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Research Article

Functional Outcomes in Irreparable Rotator Cuff Tears: Superior Capsular Reconstruction Versus Reverse Shoulder Arthroplasty: Meta-Analysis

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Abstract

Background: Irreparable rotator cuffs continue to pose a dilemma for orthopedic surgeons, despite multiple effective management strategies. The basis of this review is to assess the functional outcomes of two preferred options for irreparable rotator cuffs comparing superior capsular reconstruction (SCR) to reverse shoulder arthroplasty (RSA) in older adults following an irreparable rotator cuff tear. **Methods:** A systematic review and meta-analysis was conducted utilizing the PRISMA 2020 guidelines. The search yielded 99 results, after excluding duplications and abstract screening, 12 were selected for full-text review. Included were randomized controlled trials published from 01-01-2019 to 12-01-2023 using American Shoulder and Elbow Surgeons (ASES) scores to assess function at baseline and twelve months follow-up. Five studies were included totaling 205 participants. Mean and standard deviation were extracted to perform a random-effects meta-analysis using SPSS and to report pooled averages. **Results:** Mean ASES in the SCR group went from 42.6(±18.5) to 73.0(±19.2) while the RSA group saw a change from 42.3(±19.8) to 79.1(±14.7). Significant and large improvements in effect size were seen pre-post in the RSA group ($p<.01$, Cohen's $d= 2.07$[0.14,1.80] but not the SCR group ($p= 0.25$, Cohen's $d= 2.07$ [0.14,1.80]. No significant differences were found in subgroup analysis ($p= 0.86$). **Conclusion:** Large heterogeneity was present in the SCR group ($I2=97.7\%$) resulting in a lack of statistical significance compared to the consistent but similar average improvements found in the RSA group ($I2=0\%$). More high-quality research is required to confirm these observations and guide optimal management for irreparable rotator cuff tears in older adults.

Introduction

Irreparable rotator cuff tears, defined as tears that are large, chronic, degenerative, and not amenable to repair by conventional procedures, continue to pose a dilemma for orthopedic surgeons.10 Patients with irreparable tears experience a significant loss of motion and debilitating pain [1]. Loss of function may lead to a complete loss of shoulder elevation (pseudo-paralysis) or an active elevation of less than 90° (pseudo-paresis) [1]. While many patients with rotator cuff pathology benefit from rotator cuff repair the chronicity of the tear can impede repair and return of function [2,3]. Chronic tears cause diminished elasticity and retraction of the rotator cuff tendons, making repair arduous and seemingly implausible. In addition, chronic tears result in degenerative changes of the rotator cuff muscles. Muscle atrophy with fatty replacement hinders the success of repair, increasing re-tear rates [2,3]. Current management options for patients with chronic or degenerative massive rotator cuff tears, deemed irreparable, include rotator cuff tendon transfers, superior capsular reconstruction (SCR), and reverse shoulder arthroplasty (RSA). These options are considered on an individual case basis [4].

Surgeons are obligated to follow an individualized care regime for patients with irreparable rotator cuff tears that take into account the age, activity, exercise level, severity of joint arthropathy, and degree of debilitation from the tear [2]. A recent trend toward RSA has proven to be an effective surgical procedure for managing irreparable rotator cuff tears.10 RSA procedure, first performed by Grammont in 1985, currently referred to as the 'Grammont-styled' implant for rotator cuff arthropathy, features a more medialized technique [5]. King et al. have proposed a lateralized technique and proved its superiority to the 'medialized' approach because of recruitment and tension on deltoid muscle fibers [6]. The lateralized approach improved the range of motion (flexion and external rotation) and minimized scapular notching. The lateralized styled implant and improvements in implant technology have led to a trend toward fixing irreparable rotator cuff tears with RSA [4]. However, even with new RSA innovations, younger patients (<60 years of age) with irreparable rotator cuff tears experience an RSA failure rate approaching 25% at 3 years [6].

SCR, an alternative to RSA for irreparable rotator cuff tears, was first reported by Mihata et al. in 2012 [7]. The superior capsule is frequently torn in many patients with massive rotator cuff tears. By repairing the superior capsule, the anatomic and natural forces of the rotator cuff may be partially or fully restored [7-9,11]. The absence of the superior capsule results in glenohumeral translation in all directions and severe superior translation of the humeral head [7-9]. Popular SCR techniques use either a fascia lata or dermal allograft to reconstruct the superior capsule, serving as a static stabilizer for the humeral head and a dynamic stabilizer of glenohumeral translation while reinforcing shoulder strength [7-9,11] Multiple studies have validated SCR for the treatment of irreparable rotator cuff tears and although several theories have proposed beneficial mechanisms no prevailing consensus has been established. Few studies have juxtaposed SCR and RSA for the treatment of irreparable rotator cuff tears. This systematic review and meta-analysis aim to examine and compare SCR and RSA as treatments for irreparable rotator cuff tears.

Methods

A systematic review and meta-analysis of randomized controlled trials (RCTs) were registered on PROSPERO (CRD42024497941) and conducted utilizing the PRISMA 2020 guidelines [12].

Search Procedure

Five databases (PubMed, Embase, Scopus, WebofScience, and Cochrane Library) were queried for publications of randomized controlled trials from 01-01-2019 to 01-10-2024 using the search string ("Superior capsular reconstruction" OR "SCR" OR "reverse total shoulder arthroplasty" OR "RTSA") AND ("ASES" OR "American Shoulder and Elbow Surgeons") AND ("RCT" OR "randomized controlled trial" OR "randomized clinical trial"). This search resulted in 99 results which were exported to Rayyan.ai for duplication screening. The Rayyan.ai duplication auto-elimination screening threshold was set at 95% text match, which eliminated 63 duplications and left no articles for manual review. n=46 articles were screened by title and abstract for inclusion and exclusion criteria leaving n=12 for full-text review.

Inclusion and Exclusion Criteria

Included were full-text papers of randomized controlled trials in any language that used American Shoulder and Elbow Surgeons (ASES) scores to assess function following irreparable superior rotator cuff tears with an intact or repairable subscapularis. Excluded were studies in which participants had concomitant humerus fracture, severe bone deformity, or greater than minimal glenohumeral osteoarthritis (OA) (n=1), studies containing participants with deltoid dysfunction or axillary nerve palsy (n=0), studies which were not RCT's (n=2), and studies which not report usable data (n=2), or data at baseline and twelve months follow-up (n=2) (Figure 1). Five studies were included totalling 205 participants.

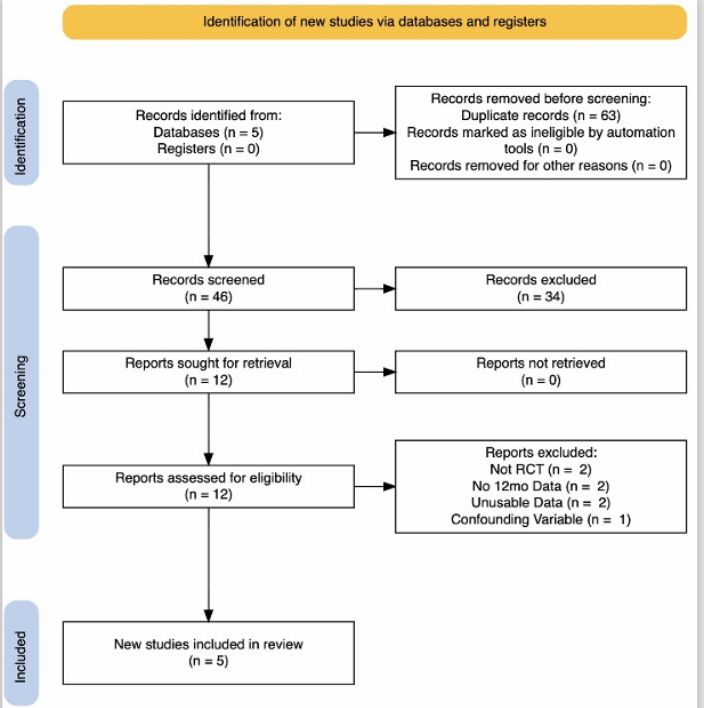

Figure 1

Data Collection and Analysis

Descriptive statistics of pooled averages and standard deviations of ASES scores at baseline and twelve months follow-up were reported in table format (Table 1). ASES score was used as it is the primary measure used to assess pain and function outcomes for RTSA and SCR where a high ASES score represents low levels of pain and high levels of function. Mean, standard deviation, and sample size were extracted to perform a random-effects meta-analysis using IBM SPSS Statistics for Windows, version 29 (IBM Corp., Armonk, N.Y., USA) [13,14]. Statistics for measures of effect were reported via statistical significance, ($p<0.05$) and effect size (Cohen's D = Mean, 95%CI [LL, UL]) via forest plot (Figure 2) where a large effect size represents a large improvement in ASES scores. Measures of non-inferiority testing were reported using Q statistics; Chi-squared (Q), degrees of freedom (df), and statistical significance ($P<0.05$), where significance represents a meaningful difference between groups (Figure 2). Heterogeneity was reported using $\boldsymbol{\tau}^2$ for standard deviation for effect sizes, H^2 representing a ratio of random effects variation to fixed effects variation, and I^2 to interpret variation outside of what is expected by random chance alone. I^2 is the primary value used to interpret heterogeneity where a low I^2 represents low variability between results and thus a high level of consistency in treatment outcomes. Following quantitative analysis, a qualitative assessment of the quality of evidence and the risk of bias was performed.

Group	SCR (1)	RTSA (2)
Number per group	46	159
Pooled Average ASES Pre (±SD)	42.6 ±18.5)	42.3 (±19.8)
Pooled Average ASES Post (±SD)	73.0 (±19.2)	79.1 (±14.7)
Average difference	30.4	36.8
Effect Size (95% CI [LL,UL])	2.45 [-1.85,6.75]	2.07 [0.14,1.80]
Subgroup Analysis (SCR vs RTSA)	0.86	0.86

Table 1

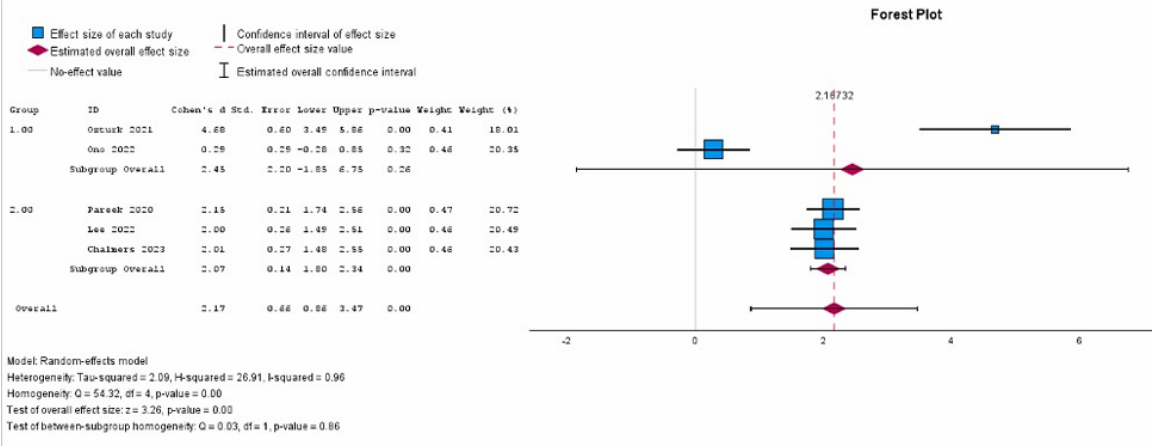

Figure 2

Risk of Bias and Certainty of Evidence Assessment

Two research team members agreed on measures of risk of bias and quality of evidence for each article. Cochranes Risk of Bias 2 [15] tool was used to assess the risk of bias because all included studies were RCTs. Data was reported by stoplight plot and summary plot using the ROBVIS [16] tool. The quality of evidence was assessed using the Grading of Recommendations Assessment, Development and Evaluation (GRADE) method [17] (Table 2). Findings were presented in the context of their impact on the outcome of the paper in the discussion section.

Author	Year	Grade	Title	Study design	Intervention	Number of shoulders	Risk of bias	Inconsistency	Indirectness	Imprecision	Publication bias	Quality of evidence
Ozturk et al	2021	High	Prospective, randomized evaluation of latissimus dorsi transfer and superior capsular reconstruction in massive, irreparable rotatorcuff tears	Prospective RCT	latissimus dorsi tendon transfer (LDT) vs. SCR	SCR: n= 21 (1 loss to f/u)	Low risk of bias	not serious	not serious	moderate	undetected	High
Ono et al	2022	Moderate	Graft Healing Is More Important Than Graft Technique: Superior Capsular Reconstruction Versus Bridging Grafts-A Prospective Randomized Controlled Trial	Prospective double-blind randomized study	SCR vs. bridging graft (BG) for massive irreparable RCTs	SCR = 25 (1 loss to f/u_	Low risk of bias	not serious	Some Concerns	Low	undetected	High
Pareek et al	2020	Moderate	Primary reverse shoulder arthroplasty did not resultin increased blood metal ion levels regardless of glenosphere size: A randomized controlled trial	Prospective RCT	RTSA impant sizes effects on metal ions, ROM and Pain	N= 72	Some Concerns	Not serious	not serious	Low	undetected	High
Lee et all	2020	High	Effects of neuromuscular electrical muscle stimulation on the deltoid for shoulder function restoration after reverse total shoulder arthroplasty in the early recovery period: a prospective randomized study	Prospective multicenter RCT	Use of Neuromuscular electrical stimulation on post-op RSA deltoid size, ROM, and recovery	N= 44 (1 loss to f/u)	Low risk of bias	Not serious	not serious	Low	undetected	High
Chalmers et al	2023	Low	Active physical therapy does not improveoutcomes after reverse total shoulder arthroplasty:a multi-center, randomized clinical trial	Prospective multicenter RCT	Supervised PT vs. a HEP after primary RTSA	N= 43 (4 loss to f/u)	High risk of bias	Not serious	not serious	moderate	Some Concerns	High

Table 2

Results

Overview of Findings

Only two manuscripts investigating SCR met the inclusion and exclusion criteria outlined in the methods. Ono et al. conducted a prospective randomized controlled trial (RCT) between January 2016 and November 2018, comparing SCR versus bridge grafting (BG) in 50 patients. Similarly, Ozturk et al. investigated latissimus dorsi transfer versus SCR for massive irreparable rotator cuffs in a prospective RCT involving 42 patients. Both studies demonstrated successful outcomes with SCR, latissimus dorsi transfer, and bridge grafting for treating irreparable rotator cuffs.

For RSA, only three manuscripts met the inclusion criteria, focusing on lateralized and new technology: Chalmers et al., Lee et al., and Pareek et al. Chalmers' group examined a home exercise program versus outpatient physical therapy in 89 patients (PT N = 43 and HEP N = 46). Pareek investigated blood metal ions (cobalt, chromium, and nickel) post-RSA with different glenosphere sizes in 72 patients between 2016 and 2018. Lastly, Lee et al. analyzed a neuromuscular electrical muscle stimulator to enhance post-operative range of motion between 2018 and 2020 in 76 patients (NMES group N = 33; non-NMES group N = 43).

Effect of Intervention

Mean ASES in the SCR group went from 42.6 (±18.5) to 73.0 (±19.2) while the RTSA group saw a change from 42.3 (±19.8) to 79.1 (±14.7) (table 2). Significant and large improvements in effect size were seen pre-post in the RTSA group (p<.01, Cohen's d= 2.07 [0.14,1.80] but not the SCR group (p= 0.25, Cohen's d= 2.07 [0.14,1.80] (figure 3, table 2). No significant differences were found in subgroup analysis (p= 0.86).

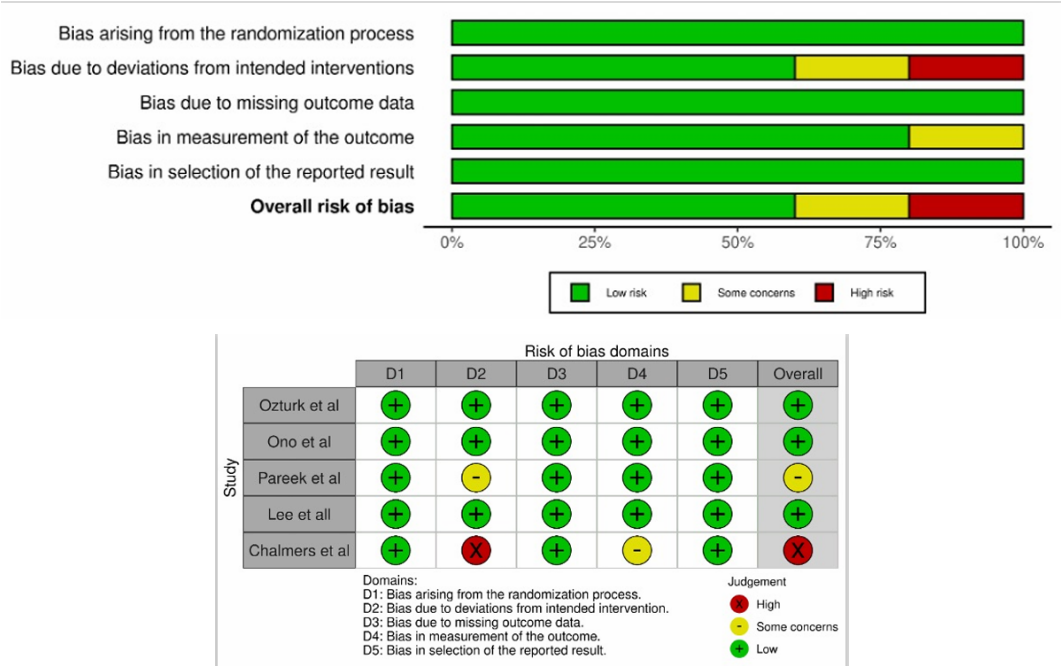

Figure 3

Heterogeneity

Heterogeneity for the SCR group was found to be $\tau^2 = 9.42$, H2 = 43.15, and $I^2 = 97.7\%$ while the RTSA group found $\square^2 = 0.00$, H2 = 1.00, and $I^2 = 0.0\%$.

Discussion

Superior Capsular Reconstruction (SCR)

Ono et al. evaluated the use of human dermal allograft (> 3mm thickness) for the repair of large to massive primary or recurrent rotator cuff tears, including those with or without subscapularis tears, after previous repair. Interventions following diagnostic arthroscopy, depending on subscapularis and biceps pathology included possible subscapularis repair with suture anchor fixation to the bone and biceps tenodesis in the lower portion of the bicipital groove with screw fixation. Posterosuperior rotator cuff pathology was addressed with subacromial smoothing and maintenance of the coracoacromial ligament. If achievable, the posterior aspect (infraspinatus and teres minor) or anterior cuff was repaired with standard suture anchor fixation to the bone by a single-row repair (partial repair) before bridge grafting (BG) or superior capsule reconstruction (SCR) was performed.

Twenty-four (96%) SCR and 23 (92%) bridge grafting (BG) patients underwent a partial repair, with only 1 (4%) SCR and 3 (8%) BG patients not undergoing partial repair. In patients receiving SCR, two or three double-loaded anchors were placed in the superior glenoid, depending on the medial defect, and sutures were passed through the graft in a simple suture and double pulley fashion. In the BG cohort, simple sutures were placed in the medial aspect of the tear (~1cm apart) to secure the graft to the retracted torn tendon. Both SCR and BG grafts were fixed to the humerus by two to three suture anchors placed in the medial aspect of the humeral footprint and two suture anchors placed in the lateral tuberosity to achieve double-row fixation. All patients followed a post-operative standardized physical therapy protocol.

Outcomes at 24 months were 74.8 ± 23.9, 66.0 ± 28.3, and 24.7 ± 26.1 for the SCR group and 77.9 ± 19.9, 69.5 ± 24.5, and 25.0 ± 19.1 for the BG grafts, recorded by American Shoulder and Elbow Surgeons (ASES), Western Ontario Rotator Cuff (WORC), and Quick Disabilities of the Arm, Shoulder, and Hands (QDash) scores, respectively. No statistically significant difference between each group was recorded at 3, 6, 12, and 24 months. Baseline ASES, WORC, and QDash SCR scores were 54.9 ± 23.4, 42.3 ± 20.6, and 44.9 ± 27.4, respectively.

Magnetic resonance imaging at 12 months demonstrated that 18 out of 24 (75%) grafts were integrated, and 6 out of 24 (25%) of the SCR grafts had re-torn. Of note, the range of motion, specifically abduction and forward flexion, was statistically greater in the SCR group than in the BG group at 3 months. It was also noted that individuals with an irreparable posterior cuff partial repair or subscapularis tear had inferior ASES scores (repaired; 81.4 ± 18.3, irreparable; 65.8 ± 24.1, P-value 0.01, N = 33) and WORC scores (repaired 72.9 ± 25.3, irreparable; 57.9 ± 25.8, P-value 0.04, N = 17) at 24 months. Graft failure was also higher in the irreparable group. The limitations of this study included surgeon blinding, type of graft used (human dermal allograft vs. fascia lata autograft), long-term evaluation, and the lack of a baseline partial repair-only group.

Ozturk et al. analyzed latissimus dorsi transfer (LDT) and superior capsule reconstruction (SCR) in 42 patients (average age 62.8) with large to massive irreparable rotator cuff tears. This prospective randomized controlled trial (RCT) included 21 patients in each arm, enrolled between January 2017 and July 2018. Primary outcome measures at the patients' last post-operative visit (average of 31 months) included the American Shoulder and Elbow Surgeons (ASES), Western Ontario Rotator Cuff (WORC), visual analog scale (VAS), Constant score, pseudo-paralysis, and radiographical analysis of acromiohumeral distance on X-ray (Grashey, lateral-Y, and axillary radiographs). Exclusion criteria comprised advanced glenohumeral arthritis, deltoid dysfunction, irreparable subscapularis tear, stiff shoulder, or previous shoulder surgery.

Twenty-four patients (11 LDT and 13 SCR) experienced pseudo paralysis before repair, with a Hamada grade of 1.4 ± 0.5 and an average Goutallier stage of 3.1 ± 0.8. Similar to Ono et al., Biceps tenodesis (Total N = 3, LDT = 1, SCR = 2) or tenotomy (Total N = 33, LDT = 15, SCR = 18) and subscapularis repair (Total N = 9, LDT = 4, SCR = 5) were performed before LDT or SCR. Retrieval of the latissimus dorsi graft involved blunt dissection and release of the muscle from the teres major, with insertion and fixation of an 8 x 4cm fascia lata graft. The SCR involved debridement of the superior and glenoid, with the graft fixed to the glenoid by horizontal mattress sutures and the lateral aspect fixed to the greater tuberosity at 30° of external rotation using a double-row fixation. Baseline ASES, WORC, Constant, VAS, and acromiohumeral interval (AHI) scores were 26.6 ± 10.1, 541 ± 184.1, 40.9 ± 15.8, 8.5 ± 0.9, 5.6 ± 2.8, and 23.2 ± 12.7, 495.2 ± 181.5, 36.6 ± 12.5, 8.2 ± 1.3, 7.1 ± 2.1 for the LDT and SCR groups, respectively. There was no statistical significance for each outcome measure at baseline; however, the AHI distance may have been clinically significant.

Postoperative values were 72.1 ± 20.5, 1427.7 ± 437.4, 73.9 ± 18.7, 2.7 ± 2.2, 7.3 ± 3.1, and 81.7 ± 12.3, 1565.6 ± 424, 81.1 ± 11.3, 1.4 ± 1.1, 7.5 ± 2.1 for LDT and SCR, respectively. All post-operative scores were statistically significant from baseline, but not significantly different between SCR and LDT. Although not statistically significant, the range of motion in flexion, abduction, and external rotation was significantly better in the SCR group at the final follow-up. The SCR group also had 12 out of 13 patients recover from pseudo paralysis, while only 5 out of 11 recovered in the LDT cohort, only one patient in each group, SCR and LDT, experienced failure.

Similar to Ono et al., the limitations of the study include the lack of surgeon blinding, long-term follow-up, and the comparison of different SCR graft types. Furthermore, this study only evaluated patients at their last follow-up.

Reverse Shoulder Arthroplasty (RSA)

Chalmers et al. investigated the efficacy of physical therapy (PT) compared to a standardized home exercise program (HEP) after reverse total shoulder arthroplasty (RSA) in a prospective randomized controlled trial (RCT). Patients who underwent conversion from total shoulder arthroplasty (TSA), those with an incompetent deltoid muscle, infections, and individuals unwilling to participate or non-compliant were excluded from the study. A total of 89 patients underwent RSA via the deltopectoral approach, using a Zimmer trabecular metal reverse implant with a retroverted humeral component and a glenoid component featuring a 25mm central post baseplate providing 4.5mm lateralization. The subscapularis was left unrepaired in all patients.

The PT group began therapy two weeks post-operatively, choosing their preferred therapist with no specific instructions. The therapy regimen consisted of twice-weekly sessions for the first 6 weeks and then weekly as needed. Patients in the HEP group followed a one-page instructional manual using pulley bands. The emphasized range of motion (ROM) in elevation, external rotation, internal rotation, and strength recovery focusing on the deltoid, infraspinatus, teres minor, and scapular retractors/stabilizers.

ASES scores for both PT and HEP groups at pre-operative, 6 weeks, 3 months, and 12 months were 35 and 59, 70 and 78, 42 and 63, then 71 and 80, respectively. The P-values at 6 weeks, 3 months, and 12 months were 0.470, 0.961, and 0.623, showing

no statistical significance among groups. The baseline P-value for ASES was not explicitly stated, but the authors report there was no significant difference found at any time point. ROM (abduction, flexion, adduction, and internal rotation) at 6 weeks, 3 months, and 12 months also did not exhibit statistical significance. Although the results were not clinically significant, the study had several limitations, including variations in physical therapists, a limited sample size, restricted long-term follow-up, concerns about the validity and accuracy of ROM testing, a high crossover rate (20%) from HEP to PT, and a minor crossover (4%) from PT to HEP. This crossover may have influenced ASES scores, inflating scores in the HEP group and undermining the PT ASES scores. Additionally, recent data has suggested repairing the subscapularis for RSA can improve the internal range of motion [18]. Our meta-analysis only included patients in the PT group for analyzing ASES to minimize bias from the HEP group and to standardize our sample.

Pareek et al. conducted a randomized controlled trial based on glenosphere size investigating blood metal ions in primary RSA. Patients with rotator cuff tear arthropathy, a posterior subluxated shoulder due to osteoarthritis, or a massive irreparable rotator cuff underwent RTA using the Stryker ReUnion system. Exclusion criteria comprised inflammatory arthritis, proximal humerus fractures requiring RSA, infections, or vulnerable patient populations. The analysis included 72 patients.

The surgical procedure involved a deltopectoral approach, biceps tenodesis to the conjoint tendon, subscapularis retraction and repair, and leading-edge supraspinatus release. Glenosphere sizes and offset included 36 + 2 (28%), 36 + 6 (25%), 40 + 2 (28%), and 40 + 6 (19%). The humerus was lateralized with either a 4mm or 10mm metal humeral tray with varying polyethylene inserts. Metal ion blood levels (nickel, cobalt, and chromium), American Shoulder and Elbow Surgeons (ASES) scores, Oxford Shoulder Score, and Subjective Shoulder Value were evaluated at 3 months and 12 months.

ASES scores were 44 ± 18.9, 73.4 ± 17.7, and 82.5 ± 16.9 preoperatively, at 3 months, and 12 months, respectively. The study found no statistical significance in blood metal ion levels at 3 months and 12 months post-operatively for all glenoid sizes. Limitations of the study included a short follow-up time and a small sample size for each group.

Lee et al. investigated the effects of deltoid neuromuscular electrical muscle stimulation (NMES) after reverse total shoulder arthroplasty from July 2018 to May 2020 in a prospective randomized controlled trial (RCT). The study included patients aged 65 years and older who had not previously undergone shoulder surgery or experienced major trauma to the superior shoulder complex. Ninety-two patients met the inclusion criteria, with 76 patients included in the one-year analysis (NMES group N = 33; non-NMES group N = 43). The Equinoxe (Exactech, Gainesville, FL) implant with a 20° retroversion onlay humeral stem, a neck shaft angle of 145, and a baseplate with a 38mm glenosphere was utilized using a deltopectoral approach.

All patients initiated self-assisted exercises at 4 weeks and active exercises at 6 weeks. The intervention involved applying two electrical pads to the anterior, middle, and posterior deltoid. NMES commenced 3 days after surgery, administered three times per day for 20 minutes, five times per week. The stimulation mode was set as a 1:3 duty cycle (10 seconds on, 30 seconds off) with symmetrical and biphasic pulses (300 μs at 25-35Hz). American Shoulder and Elbow Surgeons (ASES) scores at baseline, 3 months, 6 months, and 12 months were 38.3 ± 18.8, 58.5 ± 12.9, 69.9 ± 12.2, and 72.8 ± 10.3 for the NMES group and 39.6 ± 21.3, 60.0 ± 12.7, 70.3 ± 12.2, and 73.6 ± 11.1 for the non-NMES group, respectively. At no time points, including baseline, 3, 6, or 12 months, was there statistical significance (P-values 0.777, 0.610, 0.863, and 0.736). The only statistically significant measurement was external rotation at 3 and 6 months (NMES 36° ± 14° and non-NMES 29° ± 12°, P-value 0.003; and NMES 41° ± 12° and non-NMES 34° ± 11°, P-value 0.013). Limitations of this study primarily focused on deltoid muscle kinematics, not pertinent to RSA. Our meta-analysis only included patients in the non-NMES group for analyzing ASES to minimize additional variables and to standardize our sample.

Outcomes & implications

Our study indicates that neither treatment group showed superior improvements over the other as supported by a non-significant subgroup analysis of Homogeneity (p= 0.86). Importantly, both SCR and RSA are effective treatments for irreparable rotator cuff tears, with effect sizes of 2.45 [-1.85, 6.75] and 2.07 [0.14, 1.80], respectively. There was a small effect size difference between SCR and RSA, but the difference was not statistically significant, suggesting no additional benefit in outcomes for RSA over SCR. These results include the Ono et al. study which included six (25%) ASES scores from patients who experienced a SCR failure and likely influenced outcomes, potentially undermining the true effect of SCR. Our findings also reveal high variance in the SCR group and nominal variance for RSA (I^2; SCR = 97.7% and RSA = 0.0%), highlighting the consistency of lateralized RSA and emphasizing the variability observed in SCR. Since all other studies omitted retears from the final ASES score analysis, these outliers likely negatively skewed SCR overall ASES scores and contributed to the high variance. Additionally, Chalmers et al. reported a high crossover (20%) of patients transitioning from HEP to PT due to worsening conditions, also compromising RSA results.

SCR is a relatively novel approach for fixing massive rotator cuff tears deemed irreparable, and as such, various techniques, grafts,

and approaches are employed. In the papers by Ono et al. and Ozturk et al., highlighted in this paper, dermal allograft and fascia lata autograft were the graft types used. Lee et al. conducted a retrospective review exploring four different graft types: dermal allograft, fascia lata autograft, porcine xenograft, and long head of the biceps autograft. In both SCR studies, the range of motion was statistically significant at 3 months in Ono et. al. and at final follow-up in Ozturk et. al. when compared to BG and LDT respectively. Impressively, 12 out of 13 patients in Ozturk et al. no longer had pseudoparlaysis post-SCR. Their results demonstrated that dermal allograft, fascia lata autograft, and long head of the biceps autograft were all viable options.

The number and location of anchors placed within the glenosphere or humerus have not been extensively evaluated for SCR. Partial posterior capsule repair may also benefit patients undergoing SCR as shown in Ozturk et. al. The authors believe that the lack of standardization for SCR contributes to the variability observed in the results. As research and SCR techniques improve, so will the outcomes. The authors would also like to emphasize that the variability in graft type may have contributed to the 25% retear rate found in Ono et al. Although this failure rate is high, reports in RSA have been as high as 25%, and Ozturk et al. reported a failure rate of only 4% when fascia lata autograft was used.

Lastly, it is essential to emphasize that while RSA is a relatively routine surgery with consistent effectiveness, it comes at the cost of tissue and a smaller management reservoir upon failure. In contrast, superior capsular reconstruction (SCR), despite its high variability, stands as a relatively novel and effective surgery for individuals with irreparable rotator cuff tears. Our results demonstrate that SCR requires minimal to no tissue loss, and RSA remains a viable option if SCR fails.

The limitations of this study include a small sample size for both RSA and SCR. Although RSA is a more routine surgery, the inclusion criteria prioritized papers using the newest technology and lateralized approaches, limiting the number of available prospective randomized controlled trials (RCTs). Similarly, SCR, being a relatively novel technique, contributed to the limited availability of RCTs. Additionally, this study exclusively assessed American Shoulder and Elbow Surgeons (ASES) outcome scores. Future studies should consider evaluating a broader range of outcome measures, including range of motion, Western Ontario Rotator Cuff (WORC) scores, visual analog scale (VAS), acromiohumeral interval (AHI), and others.

In conclusion, both SCR and RSA emerge as effective surgical management options for irreparable rotator cuff tears, with no statistically significant difference observed in ASES scores between the two approaches.

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