Technical Note

Arthroscopic Double-Row Rotator Cuff Repair With Biceps Augmentation

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Abstract: Arthroscopic repair of chronic retracted rotator cuff tears remains challenging to shoulder arthroscopy surgeons. With the recent technical advances, most of the massive rotator cuff tears are managed successfully. The biceps tendon is highly vascular and a rich source of tenocytes and fibroblasts, which can promote biological healing. In massive degenerate rotator cuff tears in which the rotator cuff tissue can be released and fixed onto the footprint without much tissue tension, long head of the biceps tendon can act as an augment providing structural support to the poor-quality rotator cuff tissue and also enhancing the healing process. In this Technical Note, we describe arthroscopic rotator cuff repair using biceps augmentation for a massive degenerate rotator cuff tear with the excursion of the cuff onto the footprint with minimal tissue tension.

Massive rotator cuff tears, when left untreated, progress with deterioration of the cuff morphology and become irreparable. Many surgical methods have been described for massive irreparable rotator cuff tears, which include arthroscopic debridement with or without biceps tenotomy, partial repair of rotator cuff, tendon transfers, and superior capsular reconstruction (SCR).[1] Superior capsular reconstruction restores the restraining effect of the superior joint capsule and balanced force couple in massive irreparable rotator cuff tears.[2] The long head of the biceps tendon (LHBT) was later used for SCR instead of the autologous fascia lata graft or dermal allograft.[3,4]

A lot of confusion exists regarding the difference between biceps augmented rotator cuff repair and a reverse biceps tenodesis (Biceps SCR). SCR using the LHBT is done by fixing the biceps tendon from the superior labrum onto the rotator cuff footprint, creating a reverse biceps tenodesis effect that leads to a downward force on the humeral head due to the rerouted LHBT and the space-occupying effect of the SCR. It is indicated in massive irreparable rotator cuff tears with an intact biceps tendon.[5] Biceps augmented rotator cuff repair is indicated in extensively released retracted degenerate rotator cuff tears with an adequate excursion onto the rotator cuff footprint without undue tension. The biceps tendon provides a local autologous source of collagen graft that acts as an augment.[6]

In this Technical Note, we describe arthroscopic rotator cuff repair augmented with a LHBT in a massive rotator cuff tear with poor tissue quality.

Surgical Technique

Surgery is performed under general anesthesia and interscalene-block anesthesia. The patient can be positioned in either the beach-chair or lateral decubitus position. We position the patient in a lateral position (Shoulder Suspension System; Arthrex, Naples, Florida). After sterile preparation and draping, bony landmarks are outlined.

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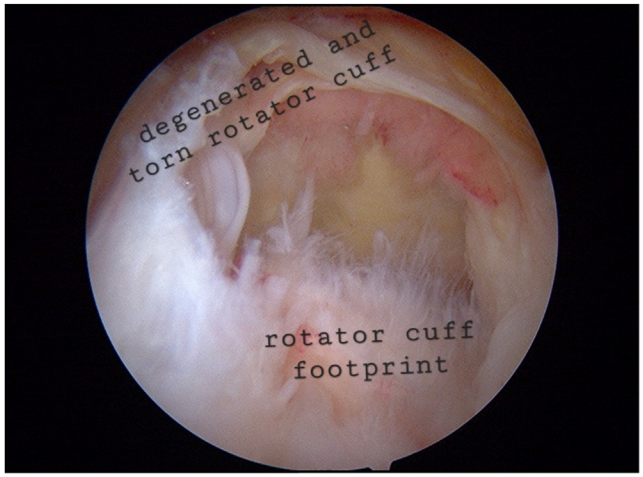

Fig 1. Patient in the lateral decubitus position. Diagnostic arthroscopy of right shoulder through posterior working portal. Through the anterior working portal, the extensive release of the torn rotator cuff is done to obtain excursion of the rotator cuff onto the footprint without tissue tension.

A standard posterior portal is used to perform a routine diagnostic arthroscopy of the glenohumeral joint. The degree of a rotator cuff tear, the lesions of the biceps tendon, and other intraarticular pathologies are evaluated. The arthroscope is then withdrawn and the arthroscope sheath is redirected into the subacromial space. A lateral portal is then made. A subacromial bursectomy is done. Acromioplasty may be done in indicated patients. Viewing through the lateral portal, the tear size is measured in the anterior-posterior direction using a calibrated probe through the posterior portal. Based on the size of the tear, degree of retraction, mobility, tissue thickness, and quality, reparability of the torn rotator cuff is assessed.

Fig 2. Patient in the lateral decubitus position. Viewing through the posterior portal. Through the anterior portal, the biceps tenotomy is done at the insertion.

Fig 3. Patient in the lateral decubitus position. Viewing through the posterior portal. Through the anterior portal, the rotator cuff footprint is debrided using a shaver.

The retracted torn rotator cuff is extensively released using a radiofrequency ablator. The decision to perform a biceps augmented rotator cuff repair or reverse biceps tenodesis depends on the remaining cuff tissue quality and mobility of the cuff after release. If footprint repair is not possible after adequate release and medialization of the footprint, we prefer to perform a reverse biceps tenodesis or SCR. If the cuff tissue is mobile enough for a footprint repair, the remaining tendon tissue quality is not good, and the suture limbs are in danger of a cut-through, we perform rotator cuff repair augmented with biceps tendon (Fig 1).

The arthroscope is inserted into the glenohumeral joint. Using arthroscopic scissors or a radiofrequency probe, a biceps tenotomy is done at the insertion site close to the posterosuperior labrum (Fig 2). Another

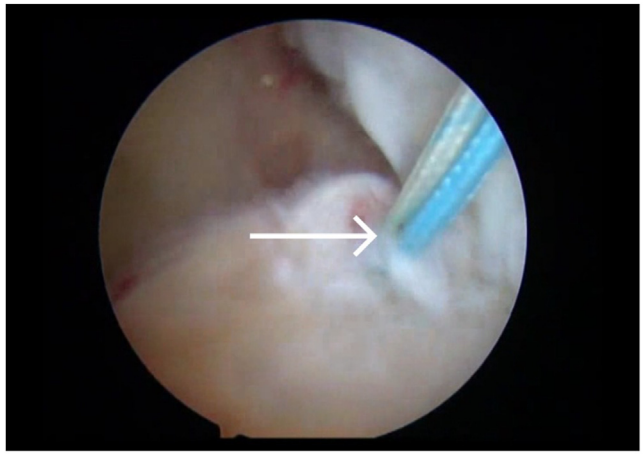

Fig 4. Patient in the lateral decubitus position. Viewing through the posterior portal. Through the anterior portal, a double-loaded anchor is inserted on the rotator cuff footprint anteriorly. The arrow mark shows the double-loaded anchor inserted.

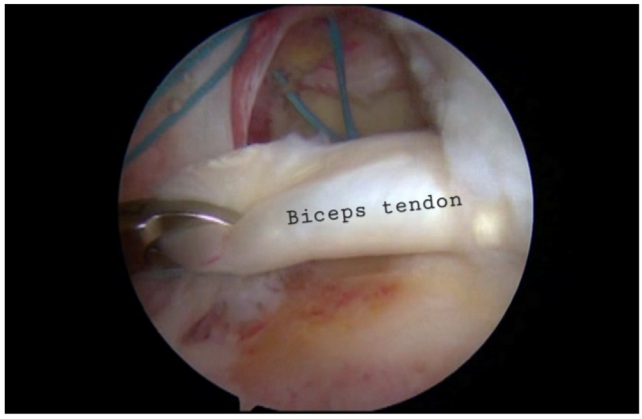

Fig 5. Patient in the lateral decubitus position. Viewing through the grand canyon view portal. The tenotomized biceps tendon is passed from the glenohumeral cavity into the subacromial space through the rotator cuff defect through the lateral portal.

portal is created posterior to the lateral portal midway between the posterior and lateral portal, known as the "grand canyon view portal," which is employed as the viewing portal for further repair. The arthroscope is again inserted into the subacromial space. The rotator cuff footprint is debrided using a shaver (Fig 3). A double-loaded anchor (HEALICOIL; Smith & Nephew) is inserted on the rotator cuff footprint anteriorly (Fig 4). The 2 limbs of 1 suture of the double-loaded anchor are shuttled through the rotator cuff using a lasso suture passer. The tenotomized biceps tendon is passed from the glenohumeral cavity into the subacromial space through the rotator cuff defect through the lateral portal (Fig 5). The second suture of the

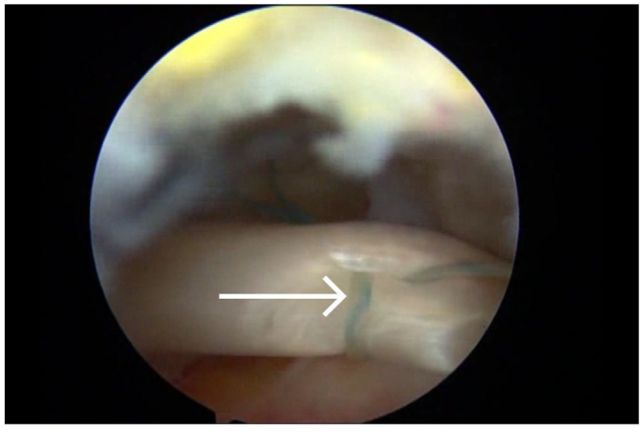

Fig 6. Patient in the lateral decubitus position. Viewing through the grand canyon view portal. Through the lateral portal, the second suture of the double-loaded anchor is retrieved through the substance of the biceps tendon using the lasso suture passer and tied using the lasso-loop technique. The first suture is shuttled through the rotator cuff using a lasso suture passer.

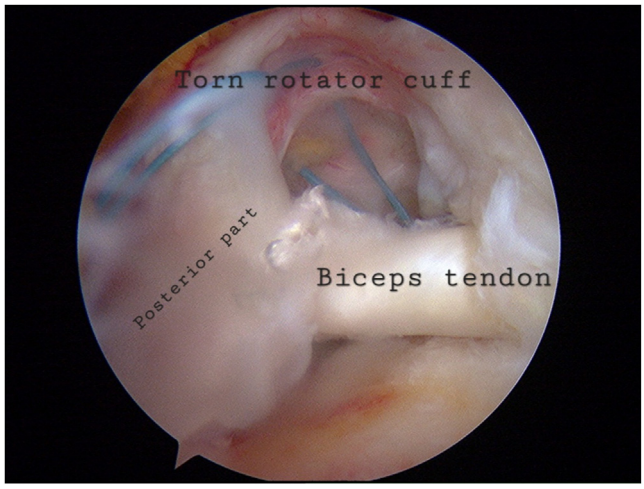

Fig 7. Patient in the lateral decubitus position. Viewing through the grand canyon view portal. Through the lateral portal, the proximal tip of the biceps tendon is tied to the posterior part of the torn rotator cuff with simple sutures.

double-loaded anchor is shuttled through the substance of the biceps tendon using the bird beak suture passer (Rhino suture passer; Arthrex) and tied using the lasso-loop technique (Fig 6). The proximal tip of the biceps tendon is tied to the posterior part of the torn rotator cuff with simple sutures (Fig 7). A second double-loaded anchor (HEALICOIL; Smith & Nephew) is inserted posteriorly at the rotator cuff footprint. The 4 sutures of the anchor are retrieved through the rotator cuff using the lasso suture passer and tied. The third double-loaded suture anchor (TwinFix Ti 5; Smith & Nephew) is placed between the first and second

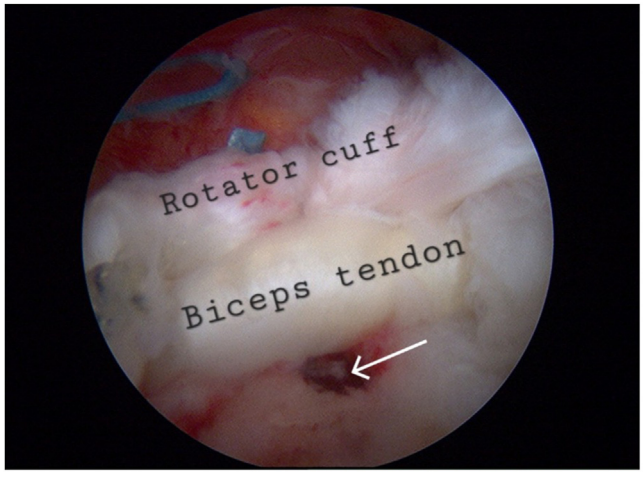

Fig 8. Patient in the lateral decubitus position. Viewing through the grand canyon view portal. Through the lateral portal, second and third double-loaded anchors are inserted at the footprint and all the sutures are retrieved through both the rotator cuff tissue and the biceps tendon using a lasso suture passer. The arrow shows the medial row anchor inserted.

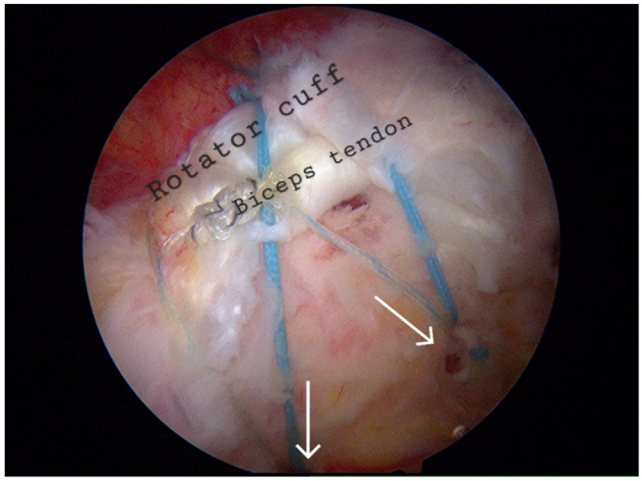

Fig 9. Patient in the lateral decubitus position. Viewing through the grand canyon view portal. Through the lateral portal, double-row rotator cuff repair is done using 2 lateral row anchors. The arrow shows the lateral row anchor.

anchors. The 4 limbs of the anchor are retrieved through both the rotator cuff and the biceps tendon proximal to the anchored part (Fig 8). Double-row repair of the rotator cuff is done with 2 lateral row anchors (SwiveLock; Arthrex) (Fig 9).

Postoperative Rehabilitation

In the immediate postoperative period, passive exercises, including pendulum, passive forward flexion, and external rotation exercises, are performed. Active range of motion is started only after 6 weeks postoperatively or after a full passive range of motion has been attained. At 6 weeks postoperatively, active-assisted exercises are initiated. Muscle-strengthening exercises are gradually introduced. For the first 6 months, activities and exercises that can cause stress to the shoulder are avoided.

Discussion

Arthroscopic repair of chronic retracted rotator cuff tears remains challenging to shoulder arthroscopy surgeons. Although 24% to 74% successful healing rates have been reported in massive rotator cuff tears, there is a high incidence of retears and incomplete healing.[7]

Table 1. Advantages and Disadvantages of Our Technique

Pearls	Pitfalls
• Structural support to the poor-quality rotator cuff tissue • Enhance healing potential • In contrast to biceps superior capsular reconstruction, biceps augmentation can be done even with an associated SLAP tear	• Technically demanding • Indicated in rotator cuff tears with an adequate excursion onto the cuff footprint without undue tension after releases • Persistent pain at the biceps tendon groove

With the recent technical advances, most of the massive rotator cuff tears are managed successfully. Due to the degenerative nature of the tears and their propensity to heal incompletely, grafting or augmentation of repair is desirable. The biceps tendon is highly vascular and a rich source of tenocytes and fibroblasts, which can promote biological healing.[8] The LHBT provides an autologous source of collagen graft that can be performed arthroscopically without additional exposure or implants.[6] In massive degenerate rotator cuff tears in which the rotator cuff tissue can be released and fixed onto the footprint without much tissue tension, the LHBT can act as an augment providing structural support to the poor-quality rotator cuff tissue and enhancing the healing process.

In massive irreparable rotator cuff tears, Mihata et al.[9,10] proposed SCR using an autologous fascia lata graft to restore the restraining effect of the superior capsule and the balanced coupled force. The LHBT is used as an alternative to the fascia lata graft and dermal allograft in SCR, avoiding a second surgical site and donor site morbidity of the fascia lata graft and the high cost of a dermal allograft.[3,4] Keeping the insertion at the superior glenoid and adjacent labrum intact, the LHBT is fixed at the rotator cuff footprint, creating a reverse tenodesis effect, which provides a downward force on the humeral head.

The decision between biceps augmented rotator cuff repair and reverse biceps tenodesis thus depends on the mobility of the cuff tissue after release and the tissue quality. If the rotator cuff tissue is mobile enough for a footprint repair but with poor tissue quality, the suture limbs through the rotator cuff tissue are in danger of a cut-through. Augmenting double-row rotator cuff repair with the LHBT improves tissue grip by providing and enhancing healing potential by bringing new blood supply to the rotator cuff tissue.

The advantages and disadvantages of our technique are described in Table 1.

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