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Minimum 2-year clinical outcomes after superior capsule reconstruction compared with reverse total shoulder arthroplasty for the treatment of irreparable posterosuperior rotator cuff tears in patients younger than 70 years

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Background: To compare clinical outcomes following arthroscopic superior capsule reconstruction (SCR) using a dermal allograft (DA) with reverse total shoulder arthroplasty (RTSA) when used to treat irreparable posterosuperior rotator cuff tears without glenohumeral osteoarthritis (GHOA) in patients younger than 70 years.
Methods: In this case-control study, patients who underwent SCR or RTSA for the treatment of irreparable posterosuperior rotator cuff tears, who were younger than 70 years at the time of surgery, and who were at least 2 years out of surgery were included. Clinical outcomes were assessed using the American Shoulder and Elbow Surgeons Standardized Shoulder Assessment Form (ASES), Single Assessment Numerical Evaluation (SANE), Quick Disabilities of the Arm, Shoulder, and Hand (QuickDASH) scores and the 12-Item Short Form Health Survey (SF-12). Return to sports and patient satisfaction along with clinical failures (recurrent pain or persistent pain or loss of function), revisions, and complications were reported.
Results: Two-year follow-up was obtained on 22/22 patients (100%) in the SCR group and 29/33 patients (88%) in the RTSA group. Group differences were significant for age (SCR mean, 57 $\pm$ 6.6 years, vs. RTSA mean, 63 $\pm$ 4.9 years; $P < .001$) and follow-up interval (SCR mean, 2.1 years, vs. RTSA mean, 2.9 years; $P = .001$). Preoperative outcome scores showed no significant differences (all $P > .05$) between groups. No significant differences in postoperative outcome scores were detected ($P > .05$) between SCR and RTSA: the mean ASES score was 82.6 $\pm$ 15.5 vs. 79.3 $\pm$ 21.4, mean SANE score was 71.4 $\pm$ 24.5 vs. 75.4 $\pm$ 23.3, mean QuickDASH score was 16.2 $\pm$ 16.9 vs. 25.3 $\pm$ 21.0, and mean SF-12 was 47.7 $\pm$ 8.8 vs. 46.9 $\pm$ 10.4. No significant differences in return-to-sport responses were noticed between groups at baseline or postoperatively ($P = .585$, $P = .758$). One SCR was revised at 1.2 years with revision SCR and 1 RTSA had the glenoid component revised day 1 postoperatively for instability. Both patient groups achieved successful clinical outcomes.
Conclusion: SCR using DA results in similar postoperative functional outcomes in a younger patient population when compared to RTSA for the treatment of irreparable posterosuperior rotator cuff tears, without GHOA, at short-term follow-up.
Level of evidence: Level III; Retrospective Cohort Comparison; Treatment Study

Keywords: Superior capsule reconstruction; acellular human dermal allograft; reverse total shoulder arthroplasty; irreparable rotator cuff tears; shoulder; clinical outcome

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Chronic massive posterosuperior rotator cuff tears are challenging to repair because of tendon retraction and inelasticity as well as muscle atrophy and fatty infiltration.[12] Various surgical approaches have been used for the treatment of irreparable posterosuperior rotator cuff tears, including arthroscopic débridement with tenotomy or tenodesis of the long head of the biceps tendon, partial repair, tendon transfers, and patch augmentation.[2,9,14,28] None of these procedures are considered optimal for the treatment of irreparable rotator cuff tears, because compared with complete repair, they have demonstrated inferior clinical outcomes and a higher rate of postoperative complications over time.[3,11,14]

Reverse total shoulder arthroplasty (RTSA) is a predictable treatment option for patients with irreparable posterosuperior rotator cuff tears when the deltoid is functioning well. Although RTSA was historically used in the elderly population, the indications for RTSA have expanded to younger populations. Significant improvements in clinical and functional outcomes have been reported in younger patient demographics; however, high complication rates and concerns about durability still remain.[5,6,13,15,20,21,25,26,29]

Mihata et al[18,19] introduced the superior capsule reconstruction (SCR) using a fascia lata autograft as an alternative treatment for patients with symptomatic massive irreparable posterosuperior rotator cuff tears without glenohumeral osteoarthritis (GHOA). The authors[16] reported excellent clinical and radiographic outcomes with a high return to sports rate and low complication rate in a young and active patient population. Subsequently, the SCR technique was modified to use acellular dermal allografts (DAs) to expedite the procedure and avoid donor site morbidity.[24] Preliminary results have shown a significant improvement in functional outcome scores at early to short-term follow-up.[4,23]

Given concerns over complications and survivorship after RTSA in younger patients,[5,26] SCR represents a promising new joint-preserving treatment alternative for irreparable posterosuperior tears in patients without GHOA. It remains unknown, however, whether the results of SCR are as good or better than RTSA.

The purpose of this study was to compare minimum 2-year clinical outcomes, return to sports, and patient satisfaction in patients younger than 70 years without GHOA who received surgery with either RTSA or SCR using DA for the treatment of irreparable posterosuperior rotator cuff tears. It was hypothesized that SCR would show similar postoperative clinical improvements, return to sports rates, and patient satisfaction compared with RTSA.

Materials and methods

Patient selection

This study was a retrospective review of prospectively collected data of patients who underwent either arthroscopic SCR using an acellular human DA or RTSA for the treatment of irreparable posterosuperior rotator cuff tears between October 2014 and November 2016 for SCRs and between January 2006 and September 2015 for RTSAs.

All patients were at least 2 years out from surgery and were treated by a single surgeon (P.J.M.). In addition, all patients had a technically irreparable tear of the supraspinatus and/or infraspinatus tendons, which was confirmed during either arthroscopic or open surgery. Patients were indicated for SCR or RTSA if they had tendon retraction (according to Patte classification[22]), muscle atrophy (according to Thomazeau classification[27]), and fatty infiltration (according to Goutallier[10] or Fuchs classification[7]) graded 3 or higher before surgery. Surgery was indicated for persistent pain, loss of strength, and impaired function of the affected arm. All patients had a negative belly press sign and a preserved teres minor with a negative hornblower sign. Patients were offered joint-preserving surgical treatment with SCR or RTSA.

To address the primary aim of comparing outcomes of SCR vs. RTSA in patients for whom either approach is a reasonable treatment choice, the sample selection of the RTSA group was constrained by several criteria. Patients were included if they chose (1) SCR as treatment of choice or RTSA as treatment of choice, (2) had no severe GHOA (Hamada grade < 2 and Kellgren-Lawrence grade < 3), and (3) were younger than 70 years.

Exclusion criteria included neurologic pathologies of the affected upper extremity, deltoid deficiency or weakness, revision SCR or RTSA, prior arthroplasty, irreparable subscapularis tear, severe GHOA (Hamada $>$ grade 2 and Kellgren-Lawrence grade > 3), or RTSA due to humeral fracture.

Surgical techniques

All operations were performed by the senior surgeon (P.J.M.). For both treatments, patients were placed on the operating table in the beach chair position.

SCR surgical technique

The technique for SCR has been described previously.[24] For SCR, the irreparability of the torn supra- and infraspinatus tendons were confirmed during diagnostic arthroscopy. If necessary, the subscapularis tendon was subsequently repaired with a knotless, single-anchor reconstruction (4.75-mm SwiveLock; Arthrex, Naples, FL, USA). If the proximal long head of the biceps tendon was still present, the intra-articular biceps was tenotomized and a subpectoral biceps tenodesis was performed with an interference screw.

An extensive débridement of the rotator interval and the superior glenoid were performed, as well as a lysis of intra-articular and subacromial adhesions. The greater tuberosity and the superior glenoid were prepared with a motorized rasp. The labrum was preserved superiorly if it was in good condition; otherwise it was removed. An arthroscopic measuring device was then used to determine the necessary graft size in the anterior-posterior and medial-lateral directions. The tear size was measured and a 3-mm-thick human acellular dermal allograft was sized accordingly to incorporate 7-8 mm coverage medially over the superior glenoid and 15-18 mm coverage laterally over the anatomic footprint of the rotator cuff on the humerus.

Using a Neviaser portal, the first superior glenoid anchor (3.0-mm SutureTak; Arthrex) was inserted at the 12-o'clock position, taking care to avoid violation of the articular cartilage. The sutures were then shuttled through the anterolateral portal and stitched through the middle and medial aspect of the graft while it was still extra-articular. Two additional sutures were placed on the lateral aspect of the graft, which was then shuttled into the shoulder through the anterolateral portal with the utilization of a knot pusher. After ensuring the graft was unfolded and in the correct orientation, the medial glenoid anchor was tied to secure the graft.

The graft was then fixed on the glenoid side with 2 additional anchors (3.0-mm SutureTak), placed at the 10-o'clock and the 2-o'clock positions, respectively. The sutures from each anchor were passed through the medial edge of the graft and tied to fixate the graft to the superior glenoid surface.

Next, lateral fixation of the DA graft was performed with a crossing knotless, double-row anchor reconstruction using 4-6 anchors (4.75-mm SwiveLock), 2 or 3 medially at the cartilage-bone border, and 2 or 3 anchors 1.5-1.8 cm lateral to the medial anchor row. The graft was also secured to the infraspinatus and subscapularis using margin convergence-to-bone sutures from the posterior and anterior medial row anchors, respectively. The rotator interval was not closed medially. Finally, posterior side-to-side fixation between the graft and remaining infraspinatus was performed using a free suture. This completed fixation of the DA medially on the glenoid, laterally on the greater tuberosity, and posteriorly to the remaining intact rotator cuff (Fig. 1).

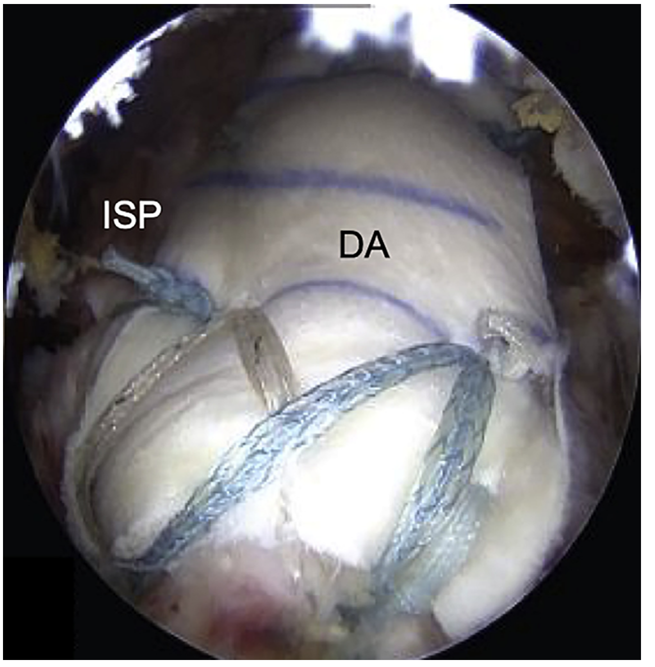

Figure 1 Right shoulder: Arthroscopic visualization (through the lateral portal) of the final superior capsule reconstruction with an acellular human dermal allograft fixated with 3 medial anchors to the glenoid, a crossing double-row anchor fixation laterally to the greater tuberosity, and side-to-side sutures to the infraspinatus tendon. *DA*, dermal allograft; *ISP*, infraspinatus

RTSA surgical technique

For RTSA, a deltopectoral approach was established from the lateral portion of the coracoid down toward the deltoid insertion. Blunt dissection was then used to release all adhesions in the subacromial space, and the deltoid was retracted laterally. The biceps tendon was identified (when still present) within the tendon sheath and the sheath was opened. Then, the biceps tendon was followed through the rotator interval with scissors to its origin on the superior glenoid where it was subsequently tenotomized. The tendon was held at the appropriate length and sutured to the upper border of the pectoralis major with sutures (no. 2 Ethibond [Ethicon Inc., Bridgewater, NJ, USA]) to achieve a soft tissue tenodesis.

At the most lateral aspect of the subscapularis tendon, a peel was performed using monopolar electrocautery, from lateral to medial, fully elevating the tendon from the bone. The torn posterosuperior rotator cuff tear was visualized and confirmed to be irreparable. Then, the humeral head was fully dislocated, and an oscillating saw was used to perform the humeral head osteotomy for a later implantation of a Grammont-style design prothesis with a 155° neck-shaft angle, followed by a capsular release for glenoid exposure. The labrum was removed and the glenoid surface was prepared a curette. The center guide pin was drilled and then appropriately reamed for insertion of a medialized baseplate at neutral version and inclination. Locking and nonlocking screws were then drilled, and excellent fixation was confirmed. The glenosphere was affixed and locked in place. Next, the humerus was reamed and broached sequentially up to an adequate size, and the humeral stem was impacted into place until stable. The liner was chosen according to appropriate deltoid tension and stability. After humeral stem implantation, closure of the subscapularis was performed if possible. A postoperative radiograph of the prosthesis is shown in Figure 2.

Postoperative rehabilitation

Patients who underwent SCR were strictly immobilized in an abduction pillow for 6 weeks. At 6 weeks postoperatively, patients began full passive and active-assisted range of motion as tolerated. At 10-12 weeks postoperatively, full active range of motion as well as strengthening exercises were allowed. Patients who were pain free and had good function were allowed to return to full activity and recreational activities without restriction at 4-5 months postoperatively.

Patients who underwent RTSA began full passive range of motion the day after surgery, with external rotation kept below 30° for the first 3 weeks when the subscapularis was repaired. At 3 weeks postoperation, patients began full active range of motion as tolerated. At 7 weeks, initial resistance strengthening was allowed. Patients who were pain free and had good function were allowed to return to full activity and sports without restriction at 4 months postoperatively.

Clinical and functional outcome assessment

Preoperatively and at final follow-up, American Shoulder and Elbow Surgeons Standardized Shoulder Assessment Form (ASES) score, Single Assessment Numerical Evaluation (SANE) score, Quick Disabilities of the Arm, Shoulder, and Hand (QuickDASH) score, the SF-12) physical component summary, and patient

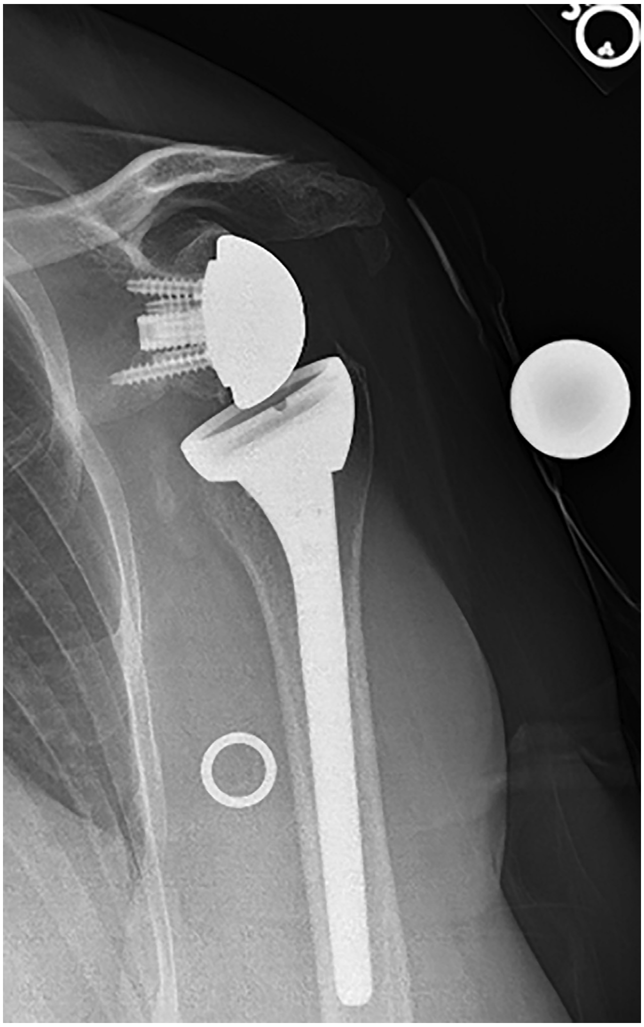

Figure 2 Postoperative anterior-posterior radiograph of a right shoulder: Final result after implantation of a reverse Grammont-style shoulder prothesis with 155° shaft-neck angle and medialized baseplate at neutral version and inclination.

satisfaction (on a 1-10 scale, with 10 representing ''very satisfied'') were collected.

Additional optional questions were obtained to assess patients' participation in sports, both preoperatively and postoperatively. These questions evaluated the functional ability to perform recreational sports with the following possible answers: ''unable,'' ''very difficult,'' ''somewhat difficult,'' and ''normal.'' All answers except ''unable'' and ''very difficult'' were defined as able to participate.

Any complications, revision surgeries, or clinical failures were reported. *Clinical failure* was defined as recurrent or persistent loss of function compared with the preoperative state and/or recurrent or persistent pain equal to or higher than the preoperative state.

Statistical analysis

Bivariate statistical techniques were employed to address the primary aim of group comparisons between the SCR and RTSA groups. First, group comparisons were made with respect to baseline covariates using the Mann-Whitney *U* test or Fisher exact test for continuous or dichotomous variables, respectively. The Mann-Whitney *U* test was also used to compare a minimum 2-year patient-reported outcome scores between groups, and the Wilcoxon signed-rank test was used to compare baseline and postoperative scores. Statistical power was considered after obtaining the fixed sample size for these retrospective cohorts. Assuming nonparametric comparison (Mann-Whitney *U* test), 2-tailed hypothesis testing, and an alpha level of 0.05, group sizes of 21 and 28 is sufficient to detect an effect size of $d = 0.85$ with 80% statistical power. Thus, we interpret that this study may be underpowered to detect group differences that are more subtle than $d = 0.85$.

All analyses were completed with the statistical computing package R, version 3.5.2 (R Development Core Team, Vienna, Austria, with additional package *twang*, accessed April 12, 2019).

Results

Patient demographics

Twenty-seven patients who underwent SCR with DA with a mean age of 57 years (range 41-65) met the inclusion criteria. Of those, 5 patients were contacted and refused to participate in the study. Of the remaining 22 patients, 22 (100%) obtained minimum 2-year follow-up outcome scores with a mean follow-up of 2.1 years (range, 2-3) (Fig. 3). One of these patients was revised 1.2 years postoperatively because of a lack of functional improvement.

Thirty-three patients who underwent RTSA, mean age of 63 years (range, 46-69), met the inclusion criteria. Twenty-nine of the 33 (88%) obtained minimum 2-year follow-up outcome scores, with a mean follow-up of 2.9 years (range, 2.0-6.75) (Fig. 3). Despite the research team's best efforts, the remaining 4 patients did not complete postoperative follow-up surveys. One patient was revised because of technical complication at postoperative day 1.

Patient baseline characteristics of the groups are summarized in Table I. Both groups significantly differed in age (SCR mean, 56.8 ± 6.6 years, vs. RTSA mean, 63.2 ± 4.9 years; $P < .001$) and length of follow-up (SCR mean, 2.1 ± 0.3 years, vs. RTSA mean, 2.8 ± 1.2 years; $P = .001$). There were no statistically significant differences in baseline patient-reported outcome scores between the 2 groups preoperatively ($P > .05$).

Clinical outcome and patient satisfaction

All postoperative outcome scores improved significantly for both groups when compared to the preoperative state at the time of most recent follow-up. SCR improved from 51.9 to 82.6 for the ASES score ($P = .0001$), 40.6 to 71.4 for the SANE score ($P = .0002$), 43.4 to 16.2 for the QuickDASH score ($P = .0001$), and 38.5 to 47.7 for the SF-12 ($P = .005$). RTSA improved from 48.0 to 79.3 for the ASES

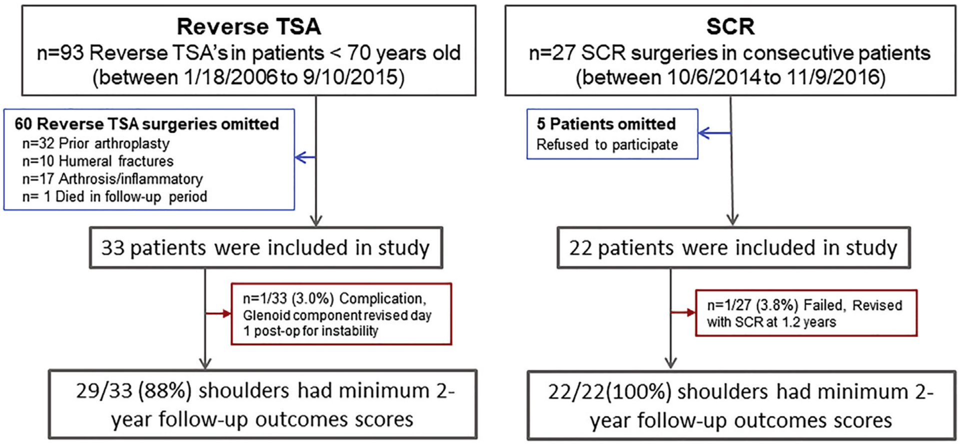

Figure 3 Patient flow diagram.

Table I Patient baseline characteristics of the SCR and RTSA groups

	SCR (n = 22)	RTSA (n = 29)	*P* value
Age, yr, mean (range)	56 (41-65)	63 (46-69)	<.001*
Follow-up interval, yr, mean (range)	2.1 (2-3)	2.9 (2.0-6.75)	<.001*
Male sex, %	57.1	60.6	.461
Previous RCT, %	76.2	63.6	.758

SCR, superior capsule reconstruction; *RTSA*, reverse total shoulder arthroplasty; *RCT*, rotator cuff tear.
* Statistically significant difference.

score (P = .0002), 46.9 to 75.4 for the SANE score (P < .0001), 46.7 to 25.3 for the QuickDASH score (P < .0001), and 37.0 to 47.0 for the SF-12 (P = .0006).

With the numbers of available scores, no statistically significant differences between SCR and RTSA outcomes were detected (all P > .05): the mean ASES score was 82.6 ± 15.5 (SCR) vs. 79.3 ± 21.4 (RTSA) (P = .830), the mean SANE score was 71.4 ± 24.5 vs. 75.4 ± 23.3 (P = .470), the mean QuickDASH score was 16.2 ± 16.9 vs. 25.3 ± 21.0 (P = .105), and the mean SF-12 was 47.7 ± 8.8 vs. 46.9 ± 10.4 (P = .355). Group comparison is illustrated in Figure 4. The mean patient satisfaction was 9 of 10 for SCR and 9 of 10 for RTSA.

Return to sports

A total of 28 patients participated in sports preoperatively, 12 patients (57%) in the SCR group and 16 patients (55%) in the RTSA group. Twenty-seven patients (96%) were able to return to sports postoperatively—all 12 patients (100%) in the SCR group and 15 patients (94%) in the RTSA group. SCR patients were more likely to have less difficulty postoperatively than preoperatively, but the comparison with RTSA was not statistically significant (P = .086; Tables II and III). RTSA did provide clear improvement in reduced difficulty participating in usual sports compared with preoperative baseline (P < .001). No significant differences in return to sport responses were noticed between groups at baseline or postoperatively (P = .585, P = .758).

Complications, surgical revision, and clinical failures

One postoperative complication occurred in the RTSA group (glenosphere dissociation from the baseplate—technical failure) at postoperative day 1. The patient was surgically revised and ended up with good clinical outcome. There was 1 clinical failure in the SCR group in a patient who developed recurrent loss of function after 1.2 years. The patient underwent revision SCR and ended up with a good clinical outcome 1 year after revision (ASES score of 90, satisfaction 10/10).

Discussion

The most important finding of this study is that SCR using DA results in significant improvement in clinical outcomes and high patient satisfaction at short-term follow-up. SCR also showed similar improvements in clinical outcomes and return to sports rate in a younger-aged patient population when compared to RTSA for patients younger than 70 years

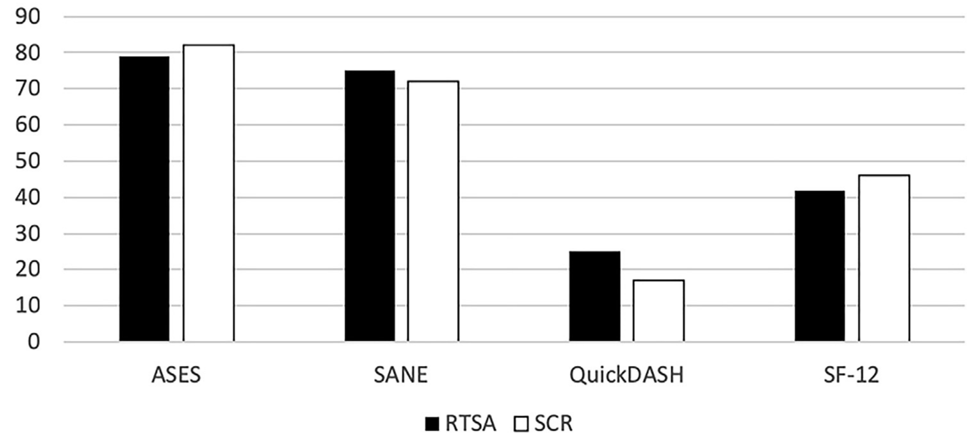

Figure 4 Postoperative clinical outcome scores comparison between SCR and RTSA. *SCR*, superior capsule reconstruction; *RTSA*, reverse total shoulder arthroplasty.

Table II Counts and percentages of sports difficulty levels pre- and postoperatively for SCR and RTSA

	Unable		Very difficult		Somewhat difficult		Normal	
	SCR	RTSA	SCR	RTSA	SCR	RTSSA	SCR	RTSA
Preoperation	7 (35)	11 (39.3)	3 (15)	8 (28.6)	9 (45)	8 (28.6)	1 (5)	1 (3.6)
Postoperation	2 (10)	1 (3.7)	2 (10)	2 (7.4)	10 (50)	13 (48.1)	6 (30)	11 (40.7)

SCR, superior capsule reconstruction; *RTSA*, reverse total shoulder arthroplasty.
Values are n (%).

Table III Comparison of mean improvement of patient-reported outcome scores between SCR and RTSA

	RTSA	SCR	*P* value
ASES score	29.1 + 25.9	30.9 + 15.8	.788
SANE score	30.1 + 20.8	29.2 + 11.5	.903
QuickDASH score	−21.0 + 17.4	−27.6 + 15.9	.212
SF-12 PCS	9.4 + 10.4	9.2 + 11.4	.954
Return to sports, n/n (%)	15/16 (94)	12/12 (100)	.086

SCR, superior capsule reconstruction; *RTSA*, reverse total shoulder arthroplasty; *ASES*, American Shoulder and Elbow Surgeons Standardized Shoulder Assessment Form; *SANE*, Single Assessment Numerical Evaluation; *QuickDASH*, Quick Disabilities of the Arm, Shoulder, and Hand; *SF-12*, 12-Item Short Form Health Survey; *PCS*, physical component summary.
Unless otherwise noted, values are mean ± standard deviation.

who had symptomatic, irreparable posterosuperior rotator cuff tears without GHOA.

Surgical treatment of young and active patients with a symptomatic posterosuperior rotator cuff tear remains challenging. This results of this study demonstrated that young patients treated with either SCR or RTSA showed significant improvements in all subjective outcome scores pre- to postoperatively (all $P \leq .005$) in the short-term follow-up, without a significant difference between treatments (ASES score, SCR mean, 82.8 ± 16.5, vs. RTSA mean, 79.3 ± 21.4; $P = .828$). Furthermore, concerns that both procedures would compromise these young and more demanding patient populations' participation in sports was not confirmed. Patients who underwent SCR and RTSA showed similar baselines of participation in sports before injury (57% vs. 55%) and had high rates of return to sports (100% vs. 94%), after their respective procedures with no significant differences ($P = .758$) in return rates when SCR and RTSA were compared.

The results from this study support the hypothesis that SCR is a reliable alternative to RTSA for patients younger than 70 years with irreparable posterosuperior rotator cuff tears without GHOA. Advantages of the SCR procedure include its arthroscopic approach and preservation of anatomy, which makes further surgical procedures possible without resorting to salvage procedures. Thus, implant longevity plays a minor role in SCR when compared to RTSA. At the short-term follow-up of 2 years, the complication profile was not different between the 2 study groups. However, in a young patient population such as this, differences in complication rates and their severity could become more important over time. Additional studies are needed to further evaluate long-term outcomes.

The results of this study are in accordance with other recently published studies on RTSA in young patients.

When comparing return to sports rates, Garcia et al[8] showed that 85% of patients undergoing RTSA return to 1 or more sporting activities at an average of 5.3 months after surgery. Age greater than 70 years was a significant predictor of decreased return to activities. Bulhoff et al[1] found a participation in sports rate prior to surgery of 71%, with a return to sports rate of 93% in patients who were treated with RTSA for cuff tear arthropathy. In addition, their longer follow-up interval of 4.8 years demonstrated sustainable results for continued participation in sports—even with the difference in age between studies (76 years vs. 63 years in this study).

In contrast, Matthews et al[15] reported a lower rate of return to recreational activities and sports of only 67% at the 4-year follow-up in patients who underwent RTSA and were younger than 65 years. Furthermore, the authors found significantly inferior outcome scores (a mean postoperative ASES score of 71) in patients who underwent RTSA and were younger than 65 years when compared with patients older than 70 years (a mean postoperative ASES score of 79).

Muh et al[20] showed significantly improved clinical outcomes at short-term follow-up in 66 patients younger than 60 years who were treated with an RTSA, with improvements in ASES score from 40 to 72 points pre- to postoperatively (vs. 48 to 79 points in the present study). However, they observed a 15% complication rate and an overall satisfaction of only 81%. This is in contrast to the presented results, which reports only a single observed complication in the RTSA group (acute glenoid component dissociation) at short-term follow-up. This difference could be explained by the fact that unlike the present study, which did not include patients with severe GHOA (Hamada grade <2 and Kellgren-Lawrence grade <3), Muh et al's[20] indications for RTSA also included osteoarthritis with more contracted and degenerated glenohumeral joints.

Leathers et al[13] further clarified the impact of age on clinical outcomes after RTSA when they reported lower ultimate clinical outcome scores after RTSA in patients younger than 65 years than in patients aged 70 years and older. The authors did show, however, that younger patients were able to achieve increased postoperative range of motion than the older group. In contrast to Leathers et al, Ernstbrunner et al[6] showed that there was no deterioration in subjective and functional improvements at 10 years in 23 patients younger than 60 years who had undergone RTSA. However, they also concluded that RTSA in younger patients was associated with a relatively high complication rate and that the complications compromised the ultimate subjective and objective outcomes in their study.[6] In another study, Ek and Gerber[5] presented the results of 46 RTSAs for the treatment of irreparable rotator cuff tears in patients younger than 65 years with a follow-up between 5 and 15 years. In contrast to the significant improvement in clinical outcomes, a high complication rate (38%) was observed.[5]

This is in line with Serhson et al[26] who evaluated the clinical outcomes of 36 shoulders in a heterogenous patient population younger than 60 years that included rotator cuff tears and revision arthroplasty. At a mean follow-up of 2.8 years, the postoperative ASES score increased to 66 points on average, and a complication rate of 25% was observed. Besides the significant improvements in clinical outcomes for RTSA in patients younger than 65 years, the high complication rate and its negative effect on clinical outcomes is concerning. Although no failures of RTSA in patients younger than 70 years were observed in the present study, which may be due to a better understanding of the biomechanical and technical aspects of the procedure as well as improved implant designs, this study is limited by its short-term follow-up. There is an expected increase in failures of RTSA over time, which makes an alternative procedure, such as SCR, an exciting alternative for young and high-demand patients. The short-term clinical results of SCR were similar to RTSA's, although the follow-up for SCR was slightly shorter. SCR has the advantages of being minimally invasive and anatomy-preserving, which allows relatively easy revision to another SCR or conversion to an RTSA in the event of failure.

The results from this study for SCR using DA are in line with other recently published studies. Pennington et al[23] presented the clinical outcome data of 86 patients treated with SCR using DA (mean graft thickness 3 mm) with a follow-up of at least 1 year and showed significant improvement in ASES scores to a mean postoperative value of 82 and a failure rate of 4.5% (4 of 88). A subgroup of 38 patients completed a 2-year follow-up and showed stable ASES scores with a mean of 85 postoperatively, which is similar to the clinical results in this study (ie, a mean postoperative ASES score of 83 and a mean graft thickness of 3 mm). Denard et al[4] presented preliminary results of SCR with DA in a multisurgeon series with a mean ASES score of 78 postoperatively in 59 patients and minimum follow-up of 1 year. These slightly inferior results may be explained by a graft thickness below 3 mm (1-3 mm in their study), which may be more likely to fail clinically. Mihata et al,[16,17] who first introduced SCR using a fascia lata autograft (graft thickness 6-8 mm), reported an increase of ASES scores from 36 to 92 in their latest midterm outcome study of 100 patients with a mean follow-up of 48 months.

Although this study has a number of interesting findings, we must acknowledge its limitations. First, the mid- and long-term viability of SCR using a DA cannot be predicted considering the short-term follow-up of this study. Second, there may be selection bias because patients were not randomized and they were allowed to codetermine their procedures. Third, because SCR with DA is a new surgical procedure with strict patient selection, our patient numbers are small and there was a small difference in the mean lengths of follow-up between the 2 treatment groups. Nevertheless, our findings give an interesting insight into the short-term clinical outcomes of one of the most exciting and promising new procedures in arthroscopic shoulder surgery.

Conclusion

SCR using DA results in similar postoperative functional outcomes in a younger patient population when compared to RTSA for the treatment of irreparable posterosuperior rotator cuff tears at short-term follow-up.

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