All-Arthroscopic Superior Shoulder Capsule Reconstruction With Partial Rotator Cuff Repair

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Abstract: Massive irreparable rotator cuff tears are difficult to treat. Although several treatment options exist, none provides superior long-term results. There is no consensus on optimal surgical technique. Superior capsular reconstruction is an operative treatment option aimed at restoring native biomechanics of the glenohumeral joint by providing a restraint to superior subluxation. Partial rotator cuff repair for massive tears has also been shown to improve shoulder kinematics and can be performed in conjunction with superior capsule reconstruction. The authors describe a technique for arthroscopic superior capsular reconstruction with a dermal allograft with concomitant partial rotator cuff repair. [Orthopedics. 2017; 40(4):e735-e738.]

They present a surgical technique for this combination.

Surgical Technique

The authors recommend that the patient be placed in the beach chair position with a mobile arm support, which allows for accurate shoulder position. The patient is prepped and draped in sterile fashion to allow free movement of the extremity. Anterior, posterior, and lateral portals with accessory anterolateral and posterolateral portals are made to facilitate superior glenoid and humerus medial row fixation (Figure 1). The arthroscope is inserted through the posterior portal, and a diagnostic arthroscopy is performed. The subacromial space is then entered and debrided from the lateral portal.

It must be confirmed that the supraspinatus is not amenable to primary repair. The supraspinatus fossa directly superior to the glenoid and the supraspinatus footprint on the humeral head are debrided with a shaver and radiofrequency ablation.
and the bony surface is prepared with a burr (Video). Care must be taken when performing debridement of the glenoid because the suprascapular nerve passes medial to the superior glenoid. The authors then take great care to repair any infraspinatus and subscapularis tears. This includes developing the planes between the labrum and the rotator cuff and between the infraspinatus and the deltoid and scapular spine. With thorough releases with or without interval slides, the authors are typically able to mobilize the infraspinatus enough for repair to the native footprint. This will facilitate posterior fixation of the SCR graft.

For glenoid fixation, Suture-Taks (Arthrex, Naples, Florida) are inserted in the standard fashion into the anterior and posterior dimensions and 15 mm is added to the lateral dimension to account for the supraspinatus footprint. Two additional holes are placed along the posterior portion of the graft for infraspinatus fixation.

The graft is measured using a 220-mm 60° arthroscopic measurement probe (model AR-4070-01; Arthrex) with the shoulder positioned so that the graft will be taut under low degrees of abduction. The authors recommend 30° of abduction, 20° of forward flexion, and 10° of external rotation. The anteroposterior glenoid dimension is measured through the anterolateral portal, and the anteroposterior humerus dimension is measured through the lateral or anterolateral portal. Mediolateral dimensions are best measured through the lateral portal. To provide tissue for fixation, 5 mm is added to the medial, anterior, and posterior dimensions and 15 mm is added to the lateral dimension to account for the rotator cuff footprint (Figure 3). A 3.5-mm-thick human dermal allograft (ArthroFlex; Arthrex) is then prepared on the back table. The dermal (rough) side of the graft is placed inferiorly to interact with the articular components. The basement membrane (smooth) side will face the surgeon during preparation and insertion into the joint and can be marked. The graft is cut to the measured dimensions. A 1-mm disposable biopsy punch (Integra Millex, Plainsboro, New Jersey) is used to make suture passing holes in the graft—1 hole at each corner of the originally measured dimensions, and 2 holes posteriorly for infraspinatus fixation. The graft is placed on a towel at the lateral portal in the orientation in which it will sit. The sutures are then sequentially passed through the respective holes with care to avoid tangling (Figure 4).
Single suture strands from each of the medial holes are tied together over a switching stick to create a double pulley system. The remaining strands are pulled taut and with constant tension, and a large arthroscopic grasper is used to feed the graft into the joint. The graft is then manipulated with a grasper to lie flat in the desired orientation. The remaining medial sutures are tied together over the graft, finalizing medial fixation. Attention is then turned to the lateral row. One suture from each medial humeral row anchor is fed through a SwivelLock, which is placed at the anterolateral portion of the supraspinatus footprint. The same technique is performed for the posterolateral fixation, thus completing the double-row humeral fixation.

The graft is then fixed posteriorly to the infraspinatus tendon, whether intact or repaired during the partial rotator cuff repair. This is most easily accomplished by viewing from the lateral portal and working through the posterior or posterolateral portal. A 45° curved QuickPass SutureLasso (Arthrex) is passed through the infraspinatus tendon adjacent to 1 posterior graft hole, then through the graft. The suture is then tied down. The same technique is performed for fixation through the remaining portion of the posterior graft. Anterior fixation at the rotator interval is not performed because this creates unnecessary graft restraint and can limit shoulder range of motion. Important technique pearls and pitfalls are summarized in the Table.

Figure 4: Clinical image of the lateral (LAT) shoulder with sutures passed through the graft. All sutures remain untangled and without soft tissue bridges. They are parked out of the LAT portal and passed through the graft. All suture management is performed ex vivo prior to insertion of the graft, which should remain base-membrane-side up, such that the dermal side contacts the articular components. Abbreviations: ANT, anterior; MED, medial; POST, posterior.

**Discussion**

Massive irreparable rotator cuff tears are a difficult clinical problem. A range of treatment strategies have been used with varied results, and there is no consensus regarding optimal treatment. Superior capsular reconstruction has been shown to restore glenohumeral stability and subacromial contact pressures in both in vitro and in vivo studies. Superior capsule reconstruction was originally described using a folded fascia lata autograft. The authors use a 3.5-mm-thick dermal allograft. This has excellent mechanical properties and suture retention, does not require a 6- to 9-mm-thick fascia lata autograft, and decreases donor-site morbidity and operative time.

The authors believe that concomitant partial rotator cuff repair of the infraspinatus and subscapularis is important to the success of SCR. Burkhart et al first described partial rotator cuff repair in the setting of massive tears, in which the transverse force couples—the subscapularis anteriorly and the infraspinatus–teres minor complex posteriorly—are disrupted. Studies have found mixed results for partial repair alone, with initial improvement in range of motion, strength, function, and pain but waning success at longer-term follow-up. This may be because restoring the transverse couple alone is not enough to limit superior subluxation of the humeral head and restore fixed fulcrum kinetics. Repair of the infraspinatus also ensures posterior side-to-side fixation of the graft, an important component in restoring the superior stability in SCR.

The authors believe that the described SCR and partial repair work in concert to restore the mechanics of the glenohumeral joint. This is a reproducible technique that improves pain and strength and may delay shoulder arthropythpathy.

**References**

2. Anley CM, Chan SK, Snow M.


