Technical Note

Arthroscopic Onlay Articular Margin Biceps Tenodesis for Long Head of the Biceps Tendon Pathology

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Abstract: The long head of the biceps (LHB) tendon is a common source of shoulder pain. LHB tendon pathology typically occurs with concomitant rotator cuff or labrum injuries but can occasionally occur in isolation as biceps tendinopathy or rupture. Tenodesis has been increasingly used to treat LHB tendon pathology, and numerous techniques have been developed that vary in approach, fixation construct, and fixation location. In this Technical Note, we describe an arthroscopic onlay articular margin biceps tenodesis with suture anchors. This technique has several advantages, namely intra-articular visualization of the tenodesis, strong fixation to high density bone of the articular margin, and most importantly, preservation of the anatomic length–tension relationship.

The long head of the biceps (LHB) tendon is a common source of shoulder pain and may be injured in isolation (e.g., biceps tendinopathy, rupture, or subluxation) or more commonly as part of a larger shoulder pathology such as rotator cuff or labrum tears.[1,2] Surgical treatment options for LHB tendon pathology include tenotomy and tenodesis. Advancement in arthroscopy coupled with concern for cosmetic "Popeye" deformity and persistent pain with tenotomy may account for the increasing popularity of tenodesis over the last decade.[2-4]

Numerous tenodesis techniques have been developed and include open or arthroscopic approaches, fixation to bone or soft tissue, and use of various fixation constructs such as interference screws, suture anchors, or cortical buttons.[5] Most recently, tenodesis location has been of particular interest, with techniques evolving to include articular margin, suprapectoral, and subpectoral fixation.[5] We describe an arthroscopic onlay articular margin biceps tenodesis with suture anchors for the treatment of LHB tendon pathology.

Surgical Technique

Patient Positioning

The patient is placed in the beach chair or lateral decubitus position with the operative shoulder prepped and draped in the usual sterile fashion.

Portal Placement

Two portals are required for this technique. First, the standard posterior viewing portal is established to visualize the glenohumeral joint. Next, the standard anterior portal is then created under direct visualization. An 8.25 × 7-mm twist in cannula is then introduced via anterior portal to allow instrumentation.

LHB Tendon Mobilization

To achieve tenodesis at the top of the bicipital groove, the LHB tendon needs to be mobilized to permit bony bed preparation. The rotator interval is opened thoroughly using electrocautery and shaver to allow for working space. If necessary, a portion of the coracoacromial ligament can be released as part of the rotator interval release.

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With the interval clear, the bicipital groove can be visualized by positioning the arthroscope superior or above the biceps tendon and turning the optics downward along the biceps tendon. The authors prefer using a 30° scope, but a 70° scope may also be used. The transverse humeral ligament encloses the LHB tendon within the bicipital groove and can be visualized with this view. An arthroscopic scissors or cautery can now be used to release the transverse humeral ligament through the anterior portal. Similar to the arthroscope, the electrocautery should be positioned above the biceps tendon and release the transverse humeral ligament from superior to inferior. The LHB tendon will be able to subluxate and displace away from the bicipital groove after complete release of the transverse humeral ligament.

LHB Tenodesis

A round burr with a guard is used to displace the biceps tendon and prepare the bicipital groove (Fig 1). A suture passer is then used to pass a FiberSnare (#2 FiberWire with loop) (Arthrex, Naples, FL) through the biceps tendon at the level of the top third of the bicipital groove. The suture is passed twice to form a grasping stitch. A second FiberSnare is passed in the same fashion just proximal to the first suture (Fig 2). Both FiberSnares are then passed through the 4.75 × 22-mm Biocomposite Double-Loaded SwiveLock Anchor (Arthrex). A tap or punch is then used at the top of the bicipital groove to prepare for suture anchor placement. Due to bone quality, the authors' preference is to use a tap. Next the SwiveLock anchor is inserted, with close attention given to maintaining proper tension on the biceps as the anchor is reduced (Fig 3). After anchor reduction, 1 limb of the suture is again passed through the biceps tendon and the 2 limbs are tied with arthroscopic knots to reinforce the tenodesis (Fig 4). The biceps tendon is then released from the superior glenoid and excess tendon removed with a shaver. This technique allows confirmation of the proper length—tension relationship of the tenodesis via direct visualization—the distal segment of the LHB should remain stationary without retraction or movement after complete proximal release at supraglenoid. This technique is also demonstrated in Video 1.

Variation in Technique With Concomitant Rotator Cuff Tear

The aforementioned technique can be modified in the presence of a superior rotator cuff tear. The initial steps of anterior and posterior portal placement are the same, but an additional standard lateral portal with a cannula is created through the tear. The lateral portal may then be used for release and preparation of the bicipital groove and passage of sutures through the biceps tendon. Tap and suture anchor placement may also be performed through the lateral portal, but it is the authors' preference to use the anterior portal for these steps.

Rehabilitation

Postoperative care involves 6 weeks of sling immobilization. Physical therapy is initiated within the first 7 to 10 days after the procedure. During the first 6 weeks, passive and active assisted range of motion is used.

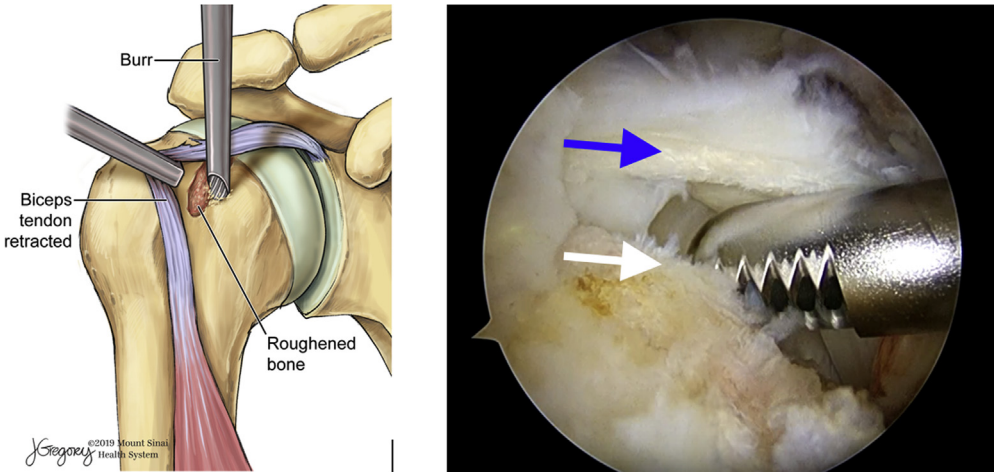

Fig 1. The patient may be positioned in the beach chair or lateral position. The right shoulder is demonstrated. A standard anterior and posterior portal are created. All visualization is performed through the standard posterior portal with a 30° arthroscope. The biceps groove is visualized (white arrow). In preparation for the tenodesis, the transverse humeral ligament is released, allowing the biceps to translate out of the biceps groove. The biceps groove is indicated with the blue arrow. The groove is debrided as demonstrated in the right image, and a round burr is used to prepare the footprint of the biceps groove. A burr with a guard is used to protect the biceps during the preparation of the groove.

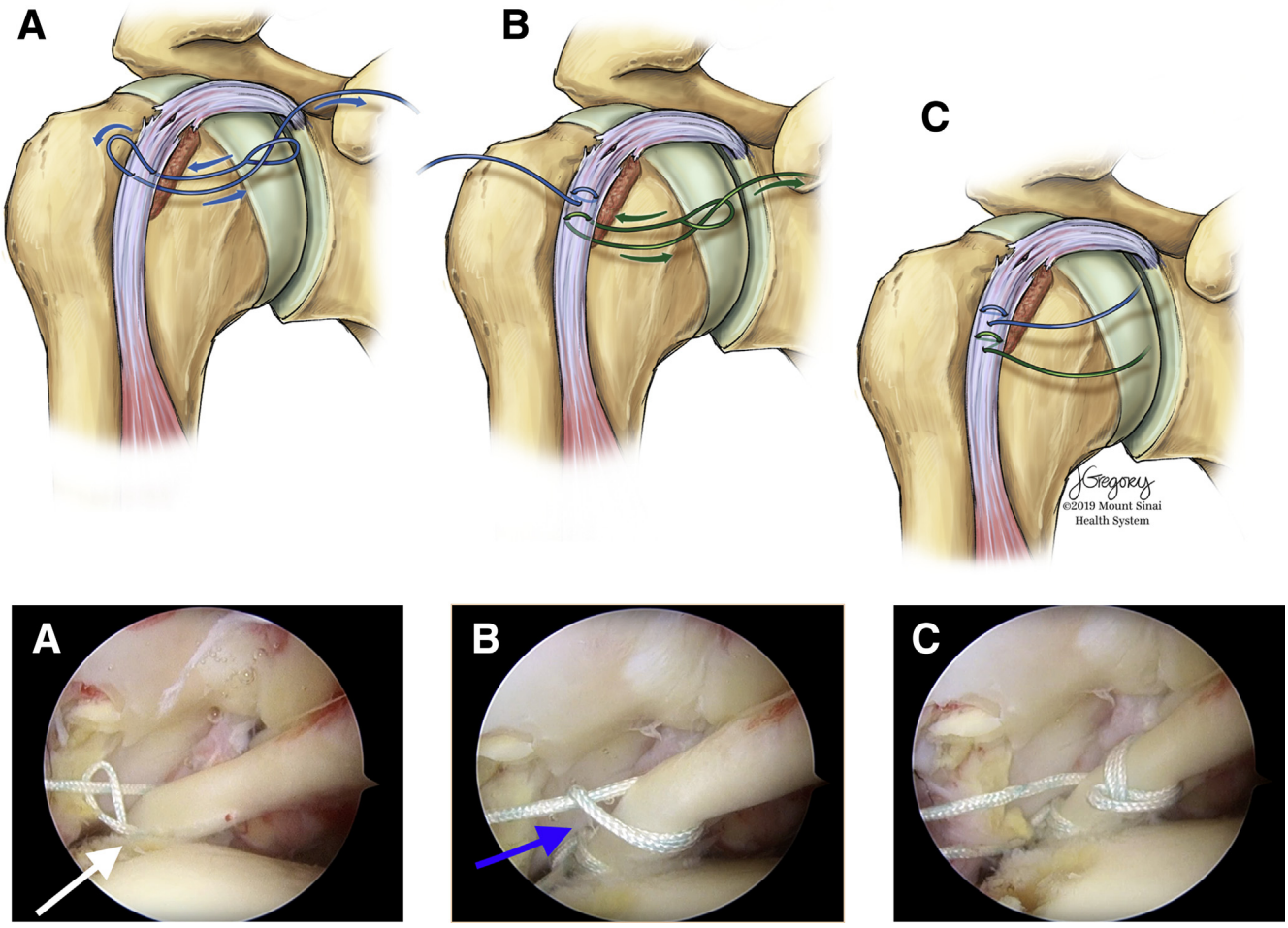

Fig 2. The right shoulder is demonstrated. Working through the anterior portal, a suture passer is used to pass a limb of the suture through the biceps tendon at the level of the prepared biceps groove. The top of the biceps groove/articular margin is illustrated with the white arrow in (A). This is performed with a self-retrieving suture passer. The retrieved (passed) suture end is then passed through the looped end of the suture and tightened, creating a grasping suture in the tendon (A). The same suture is again passed through the mid-substance of the biceps tendon using the same self-retrieving suture passer for a total of 2 passes. This is then repeated with a second suture as demonstrated (B). A tap is brought in at the same level to ensure the level of the anchor placement is the same as the suture to ensure proper tensioning. The blue arrow indicates the appropriate level of biceps for an anchor placed at the articular margin. (C) The two sutures are demonstrated passing through the tendon. The tendon is now prepared for anchor placement.

After week 6, the sling is discontinued and therapy transitions to active motion of the elbow and shoulder. At 10 to 12 weeks, strengthening is initiated.

Discussion

Numerous tenodesis techniques exist to treat LHB tendon pathology, with a recent emphasis on the ideal fixation location to optimize clinical outcomes and minimize complications. Subpectoral and suprapectoral tenodesis both improve functionality, but externalization of the biceps tendon with subsequent loss of the anatomic length–tension relationship predisposes to decreased strength and visual deformity.[6] Additional risks with subpectoral tenodesis include iatrogenic brachial plexus injury and humeral fracture due to thin cortical bone in the diaphysis.[7] Similarly, suprapectoral tenodesis may be complicated by implant pullout due to low bone density in the metaphysis.[8] Tenodesis has also been performed at the articular margin, as it obviates the need for tendon externalization and largely circumvents the complications seen with subpectoral and suprapectoral tenodesis. We present arthroscopic onlay articular margin tenodesis with suture anchors as a viable surgical alternative for the treatment of LHB tendon pathology.

In a recent biomechanics study, arthroscopic onlay articular margin tenodesis achieved comparable fixation strength as subpectoral and suprapectoral tenodesis while simultaneously conferring several advantages over these techniques.[8] First and most importantly, the

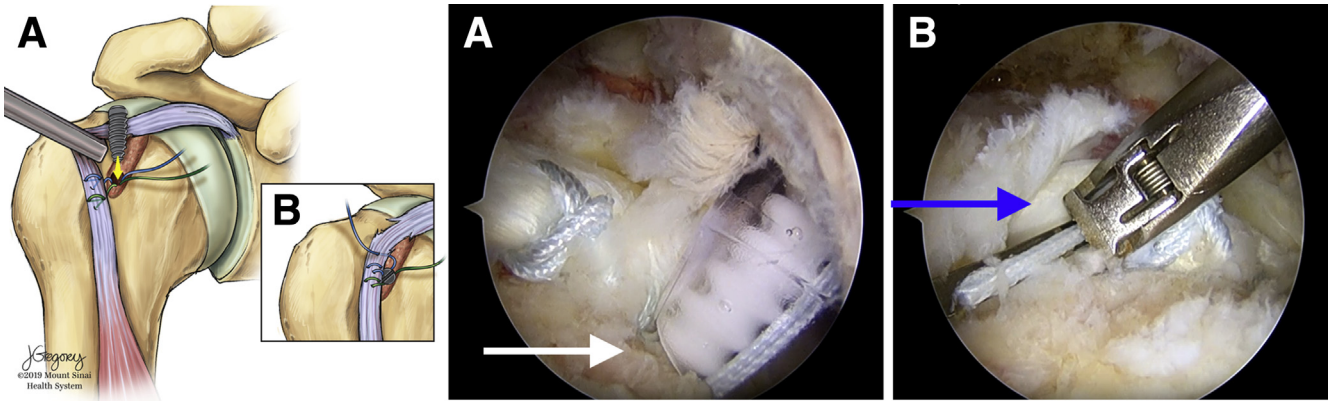

Fig 3. All visualization continues to be performed through the standard posterior portal with a 30° arthroscope. Both suture ends are passed through an anchor. A cannula is used to assist with suture management. The anchor is reduced and the sutures are tensioned (A). The white arrow illustrates the anchor reducing with the sutures tensioned allowing for an anatomic tenodesis location. Once the anchor has been completely reduced, one limb of the suture is again passed through the biceps tendon just proximal to the tenodesis site self-retrieving suture passer (B), as illustrated by the blue arrow.

onlay technique with suture anchor ensures that the LHB tendon is fixed at anatomic location before proximal release of the tendon from the supraglenoid tubercle. This preserves the length—tension relationship, which is critical for maintaining strength and achieving good cosmetic results. In addition, it reduces the likelihood of muscle cramping and fatigue seen with under-tensioning of tendon and minimizes the risk of fixation failure via implant pullout from over-tensioning.[9]

Second, this technique fixes the suture anchor within the articular margin at the top of the biceps groove, a region of particularly high bone density in the humerus.[10] Consequently, the mode of failure for this technique involves the suture knot pulling through the tendon rather than implant pullout from bone seen with subpectoral and suprapectoral tenodesis, theoretically avoiding this common latter complication.[8] Third, this technique can be performed through 2 or 3 small portals and may be less technically demanding than other approaches as intra-articular visualization is maintained using only a standard posterior portal and landmarks for tenodesis are easily identifiable. Finally, in instances of tenodesed biceps tendon rupture, a sufficient portion of the tendon remains with this technique, which allows for future subpectoral tenodesis if needed.[11]

One potential risk of this technique is the possibility of persistent shoulder pain, given that the LHB tendon remains within the bicipital groove. It has been postulated that retained diseased tendon or tenosynovium contributes to continued pain, but the exact etiology remains unknown.[12] A list of pitfalls is available in Table 1. Although several small case series have demonstrated persistent pain following articular margin tenodesis, the largest study to date by Brady et al. reported a low rate of residual pain with a low revision rate of just 0.4%.[2,11] Furthermore, McCrum et al.[13]

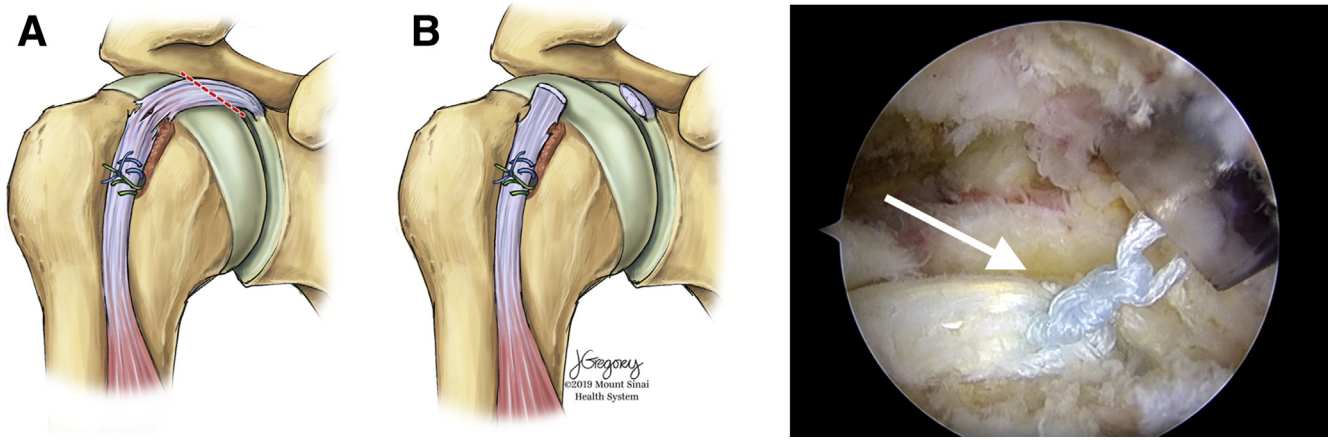

Fig 4. The arthroscopic image demonstrates the right shoulder and all portals are maintained. Finally, the 2 sutures ends are tied as illustrated by the white arrow reinforcing the tenodesis (A). Attention is turned toward the biceps tendon between the insertion and the tenodesis site. An arthroscopic biter or scissors are used to tentomize the tendon, as illustrated by the red line (A). Excess biceps on either side of the release are debrided (B).

Table 1. Procedural Pearls and Pitfalls

Pearls
Intra-articular visualizations and confirmation preservation of length and tension relationship during tenodesis
Standard arthroscopic instrumentations without need for additional portals or incisions
Strong fixation to high-density bone of the articular margin
Pitfalls
Opening rotator interval to allow adequate working space for instrumentation
Placed arthroscope and instrumentation above biceps tendon to allow full visualization of bicipital groove and transverse humeral ligament
Full release of transverse humeral ligament to allow complete mobilization of the biceps tendon

recently demonstrated no significant difference in persistent shoulder pain with biceps tenodesis with tendon in the groove or out of the groove, suggesting that structures other than the biceps tendon are pain generators. Lastly, there is still a small risk of biceps tendon rupture after tenodesis, but this risk is minimized, given preservation of the anatomic length–tension relationship with the onlay technique.

In conclusion, this technique offers a method to tenodesis the LHB tendon viewing from a standard posterior portal and working through a standard anterior portal. A summary of the advantages is presented in Table 2. The technique also offers the capacity to perform the tenodesis before the biceps is released, ensuring an accurate length–tension relationship, and the construct maximizes fixation strength with placement at the top of the biceps groove.

Table 2. Procedural Advantages and Disadvantages

Advantages
Intra-articular visualization of the tenodesis throughout the entire procedure
Strong fixation of tenodesis to high-density bone of the articular margin
Preservation of the anatomic length–tension relationship of the LHB tendon
Sufficient portion of LHB tendon remains after articular margin tenodesis, permitting future subpectoral tenodesis if needed
Disadvantages
Risk of rupture following biceps tenodesis

LHB, long head of the biceps.

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