Arthroscopic Laminar Spreader for Rotator Cuff Repair

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Abstract: Arthroscopic rotator cuff repair can be challenging and requires adequate visualization and space. However, the narrow subacromial space can make difficult to perform tendon release and repair under arthroscopy. Inadequate visualization may lead to inaccurate suture placement, compromising the reduction and fixation of the repaired rotator cuff tendons. Manual or mechanical distraction (using an arm positioner) can be used to increase the working space. However, consistent distraction is very difficult to maintain manually over time due to fatigue, whereas mechanical distraction may overstretch the brachial plexus. To overcome these difficulties, we describe a technique using a specific laminar spreader for subacromial distraction during arthroscopic rotator cuff repair. The arthroscopic laminar spreader, inserted into the subacromial space, is used to distract the humeral head inferiorly from the acromion, improving subacromial space visualization and enabling easily rotator cuff release and repair. The shoulder distraction device improves the surgeon’s performance without surgical assistance and allows reducing the operative time with safety. It can be also used anteriorly (to repair the subscapularis) or posteriorly (to repair the infraspinatus and teres minor) or to perform other procedures like superior capsular reconstruction or additional patch.

Arthroscopic rotator cuff repair (RCR) is technically demanding and requires adequate visualization and space. However, the subacromial space is narrow and varies due to individual anatomic differences, anesthesia-induced relaxation, and the diversity and magnitude of shoulder lesions. Inadequate visualization may lead to inaccurate suture placement on the tendons, compromising the reduction and fixation of the repaired rotator cuff tendons. To improve visualization and allow access of the optical instruments, the subacromial space must be enlarged.1-3 The use of intra-articular saline solution infusion under pressure to expand the joint and traction on the upper limb are commonly used techniques; however, it remains difficult to maintain the limb in the same position throughout the procedure.4 We describe a surgical technique to gain optimal access to the subacromial space during arthroscopic RCR with no traction on the arm, using an arthroscopic laminar spreader (ALS) to distract the humeral head inferiorly from the acromion.

Arthroscopic Laminar Spreader

The ALS (Latarjet Guiding System; Smith & Nephew, Andover, MA) is currently used to perform the subscapularis split during arthroscopic Latarjet and finds here a new application.5 The device (Fig 1) is used to distract the humeral head inferiorly from the acromion and increase the subacromial working space (Fig 2).

Surgical Technique (With Video Illustration)

Arthroscopic RCR is performed with the patient under general anesthesia and peripheral bloc, with the patient placed in the “lazy” beach-chair position. The arm is positioned on a movable arm support (SPIDER Limb Positioner; Smith & Nephew) without any traction applied. In addition to the posterior portal, 3 portals are typically required to perform an arthroscopic RCR. The lateral portal is used mainly as a viewing portal.
portal, whereas 2 anterior portals (anterolateral and anteromedial) are used as working portals.

**Step 1: Subacromial Decompression, Acromioplasty, and Tuberoplasty**

With the scope in the lateral portal and the electrocautery device (VAPR VUE; DePuy Mitek, Raynham, MA) in the anterolateral portal, bursal tissue is removed from the subacromial space. Using a motorized burr, an acromioplasty and a tuberoplasty are performed. The footprint is abraded with the burr, removing all soft tissue and cortical bone, creating a bleeding cancellous bone bed.

**Step 2: Tendon Release and Reduction**

Tendon mobility and reducibility are assessed by using a grasper to pull on the tendon laterally. The goal is to achieve reduction the cuff tendons to their

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Fig 1. The arthroscopic laminar spreader (ALS) closed (A) and opened (B).
anatomical position without undue tension. First, a release of the superficial adhesions between the cuff and the acromial arch is performed. In case of severe tendon retraction, the rotator interval is opened and the coracohumeral ligament released.

The ALS is introduced in the subacromial space, through the anterolateral portal, and inserted between the head of the humerus and the undersurface of the acromion. The device is opened gently to distract the humeral head inferiorly from the acromion to facilitate the tendon release (Fig 3). Alternatively, while the distal lamina is placed on the footprint of the GT, the proximal lamina can be placed under the supraspinatus tendon to facilitate the tendon release and superior capsulotomy. Pearls and pitfalls of this surgical procedure are shown in Table 1.

Step 3: Tendon Repair

Depending on the size of the cuff tear and the presence of tendon delamination, we use either a single-row (tension-band suture) or a double-row (double-layer) cuff repair technique. In case of single-row repair, we use the tension-band suture repair as described by Boileau et al. The suture is placed through the tendon in a reverse-mattress configuration, while the anchor is placed laterally on the greater tuberosity. A suture hook (Linvatec, Largo, FL), inserted through the anteromedial portal, is used to pass a polydioxanone suture close to the musculotendinous junction, in an inverted mattress fashion. A grasper is used to retrieve one of the anchor sutures and the polydioxanone suture, which is used as a shuttle to pass it through the tendon. Both strands of sutures are tied with the use of a sliding-locking knot (Midshipman’s Knot) and 3 additional surgeon’s knots. Here again, the ALS can be used to increase the subacromial space and facilitate the passage of the sutures through the tendon (Figs 4 and 5). This time, the proximal lamina is placed under the acromion, while the distal lamina is placed over the tendon. This maneuver places tension on the tendon and facilitates the passage through the tendon.

Discussion

Arthroscopic RCR is a highly demanding technique, requiring good visualization and space to work. Operating in the subacromial space can be challenging, with limited clearance for arthroscopic instrumentation, especially with large, retracted cuff tears and in smaller patients. Beside bleeding control, there is a need to increase the subacromial space. Applying manual or mechanical traction on the arm to displace the humeral head for arthroscopic accessibility is commonly used. However, continuous traction may limit the manipulation of the arm during surgery.

We describe a surgical technique using a specific distraction device to improve visualization in the subacromial space by distracting the humeral head inferi orly from the acromion and facilitating the tendon release and repair. The ALS can be used for the different surgical steps during arthroscopic RCR. Placed between the footprint and the undersurface of the cuff tendons, the distraction device facilitates tendon release, using a coblator to perform a superior capsulotomy. Placed between the acromion and the superficial surface of the acromion.
cuff tendons, it allows pressing down on the tendon stump and eases the suture passage with a hook.

The ALS, introduced through a 5-mm classical arthroscopic portal, allows noninvasive and controlled shoulder distraction without any morbidity. We used this distraction device routinely in more than 100 arthroscopic RCRs during the last year and did not observe any neurovascular complications, soft-tissue damage, or bone (acromion/tuberosity) fractures. The wider subacromial space, provided by the use of ALS is useful to improve performance and reduce the operative time during arthroscopic cuff repair.

To widen the subacromial space during open rotator cuff repair, Warner and Gerber first advocated using a modified laminar spreader with a ring placed over the humeral head and the undersurface of the acromion. However, due to its size, this device cannot be used in arthroscopic surgery. Other authors proposed some devices to improve visualization in the subacromial space and retract the deltoid muscle. Kilinc et al. propose using a Foley catheter as a balloon to achieve internal subdeltoid distraction. They reported that by increasing the angle between the deep side deltoid and the lateral cortex of the humerus they improve visualization of the subacromial space. However, we think that the widening of the subacromial space achieved by application of a spacer in the lateral subdeltoid space is less effective than

Table 1. Pearls and Pitfalls

| Pearls                                                                 | Pitfalls                                                                 |
|-----------------------------------------------------------------------|--------------------------------------------------------------------------|
| Placing the ALS between the footprint and the undersurface of the cuff tendon facilitates tendon release and superior capsulotomy. | If the release of the superficial adhesions between the cuff and the acromion is not performed, tendon reduction can be difficult even with the use of the spreader. |
| Placing the ALS between the acromion and the superficial surface of the cuff tendons, allows pressing down the tendon and eases suture passage with a hook. | If the laminas of the spreader are not flat on the humeral head and the undersurface of the acromion, distraction can be less effective. |

ALS, arthroscopic laminar spreader.

Fig 3. (A) Outside view with the patient placed in the “lazy” beach-chair position showing the self-retaining distractor introduced into the subacromial space through the lateral portal (L). (B) Arthroscopic images showing the arthroscopic laminar spreader (ALS) placed between the head of the humerus (HH) and the undersurface of the acromion (A). (C) The device is opened gently to distract the humeral head inferiorly from the acromion to widen the subacromial space. *Inferior lamina of the spreader. **Superior lamina of the spreader. (A, acromion; AL, anterolateral portal; AM, anteromedial portal; G, glenoid; HH, humeral head; SS, supraspinatus tendon.)

Fig 4. Outside view showing the arthroscope inserted through the lateral portal (L), the self-retaining lamina spreader passed through the anterolateral portal (AL), and the suture hook inserted through the anteromedial portal (AM).
the application of a spreader between the humerus and the undersurface of the acromion. Cannulas have also been used to retract the deltoid muscle. However, cannulas do not expand the subacromial space.

Our arthroscopic distraction device also can be used to increase the subdeltoid space laterally, anteriorly (to repair the subscapularis) and posteriorly (to repair the infraspinatus and teres minor). It can also be useful to perform superior capsular reconstruction. Introduced inside the glenohumeral joint, it can improve the working space during anterior or posterior arthroscopic shoulder stabilization. Finally, the self-retaining arthroscopic device can provide controlled and effective distention/distraction in other joints, either in the upper limb (elbow, wrist) or the lower limb (hip, knee or ankle). Advantages and disadvantages of the surgical technique are summarized in Table 2.

In summary, use of a distraction device, specifically designed for arthroscopy, makes arthroscopic RCR easier by expanding the workspace and the view and by placing tension on the deep or superficial surfaces of the torn cuff tendons to facilitate their release and repair.

Fig 5. (A-B) Arthroscopic images showing use of the arthroscopic laminar spreader to enlarge the subacromial space, improve visualization, and facilitate the passage of the suture through the cuff tendons with a hook. (C) Arthroscopic images showing a repaired cuff using tension-band suture repair. *Inferior lamina of the spreader. **Superior lamina of the spreader. (A, acromion; H, suture hook; SS, supraspinatus tendon.)
The distraction device, introduced through a regular arthroscopic portal (5 mm), allows easy and controlled depressing of the humeral head. Use of specific laminar spreader during arthroscopic RCR, instead of assisted manipulation on the upper limb, is a viable alternative facilitating tendon release and repair.

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