Technical Note

Transosseous Suture–Based Arthroscopic Suprapectoral Biceps Tenodesis

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Abstract: Biceps tenodesis is a well-accepted surgical treatment to relieve pain and dysfunction about the shoulder. Multiple locations and methods of tenodesis have been described, with similar outcomes. Transosseous cuff repairs and tendon repairs have been used for decades as a tried and true fixation method. This technique describes an arthroscopic transosseous technique for biceps tenodesis in the suprapectoral location that is technically simple, fast, eliminates the cost of implants, avoids an incision in the axillae which may be prone to dehiscence or infection, and releases the biceps sheath, which may be related to pain generation. Moreover, the biceps length tension relationship is easily recapitulated using anatomical landmarks.

Biceps pathology due to tenosynovitis, instability, tendonopathy, tearing, or adjacent rotator cuff disease is an increasingly recognized entity treated by the final common treatment pathway: surgical tenotomy or tenodesis.[1] Tenotomy is effective at relieving pain but may leave the patient with deformity or cramping in the biceps muscle. As a result, tenodesis at physiological length is an option to relieve pain and prevent deformity. Suprapectoral methods of tenodesis have been described with anchors, interferences screws, and anchorless techniques.[2-4] Subpectoral biceps tendodesis is effective but may have complications, such as humerus fractures of the hard diaphyseal bone in this location,[5] as well as difficulty ascertaining correct length-tension of the muscle. Wound dehiscence or infection, potentially because of the proximity of the wound to the axilla, is another concern. In addition, subpectoral tenodesis requires open instrumentation and an additional bone anchor, which can add to case cost and complexity.[6] There is evidence that location (proximal or distal) of the tenodesis method may not be an important variable in obtaining pain relief when treating the biceps tendon.[7-9] Release of the biceps sheath and tendon transection from the labrum may be the only important variables in obtaining pain relief, regardless of fixation method or location.[9] In the modern era of arthroscopy, anchors have been shown to contribute to cost, and there is downward cost pressure from health systems and payers; thus, the ability to reduce or eliminate hardware cost and achieve equivalent results may be increasingly important to deliver shoulder care in the future.[10] This article describes an arthroscopic transosseous technique for suprapectoral biceps tenodesis that is simple, avoids an axillary incision, and obtains 2-point fixation with circumferential tendon grasping sutures in the hardest bone of the proximal humerus. It also releases the biceps sheath, avoids hardware complications, and reduces cost.

Technique (With Video Illustration)

The patient is positioned in the beach chair position with a mechanical arm holder. The standard diagnostic arthroscopy is performed from a posterolateral portal. The intra-articular portion of the biceps is released off the superior labrum and the biceps is allowed to retract extra-articularly (Video 1).

The subacromial space is then entered from posterior. The low anterolateral portal is established with a spinal needle just superior to the greater tuberosity. A direct

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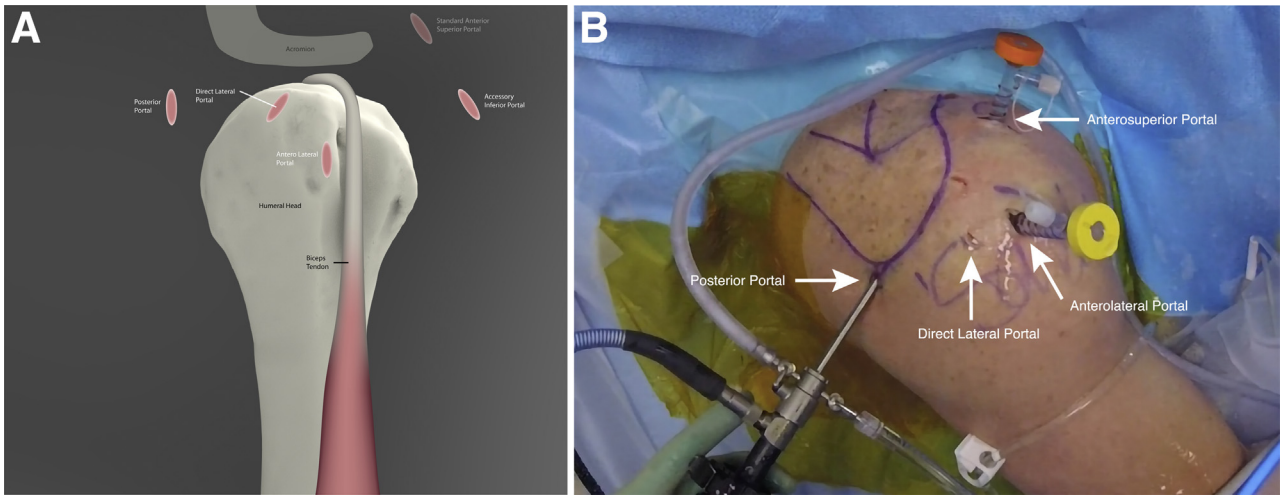

Fig 1. (A) Portal diagram: The portals of this technique are demonstrated in a right shoulder, looking from a lateral viewpoint in beach chair position. The direct lateral is the viewing portal, anterolateral portal is used as the working portal, and the accessory inferior portal is used for suture retrieval portal. (B) Outside view of right shoulder from actual case with portals labeled as in the schematic in (A).

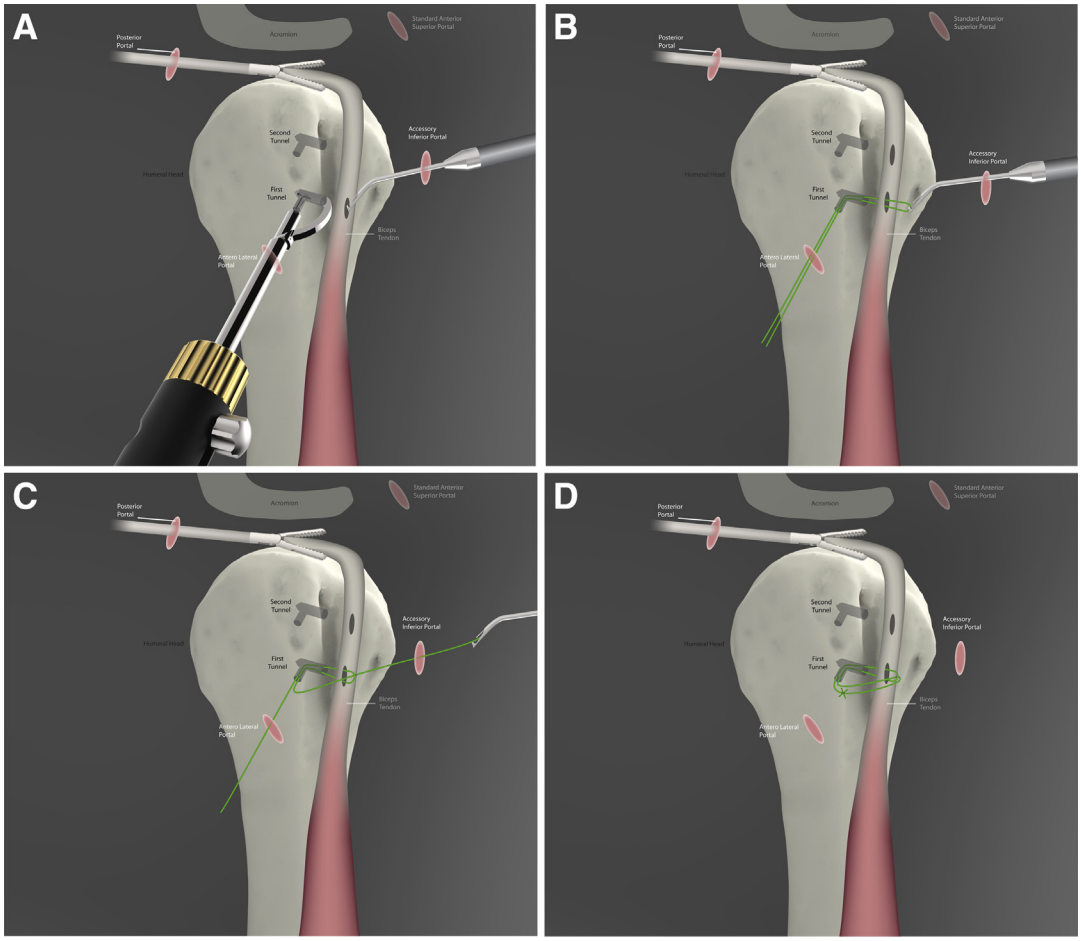

Fig 2. (A) Inferior tunnel creation: Right shoulder, lateral view in beach chair position. The orientation of the tunneling device is shown creating the inferior tunnel. The retrograde suture retriever is in the accessory anteroinferior portal, and the posterior grasper secures the biceps tendon. (B) Suture retrieval: Right shoulder, lateral view in beach chair position. A retro-grasping suture retrieval instrument is introduced through the accessory anteroinferior portal and used to pull the suture loop through the biceps. (C) Lateral suture retrieval: Right shoulder, lateral view in beach chair position. One of the lateral tails of the suture loop is pulled through the loop by means of a suture passer through the accessory portal. (D) Tied inferior tunnel: Right shoulder, lateral view in beach chair position. The tails of the inferior suture are retrieved through the anterolateral working portal and tied with a static knot.

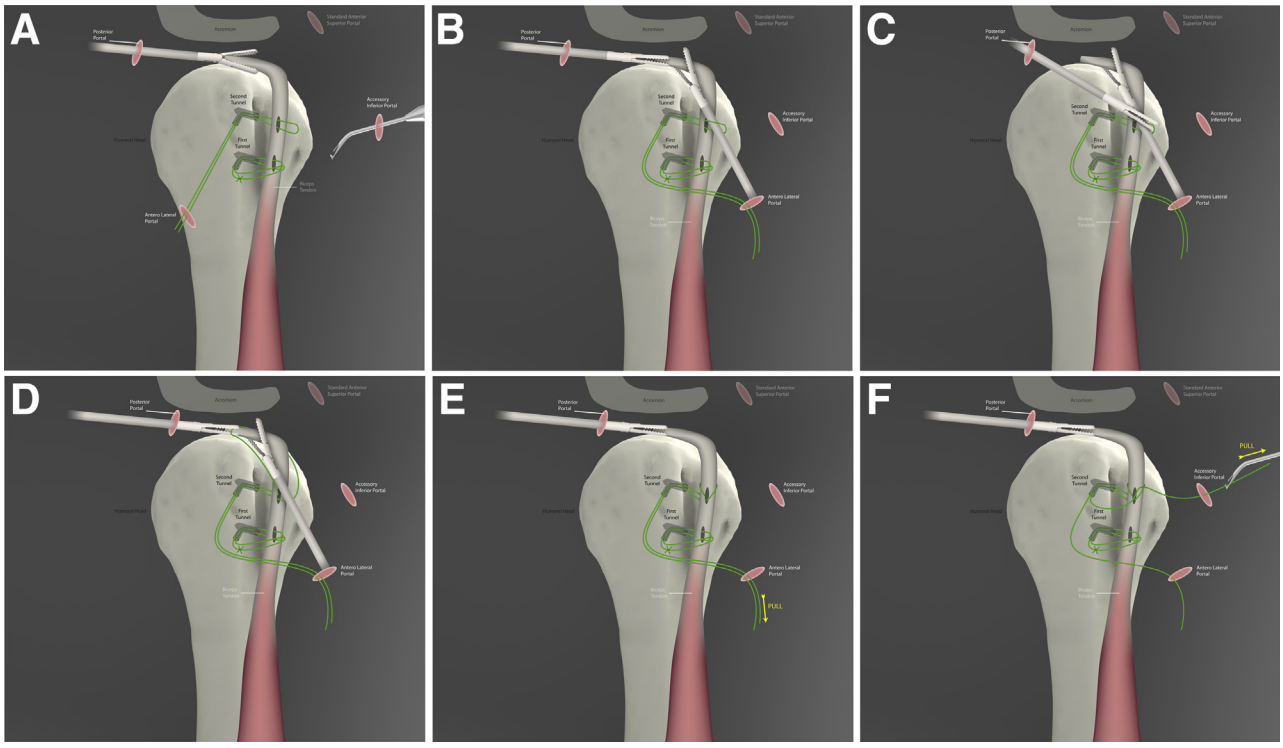

Fig 3. (A) Loop retrieval through superior tunnel: Right shoulder, lateral view in beach chair position. The superior tunnel is created in the same fashion, and a loop is passed through the biceps as before using a retro passer from the accessory portal. (B) Grasper penetrating loop: Right shoulder, lateral view in beach chair position. A grasper is placed through the transosseous suture loop from the anterolateral portal and used to stabilize the origin of the biceps tendon. (C) Grasper retrieving lateral loop: Right shoulder, lateral view in beach chair position. The posterior grasper is used to grasp the suture loop and bring it over the tendon origin posteriorly. (D) Tendon delivery: Right shoulder, lateral view in beach chair position. The loop is brought over the biceps tendon and the same posterior grasper is again placed on the tendon origin to hold it out to length. (E) Securing the loop: Right shoulder, lateral view in beach chair position. The tails of the suture loop are pulled from the anterolateral portal to bring the loop down into a cerclage around the biceps. (F) Retrieving the lateral limb through the loop: Right shoulder, lateral view in beach chair position. The retrograde penetrating grasper is introduced again from the accessory anteroinferior portal and used to retrieve one of the lateral limbs, creating a locking loop configuration.

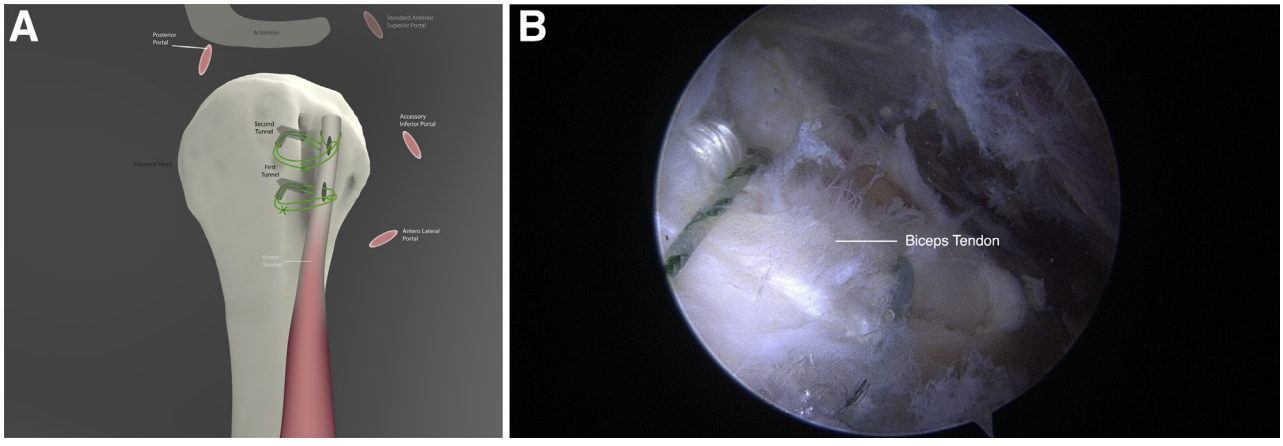

Fig 4. (A) Loops tied: Right shoulder, lateral view in beach chair position. Both sutures are tied creating dual all suture fixation of the biceps tendon at physiologic length tension relationship in the biceps groove. The remaining tendon stump can be resected. (B) Right shoulder, lateral view in beach chair position showing actual tenodesis using only transosseous sutures in the suprapectoral location.

Table 1. Advantages/Disadvantages of Suture-Based Transosseous Biceps Tenodesis

Advantages	Disadvantages
Cost effective, value based. Eliminates a bone anchor with associated cost and complications	Requires a new device
Multiple suture grasp and cerclage tendon to reduce chance of failure at tendon suture interface	Learning curve, suture management
Two separate fixation points in the dense bone of the intertubercular groove. Less risk of fracture than in the diaphyseal location with subpectoral interference screw	Bone may occasionally have cystic change
Anatomic landmarks to ascertain length tension relationship of biceps	New portals may be less familiar than subpectoral incision
Eliminates incision in axilla prone to dehiscence or infection with equivalent pain relief	

lateral portal is established 2 to 5 mm superior to the anterolateral portal (Fig 1, A and B). The arm is forward flexed 20°. After the anterior bursa is cleaned out, the biceps tendon sheath is localized by palpation with a shaver and released with an ablator. The biceps is then grasped with an arthroscopic grasper from the posterior portal and brought out to physiological length, approximating its intra-articular position on the supraglenoid tubercle at the same level in the subacromial space. The synovium is debrided with a motorized shaver. With the viewing portal in the direct lateral portal, the anterolateral portal is used to make medial 2.9-mm awl holes, slightly lateral in the biceps groove in the suprapectoral location. Both medial holes are made simultaneously. The accessory anteroinferior portal is established, which facilitates retrograde suture passage through the biceps tendon. The Trans-Os tunneler (Tensor Surgical, Chattanooga, TN) is introduced through the anterolateral portal and rotated into the medial entry point of the inferior tunnel (Fig 2A). Internal rotation of the arm is sometimes necessary to facilitate the introduction. A doubled passing loop is introduced by means of impacting the awl-pusher of the device. This loop is pulled through the tendon with a retrograde passing device from the accessory anterolateral portal and left inside the joint (Fig 2B). A locking loop is then formed by placing the penetrator through the loop and tendon again, grasping the more lateral suture, and retrieving it from the accessory anteroinferior portal (Fig 2C). These sutures are then tied for the first fixation point (Fig 2D).

The second, more superior, fixation point is then created in a similar manner (Fig 3A). Once again, a transosseous tunnel is created. The suture shuttle loop is brought out of the tunnel approximately 2 cm to facilitate grasping. The suture loop is pulled through the biceps, and a grasper is introduced through it from the anterolateral portal (Fig 3B). While the posterior grasper is holding the tendon at length, the grasper previously placed through the suture loop is used to receive the origin of the tendon from the posterior grasper, while holding the tendon at length. The posterior grasper is then used to select the more posterior suture limb of the loop (Fig 3C), and this instrument is used to bring the suture loop over the proximal tendon, creating a cerclage of the tendon (Fig 3D). The free suture ends are then pulled and the cerclage is brought back to the medial tunnel (Fig 3E). The retrograde suture passer is then used again from the anteroinferior accessory portal to pass through the cerclage loop on the tendon and grasp one of the lateral suture limbs from the tunnel (Fig 3F). This suture is managed out of the anteroinferior portal temporarily, then retrieved and tied with a lateral knot through the anterolateral portal (Fig 4, A and B). The remaining proximal tendon is transected with electrocautery and removed.

Discussion

Biceps tenodesis has become a common treatment modality in the armamentarium of the shoulder surgeon. It is becoming clear that many different methods of tenodesis and location of tenodesis are acceptable to achieve pain relief. The ability to eliminate hardware cost or complications such as anchor pullout or fixation loss may be desirable, as well as the ability to avoid the axillary incision. The limitation of this technique is that this may be an unfamiliar working area in the shoulder for some shoulder surgeons (Tables 1 and 2). In certain

Table 2. Pearls/Pitfalls

Pearls	Pitfalls
Use a mechanical arm holder and forward flex the arm 20° to work in the anterior subdeltoid space	Work superior to the anterior circumflex humeral artery to avoid bleeding
Internally rotate the arm slightly to introduce the tunneling device more easily	Avoid difficulty with tendon manipulation by creating the inferior tunnel first
Mind bone quality while introducing the medial awl	If the bone quality is insufficient for fixation (rare in this location), the surgeon may transition to an open subpectoral technique in the harder diaphyseal bone of the humerus

situations, the bone quality could be poor or have cystic changes reducing fixation, although this is rarely the case in the dense bone of the biceps groove. Bleeding can occur if the anterior humeral circumflex artery is damaged during tendon manipulation. If the biceps tendon re-tears or loses fixation postoperatively, there is little detriment to small diameter bone tunnels in the humerus, which tend to heal postoperatively, and subpectoral tenodesis may be used as a salvage with relative ease, since the bone in this location is preserved. This technique offers a cost conscious and clinically effective option to provide pain relief via biceps tenodesis while also avoiding common complications of hardware and axillary incisions.

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