Superior Capsular Reconstruction with a Partial Rotator Cuff Repair

A Case Report

John M. Tokish, MD, Amit Momaya, MD, and Troy Roberson, MD

Investigation performed at the Steadman Hawkins Clinic of the Carolinas, Greenville Health System, Greeneville, South Carolina

Abstract

Case: Chronic massive irreparable rotator cuff tears remain challenging to treat. We present the case of a 70-year-old active and healthy woman who presented with 6 months of worsening shoulder pain and function; she had experienced considerable deterioration over the past 2 months. Nonoperative management of the massive rotator cuff tear was not successful. Superior capsule reconstruction (SCR) was performed with a partial rotator cuff repair.

Conclusion: SCR is an exciting advancement for the chronic massive irreparable rotator cuff tear, one of the more challenging problems encountered by shoulder surgeons. Our patient was doing well at the 1-year follow-up and was very satisfied with the outcome.

The treatment of chronic massive rotator cuff tears remains a challenge. While several surgical options have been proposed[1-10], each has been met with concerns and limitations. An evolution on how to approach these patients has been proposed by Mihata et al.[11]. Early clinical results with superior capsular reconstruction (SCR) are promising, reporting dramatic increases in American Shoulder and Elbow Surgeons (ASES) scores and range of motion, but it should be noted that no long-term studies currently are available to assess the durability and long-term outcomes of this procedure. The rationale for this early success stems from biomechanics showing that the superior capsule is a key contributor toward the maintenance of passive stability of the glenohumeral joint[12,13]. Therefore, the proposed mechanism of action is that SCR with graft fixation from the glenoid to the greater tuberosity allows a centering effect from which the balanced force couples and the deltoid may gain advantage. While this has been well studied and the clinical results are promising, to our knowledge, there has been no report in the literature describing the incorporation of a partial superior rotator cuff repair into the SCR. We describe this modification of the SCR involving the incorporation of a partial superior rotator cuff repair.

The patient was informed that data concerning the case would be submitted for publication, and she provided consent.

Case Report

A 70-year-old active and healthy woman presented with 6 months of worsening shoulder pain and function, with considerable deterioration over the past 2 months and no success with nonoperative management. Physical examination revealed pseudoparalysis (limited active elevation even in the setting of a diagnostic injection), and magnetic resonance imaging (MRI) demonstrated a massive rotator cuff tear involving the supraspinatus and infraspinatus muscles with retraction to the glenoid and Goutallier grade-III changes (50% fatty muscle atrophy) of both tendons without arthritis (Figs. 1-A, 1-B, and 1-C).

The patient was counseled about surgical options, including an attempt at repair or partial repair, a biceps tenotomy, a reverse shoulder arthroplasty (RSA), and SCR. Considering the functional limitations and her desire to return to a high activity level, she opted for soft-tissue reconstruction in order to avoid RSA. She provided consent for an intraoperative decision for repair if adequate mobilization could be obtained, an SCR with a partial rotator cuff repair if there was residual tendon that could not be repaired without undue tension, or an SCR alone if the superior rotator cuff was completely immobile or without adequate residual tendon. In this case, an SCR was performed with a partial rotator cuff repair. The procedure is described in detail below.

Our patient was doing well at the 1-year follow-up. She reported a visual analog scale pain score of 1 out of 10. The Single Assessment Numeric Evaluation (SANE) score was 85, and the ASES score was 88. Physical examination revealed 145° of forward elevation and 30° of external rotation, with 5 of 5 strength in both planes. She was very satisfied with the outcome.

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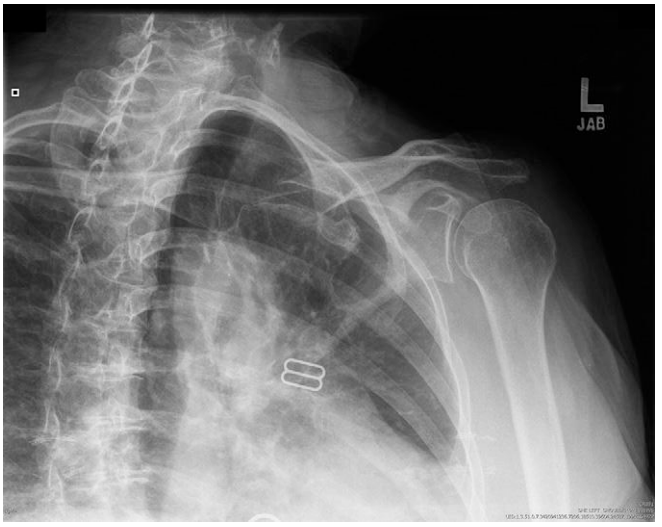

Fig. 1-A

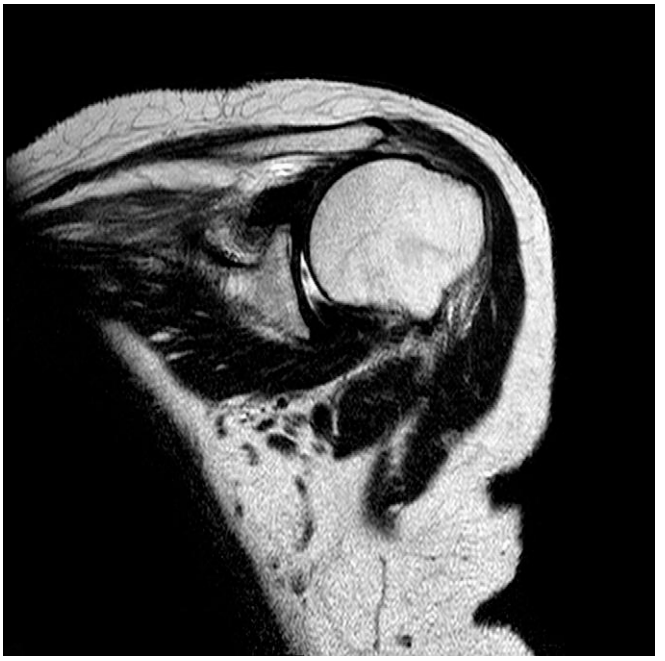

Fig. 1-B

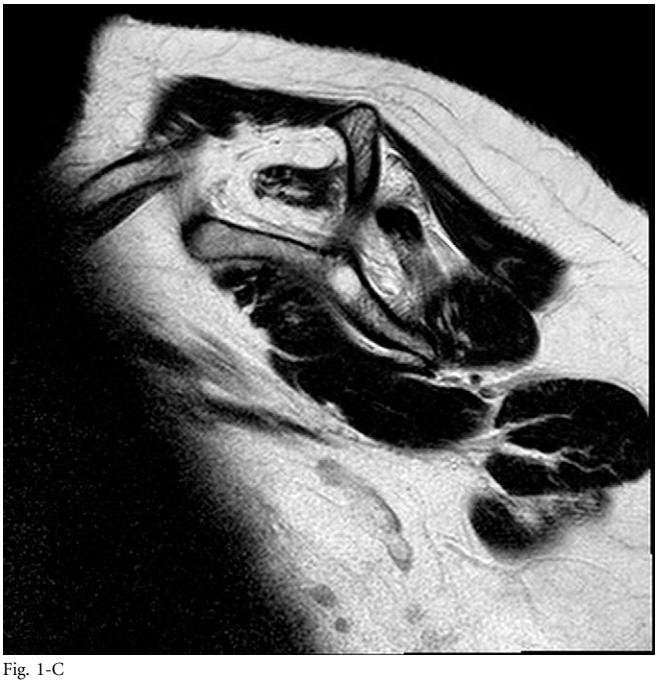

Fig. 1-C

Figs. 1-A, **1-B,** and **1-C** Imaging. **Fig. 1-A** Anteroposterior radiograph of the left shoulder. **Fig. 1-B** Coronal T2-weighted MRI of the left shoulder showing retraction of the superior rotator cuff and humeral head elevation. **Fig. 1-C** Sagittal T2-weighted MRI of the left shoulder showing the fatty degeneration of the supraspinatus and infraspinatus muscles.

Surgical Technique

Step 1: Preoperative Workup

The case described above represents a typical patient in whom SCR would be performed. Patients who have a massive irreparable rotator cuff tear are considered for an SCR procedure. Preoperative workup includes a thorough physical examination to confirm substantial weakness with external rotation and elevation. In addition to plain radiographs, MRI is obtained to evaluate for retraction of the rotator cuff, arthropathy of the glenohumeral joint, and the degree of fatty infiltration of the supraspinatus and infraspinatus.

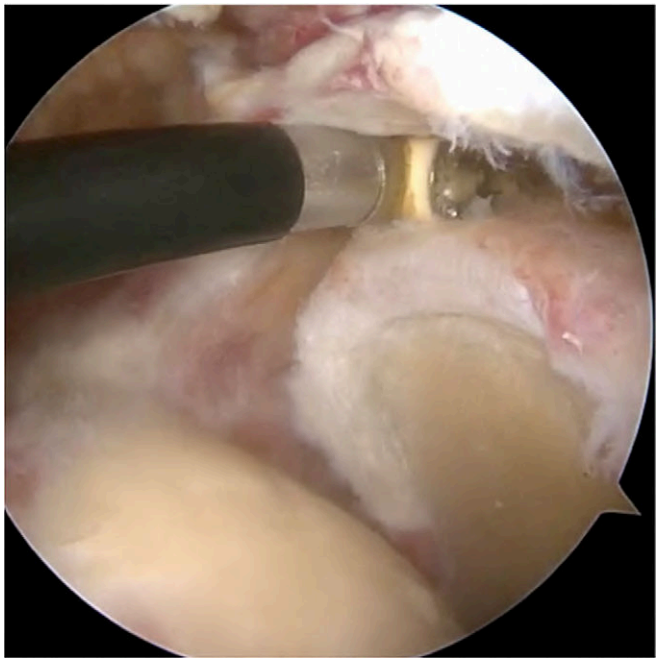

Fig. 2

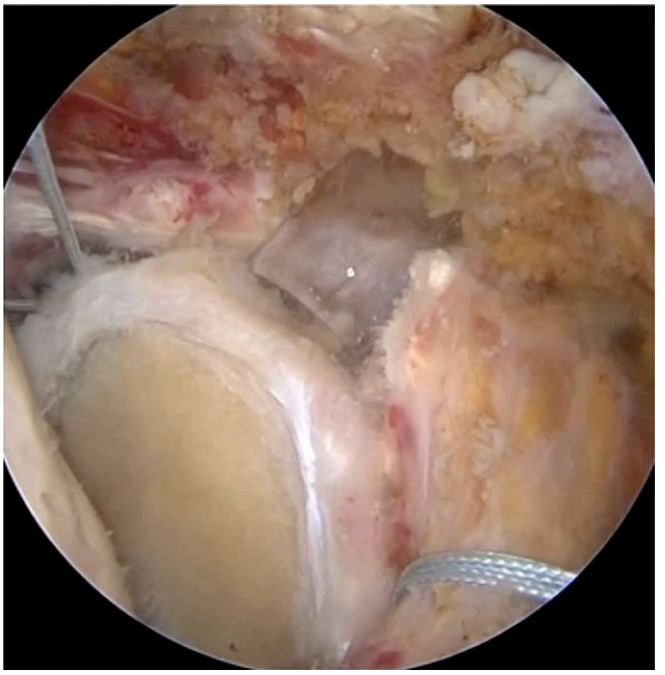

Fig. 3

Fig. 2 View of the glenoid and the rotator cuff remnant from the accessory posterolateral viewing portal, depicting adequate remaining rotator cuff tissue for incorporation into the SCR with a partial rotator cuff repair. **Fig. 3** View from the posterolateral accessory viewing portal of the cannula through the Neviaser portal, which was used as a retractor for the remnant of the rotator cuff tissue in order to access the glenoid neck for preparation and superior anchor placement.

Step 2: Surgical Positioning and Diagnostic Arthroscopy

When performing this type of surgery, the patient is placed in the lateral decubitus position on a beanbag with distal traction. Standard posterior and anterosuperior portals are created. A 10-mm-diameter PassPort Cannula (Arthrex) is established in the midlateral portal. If the rotator cuff cannot be adequately mobilized to perform a repair without undue tension and there is inadequate residual tendon for partial repair, we prepare for SCR alone. If there is residual tendon and we can incorporate a partial superior rotator cuff repair into the SCR, this option is chosen (Fig. 2).

Step 3: Debridement and Preparation

A Neviaser portal is placed with a 7-mm instrument cannula (Arthrex), and an accessory posterolateral viewing portal is made. Working from either the lateral or the Neviaser portal, any remaining soft tissue is debrided from the glenoid neck, leaving any remaining labrum intact. The debridement along the anterior glenoid neck is continued until the base of the coracoid is visualized. Superiorly, the plane between the remnant of the rotator cuff and the underlying glenoid neck is developed and debrided (Fig. 3). Debridement is extended posteriorly so that the 10, 12, and 2 o'clock positions are prepared.

Step 4: Placement of Medial Anchors

The medial edge of the graft will be secured to the glenoid neck underneath any residual rotator cuff tissue. The anterior

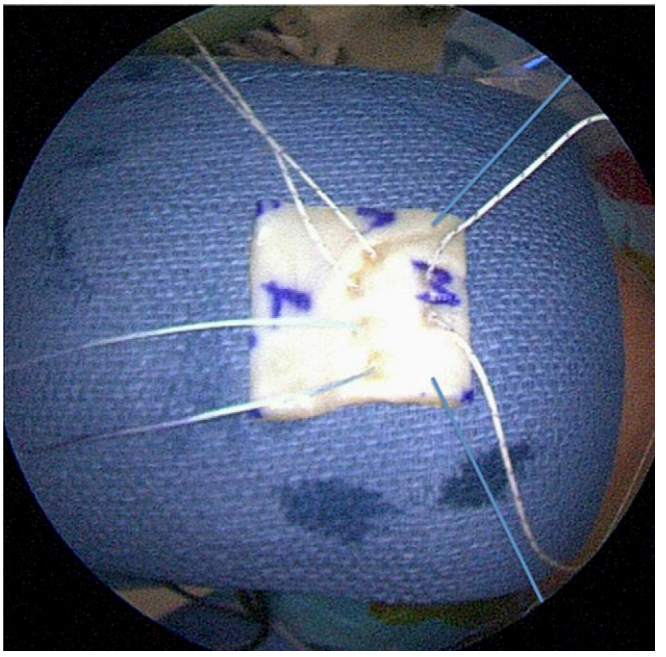

Fig. 4

Final graft preparation after appropriate sizing and passage of all of the medial (M) and central sutures to be incorporated for the partial rotator cuff repair. The medial sutures include 2 middle sutures for placement in the superior glenoid SwiveLock anchor, as well as corner stitches from each of the anterior and posterior glenoid neck anchors. Central horizontal mattress sutures are prepassed for later incorporation of the remnant of the rotator cuff tissue.

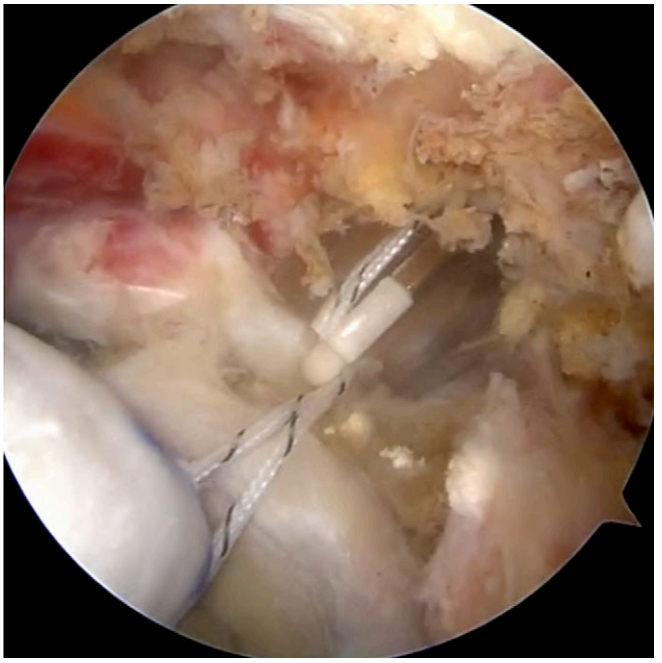

Fig. 5

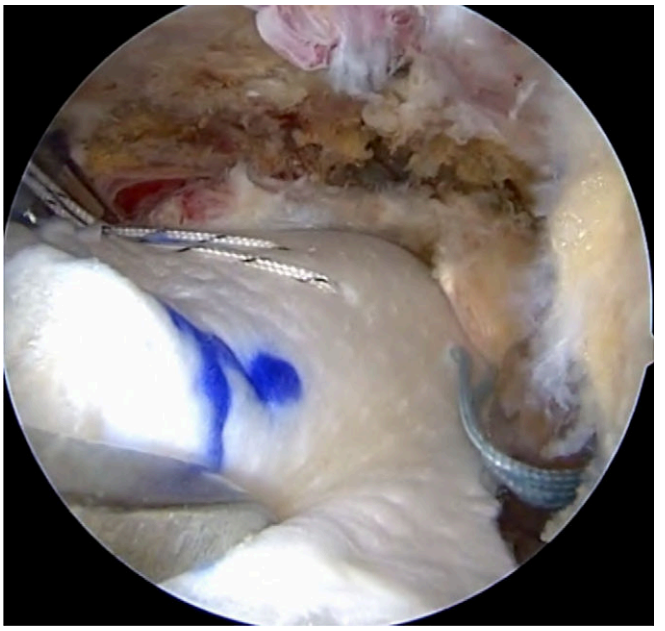

Fig. 6

Fig. 5 Placement of superior medial glenoid fixation with the SwiveLock anchor and the 2 middle stitches from the medial graft. Subsequently, the anterior and posterior medial stitches were tied. **Fig. 6** After medial fixation, the prepassed central sutures for the rotator cuff repair are retrieved from the anterior and posterior portals while lateral fixation of the graft to the greater tuberosity is performed.

anchor is placed in line with the base of the coracoid (at the 10 o'clock position in the left shoulder). For placement of a single-loaded #2 FiberWire (Arthrex) on a 3-mm SutureTak Suture Anchor (Arthrex), the hole is drilled and the anchor is placed from the anterior portal. The posterior anchor is placed from the posterior portal at approximately the 2 o'clock position in the left shoulder. A suture from each of the anterior and posterior anchors is retrieved out of the lateral PassPort Cannula (Arthrex). Using the cannula from the Neviaser portal as a retractor, a punch instrument is used to place the hole superiorly for later placement of a 4.75-mm SwiveLock (Arthrex) anchor.

Step 5: Graft Preparation, Insertion, and Medial Fixation

An acellular dermal ArthroFLEX allograft (Arthrex) is thawed, and the appropriate dimensions are determined arthroscopically. The medial-to-lateral measurement is taken with use of a calibrated probe to measure from the glenoid neck to the lateral rotator cuff footprint on the greater tuberosity. Measurements are taken at the level of the anterior and posterior anchors. The anterior-to-posterior distance is measured at the neck of the glenoid and at the lateral rotator cuff footprint. A free #2 FiberWire is passed in a horizontal mattress fashion for 5 mm, inset at about the middle third of the medial side (toward the glenoid) of the graft for later anchoring in the superior glenoid. For incorporation of the partial superior rotator cuff repair, #2 FiberWire horizontal mattress stitches are similarly passed into the midportion of the graft, 1 each in the more anterior and posterior halves of the graft. Next, the graft is brought to the patient, and the previously retrieved sutures from the anterior and posterior glenoid anchors are passed through the respective corners of the graft (Fig. 4). Each of these sutures are placed back into the joint and retrieved out of their respective portals. Then, the central medial horizontal mattress sutures are placed into the joint and retrieved from the Neviaser portal. An Allis clamp is used to fold the graft lengthwise upon itself and manually push the graft through the PassPort while pulling tension on the sutures from the anterior, posterior, and Neviaser portals. As viewed from the posterolateral accessory portal, once the graft has entered the joint, the central medial sutures are anchored by a 4.75-mm SwiveLock through the Neviaser portal in the previously drilled superior hole (Fig. 5). Medial fixation is completed by sequentially tying knots for the anterior and posterior anchors.

Step 6: Lateral Graft Fixation

The previously placed central sutures for the subsequent partial rotator cuff repair are retrieved (Fig. 6). From the lateral portal, a #2 FiberWire horizontal mattress stitch is placed in the posterolateral corner of the graft. Sutures are passed into a 4.75-mm SwiveLock, and the anchor is placed with the sutures in appropriate tension. This process is repeated in the anterior corner of the graft and the footprint.

Step 7: Partial Rotator Cuff Repair

The horizontal mattress sutures for incorporation of the superior rotator cuff repair were previously placed (as mentioned above in step 5). These sutures are retrieved through the lateral

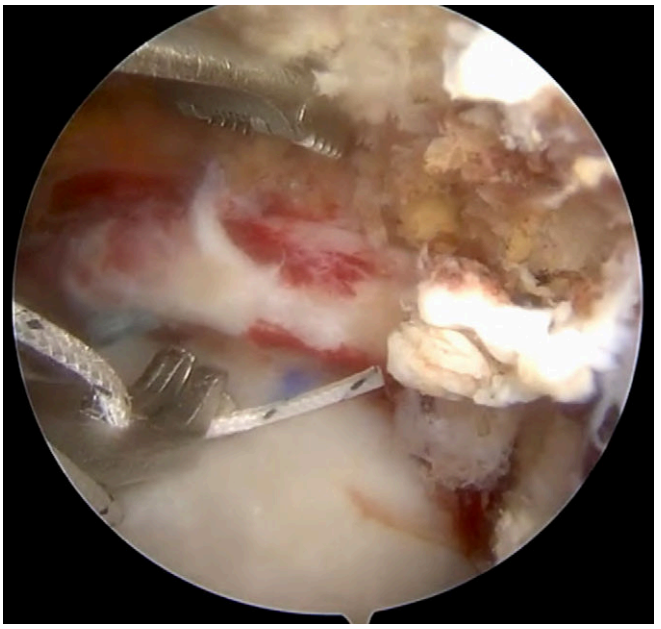

Fig. 7

After lateral fixation, the central sutures are retrieved from the lateral portal and passed with a Scorpion (Arthrex) suture-passing device in a horizontal mattress fashion in the anterior and posterior portions.

portal and passed through the residual superior rotator cuff tendon in a horizontal mattress fashion, and they are spaced, when placed in the graft, with 1 mattress stitch in the anterior portion and 1 in the posterior portion (Fig. 7). Arthroscopic knots are tied, securing the superior rotator cuff to the midportion of the graft. A #2 FiberWire is then passed through the posterior midportion of the graft. A suture-passing device is used to pass the stitch through the remaining teres minor tendon, and a knot is tied (Figs. 8 and 9). The preceding steps are demonstrated in Video 1.

Step 8: Postoperative Rehabilitation

Postoperatively, the patient is treated in the same manner as if he or she had undergone a massive rotator cuff repair. A shoulder immobilizer with an abduction pillow is used, and the patient is encouraged to perform elbow, wrist, and hand exercises for 6 weeks, along with gentle passive glenohumeral motion. Progressive motion is begun at 6 weeks, and strengthening is begun at 12 weeks. The patient is gradually returned to activity when motion, strength, and confidence return over a 6-month period.

Discussion

SCR is an exciting advancement for one of the more challenging problems encountered by shoulder surgeons: the chronic massive irreparable rotator cuff tear. The rationale behind the standard technique proposes that the superior capsular graft has a tenodesis effect, providing static glenohumeral stability upon which the balanced force couples and the deltoid may gain mechanical advantage. In some cases, this may be the best possible outcome; however, there are cases

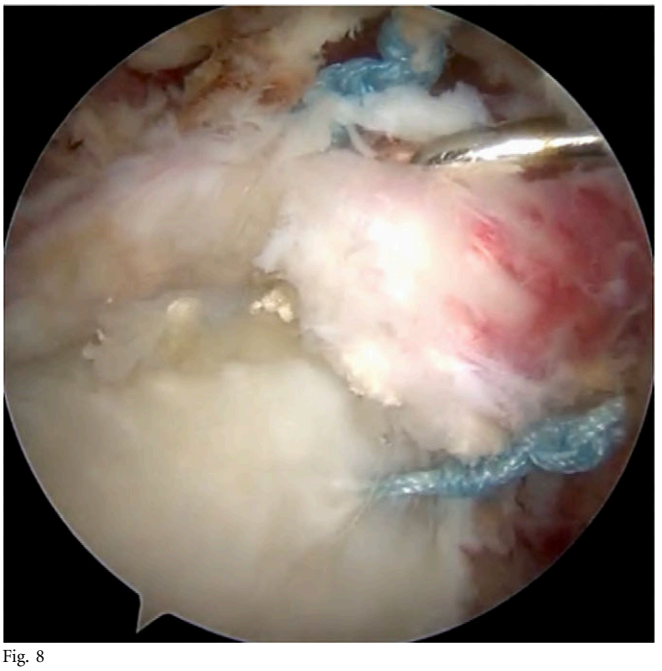

Fig. 8

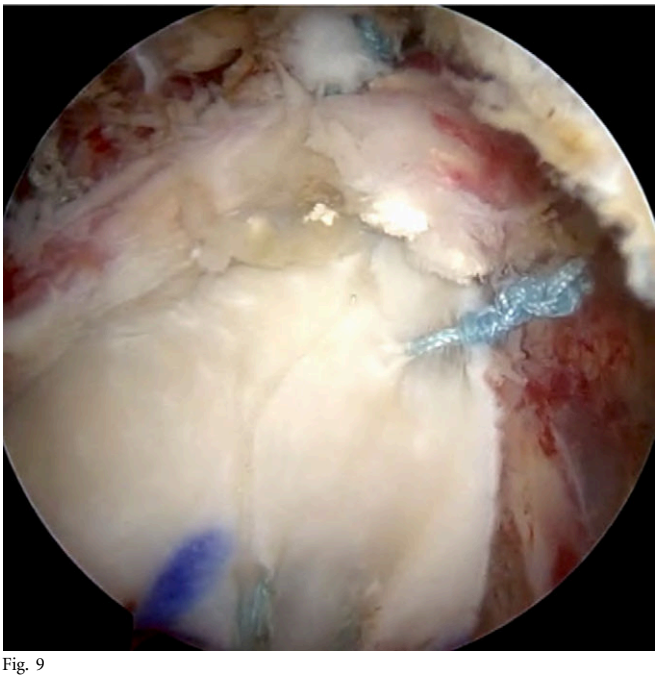

Fig. 9

Fig. 8 Side-to-side simple suturing of the posterior edge of the graft to the intact teres minor muscle/tendon, with a view of the posterosuperior horizontal mattress stitch in the remnant of the rotator cuff. **Fig. 9** The completed SCR with a partial rotator cuff repair, depicting lateral row fixation, posterior side-to-side suturing in the posterior remnant of the rotator cuff, and superior horizontal mattress suturing in the remnant of the rotator cuff. (The medial glenoid fixation, separate from the superior rotator cuff partial repair, is not shown.)

where the superior rotator cuff remains modestly mobile at or lateral to the glenoid.

In these cases, we propose that added benefit may be obtained by incorporating the superior rotator cuff remnant into the graft itself, which may improve the biologic environment for graft incorporation, as was demonstrated by a previous study showing that at least some of the vascularity of the superior capsule comes from the overlying rotator cuff[14]. Anecdotally, some have considered attempting improved biologic incorporation of the graft with use of sutures from the medial fixation at the glenoid through the remnant of the rotator cuff. However, with an anchor point at the glenoid, this would only serve as a tether from the glenoid to the rotator cuff and thus afford no potential added dynamic benefit. Therefore, we advocate that sutures be placed within the midportion of the graft for superior repair of a residual tendon when present, in addition to repair to the posterior aspect of the rotator cuff. This allows for a freely mobile superior rotator cuff with a dynamic effect. To our knowledge, this case report describes the first documentation of incorporation of the remnant of the superior rotator cuff in a partial repair to the SCR graft. Early results at our institution with the standard technique are promising, and we look forward to studying whether this technique modification will lead to a long-term improvement in outcomes. ■

John M. Tokish, MD[1]
Amit Momaya, MD[1]
Troy Roberson, MD[1]

[1]Steadman Hawkins Clinic of the Carolinas, Greenville Health System, Greenville, South Carolina

E-mail address for J.M. Tokish: jtoke95@aol.com

ORCID iD for J.M. Tokish: 0000-0003-4557-4537

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