

# Arthroscopic Single Portal, Single Anchor Knotless Subscapularis Repair with Concomitant Tenodesis of the Long Head of the Biceps Tendon



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**Abstract:** Anterior shoulder pathology involving the subscapularis is often associated with the biceps tendon because both anatomic structures intersect the lesser tuberosity. Standard procedures for such pathology often involve simultaneous subscapularis repairs and biceps tenodesis. Single anterior portal subscapularis repairs have been emerging in the past 5 years because of cost-effectiveness and efficiency. Biceps tenodesis is a common procedure performed both open and arthroscopically. This technique takes advantage of the close relation between the long head of the biceps tendon and subscapularis tendon to restore the functional length-tension relation and preserve function through fixation using a single portal and a single knotless suture anchor.

Pathology of the long head of the biceps tendon (LHBT) and subscapularis can be potential causes of anterior shoulder pain, but their relation makes the diagnosis with clinical examination alone difficult.<sup>1</sup> The LHBT originates from the supraglenoid tubercle and superior labrum and travels intra-articularly to the bicipital groove as it exits the joint.<sup>2</sup> The subscapularis originates from the scapular fossa and enters the shoulder joint anteriorly, attaching to the lesser tuberosity of the humerus.<sup>3</sup> Given the bicipital groove's juxtaposition to the lesser tuberosity of the humerus, direct palpation of the biceps tendon can often cause tenderness along the subscapularis tendon insertion,

consequently, the diagnosis of biceps pathology versus subscapularis tear cannot be reliably distinguished.<sup>4</sup>

Nonsurgical treatment for tendinitis of the LHBT include rest, ice, oral nonsteroidal anti-inflammatory drugs, and glucocorticoid injections.<sup>5</sup> Based on patient preference and whether conservative management is successful, options such as tenotomy or tenodesis of the biceps tendon are available. Although outcomes are similar, tenodesis is preferred over tenotomy because there is slightly higher risk of pain, weakness, and "Popeye" deformity.<sup>6,7</sup> With increased training of arthroscopy techniques and patient's preference for minimally invasive procedures, arthroscopic subscapularis repairs have become the standard.

Because the subscapularis tendon and LHBT share the superior glenohumeral ligament and the coracohumeral ligament at the insertion of the lesser tuberosity, there is reason to explore procedures addressing both tears simultaneously.<sup>8,9</sup> Patients with subscapularis tears were found to also have tearing of the medial wall of the bicipital sheath within the bicipital groove approximately 90% of the time, emphasizing that the subscapularis contributes to stability of the LHBT and the biceps pulley.<sup>2,9</sup> Various investigators have combined the single anterior portal approach for subscapularis repair followed by biceps tenotomy or subpectoral biceps tenodesis when pathology of the LHBT is present.<sup>2,3,10-12</sup> A recent technique article took this approach further by using

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a single portal technique for repair of the subscapularis with biceps tenodesis using a single 5.5-mm suture anchor.<sup>13</sup> The purpose of this Technical Note and accompanying video ([Video 1](#)) is to present an arthroscopic method for single portal and single anchor knotless subscapularis repair and biceps tenodesis. This described technique has the advantages of a single portal and single knotless suture anchor.

### Surgical Technique (With Video Illustration)

A demonstration of the single portal, single anchor knotless biceps tenodesis with subscapularis repair is available in [Video 1](#). Important pearls and pitfalls are summarized in [Table 1](#).

#### Preoperative Assessment

Preoperative assessment consists of history, physical examination, and imaging to assess for rotator cuff tear and biceps tendon pathology. Ultrasound and magnetic resonance imaging can further help with diagnosis and preoperative planning. Preoperative magnetic resonance imaging of this patient's left shoulder is significant for a partial interstitial tear and tendinosis of the subscapularis tendon and possible longitudinal tear of the biceps tendon ([Fig 1](#)).

#### Patient Positioning and Preparation

The patient is initially placed supine on a standard operative table and is given general anesthesia. The patient is repositioned to the lateral decubitus position with a lateral wedge and Arthroplex arm holder (Arthrex, Naples, FL), and the head and bony prominences of the patient are well-padded. The left upper extremity is treated with skin preparation solution and draped in the usual sterile fashion.

#### Arthroscopic Portal Placement and Diagnostic Arthroscopy

Landmarks of the shoulder are identified and marked on the left shoulder. A No. 11 blade is used to create a standard posterior portal for initial intra-articular

visualization. The glenohumeral joint is entered with a blunt trocar and arthroscope sheath, and the diagnostic glenohumeral arthroscopy is completed with a 30° 4.0-mm arthroscope. With direct arthroscopic visualization, a spinal needle is used to needle-localize the anteromedial portal, which is lateral to the coracoid process and anterior to the acromioclavicular joint. Through the outside-in technique, the anterior portal is created and dilated with a trocar followed by placement of an 8.25-mm cannula (Arthrex). The anterior portal allows for access to above and below the biceps tendon and top portion of the intra-articular groove ([Fig 2](#)).

#### Biceps Tenodesis and Subscapularis Repair

Viewing from the posterior portal, tendinitis of the LHBT is visualized with stressing of the bicep tendon ([Video 1](#); [Fig 3](#)). Using the Loop 'N' Tack technique, a grasper is used to pass a folded No. 2 FiberWire suture around the bicep tendon ([Fig 4](#)). The 2 free tails of the suture are passed through the looped end and pulled tight to create a hitch knot to the bicep tendon. Then, a grasping BirdBeak (Arthrex) is used to pierce the tendon distal to the hitch knot, and the FiberWire suture tails are retrieved through the bicep tendon ([Figs 5, 6](#)). Once the Loop 'N' Tack construction is completed, electrocautery is used to release the bicep tendon from the labral attachment on the superior glenoid, and the sutures are clamped to the side ([Fig 7](#)).

Regarding the subscapularis repair, the superior border of the subscapularis tendon is identified. A Scorpion suture passer (Arthrex) is used to pass a No. 2 FiberWire suture through the subscapularis tendon, creating a hitch suture to pull traction on the superior portion of the subscapularis. With this additional traction, an additional hitch suture is created in the superior one-third of the subscapularis with the Scorpion suture passer (Arthrex) ([Fig 8](#)). A punch is then used to create a pilot hole at the subscapularis footprint on the lesser tuberosity ([Fig 9](#)). All 3 FiberWire sutures are loaded onto a 4.75-mm SwiveLock suture anchor (Arthrex) and the anchor is screwed into the pilot hole ([Video 1](#); [Fig 10](#)).

#### Final Examination and Postoperative Care

After confirming the repair is stable with internal and external rotation of the arm, the anterior and posterior portals are closed in a standard fashion, and the appropriate dressings are applied. The operative arm is placed into an abductor sling and will be under immobilization for 6 weeks.

To preserve and maintain range of motion (ROM), passive ROM exercises are encouraged during weeks 0 to 2, which include 120° of forward flexion and 30° of external rotation of the operative shoulder. Active ROM of the operative shoulder is discouraged during this period, but active ROM exercises of adjacent joints

**Table 1.** Pearls and Pitfalls

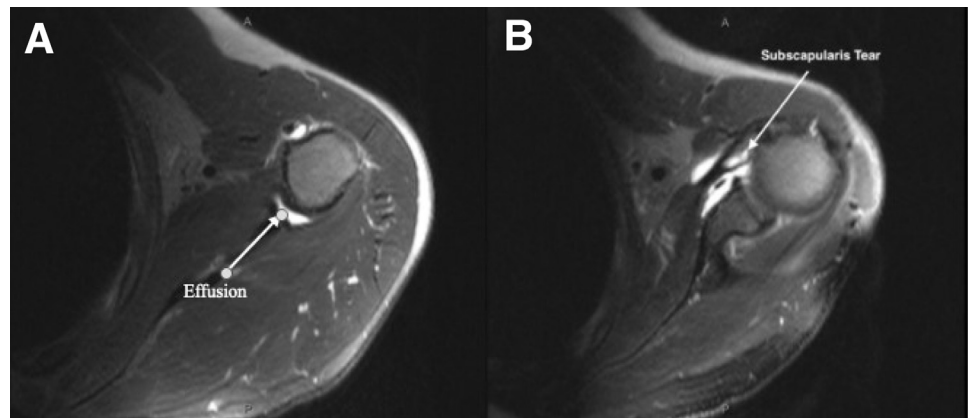
##### Pearls:

- Perform biceps Loop 'N' Tack prior to subscapularis repair for better visualization.
- Debride inflamed and damaged tissue prior to repair for improved visualization.
- Internally rotate the arm during the anchor placement for a secure subscapularis repair.

##### Pitfalls:

- Arthroscopic camera portal placement may limit visualization.
- Suture burden on the anchor may lead to under-tightening of the sutures or destabilize the anchor islet.
- Weak bone may result in increased risk of anchor failure as a result of poor fixation.
- Single anchor may not provide proper fixation for large subscapularis tears.

**Fig 1.** Preoperative T2 axial magnetic resonance imaging of the left shoulder. (A) Left image is significant for effusion surrounding the long head of the biceps tendon with medial subluxation. (B) Right image confirms a partial interstitial tear of the subscapularis with surrounding edema.

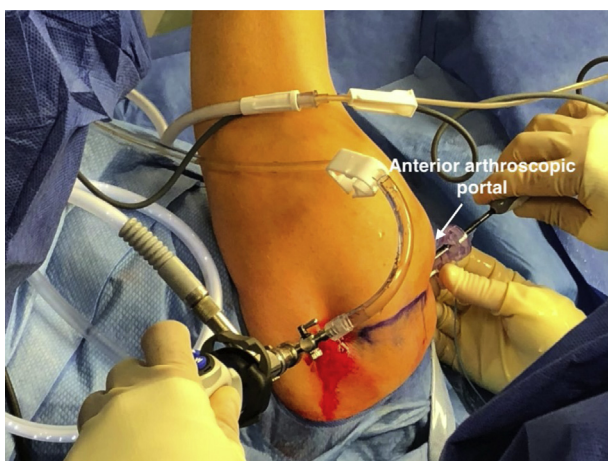


are encouraged. During weeks 2 to 6, the patient continues wearing the sling and continues passive ROM exercises to gain full passive ROM. At the end of week 6, the sling is discontinued, and active ROM exercises are initiated.

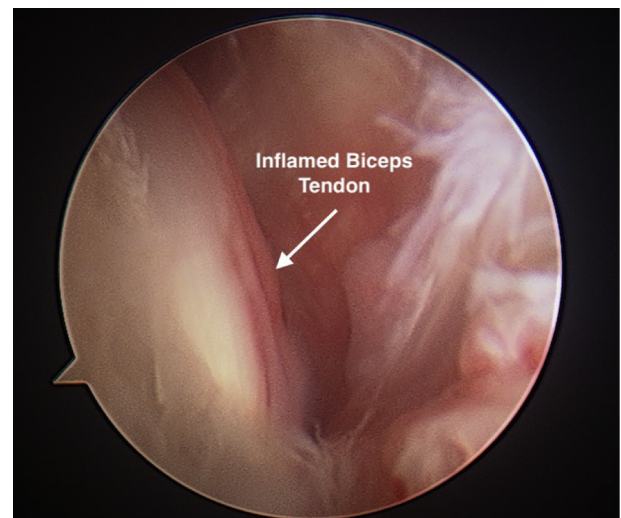
### Discussion

It is well documented that subscapularis tears are often accompanied by biceps pathology.<sup>2,3,10-13</sup> Successful biceps tenodesis can be performed along with subscapularis repairs with excellent results.<sup>13,14</sup> Katthagen et al.<sup>14</sup> showed increased patient function and good patient satisfaction for 28 patients for a single anchor upper-third subscapularis repair with subsequent open subpectoral biceps tenodesis several years after the procedure. In addition, a recent biomechanical study also found that for subscapularis tears that were

up to 50% complete, a single anchor was sufficient to repair and achieve secure fixation.<sup>15</sup> Furthermore, Fleck and Field<sup>13</sup> performed a single portal, single anchor subscapularis repair with biceps tenodesis, which was found to be secure and reliable to address both pathologies. Regarding placement of the anchor, a recent biomechanical study recommended that the anchor be placed superolateral from the native footprint, near the entrance of the bicipital groove, to preserve the “leading edge” and function of the superior aspect of the subscapularis.<sup>16</sup> Hence with the presence of an upper-third subscapularis tear and pathology of the biceps intra-articularly, a single anchor subscapularis repair with biceps tenodesis is feasible. The Technical Note and accompanying video ([Video 1](#))

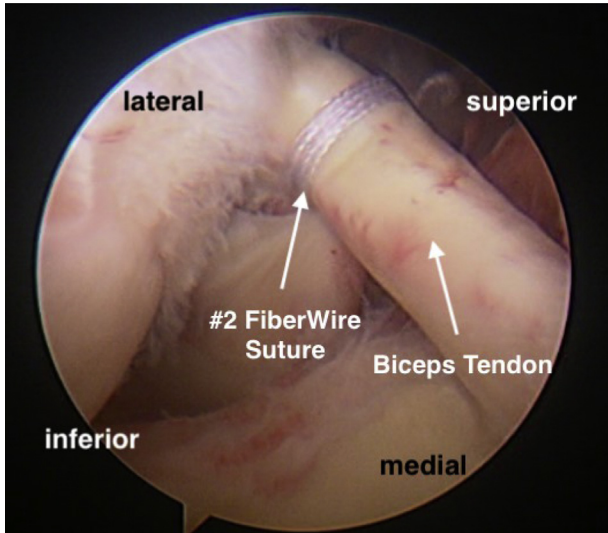


**Fig 2.** Patient positioned in the lateral decubitus position with a lateral wedge and Arthroplex arm holder (Arthrex, Naples, FL). Intraoperative image of the left shoulder with standard posterior portal for visualization and diagnostic arthroscopy. The anterior portal created using the outside-in technique allows access to the biceps tendon and intra-articular groove.



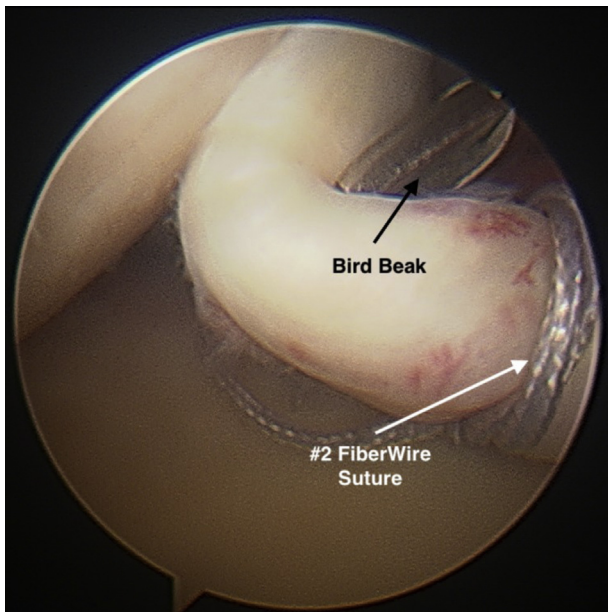
**Fig 3.** Patient positioned in the lateral decubitus position. Arthroscopic view of the left shoulder from the posterior portal with a 30° arthroscope confirms inflammation of the long head of the biceps tendon indicated by the lipstick sign, indicating long head of the biceps tenosynovitis and tendonitis.



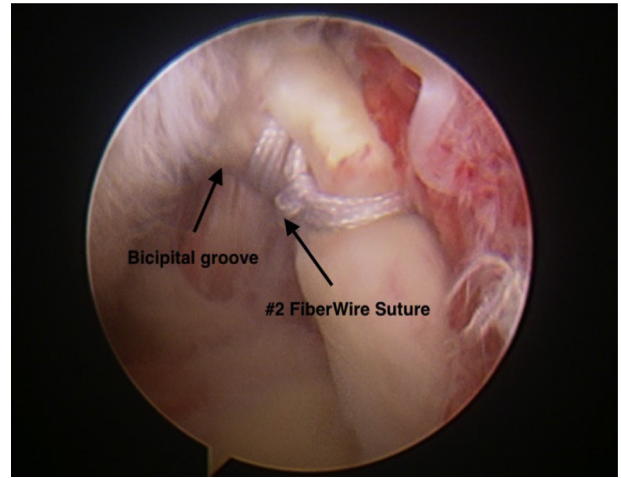


**Fig 4.** Patient positioned in the lateral decubitus position. Arthroscopic image of the biceps tendon of the left shoulder through the posterior portal with a 30° arthroscope after passage of No. 2 FiberWire suture around biceps tendon and successful suture configuration with cinch knot down to biceps tendon, which attaches to the superior labrum in the medial aspect of the image.

describe a technique for this repair, which can lead to overall efficiency, improvement in patient outcomes, and cost savings.

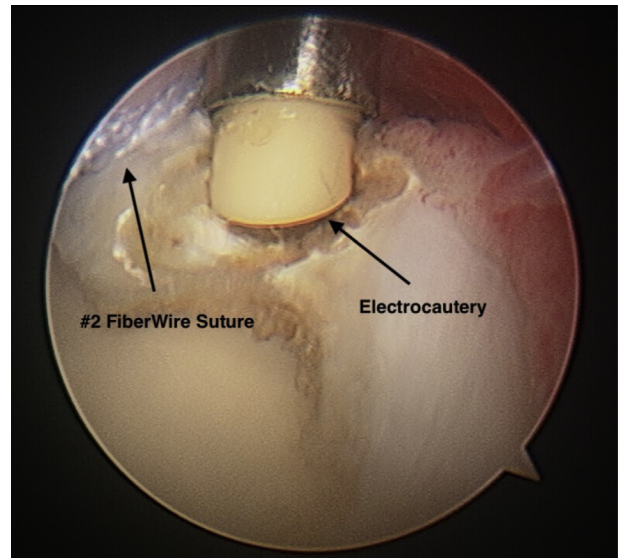


**Fig 5.** Patient positioned in the lateral decubitus position. Arthroscopic image of the biceps tendon of the left shoulder through the posterior portal with a 30° arthroscope of the grasping BirdBeak piercing through the biceps tendon in-between the bicipital groove and the looped suture configuration to perform the second task of Loop 'N' Tack biceps tenodesis technique.

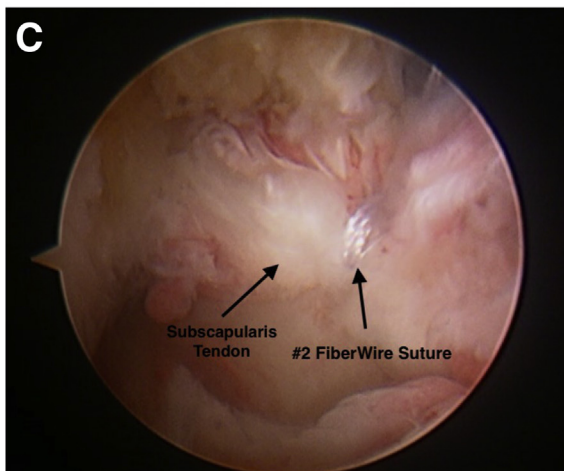
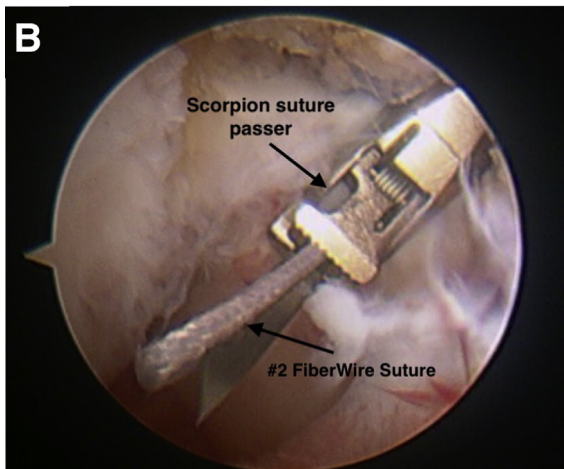
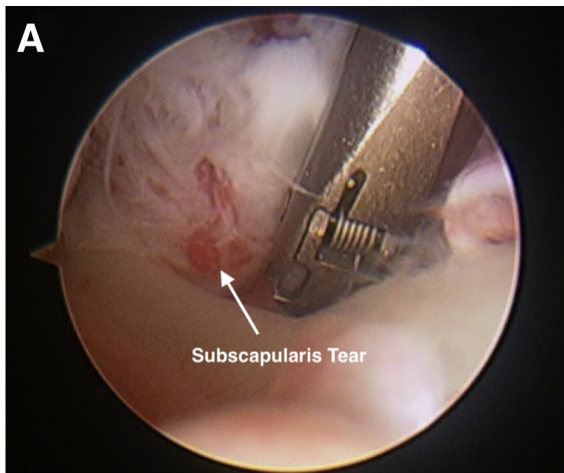


**Fig 6.** Patient positioned in the lateral decubitus position. Arthroscopic image of the biceps tendon of the left shoulder through the posterior portal with a 30° arthroscope of the Loop 'N' Tack suture configuration after retrieving No. 2 FiberWire suture through the biceps tendon to complete the Loop 'N' Tack technique for biceps tenodesis.

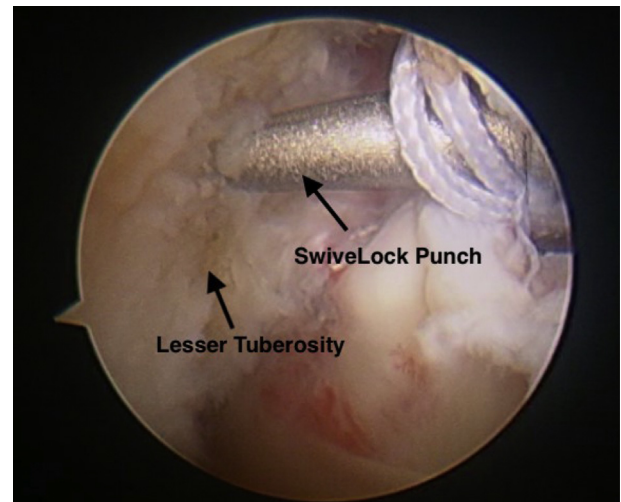
The surgical technique illustrated shows an effective method for upper one-third subscapularis tears with concomitant biceps tenodesis through a single anterior portal. Moreover, our technique combines arthroscopic knotless subscapularis repair with arthroscopic supra-pectoral biceps tenodesis using a single suture anchor. The main advantage of our technique is the use of a knotless suture anchor. Although the long-term



**Fig 7.** Patient positioned in the lateral decubitus position. Arthroscopic image of the biceps tendon of the left shoulder through the posterior portal with a 30° arthroscope showing electrocautery of the biceps tendon between the Loop 'N' Tack suture configuration and the superior labrum attachment. This releases the biceps tendon from its labral attachment.

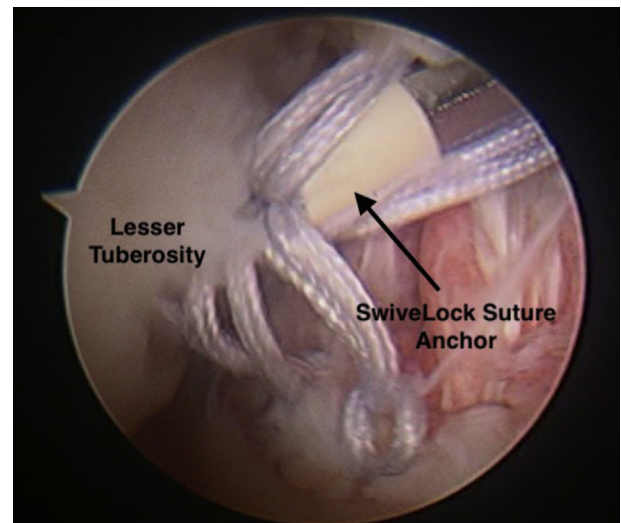


**Fig 8.** Patient positioned in the lateral decubitus position, viewed through the posterior portal with a 30° arthroscope. (A) Arthroscopic image of an upper one-third subscapularis tear of the left shoulder. (B) Scorpion suture passer passes No. 2 FiberWire suture through the subscapularis tendon. (C) A luggage tag racking suture is used to pull traction on the superior portion of the subscapularis. An additional luggage tag racking suture is created on the subscapularis with the Scorpion suture passer, leading to two No. 2 FiberWire sutures in the subscapularis.



**Fig 9.** Patient positioned in the lateral decubitus position. Arthroscopic image of the biceps tendon of the left shoulder through the posterior portal with a 30° arthroscope of a 4.75-mm SwiveLock punch entered through the single anterior portal to punch a pilot hole for suture anchor placement at the subscapularis footprint on the lesser tuberosity.

outcomes of knot versus knotless suture anchors for this type of repair is unknown, the use of knotless sutures has shown equal or greater biomechanical strength for various orthopaedic pathologies.<sup>17,18</sup> Furthermore, knotless suture anchors reduce



**Fig 10.** Patient positioned in the lateral decubitus position. Arthroscopic image of the biceps tendon of the left shoulder through the posterior portal with a 30° arthroscope of all 3 No. 2 FiberWire sutures loaded onto a single 4.75-mm SwiveLock suture anchor that is screwed into the pilot hole on the lesser tuberosity. Two No. 2 FiberWire sutures are on the subscapularis tendon, and one No. 2 FiberWire suture on the biceps tendon.



**Table 2.** Advantages and Disadvantages

## Advantages:

- Reduces risk of infection and risk of neurovascular injury from less portals used.
- Knotless suture anchors have equal (or greater) biomechanical strength compared with knotted sutures.
- A knotless approach is uniform and reduces potential adverse effects associated with a knotted suture, including knot tying variations, knot migration, loosening of knots, and patient discomfort.
- Cost-efficient.
- Standard patient positioning and portal placement.

## Disadvantages:

- Arthroscopic technique is technically challenging. Requires 3 sets of sutures through 1 suture anchor eyelet.
- Possible risk of anchor failure as a result of increased tension from a single anchor supporting both the long head of the biceps tendon and the subscapularis.
- Limited for intra-articular biceps pathology.
- Subpar visualization of the insertion of the knotless suture anchor into the lesser tuberosity.

complications including patient discomfort, knot loosening, or knot migration.<sup>17</sup> Another advantage of this technique is the use of a single portal for both repairs instead of creating an additional portal for biceps tenodesis or transitioning to an open tenodesis. This method overall reduces the risk of neurovascular injury, the risk of infection, and the recovery time for the patient. Finally, this technique can lead to significant cost savings for the patient given that only a single suture anchor is required.

A possible disadvantage includes limited use in the event in which a significantly diseased biceps tendon cannot be properly fixated with the subscapularis, leading to the need for an alternative anchor point for the tenodesis.<sup>13</sup> Additionally, with this arthroscopic approach, the work area for repair is further restrained by loading 3 sets of sutures through a single suture anchor. Although the LHBT and subscapularis are anatomically related, this technique of anchoring the biceps with the subscapularis may lead to increased risk of anchor failure because of the increased tension on the anchor caused by supporting both structures. As a result, the biomechanical properties of this technique and repair should be further investigated. A full list of advantages and disadvantages is provided in the [Table 2](#).

Given the close anatomic association between the subscapularis and the LHBT, a subscapularis tear is often accompanied with a medial wall disruption of the bicipital sheath. This close anatomic association provides the opportunity to use a single anchor for LHBT tenodesis and subscapularis repair while preserving patient function. This Technical Note presents an

efficient, cost-effective method for performing a single portal, single anchor knotless subscapularis repair and biceps tenodesis.

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