Current Concept of the Superior Labral Lesions : Functional Evaluation

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Since the first description of the lesion on the superior labrum in throwing athletes by Andrew et al.[2], a number of literatures have addressed on the mechanism, arthroscopic findings, and treatment of superior labral lesions.[1 4-8 11 12 16-18 21 25] Snyder et al.[24] first described the "SLAP" lesion, an acronym for Superior Labral Anterior and Posterior, to define the superior labral pathology. Several types of this SLAP lesion have been reported and the role of superior labrum in conjunction with the long head of the biceps tendon has been recognized by way of extensive biomechanical and clinical research.[4 9 10 13 19 21-23] The following sections will discuss the classification, diagnosis, arthroscopic treatment, and current understanding on SLAP lesions.

Functional Anatomy

The superior labrum has two anatomical variations.[6] The first type is a meniscoid labrum which has only a peripheral attachment, and a free edge on the labrum can extend onto the glenoid surface. The second type of superior labrum has both the peripheral and central attachment. The hyaline cartilage of the glenoid labrum is continuous to the fibrocartilage of the superior labrum.[6] The long head of the biceps tendon arises from the supraglenoid tubercle and the superior labrum.[6] In the majority of cases, the biceps tendon blends with the superior labrum, and only a small part of the tendon attaches to the supraglenoid tubercle. In 25% of the cases, the major portion of the tendon attaches to the supraglenoid tubercle. The attachment is often toward the posterior aspect of the labrum from the 12 o' clock position.[6 11] Rodosky et al.[23] reported that abduction and external rotation of

the shoulder during the cocking phase of throwing stresses the origin of the long head of the biceps tendon and its attachment to the posterior labrum. Glousman et al.[9] also demonstrated in their dynamic EMG studies, that the biceps is extremely active in throwing athletes when the shoulder is placed in an abducted and externally rotated position. In a recent biomechanical experiment, Kuhn et al.[16] reported that the biceps-superior labral complex failed under significantly less force for the maximal cocking position than the early deceleration position. They also observed that type II SLAP lesions occurred more frequently in the maximal cocking position. This study suggests that the position of the biceps tendon during load application is a critical component to the pathogenesis of type II SLAP lesions. As was reported by Burkhart as a peel-back mechanism,[5] abduction and external rotation of the humeral head displaces the unstable biceps-superior complex away from the glenoid margin during arthroscopic examination.

The fibers of the biceps tendon blend with the large portion of the posterosuperior labrum. The direction of the biceps tendon fibers is parallel to that of the posterosuperior labrum.[6,11] It would seem that the glenohumeral positions, that places the biceps in a position different than the orientation of the fibers that comprise the biceps-superior labral complex, may increase the likelihood of failure.

Classification

Snyder et al.[24] classified SLAP lesions into 4 different types in 1990. Type I(11%) involved a marked fraying with a degenerative appearance of the superior labrum. Type II(41%) involved detachment of the superior labrum-biceps complex from the glenoid. Type III(33%) involved a bucket-handle tear of the superior labrum with an intact attachment of the biceps tendon to the glenoid. In type IV(15%), a bucket-handle tear of the superior labrum extended into the biceps tendon. Complex SLAP lesions are a combination of any of the four types. Maffet et al.19 described three more types of SLAP lesions. Maffet's type V lesion was a combination of the Bankart lesion and the type II SLAP lesion, while the type VI lesion was an unstable flap tear of the superior labrum in addition to a biceps tendon separation, and the

type VII lesion involved separation of the superior labrum-biceps tendon complex extending anteriorly beneath the middle glenohumeral ligament. Type I SLAP lesion may simply be a variant of the normal anatomy[20] or an incidental finding in the shoulder with other, more significant injuries.[8] Burkhart[5] further divided the type II SLAP lesion into 3 subgroups depending on the location of the lesion. These are the anterior, posterior, and the combined SLAP lesions.

Diagnosis

Diagnosis of the SLAP lesion is often difficult with the history alone. The most common complaints are pain and mechanical symptoms that include catching, locking, popping, or grinding. These occur most commonly in overhead activities. Even though there are some diagnostic tests available for the SLAP lesion, they are all nonspecific. These are the compression-rotation test by Snyder,[24] the crank test by Liu,[18] SLAPpression test by Berg,[3] anterior slide test by Kibler,[14] active compression test by O' Brien.[20] Recently, the author reported a new diagnostic test, biceps load test of Kim, for the combined SLAP lesions in the shoulders with recurrent anterior dislocation of the shoulder.[15] The test is performed in the supine position. The examiner sits adjacent to the patient on the same side as the shoulder and grasps the patient's wrist and elbow gently. The arm to be examined is abducted at 90°, with the forearm in the supinated position. While the patient is allowed to relax, an anterior apprehension test is performed. When the patient becomes apprehensive during the external rotation of the shoulder, external rotation is stopped. The patient is then asked to flex the elbow while the examiner resists the flexion of the elbow with one hand, and asks how the apprehension has changed, if at all. If the apprehension is lessened, or if the patient feels more comfortable than before the test, the test is negative. If the apprehension has not changed, or if the shoulder becomes more painful, the test is positive. The test is repeated and the patient is instructed not to just pull the whole upper extremity, but to bend the elbow against the examiner's resistance. The examiner should be sitting adjacent to the shoulder to be examined at the same height level as the patient, and should

also face the patient at a right angle. The direction of the examiner's resistance should be on the same plane as the patient's arm so as not to change the degree of abduction and rotation of the shoulder. The forearm should be kept in the supinated position during the test. The biceps load test theory can be summarized as a combination of three mechanisms.[15] First, contraction of the biceps in a shoulder with an intact superior labral attachment increases torsional rigidity of the glenohumeral joint, which decreases the anteriorly directed force in the abducted and externally rotated position. Second, contraction of the biceps, diminishes the stress placed on the inferior glenohumeral ligament in the position of the anterior apprehension test. Third, contraction of the biceps can reduce the partly subluxed humeral head by the internal rotating force of the humeral head. During the biceps load test, because the internal rotation of the humeral head is precluded by the examiner, the internal rotating force can be exerted on the glenoid as an external rotating force of the glenoid which results in partial head reduction.

The biceps load test provides further clinical clues to assist in clarifying the contribution of the biceps-superior labral complex to glenohumeral stability, since the contraction of the biceps in shoulders with intact superior labrum reduce apprehension in the apprehensive position. Furthermore, the biceps load test provides evidence for the role of the biceps in the mechanism of action in translating or rotating the humeral head within the confines of the glenoid.[15]

Although, the MRI creates high soft tissue resolution, it often remains difficult to the labrum when it comes to the superior labrum. Gadolinium-enhanced MRI provides a good image for the superior labrum and increased the detection rate of the SLAP lesions.

Arthroscopic Treatment

Differentiating between a type II SLAP lesion and a normal meniscoid superior labrum can be difficult. In the normal shoulder, the superior glenoid articular cartilage extends to the labral attachment. However, with the type II SLAP lesions, there will usually be a space between the glenoid articular

cartilage edge and the attachment of the superior biceps. The torn superior labrum will often arch away 3 to 4 mm from the underlying bone when tension is applied to the biceps tendon. The peel-back mechanism also offers clues in differentiating the SLAP lesions and the normal variants. With the arm moving toward abduction and external rotation, the biceps-superior labral complex peels off the posterosuperior glenoid margin. In normal shoulders with the meniscoid superior labrum, the peel-back mechanism is negative.

Arthroscopic Technique

We prefer the lateral decubitus position for all arthroscopic shoulder surgery. The patient is positioned with the Vacupak beanbag support and the trunk tilted posteriorly approximately 15 degrees. We use three portals for the SLAP repair. The standard posterior portal is created approximately 2 cm inferior and 1 cm medial to the posterolateral edge of the acromion. Practically, palpation of the posterior glenohumeral joint line will help the proper site for the posterior portal. The anterosuperior portal is created just inferior to the anterior edge of the acromion with the guide of transarticular Wissinger rod. The third portal, anteroinferior portal, is placed just superior to the leading edge of the subscapularis tendon. This can be done by the outside-in or inside-out technique. I prefer the inside-out technique. The anterosuperior portal is by far the most critical in the SLAP repair. If the anterosuperior portal is placed far inferior from the acromion, the repair of the posterosuperior labrum can be difficult. A large diameter threaded cannula(8.4mm Cannuloc, Linvatec, Largo FL) is placed in the anterosuperior portal and the small cannula(Universal Cannula, Linvatec, Largo, FL) in the anteroinferior portal. The scar adhesion of the superior labrum is peeled off the superior glenoid neck using the liberator knife. The soft tissue on the glenoid neck can be debrided using the shaver or preferably the meniscal rasp. The bony glenoid neck is lightly decorticated using a ball burr. A small burr, 3.5mm in diameter is better than a larger size of burr and the reverse direction setting of the instrument is safe to minimize the amount of the decortication and to escape inadvertent injury to the normal

articular cartilage and the labrum A pilot marking on the superior glenoid margin was created using a 2mm pituitary forcep. The bone punch is inserted through the anterosuperior portal and placed into the pilot marking. The bone punch is then pivoted to an angle approximately 45 degrees to the articular surface and driven into the glenoid. For the posterosuperior aspect of the glenoid, the bone punch is pushed backward to keep a perpendicular of an angle to the glenoid as possible. This negates the additional portal for the posterosuperior type of SLAP lesion, which Burkart described as the port of Willmington. A mini-Revo screw load with a No-2 Ethibond suture material in the screwdriver is inserted. One limb of the suture is retrieved through the anteroinferior portal. A 45 degrees crescent hook loaded with the Shuttle-Relay(Linvatec, Largo, FL) is inserted through the anterosuperior portal, piercing the labrum at the base of the biceps tendon. A Shuttle-Relay is retrieved through the anteroinferior portal using the grasper forcep. A No-2 Ethibond suture is engaged into the eyelet of the Shuttle-Relay and then pulled out the anterosuperior portal. The suture is tied with an arthroscopic knot. We prefer an SMC knot, which is a sliding knot and has a self-locking mechanism. The SMC knot is very simple, easy to master, and has good knot security. Additional suture anchors are inserted as needed.

Postoperative Rehabilitation

The shoulder is supported using the arm sling with a pillow spacer. Pendulum exercise is initiated from the second day and strengthening exercise is gradually increased after 3 weeks. The external rotation with the arm in the 90 degrees abducted position is prevented for 6 weeks after the operation, in order not to stress the repaired biceps-superior complex.

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