Technical Note

Single Portal Technique for Subscapularis Tendon Repair

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Abstract: The fast and steady development of arthroscopy techniques in the last couple of decades led to a drastic increase of arthroscopic rotator cuff repairs over the open procedure. Supraspinatus tears are the most common of all, but the subscapularis tendon tear is a more common injury than expected. Most of the time it presents as a partial tear or is associated with a subsequent rotator cuff tendon injury, especially the supraspinatus. Nowadays, the standard procedure to repair the subscapularis tendon is performed arthroscopically, even though a real superior result over the open repair it is yet to be reported. Ideally less operative time, less scarring, and postoperative pain would be the expected benefits, but no study has compared the long-term outcome of these 2 procedures yet. To maximize possible improvements, we would like to present an arthroscopic technique: a subscapularis tendon repair performed with the aid of an angled suture passer and using a single anterior working portal.

It is still unclear if arthroscopy has a superior role in clinical outcome and tendon healing in the case of a subscapularis tendon tear compared with the open procedure. Only a few papers have investigated the results of arthroscopy on this type of injury so far, and, in addition, clinical outcomes, operative time, scarring, and postoperative pain should also be extensively investigated.

In 2003, Kim et al.² proved the introduction of arthroscopy to be not only a therapeutic tool but also an important diagnostic instrument for subscapularis tears. An isolated full-thickness subscapularis tendon tear is less common than other rotator cuff injuries, but in recent clinical analysis involving more than 100 patients with rotator cuff injuries, 37% of them had either an isolated subscapularis tear or a subscapularis tear combined with other injuries.³,⁴ Because subscapularis tears are more commonly diagnosed than previously expected, it is desirable to find a suitable, easily applicable, and reproducible repair technique.

We demonstrate the repair of the subscapularis tendon through a single anterior portal, with the use of a ReelPass SutureLasso (Arthrex, Naples, FL).

Fig 1. All the images from arthroscopy are performed in a right shoulder and viewed from the posterior portal. The tendon presents with a full-thickness tear marked by an arrow. In the background, the left-angled ReelPass is about to take a healthy bite of the tendon.
Preoperative Evaluation

The diagnosis of a subscapularis tendon rupture consists of a detailed history, comprehensive physical examination, and complementary imaging studies.

A typical patient with subscapularis tendon rupture reports pain and swelling in the anterior part of the shoulder after a possible recent fall on an outstretched arm with possible anterior shoulder dislocation. There may be an associated lesion of other muscles in the rotator cuff. Patients will complain of decreased range of motion (ROM) and weakness with internal rotation of the arm that will be assessed during the physical examination.

Inspection of both upper extremities is done during the physical examination, followed by palpation of the region of interest and evaluation of the ROM.

Special tests are used to assess more precisely subscapularis integrity: the lift-off test, the belly-press test, and the bear-hug test; all of them are most likely to be rated 2+. Ultrasound and magnetic resonance imaging are also helpful to confirm the diagnosis before possible surgical intervention.

Anesthesia and Positioning

The patient is placed supine on a beach-chair positioner, whereas an interscalene nerve block is placed in the upper extremity and general anesthesia is induced. An intraoperative examination should be performed under anesthesia to confirm our preoperative impression.

The patient is then placed in the beach-chair position with a well-padded head cushion. The operative site is

Fig 2. Right shoulder arthroscopy, viewing from the posterior portal. (A) A healthy bite of the tendon (marked with a square) is taken with the angled-suture passer inserted from the anterior portal. The PDS monofilament is abundantly uncoiled in the glenohumeral joint to be retrieved from the same anterior portal with the help of a ring grasper. (B) The center of the SutureTape, tied to the PDS monofilament, is being shuttled through the tendon and retrieved from the anterior portal to create a racking hitch stitch. (PDS, polydioxanone.)

Surgical Technique

Fig 3. Picture from outside the right shoulder showing the racking hitch stitch (circled). The 2 limbs of the SutureTape fed through the looped end, and are about to be pulled and tension the stitch.

Fig 4. Arthroscopic picture of a right shoulder viewing from the posterior portal showing the 2 FiberTape used for the subscapularis tendon repair before the anchor placement and the final reduction.
then sterilely prepped, draped, and a McConnell arm holder is used.

**Portal Placement**

A marking pen is used to highlight the anatomical landmarks of the shoulder. The posterior portal is made in the soft spot of the shoulder with an incision performed using a No. 11 blade. The glenohumeral joint is then entered using a blunt trocar with scope and sheath. A 30° 4.0-mm arthroscope is used to visualize the glenohumeral joint. A spinal needle is used to needle-localize the anterior portal under arthroscopic visualization. The anterior portal used is the classic anterior medial portal, made lateral to the coracoid process and anterior to the acromioclavicular joint. An 8-mm vertical incision is made followed by a switching stick, and then an 8.25 cannula is placed in the anterior portal (Arthrex). After standard diagnostic evaluation of the anatomic structures of the glenohumeral joint, attention is turned to the stabilization procedure.

**Subscapularis Tendon Repair**

The patient presented here had a full-thickness tear of the superior portion of the subscapularis tendon (Fig 1). While viewing from the posterior portal, the footprint of the tendon must be cleaned off from debris and remodeled with an arthroscopic shaver to place the anchor.

A 45° angled ReelPass SutureLasso (Arthrex) is then introduced into the anterior working portal and used to take a healthy bite of the upper border of the torn subscapularis tendon; depending on the operative site, a left-angled will be used for a left shoulder and a right-angled for a right shoulder. The ReelPass has 10 yards of polydioxanone (PDS) monofilament that is abundantly uncoiled into the joint. The ReelPass is then withdrawn from the portal and the loose end of the PDS is retrieved from the same anterior portal with a ring grasper. The purpose of the PDS is to shuttle a FiberTape (Arthrex) through the subscapularis tendon (Fig 2). The FiberTape is then passed in a manner to create a racking hitch stitch. Specifically, the PDS monofilament is tied to the center of the tape; it is then pulled half way through the labrum so that the center of the tape creates a loop. The free ends of the FiberTape are passed through the looped end outside the shoulder (Fig 3) and tightly cinched down to create a

**Table 1. Advantages and Disadvantages of the Single Portal Technique**

| Advantages                                      | Disadvantages                                               |
|-----------------------------------------------|-------------------------------------------------------------|
| Saves time to treat other associated conditions and avoid joint swelling | Difficult to treat bigger tendon tears                       |
| Less invasive                                  | Late repairs with muscle atrophy, retraction, or fatty infiltration |
| Knotless technique                             | Possibility of entangled sutures with only 1 working portal  |
| Shorter learning curve                         |                                                             |

**Fig 5.** Arthroscopy image of a right shoulder from the posterior portal. (A) Both sutures are loaded on the same 4.75 SwiveLock marked by an arrow. The adequate reduction of the subscapularis tendon is achieved by tensioning each suture limb independently from outside the shoulder. Next the SwiveLock is dunked into a pilot hole previously punched on the humeral head. (B) The SwiveLock is being screwed in to secure a stable repair.

**Fig 6.** Final result of the subscapularis tendon repair using single row sutures and an angled suture passer in a right shoulder scope viewing from the posterior portal.
When the SwiveLock is fully seated, all the hole and then screwed in to reduce the tendon down
SwiveLock (Arthrex). Each limb of the sutures is the next step is to load both FiberTapes on a single 4.75
bicipital groove, where the anchor will be placed.

Drilled on the lesser tuberosity (Video 1), medial to the
scapularis tendon tear. At the same time, there is no
on the difference between open and arthroscopic sub-
so far from the few articles the literature has provided

Pitfalls

• Failure to get enough tendon with the suture lasso
• Inadequate number of sutures for the relative tear size
• Weak tensioning of the sutures during the anchor placement

racking hitch stitch. We use this first stitch as a
tensioning device especially when following capacious,
hard to place, bites with the suture lasso (Fig 4).

After the application of the sutures, a pilot hole is
drilled on the lesser tuberosity (Video 1), medial to the
bicpital groove, where the anchor will be placed.

In this case, the repair warranted only 2 sutures, so
the next step is to load both FiberTapes on a single 4.75
SwiveLock (Arthrex). Each limb of the sutures is
tensioned individually to ensure an appropriate reduc-

The result of the repair is probed at the end of the
procedure to evaluate the repair and stability of the
sutures (Fig 6).

Postoperative Care and Rehabilitation

The portal incisions are closed in a standard fashion
and covered by an abundant dressing. The operative
arm is then immediately placed into an immobilizer
sling that will be used for the first 6 weeks after the
surgery.

During the “early postoperative phase” (0-2 weeks),
 passive ROM of the operative shoulder is allowed to
120° of passive forward flexion and 30° of passive
external rotation, whereas active ROM is allowed in the
adjacent joints. Active elevation of the arm to lift an
object is to be avoided during this time period. From
weeks 2 to 6, the objective is to restore passive ROM
and the sling is discontinued at the end of week 6.
Active ROM exercises are started after week 6, and the
average time to return to full activity is around
18 weeks after surgery.

Discussion

No difference in terms of outcome has been reported
so far from the few articles the literature has provided
on the difference between open and arthroscopic sub-
scapularis tendon tear. At the same time, there is no
study reporting the use of a single working portal
during arthroscopy and its long-term outcome. Minor
scarring, reduced operative time, and postoperative
pain could be the biggest improvements following this
procedure. In addition, there may potentially be a
reduced learning curve for this kind of technique:
knotless and therefore less passages are required to
secure the sutures and stabilize the lesion.

Less operative time also gives the possibility of
treating associated injuries that usually come with the
subscapularis tear, before fluids distend the joint and
limit the visibility especially in the subacromial
space.

Given that a reduction in each of these aspects is
associated with quicker return to work, further studies
to confirm these results would be helpful in recom-
mending arthroscopic over open repair.

Gilmer et al. performed a similar technique with the
same SutureLasso and found that the main limitation is
about the single-row repair especially with large or
retracted tears (Table 1). In case of muscle retraction,
muscle atrophy, or fatty infiltration, mostly due to a late
repair, a double row repair would be more suitable,
because it has the advantage to recreate a larger foot-
print. On the other hand, a double row repair requires
accessory portals that are not contemplated in the
technique described here.

The timing of a repair plays a fundamental role in
the prognosis, probably as fundamental as the size of
the tear, and both can possibly lead to re-rupture in
the future. A late repair can present with muscle at-
rophy or retraction or fatty infiltration leading to a
more complex, long, and possibly less successful
procedure.

There is no clear guideline on the ideal number of
anchors to use, but Van der Zwaal et al. suggested that
for every centimeter of subscapularis tendon tear 1
suture anchor should be placed. It is better to secure
sutures separately, before the anchor placement, in case
multiple FiberTapes are passed for the repair to avoid
entangled sutures. In case multiple sutures are entan-
gled, they can oppose the tensioning and reduction
process when the SwiveLock is set in place, thus leading
to a poorly reduced tendon and high chances failure of
the tendon repair. Van Der Zwaal et al. also advocated
for knotless sutures because of their easier application
compared with knot tying and also because they are
less time consuming; again, extra time can be used to
treat associated injuries before soft tissues swell
(Table 2). Finally, SutureTape is wider than normal
FiberWire, and this option provides a stronger fixation
and improved cut-through resistance with injured tis-
sues. Given all the good features enumerated in
Table 1 and the reproducibility of the technique, we
would like to recommend this procedure as a reliable
option for subscapularis tendon repair.

| Table 2. Pearls and Pitfalls of the Single Portal and Suture Lasso Technique |
|---|
| **Pearls** |
| • Healthy bite of the subscapularis tendon with the ReelPass |
| • Creation of a FiberTape loop to be shuttled in the tendon |
| • Check the size of the tear to determine the number of sutures |
| • Pilot hole drilled on the lesser tuberosity |
| • Adequate suture tension while placing the anchor |
| **Pitfalls** |
| • Failure to get enough tendon with the suture lasso |
| • Inadequate number of sutures for the relative tear size |
| • Weak tensioning of the sutures during the anchor placement |
References

1. Bayle X, Pham TT, Faruch M, Gobet A, Mansat P, Bonneville N. No difference in outcome for open versus arthroscopic rotator cuff repair: A prospective comparative trial. *Arch Orthop Trauma Surg* 2017;137:1707-1712.

2. Kim TK, Rauh PB, McFarland EG. Partial tears of the subscapularis tendon found during arthroscopic procedures on the shoulder: A statistical analysis of sixty cases. *Am J Sports Med* 2003;31:744-750.

3. Yoo JC, Rhee YG, Shin SJ, et al. Subscapularis tendon tear classification based on 3-dimensional anatomic footprint: A cadaveric and prospective clinical observational study. *Arthroscopy* 2015;31:19-28.

4. Ono Y, Sakai T, Carroll MJ, Lo IK. Tears of the subscapularis tendon: A critical analysis review. *JBJS Rev* 2017;5:1-12.

5. Van der Zwaal P, Thomassen BJ, Nieuwenhuijse MJ, Lindenburg R, Swen JW, van Arkel ER. Clinical outcome in all-arthroscopic versus mini-open rotator cuff repair in small to medium-sized tears: A randomized controlled trial in 100 patients with 1-year follow-up. *Arthroscopy* 2013;29:266-267.

6. Seppel G, Plath JE, Völk C, et al. Long-term results after arthroscopic repair of isolated subcapularis tears. *Am J Sports Med* 2017;45:759-766.

7. Shan L, Fu D, Chen K, Cai Z, Li G. All-arthroscopic versus mini-open repair of small to large sized rotator cuff tears: A meta-analysis of clinical outcomes. *PLoS One* 2014;9:e94421.

8. Williams G Jr, Kraeutler MJ, Zmistowski B, Fenlin JM Jr. No difference in postoperative pain after arthroscopic versus open rotator cuff repair. *Clin Orthop Relat Res* 2014;472:2759-2765.

9. Gilmer BB, Crall TS, Guttman D. Knotless arthroscopic repair of subscapularis tendon tears using looped suture. *Arthrosc Tech* 2015;4:e267-e271.

10. Van der Zwaal P, Schuller L, Urlings TAJ, Coerkamp EG, van Arkel ERA, van der List MPJ. Clinical outcome and structural integrity of all-arthroscopic repair of degenerative subscapularis tendon tears. *Knee Surg Sports Traumatol Arthrosc* 2013;21:1620-1625.