Technical Note

Arthroscopic All-Inside Biceps Tenodesis: Technique and Outcomes

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Abstract: The long head of the biceps tendon (LHBT) is a frequent source of disorders and pathology in the shoulder. Significant evidence is available on the management of disorders of the LHBT in the literature, and the LHBT is frequently addressed intraoperatively when involved in shoulder pathology. An all-arthroscopic, intra-articular biceps tenodesis with suture anchor fixation has several advantages that have not been well described previously, and it does not add significant morbidity to arthroscopic surgery to treat the rotator cuff or other sources of pain. Intra-articular LHBT tenodesis in the bicipital groove thus has advantages of less surgical time and a decreased bone footprint.

The long head of the biceps (LHB) tendon is a frequent cause of shoulder pain. Multiple studies have previously identified that a pathologic LHB tendon is a frequent cause of shoulder pain, either in isolation or, more commonly, concurrently with other shoulder conditions.[1-4] In addition, the sling surrounding the biceps tendon is often abnormal in shoulder conditions involving anterior-superior rotator cuff tears, and related symptoms are difficult to distinguish clinically and radiographically.[4,5] Because of the high frequency of biceps tendon involvement (or potential involvement) in the pathogenesis of shoulder pain, many authors and clinicians consider it essential to address the LHB when it is noted to be involved in anterior-superior shoulder pathology intraoperatively.[6]

Multiple techniques for performing biceps tenodesis have been previously reported in the literature. These procedures have included soft-tissue tenodesis techniques in which the LHB undergoes tenotomy and is then tied into the surrounding soft-tissue structures or undergoes tenodesis to the bone surface with suture anchors[1,7,8] or in which the LHB is secured into a bone socket with suture, a cortical button, or an interference screw.[3,9-11] Biomechanically, no significant difference was noted in maximum load to failure among cortical button fixation, suture anchor fixation, and interference screw fixation.[7,12-14] In addition, no statistically significant difference was noted in displacement of the tendon representative of tendon creep after cyclic loading[15,16] in any of the aforementioned techniques. These studies have shown that each technique allows early rehabilitation and strong fixation of the biceps tendon in experienced hands. Suture anchor fixation provides the smallest bone footprint and thus less procedure-related surgical morbidity to the patient, but many surgeons do not perform this maneuver because of the technically demanding nature of the arthroscopic technique. Data on the rate of postoperative complications when comparing open versus arthroscopic biceps tenodesis are conflicting, which is likely reflective of the heterogeneity in surgical technique and tendon disorders.[17]

The most appropriate location of the biceps tenodesis has become a further clinical question of controversy. Some recent studies have suggested that arthroscopic biceps tenodesis that is performed high in the groove and does not address the bicipital sheath has a higher incidence of revision surgery and a higher incidence of residual shoulder pain.[2,18] These studies have reported a revision rate as high as 45% after this operation. Authors have suggested that because of this high revision rate, tenodesis either low in the groove or in the subpectoral region is the preferred location for biceps

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Table 1. Benefits and Limitations of Intra-articular Tenodesis Technique

Benefits
No open incision
No Popeye deformity and better cosmetic result (owing to preservation of biceps length)
Able to be performed with standard arthroscopic technique at time of additional arthroscopic interventions
Limitations
Must be able to identify intra-articular bicipital groove and access for tenodesis
Tenodesis anchor may cause screw-site morbidity and pain, as well as possible risk of iatrogenic humeral fracture[7]
May not adequately treat pain from within bicipital groove

tenodesis.[18] The Burkhart's research assocation of shoulder specialists (BRASS) study group reported the largest case series of its kind addressing this question. This group looked at postoperative outcomes, complications, and rates of revision surgery when performing proximal biceps tenodesis via an arthroscopic approach with interference screw fixation of the biceps tendon in the bicipital groove in 1,053 patients; excellent postoperative outcomes were noted. However, no previous literature has described postoperative outcomes, complications, and revision rates in a series of patients undergoing proximal biceps tenodesis by suture anchor fixation, which provides the least theoretical iatrogenic injury to the humerus (Table 1).

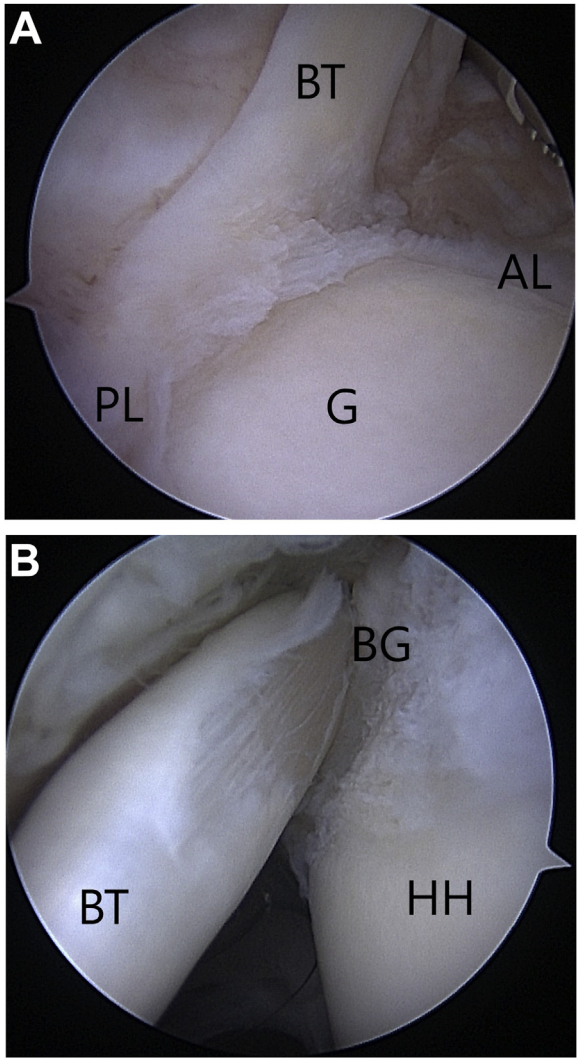

Fig 1. View from the posterolateral portal in the lateral decubitus position in a right shoulder. The long head of the biceps tendon (BT) is visible with significant tendinosis extending from the anchor (A) into the bicipital groove (BG) at the articular margin (B). (AL, anterior labrum; G, glenoid; HH, humeral head; PL, posterior labrum.)

Surgical Technique

Patient Positioning and Preparation

The patient is transferred to a standard operating table, a standard preoperative timeout is performed, and general anesthesia is induced. The patient is positioned in the lateral decubitus position with a beanbag positioner on a standard operating table with the operative shoulder up. Care is taken to pad bony prominences, and an axillary roll is placed. The operative shoulder is prepared and draped and is then placed into a traction device with approximately 10 lb of shoulder traction to maintain positioning of the arm in approximately 15° of abduction and in neutral rotation.

Arthroscopic Procedure

Video 1 shows a technical demonstration. The posterior soft spot is palpated, and a posterior portal is created. A diagnostic arthroscopy is performed. We use a 30° arthroscope throughout. An anterosuperior working portal is created under direct visualization with

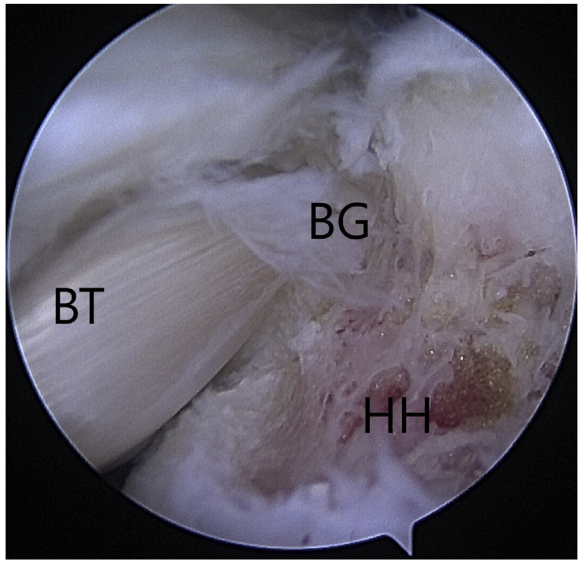

Fig 2. The position for the tenodesis site is identified prior to biceps tenotomy at the edge of the articular margin superior to the bicipital groove (BG). This area is decorticated using a shaver. (BT, biceps tendon; HH, humeral head.)

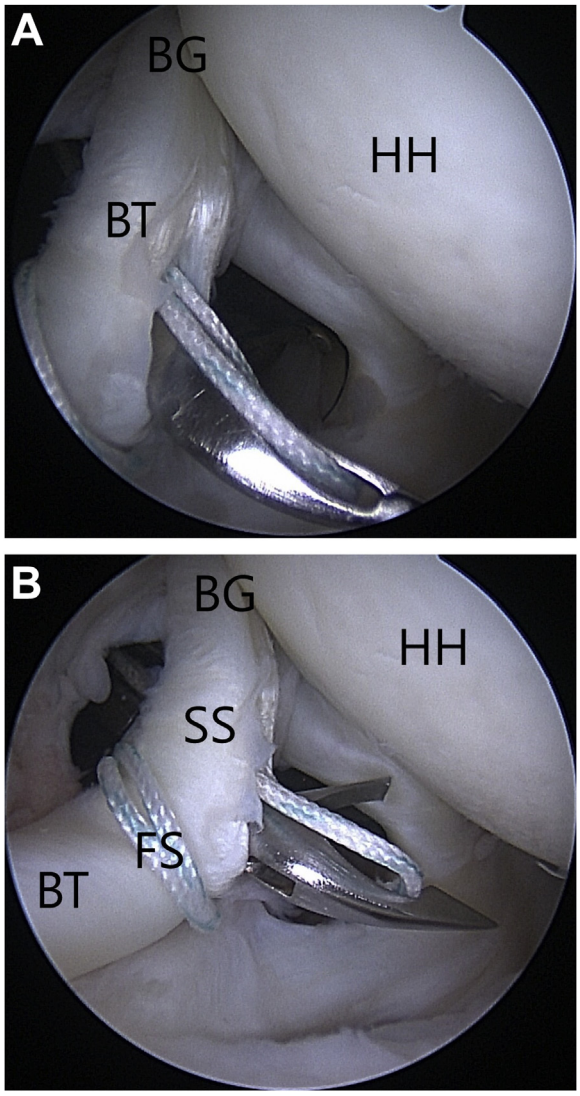

Fig 3. (A) A BirdBeak suture passer is used to first puncture the long head of the biceps tendon (BT) and pass the suture through the tendon. (B) The tendon is passed back around the BT in luggage-tag fashion. (BG, bicipital groove; FS, first suture; HH, humeral head; SS, second suture.)

an outside-in technique using a spinal needle to verify the location of the portal. The anterosuperior portal is created as high as possible within the rotator interval and anterolateral acromion. An additional anteroinferior portal is created just lateral to the coracoid, typically slightly more medial than the anterosuperior portal. This portal also enters the joint within the rotator interval.

With visualization through the posterolateral portal and instrumentation through the anterosuperior portal, the biceps tendon is identified from its supraglenoid attachment and observed through its course inside the shoulder joint to the most proximal aspect of the intra-articular bicipital groove (Fig 1). In this technique, the biceps tendon undergoes tenodesis prior to release from the supraglenoid tubercle to maintain the

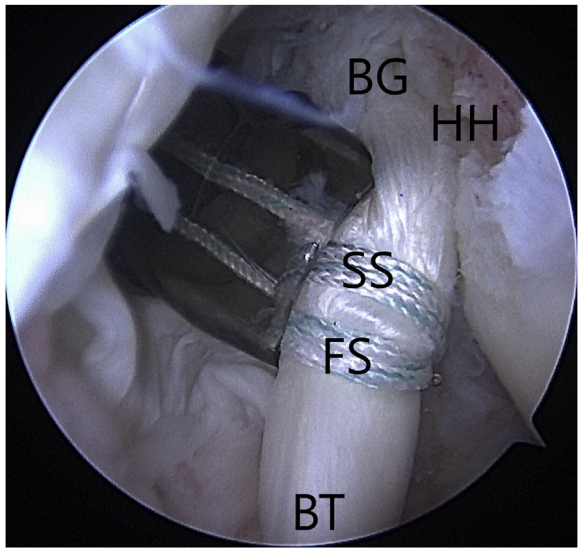

Fig 4. Two total luggage-tag sutures are passed through the long head of the biceps tendon (BT). (BG, bicipital groove; FS, first suture; HH, humeral head; SS, second suture.)

length-tension relation of the tendon. Thus, the location of the eventual suture anchor is first identified at the proximal aspect of the bicipital groove (Fig 2). The biceps tendon is marked at this location. Next, we prepare the tendon for eventual tenodesis with suture passage. Two luggage-tag sutures are passed through the biceps tendon using a sharp-tipped BirdBeak (Arthrex, Naples, FL) at the level of the tenodesis (Fig 3). To achieve this, a No. 2 FiberSnare (Arthrex) is passed through the LHB tendon and cinched onto itself in a "luggage-tag" fashion for each suture. The sutures

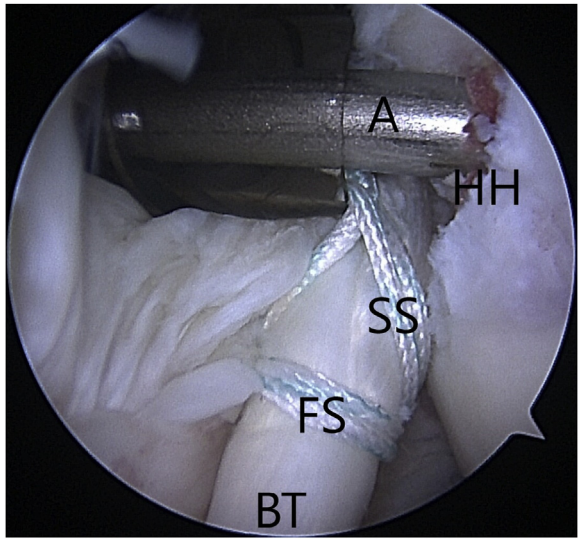

Fig 5. Both luggage-tag sutures are passed through a SwiveLock anchor (A); the anchor is placed into bone after punching and tapping. (BT, biceps tendon; FS, first suture; HH, humeral head; SS, second suture.)

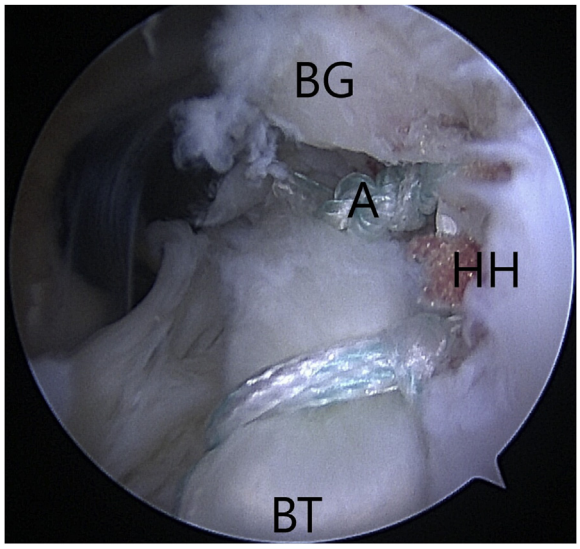

Fig 6. The included eyelet sutures are tied into a knot on top of the anchor (A) to reinforce the tenodesis. (BG, bicipital groove; BT, biceps tendon; HH, humeral head.)

are passed out of the anteroinferior accessory portal for later tenodesis (Fig 4).

Next, the site of the suture anchor is prepared. The previously identified area at the proximal aspect of the intra-articular bicipital groove is visible from the posterolateral portal. This area of the bicipital groove is abraded using a shaver to decorticate the area and reveal bleeding bone. We then prepare to place a 4.75-mm Arthrex SwiveLock C anchor by using the included punch and perform tapping. The previously placed luggage-tag suture tails are loaded into the SwiveLock suture anchor, and tension is maintained while the SwiveLock is inserted into bone via a mallet and then screwed into place (Fig 5). With the arthroscope, the anchor is visualized to be flush with the humeral head bone. The luggage-tag sutures can then be tied on top of the anchor with arthroscopic knots to reinforce the tenodesis if desired, although knotless fixation is adequate (Fig 6). This reapproximates the biceps tendon at the proximal superior edge of the bicipital groove with the length-tension relation maintained. The proximal attachment of the biceps tendon is then released from the supraglenoid tubercle using an arthroscopic ablation wand, and the remaining tendon is debrided (Figs 7 and 8). Table 2 shows pearls and pitfalls of our technique.

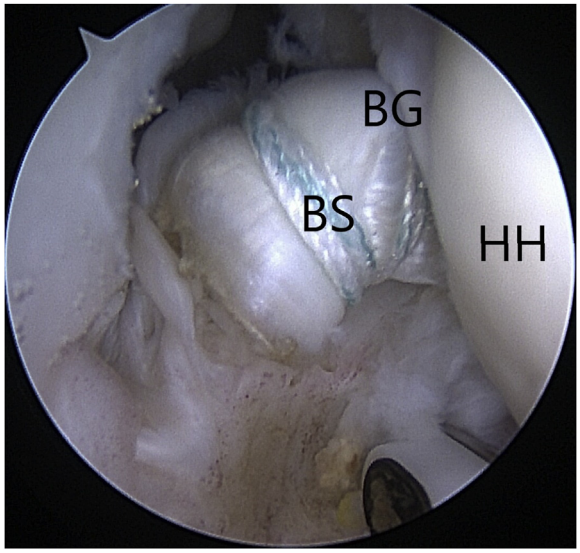

Fig 7. The tenodesis of the long head of the biceps tendon has been completed, thus preserving the length-tension relation of the tendon. The long head of the biceps tendon is then tenotomized using an electrocautery wand. (BG, bicipital groove; BS, biceps tendon stump; HH, humeral head.)

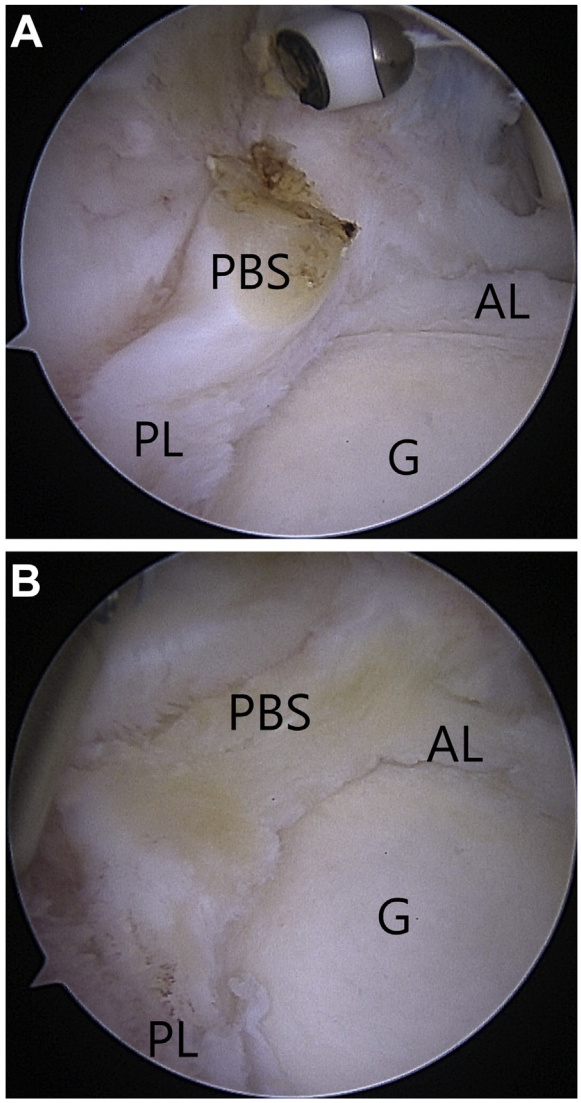

Fig 8. (A) The long head of the biceps tendon stump is debrided with an electrocautery wand and shaver to clean the labrum. (B) Appearance of the proximal biceps stump (PBS) and glenoid (G) at the end of the procedure. (AL, anterior labrum; PL, posterior labrum.)

Table 2. Pearls and Pitfalls of Intra-articular Suprapectoral Biceps Tenodesis

Pearls
The surgeon should use 2 luggage-tag knots for loading the tenodesis anchor to improve pullout strength and provide additional reinforcement by tying the eyelet suture.
Pitfalls
The luggage-tag suture must be passed centrally through the tendon; an eccentrically passed suture increases the risk of pullout.
To avoid suture cutout and tenodesis failure, the surgeon should not tenotomize the LHBT within 1 cm of the sutures.

LHBT, long head of biceps tendon.

Postoperative Rehabilitation

The described procedure is typically performed in conjunction with arthroscopic rotator cuff repair or debridement, subacromial decompression, and/or distal clavicle resection; thus, these procedures generally dictate the postoperative rehabilitation protocol. For an isolated intra-articular biceps tenodesis performed with this technique, we begin passive motion exercises with physical therapy starting on postoperative day 1 with a sling used for 4 to 6 weeks. Active range of motion begins at 6 weeks, and resisted exercises with elbow flexion and shoulder flexion begins at week 12 postoperatively, with a return to unrestricted activity generally resumed at 4 months postoperatively pending progress with physical therapy.

Discussion

Arthroscopic intra-articular tenodesis of the LHB tendon requires advanced arthroscopic surgical skills because knowledge of the intra-articular anatomy of the biceps tendon is necessary. The described technique requires minimal arthroscopic knot tying. The technique uses looped sutures for luggage-tag knots and a knotless anchor but still requires arthroscopic knot tying for the reinforcement suture. This technique provides the patient with excellent cosmesis and low surgical morbidity at the time of other arthroscopic surgical procedures, and it does not add significant surgical time. The downside of an intra-articular biceps tenodesis is that it may not address bicipital groove pain because of the intra-articular tenodesis location.

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