of our technique, is that we cannot repair arthroscopically concomitant pathologic entities such a rotator cuff tear.

On the other hand our study has some potential strengths. We focused only on isolated type II SLAP lesions. All patients were treated by the same surgeon using the same fixation method. They were evaluated by an independent observer using a standard evaluation score (modified Constant-Murley score, adapted to age and sex), and no patients were lost to follow-up during the study period.

In conclusion, arthroscopic repair of an isolated type II SLAP lesion using a two portal technique, without using a trans-rotator cuff portal, appeared as a reliable and effective procedure with respect to shoulder function and anatomy. Good or excellent results, as measured by the modified Constant-Murley score, can be expected for the majority of patients who undergo this procedure.

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