The Double Bankart Bridge: A Technique for Restoration of the Labral Footprint in Arthroscopic Shoulder Instability Repair

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Abstract: It has been proved by many researchers in the last few years that arthroscopic capsulolabral repair is an efficient method for surgical management of anteroinferior shoulder instability. Different arthroscopic techniques using different fixation devices and constructs have been described in the literature, but the suture anchors were the most used implants to shift the inferiorly displaced capsulolabral complex and fix it to the glenoid. In the majority of these techniques, the anchors concentrate the load at specific points (e.g., at 3 or 4 interrupted points over the glenoid directly opposite the anchors) without putting direct pressure on the area of the labral footprint that is between the anchors. We describe here a technique using 2 standard suture anchors inferiorly in conjunction with a knotless suture anchor (e.g., 3.5 mm PushLock, Arthrex, Naples, FL) superiorly. No additional separate sutures or suture tapes are required other than those already loaded in the inferior 2 anchors, which are used to compress the capsulolabral complex to the glenoid in the areas between the suture anchors, producing a uniform pressure that may contribute to better healing.

Recurrent shoulder instability requires surgical stabilization, particularly in the young active patients where the incidence of redislocation is very high. Methods of stabilization include the traditional open Bankart repair and more recently the arthroscopic Bankart repair. Different types of lesions of the capsulolabral complex can be mobilized and stabilized arthroscopically, which is currently the gold standard procedure. The classic Bankart lesion or what has been described as the essential lesion as well as the more chronic and displaced ALPSA lesion (anterolabral periosteal sleeve avulsion) have been treated arthroscopically with differing degrees of postoperative failure and recurrence. The ALPSA lesion particularly, which is more common in younger patients, has a higher rate of postoperative recurrence of instability after arthroscopic stabilization.\(^1,2\)

Continuous efforts to improve the arthroscopic techniques and implant types have led to the introduction of many types and concepts of fixation constructs. Suture anchors were initially developed and considered the standard. The knotless anchors were more recently introduced to facilitate the fixation and decrease the incidence of cartilage injury due to irritation by the knots on the labral side.\(^3,4\)

Several techniques aiming to improve the capsulolabral shift and increase the area and pressure of contact between the glenoid and the capsulolabral tissues have been described.\(^5-8\)

The standard fixation techniques are based on the use of 3 anchors, whether knotted or knotless, to shift the capsulolabral complex in a south-to-north direction and secure it to the glenoid at 3 distinct points, leaving the areas between the anchors points of attachment without direct fixation. We think that this might be a factor that results in incomplete and weak healing between the capsulolabral tissues and the glenoid bone and thus may contribute to more fibrous tissue healing and thus failure and recurrence of instability. This is particularly important with ALPSA lesions, where the absence of the periosteal hinge and thus the lower surface area for contact and healing lead to a higher recurrence rate.\(^2,3,9\)
Double-row repair techniques have been proposed to improve the contact pressure and increase the contact surface area and thus improve the healing and decrease the recurrence. However, these are technically demanding and may not be reproducible in every surgeon’s hands.7,8

Single-row techniques using a combination of knotted and knotless anchors have been recently described to achieve the same purpose in an easier fashion.5,6 We believe that these techniques are either difficult to reproduce and technically demanding or require extra materials that may significantly increase the cost of the operative procedure.

We describe here a technique (Fig 1) that was designed and tested in the laboratory by the first author (M.A.) and performed clinically together with the last author (Y.B.). The technique is a hybrid construct consisting of 2 knotted suture anchors (2.8 mm Fastak, Arthrex; or 2.8 mm Twinfix, Smith & Nephew) in combination with a third knotless anchor (3.5 mm Bio-PushLock anchor; Arthrex). The sutures of the 2 inferior anchors are used to produce a uniform compression along the whole intervening area up to the third most superior anchor.

Surgical Technique

Indications of the technique are history of recurrent shoulder instability and clinical and radiological findings indicating an anteroinferior capsulolabral lesion without significant bony lesion on either or both the glenoid and the humeral sides that may require a bony procedure (Video 1).

The patient can be positioned in either the lateral decubitus position (our preference) or the beach-chair position (according to the surgeon’s preference). A hydraulic arm holder is used in the beach-chair position (Spider; Smith & Nephew), and a shoulder traction tower (Arthrex 3-point Shoulder Distraction System; Arthrex) is used in the lateral decubitus position. Clinical assessment of the glenohumeral translation is performed in different directions and increasing degrees of abduction and external/internal rotation to determine the direction and degree of instability. A diagnostic arthroscopy is performed at the beginning through the standard posterior portal. The lesion, its type, and extent are visualized and documented. The working portals (anteroinferior and anterosuperior) are established using a spinal needle in an outside-in-technique, and 2 transparent plastic cannulas are inserted (8.5 mm diameter in the anteroinferior portal and 7 mm diameter in the anterosuperior portal).

The capsulolabral tissues are carefully and fully mobilized from the glenoid neck bone using the tissue liberator, motorized shaver, and a hooked electrocautery device inserted via the anteroinferior and anterosuperior portal alternatively as required. Careful release and debridement is necessary to obtain a raw bleeding surface.
of the glenoid rim that ensures better healing without compromising the bone stalk or the articular surface.

The insertion sites of the suture anchors at the 5:30, 4:30, and 3:00 o’clock positions (right shoulder joint) are marked with an arthroscopic burr or a Rongeur.

The capsulolabral tissue is penetrated with a 45° suture passing instrument (Spectrum, Mitek; or SutureLasso, Arthrex) introduced through the anteroinferior portal and starting at the most inferior part opposite the 5:30 o’clock of the glenoid edge, ensuring a good grip of the tissues. A 45° right curved suture passing instrument (Spectrum, Mitek; or SutureLasso, Arthrex) is used for the right shoulder in the lateral position and vice versa. A nitinol wire loop or monofilament nonabsorbable suture (Proline/PDS) is passed through the capsulolabral tissue and retrieved outside the anterosuperior portal with a suture retrieval instrument or a grasper.

The first anchor is inserted at the 5:30 o’clock position via the anteroinferior portal according to the manufacturer’s instructions (metal or bioabsorbable suture anchors can be used, either self-drilled or predrilled). The 2 suture limbs are retrieved through the anterosuperior portal. One limb of the 2 sutures is tied to the nonabsorbable shuttle suture (or through the lasso loop) and passed through the capsulolabral complex in a lateral to medial direction to outside the shoulder. The second suture limb may be passed through the capsulolabral complex in the same way, aiming to produce a mattress configuration according to the surgeon’s preference. The 2 limbs of the suture are retrieved again with a suture retriever through the anteroinferior portal.

The labrum is shifted superiorly with the aid of a tissue grasper introduced through the anterosuperior portal, and a sliding arthroscopic knot (Weston knot) is performed and secured with 3 reversing half hitches. The 2 suture limbs are left uncut, retrieved, and parked in the anterosuperior portal cannula (Fig 2). The same procedure is repeated for the 4:30 o’clock anchor, and then all 4 suture limbs are retrieved and parked in the anterosuperior portal cannula (Fig 3).

The capsulolabral tissue opposite the 3 o’clock position of the glenoid is pierced with the suture passer once again, and the shuttle suture is used to shuttle another strong nonabsorbable suture (FiberWire; Arthrex), which is then reliably used to shuttle the 4 suture limbs of the first 2 anchors from medial to lateral so that they exit between the labrum and the glenoid. A knotless anchor (3.5 mm Pushlock; Arthrex) is used for fixation and finishing the construct at the 3 o’clock position.
and pressure of contact and thus improve healing.7,8 These techniques are technically very demanding and require a high degree of experience, and they are not reproducible in every arthroscopic surgeon’s hand.

To overcome these challenges, simpler techniques to achieve the same target were suggested and described.5,6 These techniques are particularly useful in chronic anterior instability cases and with ALPSA lesions. From our point of view these techniques need modifications and improvement to avoid their weak points and disadvantages, which are sometimes stated by the authors themselves (Table 2).

The “flying swan” technique is composed of 2 knotted anchors created at the 5- and 1 o’clock positions of the glenoid.6 One suture limb from each anchor is cut, and the remaining 2 sutures are passed through the capsulolabral complex from lateral to medial opposite the 3 o’clock position and used to compress the tissues to the glenoid via a knotless anchor. We tried to perform this technique in the lab both arthroscopically and in an open manner. However, we found it a little bit difficult to pass the sutures through the tissues with the suture passing instrument as well as to drill for the anchor at the 3 o’clock position after tying the knots and approximating the tissues to the glenoid at the 1 and 5 o’clock positions. Furthermore, we think that cutting one suture limb from each anchor and using the other suture limb, one from above and the other from below, will not produce sufficient pressure or can reconstruct the desired larger contact area at the footprint. In this instance, a tape or at least 2 suture limbs may be needed. Another potential disadvantage of this technique is that the capsular shift is produced only through the inferior 5 o’clock anchor, which may not be

### Table 2. Advantages and Disadvantages of the Double Bankart Bridge Technique

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<tr>
<th><strong>Advantages</strong></th>
<th><strong>Disadvantages</strong></th>
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<tr>
<td>1. Creation of homogenous and uniform pressure distribution over the footprint.</td>
<td>1. Relatively technically demanding.</td>
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<td>2. Disruption of any point (anchor) will not lead to complete failure of the construct.</td>
<td>2. Suture management may be sometimes troublesome.</td>
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<td>3. Capsular shift can be performed using the 2 inferior anchors.</td>
<td>3. No biomechanical testing studies were performed to prove the initial stability of the construct.</td>
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<td>4. Downward traction over the inferior 2 anchors is neutralized through their sutures being attached to the third most superior anchor.</td>
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<td>5. No additional implants or sutures are needed other than 3 anchors (2 anchors loaded with sutures and one knotless anchor.</td>
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<td>6. Relatively average arthroscopic experience needed (i.e., the extremely high experience needed with the double-row technique is not needed).</td>
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<td>7. Knot slippage of the 2 inferior anchors is not possible (as the sutures are pulled upwards together).</td>
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### Discussion

Adequate healing after arthroscopic anterior Bankart stabilization depends on stability of the construct to resist cycling loading in the early postoperative period until biological healing occurs. The degree of compression and thus fixation of the capsulolabral tissues to the glenoid as well as the degree of the capsular shift can significantly affect the quality of repair tissue between the glenoid and the labrum.7,8 With inadequate capsular shift and insufficient fixation pressure over the footprint there may be a larger amount of fibrous tissue at the healing interface that may predispose to failure and reinstability. Classical methods of repair depend on multiple points of fixation “spot welds” opposite the inserted anchors to maintain the labral tissues in contact with the glenoid till healing occurs. Reinstability rates after arthroscopic Bankart repair have provoked surgeons to develop and improve newer techniques to decrease the failure rates.

Some authors described double-row techniques similar to rotator cuff repair to increase the surface area.

### Table 1. Pearls and Pitfalls

| **1.** | Good and meticulous mobilization of the capsulolabral tissue is necessary to obtain an adequate amount of tissue that can be pressed against the glenoid. |
| **2.** | Consider creating an additional percutaneous small portal through the subscapularis to park the sutures of the first anchor while tying the knot of the second anchor. |
| **3.** | Consider using a strong suture suture to pass the 4 limbs of sutures through the capsulolabral tissues from medial to lateral (e.g., FiberWire, Arthrex). |
| **4.** | Shuttle all the 4 suture limbs opposite the 3 o’clock position of the glenoid and retrieve and load them into the eyelet of the knotless anchor (3.5 mm Pushlock, Arthrex). |
| **5.** | A final adequate tensioning of the 4 suture limbs individually is necessary before insertion of the anchor into the bone. |

Predrilling is performed through the anteroinferior portal. The eyelet of the anchor is loaded with the 4 suture limbs, and the anchor is then inserted into the drill hole already made at the 3 o’clock position. The suture ends are pulled separately to tension all the suture limbs before advancement of the anchor into the drill hole (Fig 4). When the tension is sufficiently obtained, the anchor is advanced into the bone by hammering while maintaining the appropriate tension on the suture ends that is sufficient to produce adequate compression over the tissues without preventing the anchor from advancement into the bone. The insertion device is removed by twisting it in a counterclockwise direction. The ends of the sutures are then cut with an arthroscopic suture cutter at the surface of the glenoid (Fig 5). With smaller lesions requiring only 2 anchors, the inferior anchor is used to produce the capsulolabral shift, and the superior anchor can be a knotless one to complete the bridge construct (Table 1).
enough, particularly if more capsular shift is needed or an anchor-based capsular plication is required.

A more interesting modification of the idea is the labral bridge technique described by Ostermann et al.\(^5\) The technique uses essentially one LabralTape (Arthrex) with 3 knotless anchors (PushLock; Arthrex) to produce a uniform pressure distribution over the footprint. According to the authors, the technique is highly demanding and requires a high and long learning curve, and any technical mistake occurring in the middle of the procedure is not liable to be easily revised and corrected. Additionally, the construct is performed in a continuous manner depending totally on the LabralTape so that any breakage at any single point, particularly the middle anchor, will lead to complete failure of the construct. The technique can provide a good and uniform restoration of the footprint, but similar to the previous technique, it does not offer the chance to perform capsular shift or anchor-based plication through a second anchor. This construct is considered advantageous by the authors for 2 reasons. First, avoiding the horizontal sutures will decrease the risk of endangering the vascularity of the labral tissues, as shown in the work of Cooper et al.\(^{10}\)

Second, placing the sutures in a horizontal mattress pattern better restores the labral height and anatomy. We think that this conclusion, that is, the interruption of the vascularity with the simple horizontal suture pattern and its inadvertent effect on healing, needs more conclusive and well-designed research to prove it and should not be based merely on anatomical study. In addition, considering the stitches created with his technique equivalent to the horizontal mattress stitches that produce better anatomical restoration of the labral anatomy as described by Hagstrom et al.\(^{11}\) may not be accurate. The proposed advantages of our technique are listed in Table 2.

As with other described single-row techniques, no biomechanical testing studies were performed to prove the initial stability of the construct compared with the standard techniques.

References