



Arthroscopic Subscapularis Retensioning Repair Using a Knotless-Type Anchor Shared With Supraspinatus Repair

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Abstract: Various arthroscopic subscapularis repair techniques using knotless-type anchors have been reported; however, some limitations remain, including potential damage to the original footprint during anchor insertion and interference with the anteromedial anchor for the supraspinatus. This Technical Note describes an arthroscopic repair of subscapularis tears with concomitant full-thickness supraspinatus tears using a single knotless anchor. Using this technique, the original subscapularis tendon footprint is preserved, and both the subscapularis and the anterior portion of the supraspinatus can be addressed with a single anchor, potentially providing an anatomic, simple, fast, and cost-effective solution.

For many years, rotator cuff tears have primarily focused on supraspinatus tears with or without concomitant infraspinatus involvement.^{1,2} However, increasing attention has recently been directed toward subscapularis tears.³⁻⁵ With advancements in shoulder arthroscopy, the detection and repair of subscapularis tears have become increasingly common, and numerous studies have reported favorable outcomes following subscapularis repair.⁶⁻⁸

Arthroscopic repair of the subscapularis tendon remained technically challenging due to the narrow space and poor visualization.^{7,9} The introduction of knotless-type anchors has facilitated the development of simpler, faster, and more reliable subscapularis repair.^{10,11} Denard and Burkhart¹² first reported all-inside knotless anchor fixation of an upper

subscapularis partial tear, and many authors reported similar techniques.^{1,13,14}

However, this technique could damage the original subscapularis tendon footprint during anchor insertion, which could be disadvantageous to tendon-to-bone healing.^{12,14} Furthermore, the subscapularis anchor is placed near the anteromedial anchor for supraspinatus repair, which may cause interference, leading to reduced anchor stability. By sharing a single anchor placed at the junction of the subscapularis and supraspinatus footprints, these limitations may be effectively addressed.

The surgical technique presented in this study could be applied for a partial-thickness subscapularis tear along with full-thickness supraspinatus tears. It is particularly applicable to partial-thickness subscapularis tears such as Lafosse type 1 or 2 or Yoo and Rhee classification type IIA or IIB.^{15,16} If additional management is performed on the lower portion of the subscapularis tear, this technique also can be applied to full-thickness subscapularis tears.¹⁰

Surgical Technique

With the patient positioned in the standard lateral decubitus position, diagnostic arthroscopy is performed with a 30° arthroscope through a standard posterior portal. Through the rotator interval, the standard anterior portal is made. In addition to standard shoulder arthroscopy instruments, a working cannula, a suture lasso (ACCU-PASS suture shuttle; Smith & Nephew), an antegrade arthroscopic suture passer

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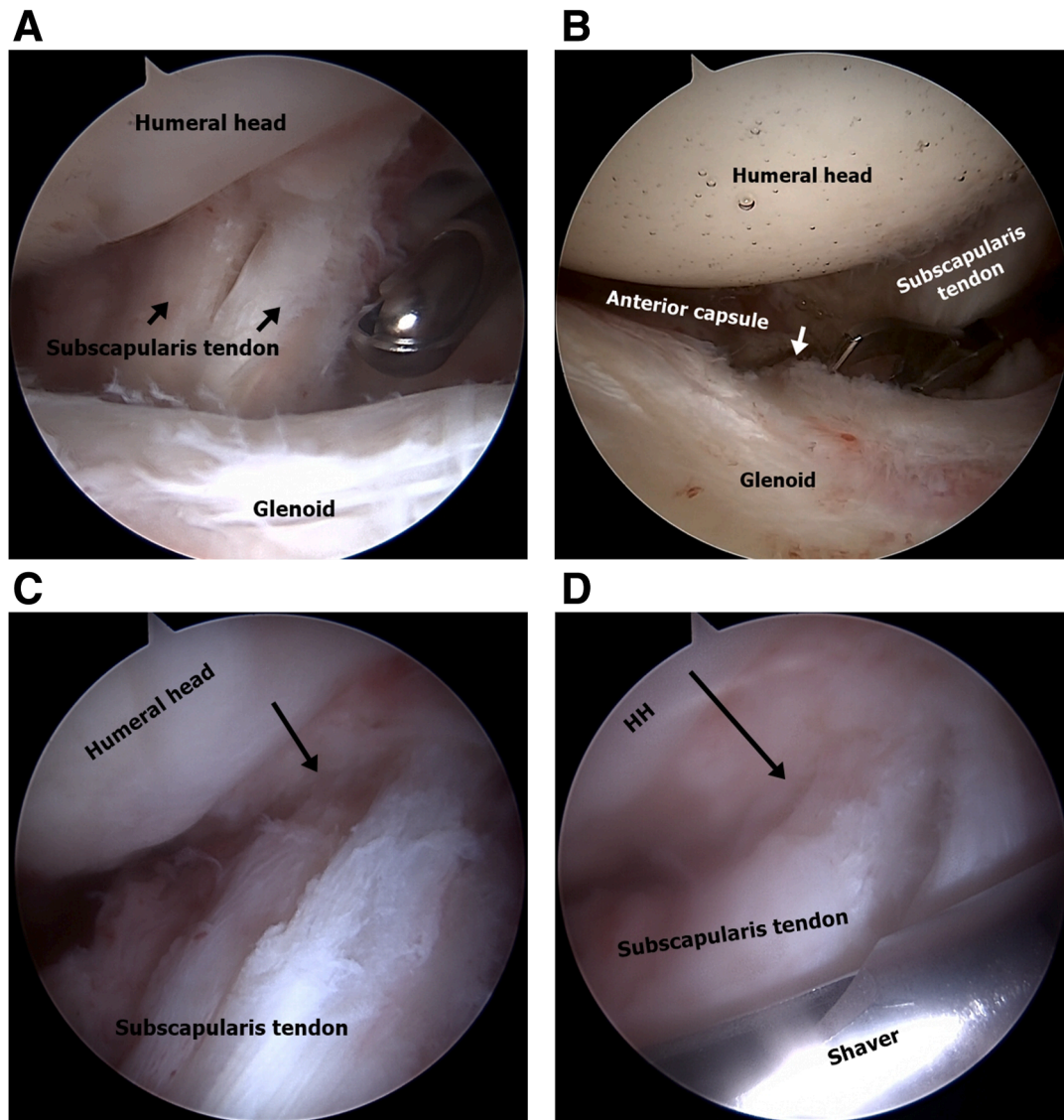


Fig 1. Arthroscopic view of the left shoulder, with the patient in the lateral decubitus position. (A) Viewed with the 30° arthroscope in the posterior portal, a subscapularis tendon tear (arrow) is observed. (B) Anterior capsule is released using arthroscopic scissors until the subscapularis muscle (arrow) is observed. (C) Viewed with the 70° arthroscope in the posterior portal, the subscapularis first facet and intra-articular portion of the subscapularis tear site (arrow) are observed with the arm in slight internal rotation. (D) Subscapularis tear (arrow) is debrided using a shaver from the anterior portal. (HH, humeral head.)

(Scorpion; Arthrex), 2 FiberWire sutures with different colors (white/blue and white/black; Arthrex), and a knotless-type anchor (SwiveLock anchor 4.75 mm or 5.5 mm; Arthrex) are prepared.

A systematic examination of the rotator cuff tendons and the long head of the biceps (LHB) tendon is performed (Fig 1A, Video 1).^{1,3,17} The LHB tendon partial tear and medial pulley disruption are examined by pulling the LHB tendon, using a retriever from the anterior portal.¹⁸ To mobilize the subscapularis tendon, the anterior capsule, including the middle and anteroinferior glenohumeral ligaments, is released using electrocautery or arthroscopic scissors to visualize the medial muscular portion of the subscapularis (Fig 1B, Video 1).^{7,17}

The rotator interval tissue is removed with electrocautery and an arthroscopic shaver to visualize and mobilize the upper end of subscapularis tendon. To observe the subscapularis first facet and tear site, a 70° arthroscope is used and introduced from the posterior portal. Slight internal rotation of shoulder could help visualization of the subscapularis first facet (Fig 1C, Video 1).⁶ Using a shaver through the anterior portal, the intra-articular portion of the subscapularis tendon tear is debrided (Fig 1D, Video 1). The subscapularis footprint is also prepared with the burr to promote tendon-to-bone healing (Video 1).

Slight external rotation of the shoulder improves visualization of the medial margin of the

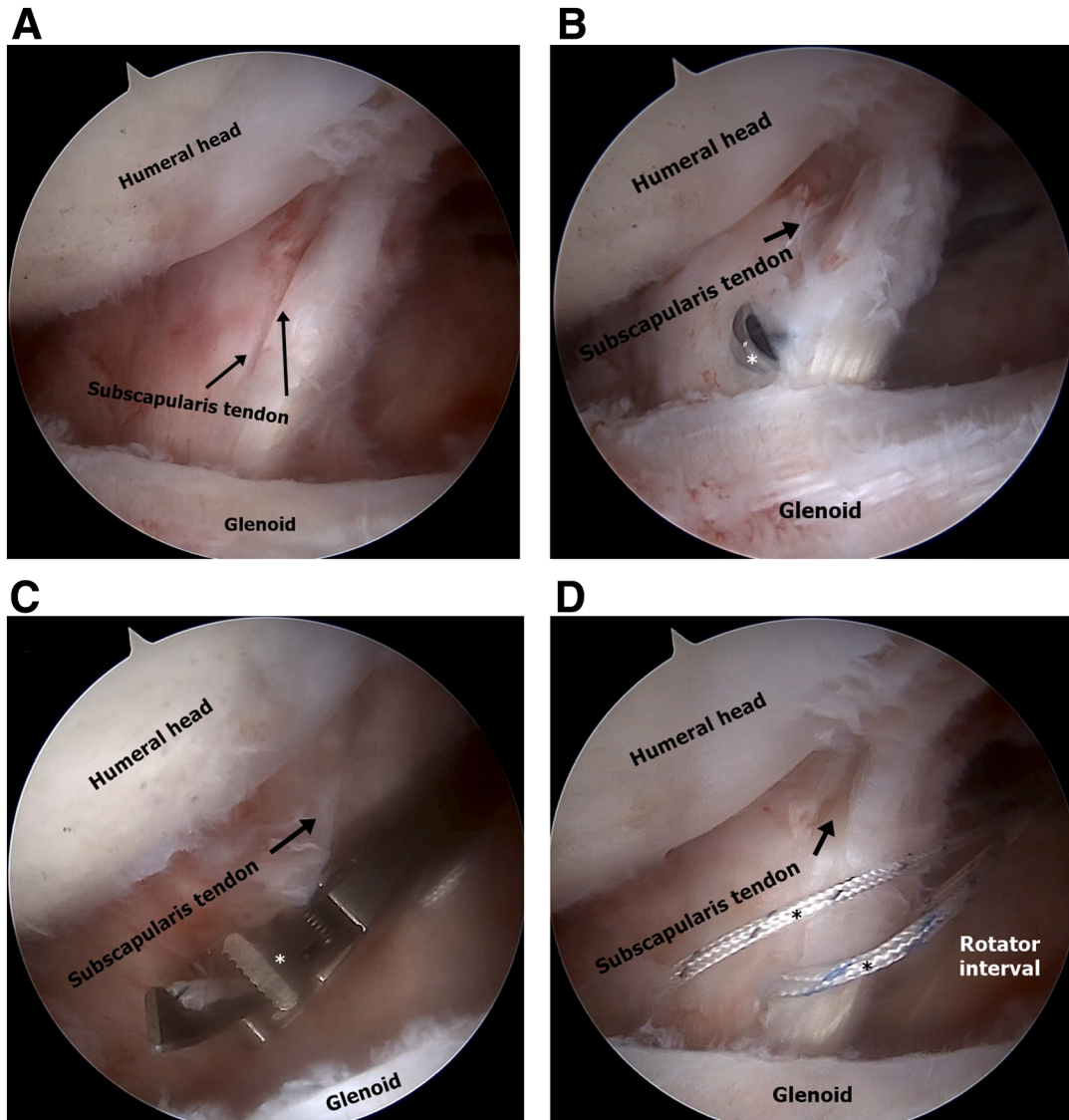


Fig 2. Arthroscopic view of the left shoulder in the lateral decubitus position, using a 30° arthroscope through the posterior viewing portal. (A) Slight external rotation of the shoulder improves visualization of the medial margin of the subscapularis tear (arrow). Two FiberWire (Arthrex) sutures are passed through the subscapularis tendon (arrow): one at the leading edge just medial to the tear using a suture lasso (asterisk) (B) and the other at an inferomedial position, approximately 1 cm below the superior tendon edge (arrow) and 1 to 1.5 cm medial to the lateral tendon edge, using an antegrade suture passer (asterisk) (C). (D) Final configuration of the passed sutures (asterisk) positioned medial to the margin of the subscapularis tear (arrow).

subscapularis tear (Fig 2A, Video 1). From the anterior portal, a suture lasso is introduced and used to pierce the leading edge of the tendon just medial to the tear site, followed by relaying a FiberWire suture (Fig 2B, Video 1). A second FiberWire suture is passed using an antegrade suture passer (Fig 2C, Video 1). The passing point is located inferomedial to the subscapularis tear, approximately 1 cm inferior to the superior tendon edge and 1 to 1.5 cm medial to the lateral tendon edge, which is 1 cm inferior to the first suture passed point. Then, each limb of the 2 FiberWire sutures is pulled to equalize their lengths (Fig 2D).

For subacromial space procedures, a standard lateral working portal and a posterolateral viewing portal are established, and acromioplasty is performed as necessary. Viewing from the posterolateral portal, subacromial bursectomy, coracohumeral ligament release, and adhesiolysis between the coracoid and subscapularis tendon are performed using a blunt dissector and shaver from the lateral portal, with caution not to damage previously passed sutures (Fig 3A, Video 1).¹⁷ In cases of an LHB tendon lesion, suprapectoral LHB tenodesis is performed (Video 1).

The supraspinatus tendon is prepared for repair through debridement of nonviable tissue, and

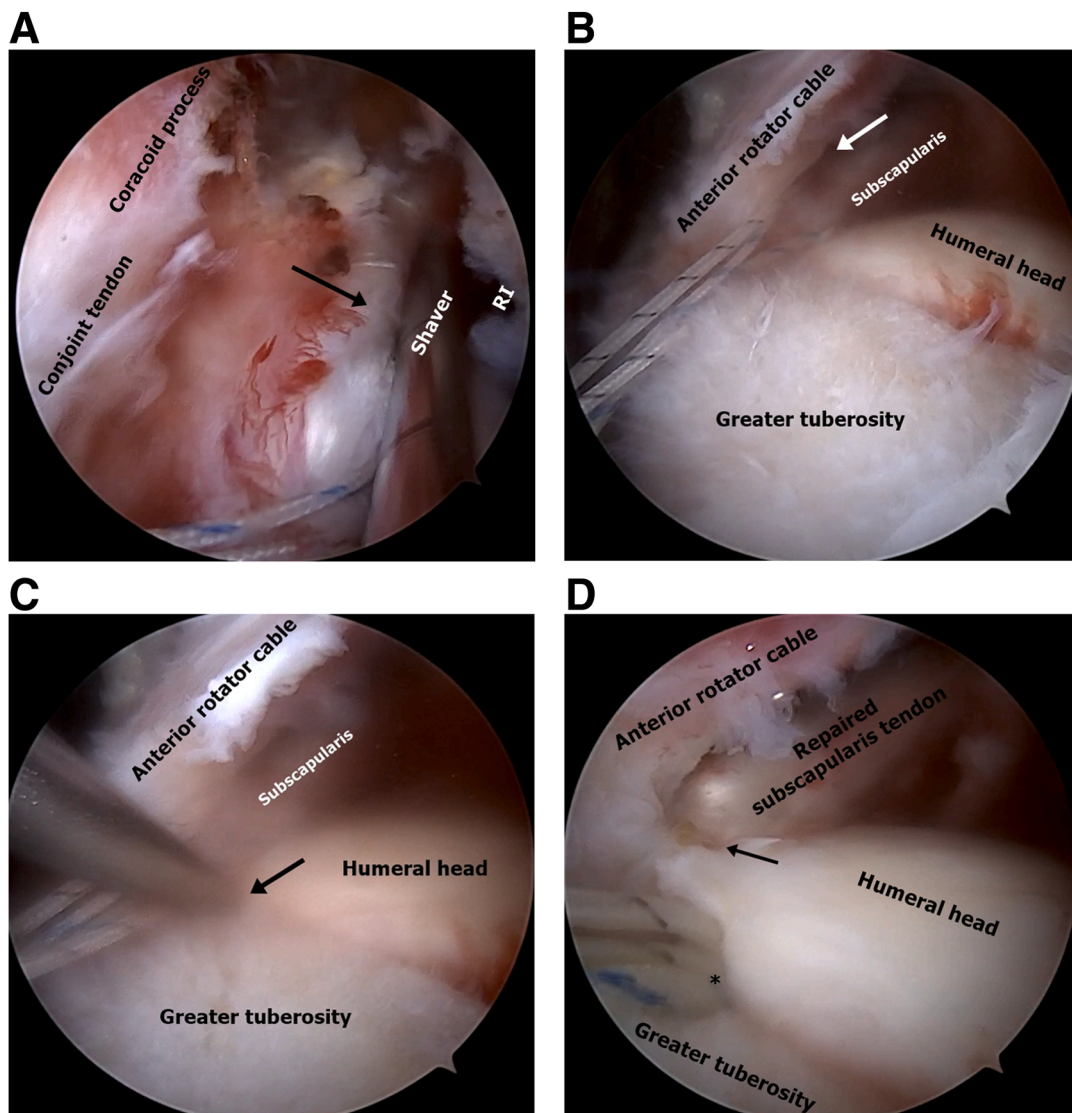


Fig 3. Arthroscopic view of the left shoulder in the lateral decubitus position, using a 30° arthroscope through the posterolateral viewing portal to visualize the subacromial space. (A) The coracohumeral ligament is released and debrided using electrocautery and a shaver through the lateral portal. Subcoracoid adhesions are also released. Then the upper margin of the subscapularis tendon is visualized (arrow). (B) FiberWire (Arthrex) strands are passed through the rotator interval (arrow) using a retriever from the anterior portal and retrieved to the lateral portal beneath the anterior rotator cable of the supraspinatus tendon. (C) A standard anchor portal is created just lateral to the lateral margin of the acromion, and an awl is inserted through the anchor portal. The awl is positioned at the anteromedial supraspinatus anchor site, corresponding to the anatomic junction of the subscapularis and supraspinatus footprints (arrow). (D) Tension is applied to the suture limbs, and they are secured using a 4.75-mm knotless anchor (asterisk), resulting in restoration of the subscapularis tendon (arrow) to its native footprint. (RI, rotator interval.)

mobilization is achieved by releasing adhesions involving the tendon. For large to massive supraspinatus tears, approximately 5 mm of the lateral humeral head cartilage is removed using a ring curette to medialize the footprint. Using a retriever from the anterior portal, FiberWire sutures are passed through the rotator interval and retrieved to the lateral portal beneath the anterior cable of the supraspinatus tendon (Fig 3B, Video 1). If the LHB tendon is present, the sutures are positioned beneath it. Suture passage over

the anterior rotator cable or the LHB tendon could induce strangulation of these structures.

A spinal needle is used to localize the anchor portal, typically positioned just off the lateral margin of the acromion. After establishing the portal, a smooth cannula is inserted, and the suture limbs are retrieved through it. An awl is then introduced to create a bone hole for anchor insertion. The hole is positioned similarly to the standard anteromedial anchor site used in double-row suture bridge repair of the supraspinatus or

Table 1. Pearls and Pitfalls**Pearls**

Use a 70° scope from the posterior portal for clear visualization of the subscapularis tendon tear at the first facet
 Slight internal rotation of the arm for exposure of the subscapularis first facet
 Anterior capsule, rotator interval, coracohumeral ligament, and subcoracoid adhesiolysis for subscapularis tendon mobilization and visualization
 Suture passage medial and inferomedial to the subscapularis tear for good tendon quality
 Use of different-colored subscapularis passing sutures from the free suture within the knotless anchor
 Adequate rotator interval release for suture passage under the anterior rotator cable
 Knotless anchor insertion at the junction of subscapularis and supraspinatus footprints
 Small bone hole placement for poor-quality humeral head bone

Pitfalls

Avoidance of overtension during subscapularis suture pulling
 Suture passage over the rotator cable or long head of the biceps, risking strangulation of the structures
 Single knotless anchor repair may be inadequate for large subscapularis tears, requiring additional inferior repair

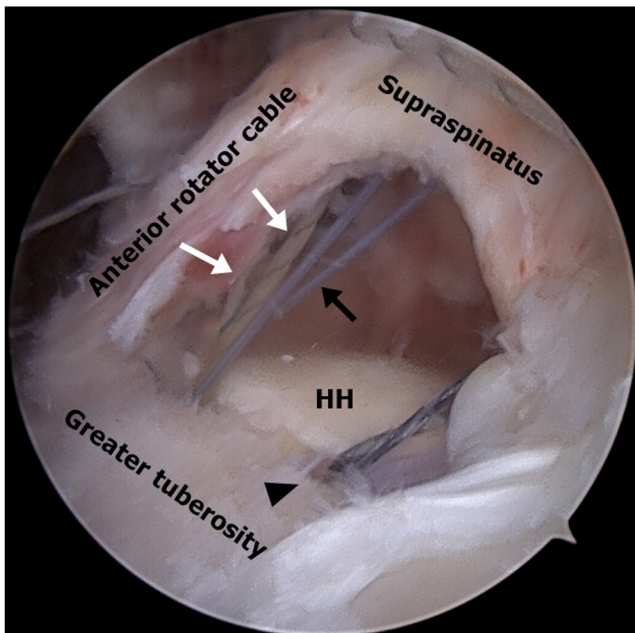


Fig 4. Arthroscopic view of the left shoulder in the lateral decubitus position, using a 30° arthroscope through the posterolateral viewing portal. A free suture within the anchor (blue, black arrow), along with 2 FiberWire sutures (white/black and white/blue, white arrows; Arthrex), is used for anterior supraspinatus tendon repair. As an anterior-to-posterior dimension of the tear exceeds 1.5 cm, an additional posteromedial anchor (arrowhead) is applied. (HH, humeral head.)

slightly medial to it (Fig 3C, Video 1). Specifically, it is located at the junction of the subscapularis and supraspinatus footprints, indicating the humeral attachment site of the anterior rotator cable. In cases of poor bone quality, creating a smaller bone hole may enhance anchor stability. This technique does not apply to small or partial supraspinatus tears (Table 1).

The suture limbs are then loaded onto a 4.75-mm knotless anchor and inserted with moderate tension,

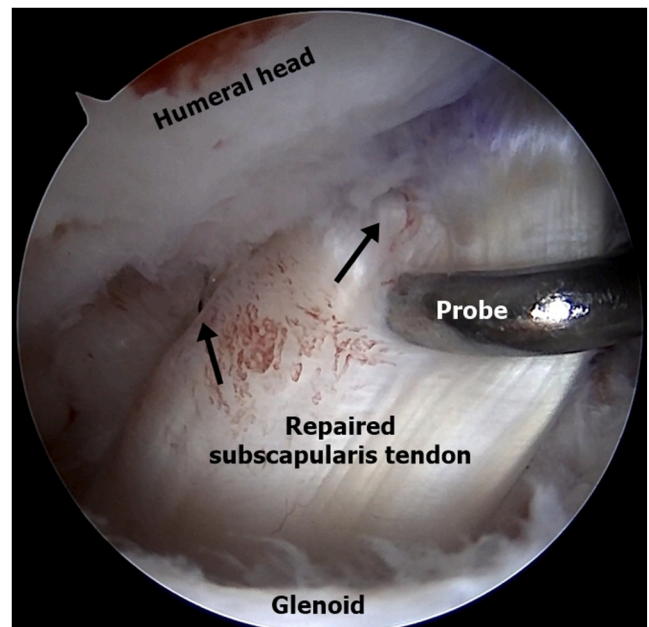


Fig 5. Arthroscopic view of the left shoulder in the lateral decubitus position, confirming subscapularis tendon fixation (arrow) from the intra-articular space using a 30° arthroscope inserted through the posterior viewing portal.

placed onto the FiberWire suture limbs through the cannula. As the anchor threads contact the bone, the assistant presses the anchor handle against the cortex to prevent backout, while the operator applies tension to each limb of the same suture by wrapping them around the fingers. Tensioning of the suture limbs allows compression of the tendon to the lesser tuberosity (Fig 3D, Video 1).

A free suture within the anchor (blue strand) and the 2 FiberWire sutures used for subscapularis repair is used for supraspinatus repair (Fig 4, Video 1). If the anterior-to-posterior dimension of the tear exceeds 1.5 cm, a posteromedial anchor is inserted. A standard double-

Table 2. Strengths and Limitations

Strengths
Single anchor without knot tying, resulting in a simple and fast procedure
Reduced anchor usage, leading to lower economic burden
Prevention of anchor crowding through shared anchor fixation of subscapularis and supraspinatus tendons
Single-anchor fixation at the footprint junction, enabling preservation of the cortical bone bed for tendon healing
Limitations
Anchor pullout risk in patients with poor bone quality
Single-row repair limitation in addressing the inferior portion of the subscapularis tear
Anchor fixation lateral to the subscapularis footprint, potentially resulting in overtensioned repair

row suture bridge repair is performed for the supraspinatus tear (Video 1). During the procedure, meticulous knot tying and suture tensioning are required to prevent dislodgement of the fixed knotless anchor, which supports both the subscapularis and supraspinatus tendons. Final subscapularis fixation is confirmed from the intra-articular space using a 30° arthroscope through the posterior viewing portal (Fig 5, Video 1). The portals are closed in the usual manner, and sterile dressings are applied. Standard postoperative rehabilitation for rotator cuff repair is applied.

Discussion

With the advancement of shoulder arthroscopy, the diagnosis and surgical management of the subscapularis is increasingly performed.¹⁹ Although debates remain regarding the repair of partial subscapularis tears, it seems reasonable from the perspective of anatomic restoration.⁶ Even with the use of a knotless anchor, previously reported techniques have limitations due to the difficulty of anchor insertion on the limited exposed footprint.¹³ Additionally, when repairing an anterosuperior tear, the anteromedial anchor for the supraspinatus is positioned close to the subscapularis anchor, potentially leading to anchor interference and compromising stability. Single-anchor sharing for both subscapularis and supraspinatus repair addresses this issue, offering a simplified procedure with reduced operative time and economic burden.

The limitation of this technique is that it has an anchor stability concern, as the sutures are used to secure both the subscapularis and supraspinatus tendons. This may impose greater pullout stress on the anchor, potentially leading to anchor loosening or failure, particularly in osteoporotic patients. Meticulous suture management during supraspinatus repair, creation of a small bone hole with the awl, and selection of a larger anchor size (5.5 mm SwiveLock; Arthrex) in patients with poor humeral head bone quality are recommended (Table 2).

Disclosures

All authors (S.C.K., Y-S.K., J.S.K., H.G.K.) declare that they have no known competing financial interests

or personal relationships that could have appeared to influence the work reported in this paper.

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