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Technical Note

A Simple, All-Arthroscopic, Knotless Suture Lasso Loop Technique for Suprapectoral Biceps Tenodesis

David Saper, M.D., and Xinning Li, M.D.

Abstract: A variety of pathology of the long head of the biceps tendon can contribute to anterior shoulder pain in adults that can be managed with either arthroscopic tenotomy or tenodesis when conservative treatment fails. Biceps deformity or the Popeye sign is a major concern in patients after tenotomy. Biceps tenodesis can be performed in a variety of ways with different sized anchors and at different locations (suprapectoral or subpectoral). Several studies have shown that patient outcomes and complication rates are similar between all-arthroscopic suprapectoral biceps tenodesis and open subpectoral biceps tenodesis. We describe a simple, knotless, arthroscopic intra-articular biceps tenodesis technique using a 1.5-mm LabralTape lasso loop technique and a 2.9-mm PushLock anchor.

Surgical intervention for pathology of the long head of the biceps has been well established in the literature. Although simple biceps tenotomy may yield good results, biceps tenodesis may offer increased patient satisfaction and a lower incidence of undesirable Popeye deformity and biceps cramping.[1,2]

Both open subpectoral and arthroscopic tenodesis techniques have been advocated in the literature.[3-9] In a biomechanical study comparing these 2 techniques, Mazzocca et al.[6] found no difference in cyclic loading or yield to failure using different interference screw tenodesis strategies. In addition, no clinical difference has been found between arthroscopic suprapectoral biceps tenodesis and open subpectoral biceps tenodesis.[9,10]

We present a simple surgical technique for all-arthroscopic tenodesis of the long head of the biceps above the pectoral major insertion and at the top of the biceps groove using a 1.5-mm LabralTape (Arthrex, Naples, FL) lasso loop technique and a single 2.9-mm BioComposite interference screw (2.9-mm PushLock anchor; Arthrex). Advantages with our technique include increased biomechanical fixation with LabralTape compared to suture tying, maintenance of appropriate tendon length and strain, ease of tenodesis, and absence of knot tying.

Surgical Technique

Table 1 shows the critical steps of our procedure, along with technical pearls. The patient is placed in either the beach-chair or lateral decubitus position based on surgeon preference. After diagnostic arthroscopy and confirmation of biceps pathology, anterior and anterolateral portals are made medial and lateral to the biceps tendon (Fig 1, Video 1). Eighteen-gauge spinal needles should be used to assist in the appropriate portal placements. The anterosuperolateral portal should be placed high in the rotator interval and right next to the leading edge of the supraspinatus tendon. The anterior portal is placed within the rotator interval. Once the optimal portal placements have been identified with the spinal needles, a No. 11 blade is used to make small arthroscopic incisions and two 6.0-mm threaded cannulas are introduced into the glenohumeral joint space by use of a switching stick.

Once the two 6.0-mm threaded cannulas are introduced into the glenohumeral space, an 18-gauge spinal needle is used to perforate the biceps tendon just superior to the bicipital groove (Fig 2A) within the

From the Sports Medicine Service, Orthopaedic and Rehabilitation Centers (D.S.), Chicago, Illinois; and Sports Medicine and Shoulder Surgery Service, Department of Orthopaedic Surgery, Boston University School of Medicine—Boston Medical Center (X.L.), Boston, Massachusetts, U.S.A.

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Address correspondence to Xinning Li, M.D., Sports Medicine and Shoulder Surgery Service, Department of Orthopaedic Surgery, Boston University School of Medicine—Boston Medical Center, 850 Harrison Ave Dowling 2-North, Boston, MA 02118, U.S.A. E-mail: Xinning.li@gmail.com

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Table 1. Critical Surgical Steps of All-arthroscopic Intra-articular Biceps Tenodesis With Pearls

1. The patient is placed in the beach-chair or lateral decubitus position.
2. Standard anterior and anterosuperolateral portals are established. The anterior portal is within the rotator interval in front of the biceps tendon.
3. The anterosuperolateral portal is just posterior to the biceps tendon and anterior to the leading edge of the supraspinatus tendon.
4. It is critical to use 18-gauge spinal needles to help locate the optimal location for the cannulas.
5. Making a small capsulotomy next to the supraspinatus tendon with a No. 11 blade will help with passage of the cannula into the joint. We prefer to use a switching stick and a 6-mm cannula on a handle to help position the cannula in the intra-articular space.
6. The surgeon uses a spinal needle to puncture the biceps tendon, passes a No. 1 PDS suture through the tendon, and retrieves the PDS through the anterior portal.
7. Using a probe in the anterior cannula to bring the biceps tendon into the joint will help with the spinal needle penetrating the tendon at the location just above the groove. This location allows the biceps to be properly tensioned given that slight retraction of the biceps tendon will happen after you release it from the top of the glenoid. This step helps to maintain the tension length relationship of the biceps complex without over tensioning.
8. Alternatively, a 90° suture passer may be used in the anterior cannula to help in the passage of the LabralTape across the biceps tendon.
9. A 1.5-mm LabralTape suture is tied to the PDS and shuttled through the biceps tendon. Using a Mulberry knot proximal to the LabralTape on the PDS will help create a small hole in the tendon first and ease the passage.
10. The surgeon retrieves the end of the LabralTape superior to the biceps tendon out of the anterosuperolateral portal.
11. The Labral Tape grasper (Arthrex, Naples, FL) is used through the anterior portal to grab a limb of the tape near the anterosuperolateral portal and pass it around the front of the biceps tendon. Grabbing the limb of the LabralTape from the anterosuperolateral portal is accomplished with the assistance of using a regular lopped grasper to deliver the limb behind the biceps tendon to the LabralTape grasper. This step will complete the lasso loop around the biceps tendon.
12. The surgeon passes the LabralTape grasper through the created loop and grabs a limb of the suture tape that is exiting the anterosuperolateral portal posterior to the biceps tendon. This step will complete the lasso loop around the biceps tendon.
13. Both suture limbs are retrieved through either the anterior portal or the anterosuperolateral portal, depending on which portal will provide the best location for the drilling and placement of the 2.9-mm PushLock anchor.
14. The 2 limbs of the LabralTape are loaded through the 2.9-mm PushLock anchor, and tenodesis of the biceps tendon is performed at the top of the bicipital groove within the intra-articular space.
15. The biceps tendon is released from the top of the glenoid anchor location prior to the tenodesis to help better establish the length-tension relation.
16. Residual stump of the biceps is truncated with a radiofrequency wand. Care should be taken not to cut into the LabralTape after the tenodesis.

intra-articular space. A No. 1 PDS suture (Ethicon [Johnson & Johnson], Somerville, NJ) is passed through the tendon and delivered through the anterior portal. The other limb is passed through the anterosuperolateral portal with the assistance of a loop grasper. Alternatively, a 90° suture passer can also be used to penetrate the biceps tendon and help deliver the LabralTape across. In an extracorporeal manner, one Mulberry knot is made to help facilitate the passage of the 1.5-mm LabralTape across the biceps tendon. The proximal Mulberry knot in the No. 1 PDS suture is used to create a space for passage of the LabralTape, especially in thickened and hypertrophied tendons, whereas the distal Mulberry knot is loaded with LabralTape. With the PDS suture being pulled through the anterosuperolateral portal, the tendon perforation is

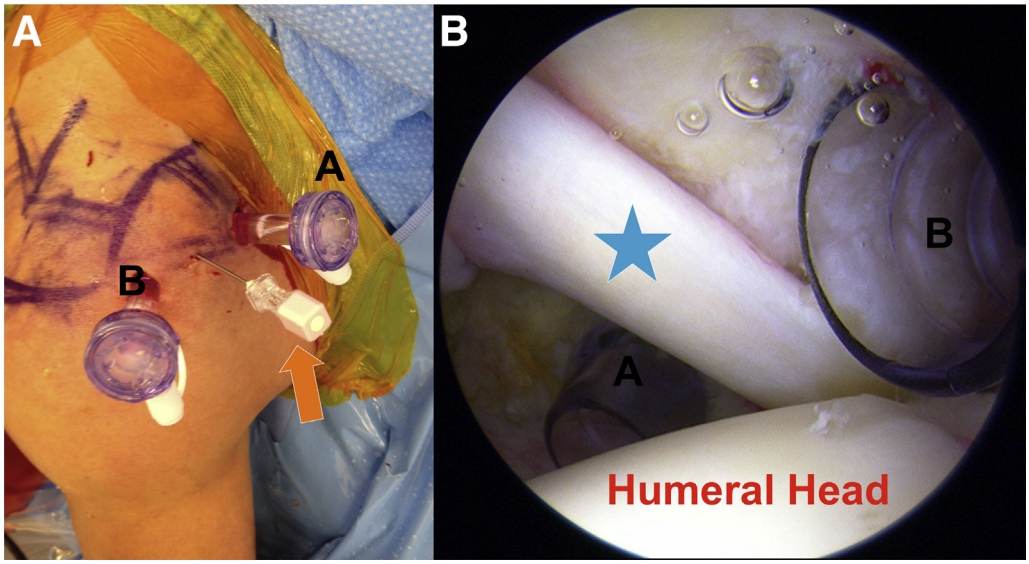

Fig 1. (A) The anterior (A) and anterosuperolateral (B) portals are made anterior and posterior to the biceps tendon. A spinal needle is used to pierce the biceps tendon just above the groove (arrow). (B) Arthroscopic view of the 2 portals (anterior [A] and anterosuperolateral [B]) around the biceps tendon (star). The patient is in the beach-chair position with posterior viewing by use of a 30° arthroscope; the right shoulder is shown.

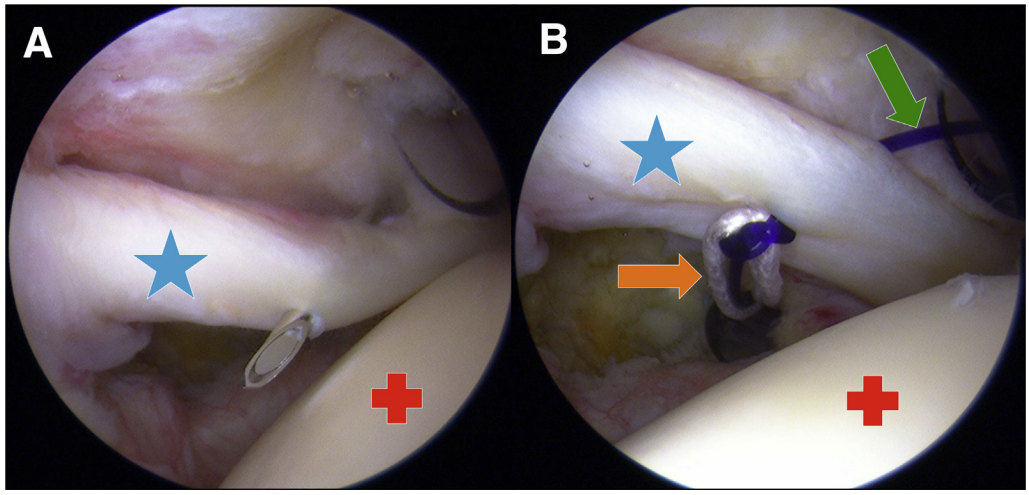

Fig 2. (A) The spinal needle penetrates the biceps tendon (star) just above the groove. The humeral head is marked with a cross. (B) PDS sutures (green arrow) are used to shuttle the LabralTape (orange arrow) across the biceps tendon (star). The humeral head is marked with a cross. The patient is in the beach-chair position with posterior viewing by use of a 30° arthroscope; the right shoulder is shown.

enlarged and the LabralTape is passed through and then unloaded from the PDS suture (Fig 2B).

A LabralTape grasper (Arthrex) is introduced into the glenohumeral joint from the anterior portal and grabs a loop of LabralTape that has been passed through the tendon near the anterosuperolateral portal. From the anterior portal, the LabralTape grasper grabs a limb of suture tape from near the anterosuperolateral portal and makes a loop in the glenohumeral space in front of the biceps tendon. The LabralTape grasper then releases the tape and goes through the loop. The limb of tape exiting the anterosuperolateral portal is grasped with the regular ring grasper and delivered into the glenohumeral joint posterior to the biceps tendon. The LabralTape grasper then grabs this limb of the tape from the anterosuperolateral portal to complete the lasso loop around the biceps tendon. The 2 ends of the tape suture are delivered out of the anterior portal (Fig 3A), creating the lasso loop. The biceps is then released with radiofrequency ablation or with a narrow meniscal biter off of its anchor insertion on the superior glenoid rim. This is done to help establish the length-tension relation between the biceps tendon and the location of the tenodesis.

With both limbs of the lasso loop suture now through the anterior portal (tenodesis can also be performed by use of the anterosuperolateral portal), a 2.9-mm PushLock BioComposite anchor is loaded. The tenodesis site at the top of the bicipital groove in the intra-articular

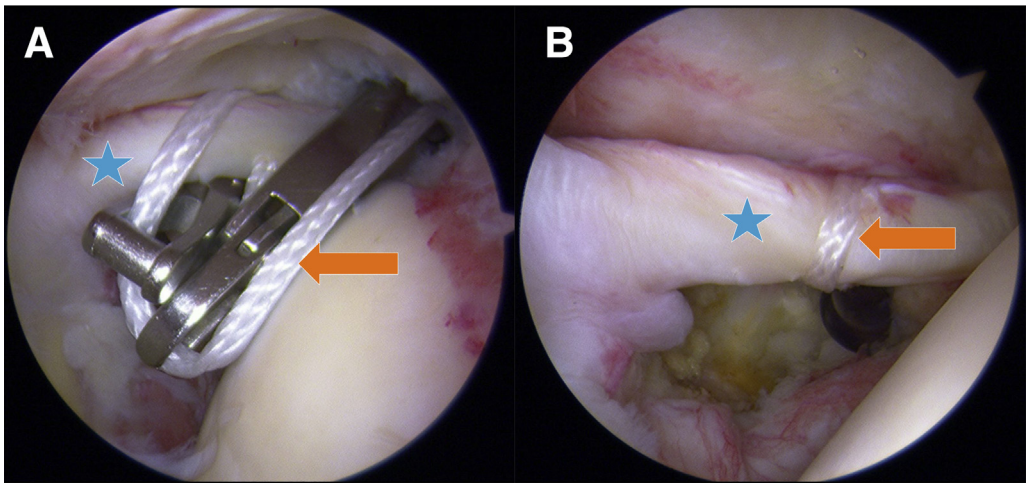

Fig 3. (A) The LabralTape grasper is used to shuttle a loop of the LabralTape (arrow) anterior to the biceps tendon (star) by use of the anterior portal. With the regular loop grasper in the anterolateral portal, one limb of the LabralTape is delivered posterior to the biceps tendon and the Arthrex tape grasper is used to create the lasso loop around the biceps tendon. (B) The lasso loop (arrow) around the biceps tendon (star) is tightened around the biceps with both limbs exiting out of the anterior portal. Either the anterior or the anterosuperolateral portal can be used for the drilling and placement of the PushLock anchor. The patient is in the beach-chair position with posterior viewing by use of a 30° arthroscope; the right shoulder is shown.

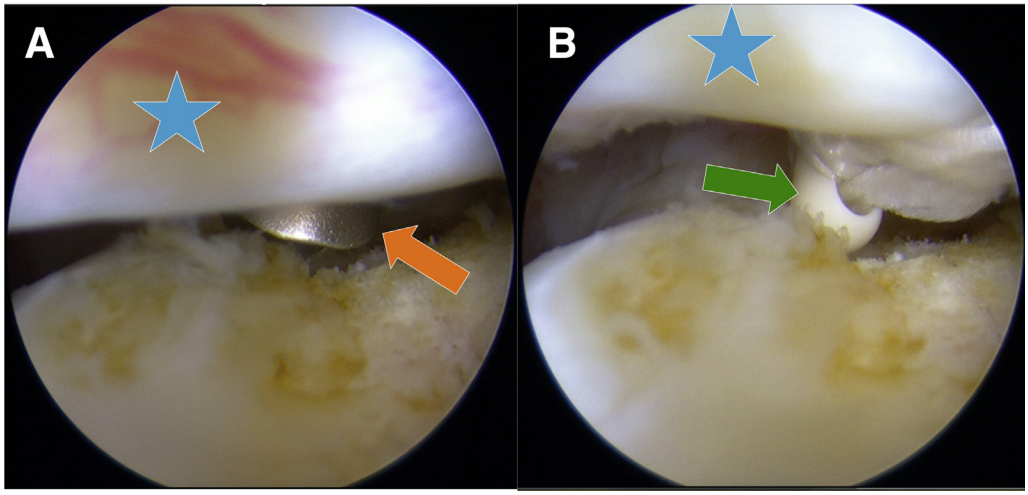

Fig 4. (A) The drill guide (arrow) is used from the anterior portal to drill the hole for the placement of the 2.9-mm PushLock anchor and the LabralTape around the biceps tendon (star). (B) The tip of the 2.9-mm PushLock anchor (arrow) is seen prior to the biceps tenodesis (star). The patient is in the beach-chair position with posterior viewing by use of a 30° arthroscope; the right shoulder is shown.

location is prepared and drilled. The PushLock anchor is introduced into the glenohumeral space and the 1.5-mm LabralTape is tensioned before delivery of the anchor into the prepared and drilled hole in the intra-articular and suprapectoral location. Residual tendon is ablated, and the tenodesis site is checked for security with an arthroscopic probe (Fig 3B). Rotation of the arm with a Spider Arm Holder (Tenet Medical, Smith & Nephew, Andover, MA) with the patient in the beach-chair position will help with positioning the drill and the PushLock anchor in the right location for the tenodesis (Figs 4 and 5).

Discussion

Arthroscopic suprapectoral and open subpectoral biceps tenodesis techniques for the management of biceps pain have been shown to have similar outcomes and complication rates in the literature.[9,10] Although there have been several biomechanical analyses of differing tenodesis techniques,[6,7,11,12] compelling clinical data showing the superiority of one technique over another have not yet been presented.

Patzer et al.[7] described a similar technique with a lasso loop Orthocord suture (DePuy Mitek, Raynham, MA) and a SwiveLock anchor (Arthrex). However, in their technique, they discussed the need for knot tying and delivering a limb of tendon into the interference screw site. We believe that incorporating the tendon remnant into the tenodesis site with the interference screw can change the length-stress relation, possibly resulting in persistent anterior shoulder pain after the tenodesis. In addition, these authors have compared the biomechanical strength of techniques using differing interference screw sizes and have failed to show clinical superiority or a clinical difference with one technique over another. Proximal humeral fractures have been reported with the use of larger interference screws[13]; thus, for our all-arthroscopic intra-articular biceps tenodesis technique, we prefer to use the 2.9-mm PushLock anchors.

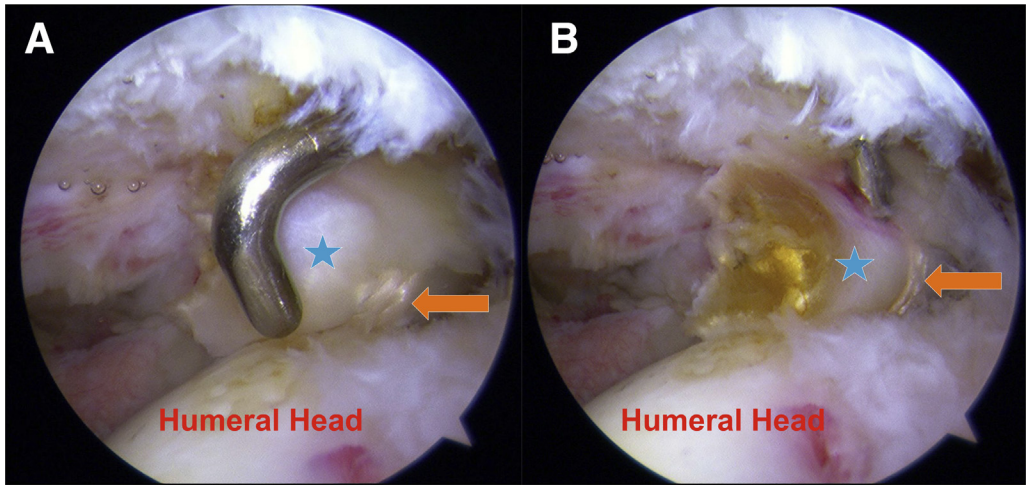

Fig 5. (A) Posterior viewing with a 30° arthroscope shows the final biceps tenodesis (star) in the suprapectoral location at the top of the groove. The LabralTape (arrow) is seen. (B) Another view of tenodesis. The biceps (star) and LabralTape (arrow) are seen. The patient is in the beach-chair position with posterior viewing by use of a 30° arthroscope; the right shoulder is shown.

Table 2. Advantages and Limitations of Technique

Advantages
Our technique is a simple, intra-articular technique that does not over-tension the biceps tendon because no interference fixation is used.
By passing the lasso loop while the biceps is still anchored to the top of the glenoid, the length-tension parameters of the tendon can be closely approximated.
Using a 1.5-mm LabralTape in a lasso loop fashion for the tenodesis increases the overall surface area for the fixation compared with using sutures.
Using a 2.9-mm PushLock anchor decreases the overall risk of proximal humeral fracture compared with the traditional 7- or 8-mm interference screws used for this fixation when an interference technique is performed.
This all-arthroscopic tenodesis technique can be independent of any other shoulder pathology procedures including potential rotator cuff repairs.
The technique does not require any extra equipment or retractors compared with the subpectoral biceps tenodesis.
The technique does not require any knot tying, which decreases irritation from the knot and saves operative time.
Limitations
In a small shoulder with no rotator cuff tear, establishing the anterosuperolateral portal in the rotator interval right next to the supraspinatus tendon can be challenging.
Suture management with the PDS and LabralTape can be difficult in the beginning.
With the patient in the beach-chair position, the optimal drilling position for the PushLock anchors may be difficult to obtain with the patient's head in the way of the drilling guide.

Some authors have failed to show any difference in strength or residual pain between biceps tenotomy and tenodesis, and the advantage of tenodesis is often the prevention of an undesirable cosmetic Popeye deformity related to tenotomy.[10,14] Although open subpectoral tenodesis techniques using large interference screws may be biomechanically stronger than use of an all-arthroscopic suprapectoral tenodesis, the outcomes are similar. A disadvantage of the open subpectoral tenodesis technique is that it requires an extra incision, and cases of proximal humeral fracture along with brachial plexus injury have been reported in the literature.[1,13,15]

We are not aware of any literature showing disparate rates of Popeye deformity, patient satisfaction, or functional outcomes with differing arthroscopic tenodesis techniques. Our technique obviates knot tying and simplifies the process for this all-arthroscopic intra-articular suprapectoral biceps tenodesis with decreasing technical difficulty and operative time. In addition, the broadness (increased surface area) of the 1.5-mm LabralTape suture may decrease suture cutout through the tendon, thus further preventing failure. Table 2 shows all of the advantages and limitations of this technique.

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