



Arthroscopic On-Lay Biceps Tenodesis: The Loop-Lock Technique

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Abstract: The biceps tendon is a common pain generator in the shoulder. Long head of the biceps tendon pathology occurs in a variety of different ways. There are several different treatment options available to address the long head of the biceps. With advances in arthroscopy, all-arthroscopic tenodesis is becoming a more popular choice to address biceps tendon pathology. We describe an all-arthroscopic technique, termed “the loop-lock,” for performing a biceps tenodesis.

The biceps tendon is a common pain generator in the shoulder. Biceps tendon pathology is often multifactorial, with degenerative, inflammatory, and traumatic causes. Biceps pathology usually presents with anterior shoulder pain and is commonly seen with other injuries such as rotator cuff disorders, labral pathology, and impingement and occasionally in isolation as tendonitis or tears.^{1,2} Biceps tenodesis has been increasingly used over the last several years as a treatment for long head of biceps tendon and labral pathology. There are several different treatment options to address pathology of the long head of the biceps tendon, including arthroscopic tenodesis, open tenodesis, and tenotomy, yet no consensus exists over the optimal treatment.³

Previous studies have demonstrated that a biceps tenodesis can be performed with good results with all arthroscopic suprapectoral tenodesis or an open subpectoral biceps tenodesis.^{4,5} The following description is a biceps tenodesis technique that allows the biceps to be

fixated within the groove without externalizing the tendon through a portal using 2 small implants.

Surgical Technique

Preoperative planning involves thorough evaluation of the shoulder in the clinical setting. On physical exam, patients often have anterior shoulder pain and pain with palpation over the biceps tendon. Provocative testing of the biceps and biceps/labral complex can also cause pain and be further indicative of biceps pathology. Magnetic resonance imaging with arthrogram is often obtained and can demonstrate pathology of the long head of biceps tendon, its labral attachment, or structural stabilizers of the biceps within the groove. Surgery is reserved for patients who fail conservative treatments.

The patients are placed in the beach chair position with the operative shoulder prepped and draped in the usual sterile fashion (Video 1). Four portal sites are prepared for the procedure: a standard posterior portal roughly 2 cm inferior and 1 cm medial to the posterior edge of the acromion, a direct lateral portal just 1 cm distal to the lateral acromion, an anterolateral portal roughly 1 cm lateral to the anterolateral edge of the acromion, and a standard anterior portal (Fig 1).

After the creation of portals with an 11-blade scalpel, the glenohumeral joint is entered through the posterior portal and the shoulder is insufflated with normal saline solution. The biceps tendon is examined closely for any pathology. The tendon is pulled into the joint for visualization of any tenosynovitis within the bicipital groove. Shoulder flexion and external rotation are used to help visualize the distal aspect of the biceps tendon (Fig 2, Table 1).

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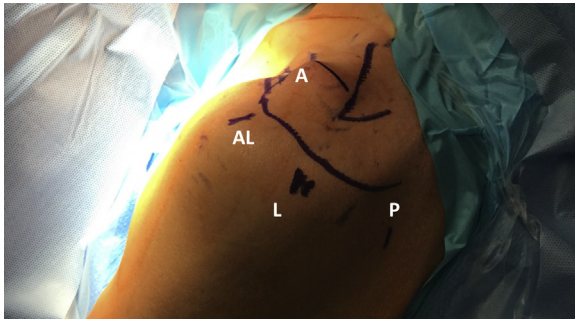


Fig 1. Four portals are used for the loop-lock technique of biceps tenodesis on this left shoulder: the posterior portal (P), anterior portal (A), lateral portal (L), and anterolateral portal (AL).

Upon the decision to perform a biceps tenodesis, the biceps tendon is tagged with an 18-gauge spinal needle placed just anterior to the anterolateral portal. The needle is directed toward the joint until it is visualized piercing the biceps intra-articularly through the bicipital tunnel. Using a radiofrequency ablation device, the biceps tendon is detached from the superior labrum. Any remaining tendon stump attached to the labrum is ablated down to be congruent with the labrum. The camera scope is then moved into the subacromial space through the posterior portal, and both the arthroscopic shaver and radiofrequency ablation device are used to obtain adequate visualization of the subacromial space. The viewing portal is then switched to the direct lateral

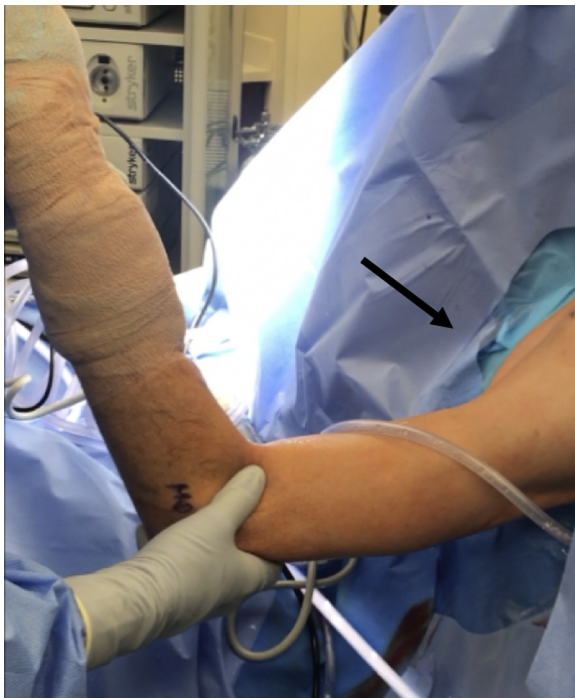


Fig 2. The left shoulder (arrow) is forward flexed and externally rotated to better visualize the bicipital groove in the left shoulder during arthroscopic biceps tenodesis.

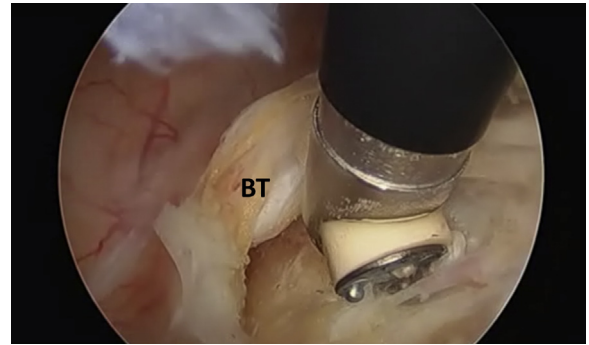


Fig 3. The bicipital groove is opened using a radiofrequency device to visualize the biceps tendon (BT) through a lateral portal in this left shoulder during arthroscopic biceps tenodesis.

portal, and dissection with radiofrequency ablation device is further performed to expose the biceps tendon and bicipital groove through the anterolateral portal. The biceps can often be palpated within the groove with the radiofrequency device, and the bicipital tunnel is opened just posterior to the tendon (Fig 3). Careful dissection is performed until the fibrocartilage superior to the pectoralis major muscle is identified. There is often a rich vascular supply in this area, and it is important to obtain hemostasis for adequate visualization. A grasper is then inserted into the subacromial space to grasp the biceps tendon through the anterolateral portal. The spinal needle is removed from the articular portion of the tendon, and the grasper is used to pull the tendon out into the subacromial space. A second grasper is then inserted through the posterior portal and secured to the tip of the tenotomized biceps. The grasper now holds the end of the biceps tendon and is used to keep the tendon at length.

A Passport (Arthrex, Naples, FL) cannula is then placed into the anterolateral portal and secured. A drill guide is inserted into the subacromial space and placed in the distal end of the biceps groove, superior to the



Fig 4. The distal anchor for arthroscopic biceps tenodesis is inserted through an anterolateral portal just superior to the pectoralis major (arrow) attachment in this left shoulder while viewing through a direct lateral portal.



Fig 5. The suture anchor is placed through the guide in the anterolateral portal at the superior aspect of the pectoralis major in this left shoulder that is abducted and externally rotated.

pectoralis major (Fig 4). A drill is used to create a space for the suture anchor to be placed. A single loaded FiberTak (Arthrex) is inserted into the created hole (Fig 5). Using a grasper, one of the sutures is passed underneath the biceps tendon, placing a loop on the opposite side where the tape originated. The grasper is then placed through the loop, and the suture tail is grasped and subsequently pulled tight to create a cinch on the tendon in the groove (Fig 6). The grasper is used to put the appropriate tension on the biceps tendon as

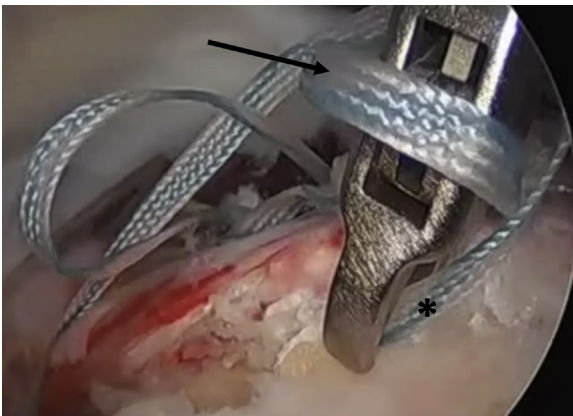


Fig 6. The suture passer is placed in the anterolateral portal through the loop of the suture and grasps the free tail (*) of the looped suture (arrow) to cinch the biceps tendon to the anchor and bone in this left shoulder.



Fig 7. A suture-passing device passes the suture through biceps tendon and then is tied in this left shoulder in the beach chair position.

this occurs. With the free ends of the tape outside of the portal, a knot pusher is used to tightly secure the tendon down to the anchor using alternating half-hitches. The post used for tying the knot is the suture that pulls the tendon down toward the anchor when tensioned. The tape is then cut at the level of the knots. Another anchor is added in the groove using the same technique approximately 10 mm proximal to the first anchor. The suture is once again looped around the biceps tendon and cinched down toward the anchor. A scorpion device (Arthrex) is used to pass the nonpost suture through the middle of the tendon, and the same knot is completed on the second suture (Fig 7). After the second anchor is added, the leftover end of the biceps tendon is ablated slightly superior to the proximal anchor. The free tendon end is removed using the grasper through either the Passport cannula (Arthrex) or posterior portal (Fig 8).

Rehabilitation after isolated biceps tenodesis is focused on early mobilization and progressive return to activity. At the time of surgery, the patient is placed in a simple sling. At postoperative day 3, the patient begins a self-directed, active-assist range-of-motion program. At 2 weeks of follow-up, the sling is discontinued and both

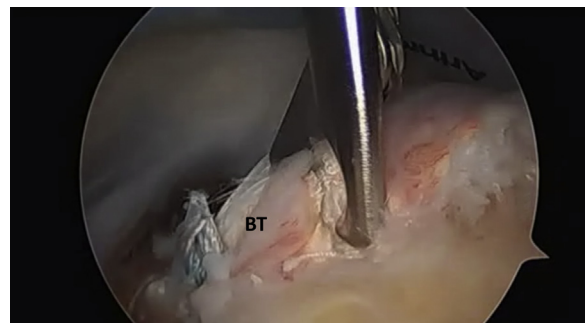


Fig 8. After fixation of the biceps tendon (BT) in this left shoulder using the "loop-lock" technique in arthroscopic biceps tenodesis, the remaining excess tendon is incised and then removed through the anterolateral arthroscopic portal.

Table 1. The Pearls and Pitfalls of the Loop-Lock All-Arthroscopic Biceps Tenodesis Technique

Surgical Step	Pearls	Pitfalls
Spinal needle placed in biceps	Placing the spinal needle anterior to the anterolateral portal through the tendon prior to tenotomy allows for maintenance of tension.	Errant placement of the spinal needle can cause iatrogenic to the rotator cuff or cartilage.
Opening of the bicipital groove	Palpate the tendon with the edge of the electrocautery device localized the tendon, and then electrocautery is used posterior to the tendon.	Errant use of the electrocautery can damage the biceps tendon within the bicipital groove.
Performing the "loop-lock"	Lifting the biceps tendon with the grasper through the posterior portal allows for easier passing the loop under the biceps tendon.	Inadequate debridement of the area over the bicipital groove can trap the loop and subsequent visualization of the loop becomes challenging.
Tightening of the "loop-lock"	The knot can be tightened into the groove using one of the tails of suture and is brought out of the groove with the other. Use the free end.	Using the wrong suture tail results in a loose knot within the bicipital groove.

passive and active range of motion are encouraged. Progressive resistance exercises begin at the eighth week postoperatively, with full release usually occurring at 12 weeks after surgery.

Discussion

All-arthroscopic tenodesis of the long head of the biceps provides a suitable option for improved functional outcomes in the treatment of labral and biceps pathology.⁵⁻⁷ In the realm of all-arthroscopic techniques, there are numerous approaches described, varying with patient placement, number of portals, fixation devices, and their location.

Current results of biceps interventions vary dependent upon the technique used. There is a risk of Popeye deformity in 6% of cases during subpectoral tenodesis⁸ and 45% of cases in tenotomy.⁹ Subpectoral biceps tenodesis has also been associated with an increased risk of humeral fracture.¹⁰ Suprapectoral biceps tenodesis may be less invasive and have similar functional outcomes as subpectoral tenodesis, but most techniques still require externalization of the tendon and 35% still report pain with heavy lifting.⁵

This technique also allows for maintenance of the length-tension relation with theoretical strength preservation. By using a grasper to hold the released tendon, accurate positioning can be obtained by pulling it at the level of its original anatomical site. Suture anchors were chosen over interference screws because of the lower risk in anatomical failure¹¹ and the small 1.6 drill hole required for each of the 2 anchors. Using 2 anchors allows for maintaining adequate fixation strength, with the strength of fixation not just resulting from the anchor-tendon interface, but also from the frictional strength developed on the tendon-bone interface between the 2 soft tissue anchors within the bicipital groove.

There are risks and potential complications with this technique. There are some risks of continued pain with an all-arthroscopic tenodesis within the bicipital groove. Specifically, there is a theoretical risk of persistent tenosynovitis and persistent anterior shoulder pain after tenodesis of the biceps tendon within the groove. Additionally, there is still the risk for rupture of the tenodesed tendon after tenodesis. With this technique, care must be taken to ensure the 2 suture anchors are a safe distance apart to avoid iatrogenic bone damage that could jeopardize the tenodesis.

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