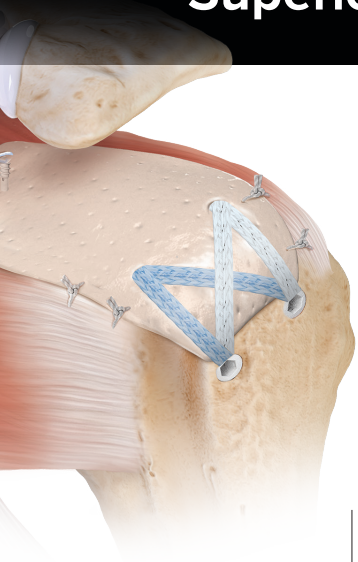


# Superior Capsular Reconstruction Scientific Update



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Superior capsular reconstruction (SCR) has emerged as a viable technique both as isolated treatment of irreparable rotator cuff tears, as well as in conjunction with rotator cuff repair for cases with poor healing potential. Anatomically, SCR has strong foundation in that the superior capsule normally provides a static superior restraint. Biomechanically, massive rotator cuff tears lead to increased superior migration, which can be restored with SCR. Clinically, SCR has demonstrated improvement in functional outcomes. The technique for SCR has evolved and is dependent upon precise graft measurement and strong fixation.

## Anatomical Studies

[The superior capsule of the shoulder joint complements the insertion of the rotator cuff.](#)

*J Shoulder Elbow Surg.* 2012;21(7):867-872. doi:10.1016/j.jse.2011.04.034

- This anatomic study of the superior capsule and rotator cuff insertion, in contrast to previous studies, viewed the capsule and rotator cuff insertions as a unit; the capsule and rotator cuff were dissected separately to determine the insertion of each on the shoulder joint
- The superior capsule occupied 3.5 mm (minimum) to 9.1 mm (maximum) of the insertion on the greater tuberosity
- At the anterior and posterior margins of the greater tuberosity, the superior capsule occupied a greater footprint than the rotator cuff

**Takeaway:** The superior capsule is an important anatomic structure that occupies a substantial amount of the insertion on the greater tuberosity. Therefore, the superior capsule should be considered during rotator cuff repair; this also provides an anatomic basis for SCR when the rotator cuff cannot be repaired.

## Biomechanical Studies

[Superior capsule reconstruction to restore superior stability in irreparable rotator cuff tears: a biomechanical cadaveric study.](#) *Am J Sports Med.* 2012;40(10):2248-2255.

doi:10.1177/0363546512456195

- Massive rotator cuff tears were simulated in 8 cadavers, followed by patch graft vs SCR
  - Patch grafts were sewn to remaining cuff medially
  - SCR graft was secured to glenoid medially
  - Both grafts were secured to the greater tuberosity
- Superior translation and subacromial pressure increased following a rotator cuff tear
- Subacromial pressure was restored after both procedures
- Only SCR restored superior translation

**Takeaway:** Superior capsule reconstruction with medial fixation to the glenoid, as opposed to sewing into the remaining rotator cuff medially (patch grafting), results in restoration of superior translation in a massive rotator cuff model. A patch graft does not restore superior translation to baseline levels.

Mihata T,  
McGarry MH,  
Pirolo JM,  
Kinoshita M,  
Lee TQ



Mihata T,  
McGarry MH,  
Kahn T,  
Goldberg I,  
Neo M,  
Lee TQ

[Biomechanical role of capsular continuity in superior capsule reconstruction for irreparable tears of the supraspinatus tendon.](#) *Am J Sports Med.* 2016;44(6):1423-1430. doi:10.1177/0363546516631751

- SCR was tested in 7 cadavers, comparing SCR alone to the addition of 1) posterior margin convergence to the native rotator cuff and 2) anterior and posterior margin convergence
- SCR without margin convergence decreased subacromial contact pressure, but did not reduce superior translation
- The addition of posterior margin convergence suturing reduced superior translation
- Anterior margin convergence did not provide any benefit

**Takeaway:** Posterior margin convergence to the native rotator cuff is essential during SCR.

Mihata T,  
Bui CNH,  
Akeda M,  
Cavagnaro MA,  
Kuenzler M,  
Peterson AB,  
McGarry MH,  
Itami Y,  
Limpivasti O,  
Masashi N,  
Lee TQ

[A biomechanical cadaveric study comparing superior capsule reconstruction using fascia lata allograft with human dermal allograft for irreparable rotator cuff tear.](#) *J Shoulder Elbow Surg.* 2017;26(12):2158-2166. doi:10.1016/j.jse.2017.07.019

- 8 cadavers were used to compare SCR with fascia lata (FL) and humeral dermal (HD) allografts
- Superior humeral translation was approximately 2 mm in the intact state and increased to approximately 8 mm following a simulated rotator cuff tear
- Following SCR with HD allograft, superior translation was reduced by 50% to approximately 4 mm. This was statistically significant compared to the tear state at 0° and 30° of abduction.
- Following SCR with FL, superior translation was reduced to approximately 1 mm
- HD allografts elongated approximately 15% during testing

**Takeaway:** Both FL and HD allografts decreased superior translation in a rotator cuff tear model. HD allograft does not decrease superior translation to native levels. However, FL provided a supraphysiologic reduction in translation, which may also have clinical consequences (ie, excessive restraint leading to arthritis).

HD allograft is elastic and therefore elongates during testing. This should be considered during tensioning, as well as during suture placement (ie, consider securing HD allograft at slightly higher degrees of abduction or place sutures 10%-15% inside of measured dimensions).



Pogorzelski J,  
Muckenhirn KJ,  
Mitchell JJ,  
Kattagen JC,  
Schon JM,  
Dahl KD,  
Hirahara AM,  
Dines JS,  
Adams CR,  
Dooney T,  
Denard, P,  
Turnbull TL,  
Millett PJ

[Biomechanical comparison of 3 glenoid-side fixation techniques for superior capsular reconstruction.](#) *Am J Sports Med.* 2018;46(4):801-808. doi:10.1177/0363546517745626

- 36 cadavers were randomized to test glenoid-sided fixation of the dermal allograft
  - 3 knotless screw-in anchors (3.5 mm SwiveLock® anchor) with central labral tape and cinch sutures on the corners
  - 3 knotless push-in anchors (3.0 mm Knotless SutureTak® anchor) with independent mattress sutures
  - 4 anchors in a hybrid construct, using a central double-pulley (two 3.0 standard SutureTak anchor) and peripheral cinch sutures (two 2.9 mm PushLock® anchor)
- There was no difference in load-to-failure between techniques 1 and 2
- Fixation strength was highest with independent fixation (techniques 1 and 2)

**Takeaway:** Independent glenoid fixation with 3 knotless anchors provides the strongest construction for glenoid-sided fixation of SCR.

## Clinical Studies

Mihata T,  
Lee TQ,  
Watanabe C,  
Fukunishi K,  
Ohue M,  
Tsujimara T,  
Kinoshita M

[Clinical results of arthroscopic superior capsule reconstruction for irreparable rotator cuff tears.](#) *Arthroscopy.* 2013;29(3):459-470. doi:10.1016/j.arthro.2012.10.022

- Retrospective evaluation of 24 SCRs using FL for irreparable rotator cuff tears reviewed at a minimum of 2-years postoperative
- Acromiohumeral distance increased from 4.6 mm preoperatively to 8.7 mm postoperatively
- ASES scores improved from 24 preoperatively to 93 postoperatively
- 83% of the grafts healed

**Takeaway:** This was the first clinical study that demonstrated the clinical utility of SCR in the treatment of irreparable rotator cuff tears with substantial improvements in all clinical parameters.

Denard PJ,  
Brady PC,  
Adams CR,  
Tokish JM,  
Burkhart SS

[Preliminary results of arthroscopic superior capsule reconstruction with dermal allograft.](#) *Arthroscopy.* 2018;34(1):93-99. doi:10.1016/j.arthro.2017.08.265

- Retrospective review of SCR with dermal allograft
- 59 patients were evaluated 1 year after SCR with dermal allograft using earlier techniques (2 medial anchors and knotless fixation on the tuberosity)
- Successful outcomes were achieved in 68% of cases
  - 76% success rate in Hamada 1 and 2 cases
  - 44% success rate in Hamada 3 and 4 cases
- 100% of grafts that healed were considered clinical successes based on postoperative function

**Takeaway:** The results of this study, of which a high percentage of cases were for revision (42%), should be considered as an initial series with broad indications. It should also be noted that the technique has evolved substantially since this original publication. When graft healing occurred, functional outcome was excellent. This highlights the importance of strong fixation and slow rehabilitation. The outcome varied by indication and the best results were in patients without arthritis (Hamada 1 and 2). Patients with adaptive changes of the proximal humerus or arthritis were less likely to see improvement.



Pennington WT,  
Bartz BA,  
Pauli JM,  
Walker CE,  
Schmidt W

[Arthroscopic superior capsular reconstruction with acellular dermal allograft for the treatment of massive irreparable rotator cuff tears: short-term clinical outcomes and the radiographic parameter of superior capsular distance.](#) *Arthroscopy*. 2018;34(6):1764-1773. doi:10.1016/j.arthro.2018.01.009

- Retrospective review at a minimum 1-year postoperative of 86 patients who underwent SCR with dermal allograft
- No patients had severe arthritis or adaptive changes
- ASES scores improved from 52 to 82
- Acromiohumeral distance increased from 7.1 mm to 9.7 mm

**Takeaway:** In properly selected patients (absence of arthritis or adaptive changes), SCR with dermal allograft leads to reduction in pain and improvement in functional outcomes.

Burkhart SS,  
Hartzler RU

[Superior capsular reconstruction reverses profound pseudoparalysis in patients with irreparable rotator cuff tears and minimal or no glenohumeral arthritis.](#) *Arthroscopy*. 2019;35(1):22-28. doi:10.1016/j.arthro.2018.07.023

- SCR with dermal allograft was used to treat 10 patients with profound pseudoparalysis (defined as forward flexion of <45°)
- 9 out of 10 patients recovered overhead elevation
- 70% of grafts were fully intact on MRI and 30% were partially intact

**Takeaway:** SCR can be used for joint preservation, even in the setting of pseudoparalysis.

Mihata T,  
Lee TQ,  
Hasegawa A,  
Fukunishi K,  
Kawakami T,  
Fujisawa Y,  
Ohue M,  
Doi M,  
Neo M

[Superior capsule reconstruction for reinforcement of arthroscopic rotator cuff repair improves cuff integrity.](#) *Am J Sports Med*. 2019;47(2):379-388. doi:10.1177/0363546518816689

- 34 SCRs with combined rotator cuff repair were compared to 91 isolated rotator cuff repairs
- Mean follow-up was 36 months (range 24-52 months)
- SCR was combined with rotator cuff repair, even if the cuff could be repaired alone, if the rotator cuff demonstrated poor potential for healing
  - Poor healing was determined as 2 of 3 of significant atrophy, tendon degeneration, or tendon retraction medial to the humeral head
- Despite the association of these factors with poor healing, there were no retears in the patients with combined SCR and cuff repair

**Takeaway:** SCR may have an important role not only in the treatment of irreparable rotator cuff tears, but also as an anatomic augmentation in patients with poor healing potential due to advanced atrophy and tendon degeneration.



Mihata T,  
Lee TQ,  
Hasegawa A,  
Fukunishi K,  
Kawakami T,  
Fujisawa Y,  
Ohue M,  
Neo M

[Five-year follow-up of arthroscopic superior capsule reconstruction for irreparable rotator cuff tears.](#) *J Bone Joint Surg Am.* 2019;101(21):1921-1930. doi:10.2106/JBJS.19.00135

- Minimum 5-year follow-up of 30 patients who underwent SCR with FL graft
- Functional outcome was maintained compared to 1-year post-op and, in fact, ASES scores significantly improved from 1 year to 5 years postoperative
- 27 of 30 grafts healed
  - None of the grafts with healing developed arthritis
  - All 3 patients with failure of healing developed rotator cuff arthropathy by 5 years postoperative

**Takeaway:** 5-year outcomes of the SCR appear to be durable. Moreover, a healed graft may interrupt the natural history of a massive rotator cuff tear by preventing rotator cuff arthropathy.