Superior Capsular Reconstruction

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abstract

Superior capsular reconstruction (SCR) of the shoulder has recently gained popularity as an option for joint-preserving shoulder surgery for patients with an irreparable rotator cuff tear. In the absence of glenohumeral arthritis, rotator cuff tear irreparability should only be diagnosed for most patients after a careful diagnostic arthroscopy. Superior capsular reconstruction adds biological, passive, superior constraint to the glenohumeral joint, thereby optimizing the rotator cuff force couples and improving joint kinematics. At short-term follow-up, SCR has been shown to be effective for pain relief and restoration of active shoulder motion, even in the worst cases of shoulder dysfunction (true shoulder pseudoparalysis). The rapid early adoption and expansion of SCR is justified by its excellent anatomical, biomechanical, and short-term clinical results. The techniques for arthroscopic SCR using dermal allograft continue to improve; however, the operation remains technically demanding. Patients with risk factors for irreparability and who might benefit from reconstruction of the superior capsule should be counseled about the operation as an additional, joint-preserving procedure that can be done in conjunction with arthroscopic, partial rotator cuff repair. [Orthopedics. 2017; 40(5):271-280.]

Currently, arthroscopic superior capsular reconstruction (SCR) is arguably the “hottest topic” in shoulder surgery. Orthopedic surgeons have adopted SCR at an amazing pace, as evidenced by more than 10,000 cases worldwide from 2014 to the present being reported by a single implant vendor for this procedure (T. Dooney, Group Product Manager, Upper Extremity, Arthrex, Inc, personal communication, July 2017). This is similar in magnitude (ie, a few thousand per year) to the estimated number of revision shoulder replacements or total elbow replacements that were performed annually in the United States during the previous decade. The enthusiasm for SCR as a novel procedure testifies to the difficulty of the problem it is intended to address: an irreparable rotator cuff tear in the patient poorly suited for alternative procedures, especially reverse shoulder arthroplasty. Additionally, anecdotal evidence, early published clinical results, and anatomical and biomechanical basic science studies support SCR as a viable surgical option for many patients who previously had few good choices. Yet, SCR represents an important additional tool for the shoulder surgeon and not a panacea for every challenging rotator cuff tear. Many questions remain about the best indications and techniques, the risks and complications, and the cost-effectiveness of this operation. In this article, the authors review the available evidence concerning arthroscopic SCR and attempt to place this knowledge into the broader context of the current state of shoulder surgery.

WHAT IS AN “IRREPARABLE” ROTATOR CUFF TEAR?

In rotator cuff surgery, the term “irreparable” has had an inconsistent definition during the past few decades. For example, when the authors previously published about the results of partial rotator cuff repair, they used the term irreparable to mean “operatively irreparable,” indicating that an operative repair had been attempted and no or only partial repair was possible. Prior to around the year 2000, the term irreparable was used similarly...
particularly attempted arthroscopic repair. The authors’ intraoperative experience has been that many seemingly irreparable tears turn out to be easily reparable with the right combination of reduction and/or mobilization techniques. Thus, the authors advocate that surgeons avoid the term irreparable unless this determination has been made intraoperatively.

How common are intraoperatively irreparable rotator cuff tears? In 2004, of all rotator cuff repairs performed by a single surgeon (S.S.B.), 95% of tears were completely reparable (unpublished data). In revision rotator cuff surgery and in massive cuff tears, the authors have found that approximately 85% of tears are completely reparable. With the advent of SCR, the authors’ referral practice for difficult rotator cuff tears has greatly expanded. So, it seemed reasonable to determine, in the current era, how many primary, massive rotator cuff tears were operatively irreparable with arthroscopic techniques and whether irreparability actually could be predicted with confidence based on preoperative imaging. Of 86 massive, primary rotator cuff tears, 76 (88%) were fully reparable. Preoperative tangent sign and Goutallier 3-4 fatty infiltration of the supraspinatus were associated with irreparability; however, most of the tears with these preoperative characteristics (70% and 57%, respectively) were fully reparable intraoperatively. Thus, surgeons should be cautious about presuming the ability to correctly predict the intraoperative irreparability of rotator cuff tears.

### Historical Aspects of SCR

Hanada et al first described a “superior capsular reconstruction” of the glenohumeral joint (Figure 1) as a revision operation in a paraplegic patient with an irreparable supraspinatus tendon tear. Despite its stated rationale, the operation in this original report failed to restore superior stability, provide pain relief, or restore shoulder range of motion, and its result was deemed “unsatisfactory.” Nearly 20 years later, Mihata et al presented both excellent clinical results and biomechanical data to support the previously described concept of a fascia lata allograft patch for the irreparable supraspinatus attached medially to the glenoid—as a reconstruction of the superior capsule—instead of to the irreparable tendon stump. Subsequently, a variety of allograft techniques have been described as modifications of the arthroscopic procedure of Mihata et al. In the authors’ practice, SCR essentially has never been performed as an isolated procedure. Rather, SCR represents an additional reconstruction that can be added to one or more of the following: partial rotator cuff repair, biceps tenotomy or tenodesis, modified subacromial decompression, and coracoplasty.

### SCR Clinical Results

Published and unpublished early clinical results for SCR have been promising. The original series by Mihata et al with a fascia lata autograft showed amazingly good clinical outcomes at minimum 2-year follow-up in 24 shoulders with irreparable large and massive posterosuperior cuff tears that underwent partial cuff repair and SCR. Improvements in clinical outcome scores and range of motion were dramatic (mean American Shoulder and Elbow Surgeons score: 24 preoperative to 93 postoperative, P<0.0001; mean elevation: 84° preoperative to 148° postoperative, P<0.001), particularly for the 83% of patients with healed grafts on postoperative magnetic resonance imaging. Perhaps of most interest, of 5 patients who had severe loss of active forward elevation (20° to 30°), 4 (80%) regained active overhead motion.

In the senior author’s (S.S.B.) personal, unpublished series of 97 arthroscopic SCRs using dermal allograft (Arthroflex 301; Arthrex, Inc, Naples, Florida), 34 shoulders have minimum 1-year follow-up. Only 2 patients (6%) have had further surgery, both after traumatic re-injury. One patient had revision SCR, and the other
was revised to a reverse shoulder arthroplasty. The remaining 32 patients have all reported satisfaction with the surgery, and there have been no complications. The mean visual analog scale pain score (0 to 10) decreased from 4.6 preoperative to 0.7 postoperative (P<.0001). The mean American Shoulder and Elbow Surgeons score improved from 51 preoperative to 88 postoperative (P<.001). The mean subjective shoulder value score improved from 37% preoperative to 87% postoperative (P<.001). The mean active forward elevation improved from 140° preoperative to 168° postoperative (P<.001). Six patients with the most severe dysfunction (in the authors’ opinion, unarguable true pseudoparalysis) had a mean forward elevation of 26° preoperative and 157° postoperative, with all regaining active overhead use of the arm at 1 year postoperatively.

**Anatomical and Biomechanical Rationale for SCR**

In the authors’ practice, strong justification for early adoption of SCR has come from basic science research that supports the operation as an anatomical and biomechanically sound shoulder reconstruction. In fact, the role of the superior capsule of the shoulder was likely underappreciated by surgeons in the past. The superior capsular complex has intricate anatomical features. Blending of fibers occurs both between the cuff tendons and from tendon into the superior capsule. Thus, the superior capsule serves to transmit force from the cuff musculature to bone and to reinforce the tendon insertions. In this manner, the superior capsular complex contributes to active glenohumeral stability.

Careful anatomical studies have revealed a larger insertional footprint of the superior capsule (Figure 2) than had previously been recognized—up to 5 to 9 mm in medial–lateral width at the anterior and posterior margins. The footprint of direct supraspinatus and infraspinatus tendinous insertion to tuberosity correspondingly is smaller (and of different geometry) than has been traditionally described. The origin and midsubstance (including cable vs crescent dominant) patterns of the fibers of the superior complex also exhibit significant variability. The important point is that the superior capsular complex is a robust structure that contributes to passive glenohumeral stability. Reconstruction of the superior capsule restores superior stability more effectively than tendon patch grafting.

**Clinical Rationale for SCR, Indications, and Alternatives**

Previously described open arthroscopic procedures for irreparable posterosuperior rotator cuff tears have included debridement, biceps tenotomy or tenodesis, partial rotator cuff repair, subacromial decompression, tuberosity, tendon reconstruction with bridging graft, tendon transfer, and reverse shoulder arthroplasty. With the emergence of SCR as an additional option for the irreparable cuff, it is necessary to address the question of when SCR should be clinically indicated.

One strong indication for SCR is in the patient with pseudoparalysis with superior instability who is a poor candidate for a reverse shoulder arthroplasty because of age or desired activity level. The authors have found revision and partial rotator cuff repair without SCR to be less reliable in reversing pseudoparalysis than complete, primary repair or partial repair in conjunction with SCR. Therefore, an irreparable cuff tear with pseudoparalysis (especially when less than 6 months in duration) with or without a failed prior repair has become a key indication for SCR in the authors’ practices, especially for younger patients. Because a low rate of complications has been reported for SCR, it can be viewed as a salvage option that does not “burn any bridges” for the typical patient with this challenging problem.

Partial rotator cuff repair (and associated procedures, such as biceps tenotomy) remains a good option for elderly patients desiring pain relief who have preserved overhead function of the shoulder. Many of these patients have medical comorbidities or poor bone stock, which would make adding SCR an unwise choice with limited marginal benefit for the patient. On the other hand, the authors have found...
that patients who have radiographic or arthroscopic evidence of proximal humeral migration and a chronic acromiohumeral fulcrum (with preserved motion) will have excellent pain relief with SCR. The authors suspect that, in these cases, the graft provides an improvement in pain relief over partial cuff repair, a topic that is currently under study in their group.

Reverse total shoulder arthroplasty as a planned, primary procedure in lieu of arthroscopy for massive rotator cuff tears without glenohumeral arthritis has a role in specific cases with a combination of patient and disease factors. These factors include older age (preferably older than the seventh decade), sedentary lifestyle, multiple failed cuff repairs, chronic pseudoparalysis (>6 months), recurrent shoulder instability or frank anterosuperior escape (subcutaneous), inflammatory arthritis, and extensive fatty infiltration of multiple cuff muscles on magnetic resonance imaging. When several of these are present, particularly with chronic pseudoparalysis, reverse shoulder replacement (with or without tendon transfer) presents a reliable option for pain relief and restoration of overhead function.

**Preoperative Assessment in Massive Cuff Tears**

**Physical Examination**

The definition and the management of severe shoulder dysfunction (pseudoparalysis or pseudoparesis) continue to be contentious topics in shoulder surgery. For many, a commonly used definition of pseudoparalysis— inability to raise the arm above shoulder level (90°) with full passive range of motion and pain eliminated—is too broad because it includes shoulders that have limited elevation because of painful weakness (ie, pseudoparesis). The debate over the terminology of severe dysfunction (elevation pseudoparalysis vs pseudoparesis) may seem trivial, but it does highlight one important concept about the shoulder: variable combinations of instability and weakness (and pain) may lead to the inability to raise the arm. It has been proposed by expert opinion that a dysfunctional shoulder with predominance of anterosuperior instability has no option except reverse shoulder arthroplasty but that a centered and weak shoulder remains a candidate for other procedures (an opinion with which the authors disagree).

In considering this matter, two important questions arise. First, what degree of irreparable cuff pathology can be salvaged with joint-preserving surgery (arthroscopic reconstruction with SCR), and what degree requires prosthetic reconstruction (reverse shoulder arthroplasty with or without tendon transfer)? Second, should this determination be made by physical examination alone? For the sake of argument, assume that the physical examination can inform the surgeon that superior instability is the main factor leading to severe dysfunction (in this case, true pseudoparalysis). Does it then follow that a reverse shoulder arthroplasty is the only way to restore stability? Is it impossible (or so unlikely as to be impossible) that a soft tissue reconstruction could serve the same function—the restoration of superior restraint?

In the authors’ opinion, it is a mistake to try to simplify the surgical decision-making process such that a straight line can be drawn from physical examination to choice of operation. It may be the case that severe shoulder dysfunction (eg, shoulder shrug with minimal active motion, anterosuperior escape, lag signs) is associated with other factors (advanced age, poor tissue quality, large tear size, tear chronicity) that would discourage joint-preserving surgery. However, the authors have successfully restored function (Video) using an arthroscopic reconstruction for many patients with severe dysfunction who had been told by shoulder surgeons that they had no option except for a reverse total shoulder arthroplasty. Thus, the authors have seen that adequate passive, superior stability can be restored by SCR in clinical practice and in the biomechanics laboratory. Therefore, there is no one physical examination finding that can substitute for thorough consideration of all patient and disease factors in considering a difficult rotator cuff tear, which in large part makes the entire debate over the terminology of the physical examination an exercise in futility.

**Imaging**

Preoperative radiographs are required in the assessment of massive cuff tears for several reasons. Evidence of significant joint arthrosis (large osteophytes and joint space narrowing) should prompt consideration for reverse total shoulder arthroplasty. However, the authors have performed SCR with good results for patients with only early signs of arthrosis (small marginal osteophytes and preserved joint space). Loss of the greater tuberosity (proximal humeral femoralization) from a chronic acromiohumeral fulcrum often indicates an irreparable supraspinatus. On the other hand, proximal humeral migration is in no way a contraindication to attempting an arthroscopic repair, in the authors’ opinion. In fact, SCR has been shown to increase the acromiohumeral interval.

As discussed, magnetic resonance imaging poorly predicts the intraoperative reparability of massive cuff tears. Furthermore, the authors have shown good clinical results in repairing cuffs with high-grade fatty infiltration. Because the repaired tendons in these patients had poor-quality muscles, perhaps the mechanism for improvement was the restoration of passive restraint of the joint via the capsule, similar to SCR. Thus, although it is incontrovertible that poor muscle quality should be a factor in the decision-making process when treating rotator cuff tears, the authors discourage surgeons from using this assessment as the primary factor or as a contraindication to an arthroscopic repair.

**Surgical Techniques for SCR**

Repair or reconstruction of the massive rotator cuff tear, with or without SCR, requires a significant amount of surgical
time, patience, and technical skill. The authors usually allow 2 to 4 hours for these operations, and they ensure that an experienced team (first assistant, lead surgical technician, and secondary technician) will be present for each case. The anesthesiology team and the patient should be prepared for the significant swelling that can occur intraoperatively and in the immediate postoperative period.

As discussed above, proper intraoperative assessment of the massive rotator cuff tear will guide the surgeon as to which type of reconstruction to perform. Some manner of partial repair (subscapularis and infraspinatus—teres minor) is almost always possible in the massive cuff tear, and this should not be neglected even though it adds time to the case. With SCR, the surgeon now has an additional option for reconstruction of a cuff that will just barely reach the bone bed—and likely also has tissue loss, stiffness, or poor quality. When to add SCR in the setting of what otherwise would have been a tenuous repair (Video) is currently an unanswered question. However, the authors’ early experience with SCR leads them to suspect that reconstruction of the capsule will prove to be beneficial as a supplement to tenuous cuff repairs in the future.

Surgical Sequence

The authors consider the sequencing of steps in complex rotator cuff surgery to be a critical part of performing a successful reconstruction. In particular, the specific technical steps of the graft (SCR proper) are performed as part of the final portion of the reconstruction. The overall order of steps in the operation is as follows: (1) diagnostic arthroscopy; (2) treatment of the biceps and subscapularis repair; (3) subacromial work (bursectomy, acromioplasty, tuberosity preparation); (4) assessment of the posterosuperior cuff and interval slides; (5) partial repair of the posterosuperior cuff; (6) SCR proper; (7) side-to-side repair of the graft to the posterior cuff and to the rotator interval comma tissue (if present) anteriorly; and (8) side-to-side repair of the remnant of the supraspinatus tendon to infraspinatus over the top of the graft, if feasible.

Setup and Materials

Lateral decubitus remains the authors’ preferred position for complex shoulder arthroscopic procedures, primarily because they have found that visualization is improved in this position. Coincidentally, the best arm position for graft sizing and fixation during the SCR proper is equivalent to the authors’ standard position during lateral arthroscopic shoulder surgery (20° of forward flexion and 20° to 30° of abduction), thus helping to prevent the surgeon from inadvertently performing the reconstruction with an inadequately tensioned graft.

Although Mihata et al originally performed SCR with autograft approximately 6 to 8 mm thick, the authors prefer a dermal allograft reconstruction. Allograft lowers the morbidity of the operation for the patient and reduces operative time. The authors’ preferred graft (Arthroflex 301) has a 3.0-mm nominal thickness and excellent biocompatibility and mechanical strength. A thick graft has certain biomechanical and structural advantages (spacer effect). However, the authors have seen excellent results with a 3.0-mm dermal graft, which has other advantages such as being readily available, having no morbidity, being easier to shuttle, and more easily accommodating a cuff repair over the top of the SCR when feasible.

Treatment of the Biceps

The authors prefer a high biceps tenodesis at the articular margin for younger patients and a tenotomy for older, more sedentary patients. A high tenodesis anchor can be used for subscapularis repair or as an anterior medial row humeral SCR anchor (SwiveLock Tenodesis; Arthrex, Inc).

Management of the Subscapularis

The subscapularis should be repaired if its tendon fibers have been detached from the bone. The subscapularis has a critical role in both passive and active shoulder stability, and neglected subscapularis tears can cause persistent pain after rotator cuff surgery. Subscapularis tears are particularly critical to repair in the setting of pseudoparalysis and proximal humeral migration. A variety of arthroscopic repair techniques have been described and should be familiar to the surgeon who would undertake an SCR reconstruction.

Subacromial Work

After any necessary work on the biceps and subscapularis, the authors proceed with preparation of the subacromial space. The authors preserve the coracohumeral ligament in massive cuff surgery, but limited anterior and lateral acromioplasties often help to smooth the undersurface, relieve impingement on the graft, and improve visualization. Bony landmarks such as the spine of the scapula and acromioclavicular joint should be clearly exposed. Bursectomy should proceed until the muscle tendon units are clearly seen.

Intraoperative Assessment in Massive Cuff Tears

The surgeon should take care in every posterosuperior rotator cuff repair to assess the mobility of the entire length of the lateral margin of the tear in multiple directions. The authors perform this assessment using a tendon grasper through a lateral portal while viewing from a posterior or posterolateral portal with a 70° arthroscope. Again, this step is not performed until the space has been cleared of the bursa and “bursal leaders,” or bands of fibrous scar tissue between the cuff and the internal deltoide fascia. Often, massive L-shaped or reverse-L cuff tears seem irreparable when attempting to reduce the tear from medial to lateral but reach the bone easily simply by finding and reducing the corner of the L in an oblique direction.

Once a tear has been determined to be massive and contracted (immobile), the
A FiberWire (Arthrex, Inc, Naples, Florida) suture placed into the irreparable supraspinatus (SS) tendon is retrieved through Nevaiser’s portal (A). Exposure of the superior glenoid (G) (B) is greatly improved by pulling the tendon superiorly (blue arrows) (C).

Figure 4: Correct anterior glenoid anchor placement ensures that the graft will constrain the humeral head by creating a “monk’s hood” effect. This anchor position is at the coracoid base, anterior to the vertex of the superior glenoid. (Reproduced with permission from Burkhart SS, Brady PC, Denard PJ, Adams CR, Hartzler RU. The Cowboy’s Conundrum: Complex and Advanced Cases in Shoulder Arthroscopy. Philadelphia, PA: Wolters Kluwer; 2017.)

A good angle of approach for the middle or posterior margins of the planned graft. Poor-quality tissue is commonly encountered in this setting; when it is found, the surgeon should consider a load-sharing rip-stop construct33,54 for the partial repair.

Glenoid Preparation and Anchor Placement

Work on the glenoid side represents a technical challenge during SCR proper and has certain pitfalls. Anterosuperolateral, modified Nevaiser, and accessory anterior and posterolateral portals may be necessary and should be created outside-in using a spinal needle.58 A good angle of approach for the anterior glenoid anchor can usually be obtained using the anterosuperolateral portal. As long as it has not been placed too medially, Nevaiser’s portal may have a good angle for the middle or posterior glenoid anchors. Dangers of using this portal for anchor placement include intra-articular penetration (middle) or skiving posteriorly. A posterolateral portal is often necessary for posterior anchor placement.

The superior glenoid bone should be cleared of soft tissue using electrocautery and then lightly freshened with a burr on reverse or ring curette to provide a healing surface for the graft. Nevaiser’s portal can be helpful for performing this work. When the superior labrum remains well attached and does not technically impede the glenoid work, it can be left attached. However, a hypertrophic labrum should be “debulked” with electrocautery to allow better apposition of the graft to bone.

The anterior anchor should be placed anteriorly enough to ensure a “monk’s hood” effect of the graft. This anchor position is at the coracoid base, anterior to the vertex of the superior glenoid (Figure 4). The posterior anchor is placed at the anterior margin of the intact (or repaired) posterior cuff. When the length of the glenoid side of the graft will be greater than 30 to 35 mm, the authors recommend adding a third anchor. Usually, the quality of glenoid bone allows push-in anchors (eg, SutureTak; Arthrex, Inc). Double-pulley, knotted mattress, or knotless mattress suture patterns have all been employed successfully for glenoid fixation.

Humeral Preparation and Anchor Placement

The greater tuberosity should be meticulously prepared to maximize the chances of allograft to bone healing in SCR. Electrocautery is used to remove all soft tissue remnants, and then light burning on reverse freshens the surface and removes any “charcoal” appearance of the bone. The use of cannulated suture anchors and microfracture of the tuberosity allows marrow elements to reach the graft–bone interface. Two humeral anchors (4.75-mm SwiveLock) are placed medially just off the articular surface at the anterior and posterior margins of the planned graft. Three anchors are required for very large grafts (>35 mm on the lateral, or humeral, dimension of the graft).

Graft Sizing and Preparation

After all anchors have been placed (typically 2 to 3 glenoid and 2 to 3 humeral), the dimensions between anchors are measured...
and recorded as a template on the back table (Video, Figure 5). The final graft size should have 5 mm of extra tissue on 3 sides (medial, anterior, and posterior) and 10 mm extra laterally to cover the greater tuberosity. Small holes can be punched for the humeral sutures (FiberTape and FiberWire safety sutures; Arthrex, Inc) using the anchor inserter (Video, Figure 5).

**Graft Shuttling and Glenoid Fixation**

Placing the prepared graft into the shoulder and achieving initial fixation is best accomplished by using the glenoid anchor sutures for shuttling. This strategy has several variations that the authors have used successfully depending on the choice of glenoid anchor and the size of the graft. Several technical pearls can help to prevent complications during this technically challenging portion of the case.

First, a 10- to 12-mm flexible cannula (PassPort; Arthrex, Inc) should be placed through the lateral portal to facilitate suture management and graft passage through the skin and deltoid. Often, the authors cut the cannula along one side so that it can be removed during graft passage, if necessary. Second, the humerus anchor sutures are retrieved sequentially and held in the “inferior” quadrants of the cannula by the assistant. Third, the glenoid sutures are retrieved sequentially and held in the “superior” quadrants of the cannula by the assistant.

Next, the glenoid sutures are sequentially passed through the graft, usually using a Scorpion suture passer (Arthrex, Inc). If the glenoid anchors are knotless SutureTaks, the sutures are passed as horizontal mattress sutures. If standard double-loaded SutureTaks are used, the FiberWires can be placed as simple sutures using mulberry knots on the subacromial side of the graft or as a medial double-pulley suture (Video). The humeral sutures are then brought through the prepunched holes in the graft (Figure 6).

Finally, the graft is brought into the shoulder either through the cannula or percutaneously following cannula removal around the sutures (via the preplaced split). A combination of pushing and pulling of the graft helps to deliver this atraumatically. The graft can be pushed via the ZipLine pushing instrument (Arthrex, Inc, Naples, Florida) (green arrow) can be slid along the sutures behind the graft to push the graft into the shoulder. A percutaneous suture can be used to pull the graft (red arrow) into the shoulder (B). (Reproduced with permission from Burkhart SS, Brady PC, Denard PJ, Adams CR, Hartzler RU. The Cowboy’s Conundrum: Complex and Advanced Cases in Shoulder Arthroscopy. Philadelphia, PA: Wolters Kluwer; 2017.)

In the knotless glenoid technique, the graft is secured as soon as it has been fully seated and the sutures have been finally tensioned (Video). In a knotted glenoid technique (simple sutures or double-pulley suture), the surgeon must sequentially retrieve and tie these sutures.

**Humeral Fixation**

Once graft shuttling and medial fixation have been completed, the graft is fixed on the humeral side. Mihata et al. mentioned only one graft tear in their initial series of SCR, and the mode of failure was not reported. Early results from the Burkhart Research Association of Shoulder Specialists group indicate that the humerus is the most common site of graft failure.
let-rich plasma) (ACP; Arthrex, Inc) is injected into the joint at the graft–bone junction prior to closing the arthroscopy portals. Although the authors are unaware of specific evidence to support its use in SCR, it helps to reduce postoperative pain after rotator cuff repair and has a theoretical benefit for graft healing.

**Postoperative Rehabilitation**

The authors base their rehabilitation protocol after SCR on the following observations: (1) stiffness after arthroscopic rotator cuff repair requiring reoperation is uncommon; (2) when postoperative stiffness does require reoperation, the repair typically is healed and restoration of motion with a capsular release is routinely successful; (3) tendon to bone healing cannot be assumed until approximately 3 months postoperatively; and (4) the strength of the allograft cannot be assumed to be adequate to withstand even low loads until at least 3 months postoperatively.

For the first 6 weeks after surgery, the authors employ sling immobilization with a small abduction pillow. After 6 weeks, active assisted range of motion begins with rope and pulley exercises. Critical, active overhead motion and strengthening are not allowed until 4 months postoperatively, when adequate time for allograft incorporation and cuff healing has passed. High-demand (acceleration) activities such as throwing, golfing, and weight lifting are restricted for 1 year postoperatively.

For many patients undergoing SCR, the authors employ sling immobilization with a small abduction pillow. After 6 weeks, active assisted range of motion begins with rope and pulley exercises. Critical, active overhead motion and strengthening are not allowed until 4 months postoperatively, when adequate time for allograft incorporation and cuff healing has passed. High-demand (acceleration) activities such as throwing, golfing, and weight lifting are restricted for 1 year postoperatively.

**Conclusion**

Superior capsular reconstruction should be thought of as a complex but highly useful tool for the shoulder surgeon to use in treating selected patients with irreparable rotator cuff tears. Rotator cuff tear irreparability cannot be accurately predicted, should not routinely be assumed by the surgeon, and should only be diagnosed after a careful diagnostic arthroscopy. Patients with risk factors for irreparability and who might benefit from reconstruction of the superior capsule should be counseled about the operation as an additional, joint-preserving procedure that can be added if complete rotator cuff repair is not possible intraoperatively. Superior capsular reconstruction adds biological, passive, superior constraint to the glenohumeral joint, thereby optimizing the rotator cuff force couples and improving joint kinematics. Superior capsular reconstruction is technically demanding, but early adopters of the procedure are supported by its excellent anatomical, biomechanical, and short-term clinical results.

**References**

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