Systematic Review

Acellular Dermal Allograft and Tensor Fascia Lata Autograft Show Similar Patient Outcome Improvement and High Rates of Complications and Failures at a Minimum 2-Year Follow-Up: A Systematic Review

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Purpose: To compare clinical and radiologic outcomes following superior capsular reconstruction (SCR) using dermal allograft versus tensor fascia lata (TFL) autograft for massive rotator cuff tears with a minimum 2-year follow-up. **Methods:** A literature search was performed by querying Scopus, EMBASE, and PubMed computerized databases from database inception through September 2022 in accordance with the 2020 Preferred Reporting Items for Systematic Reviews and Meta-Analyses guidelines. Studies evaluating clinical and radiologic outcomes, as well as complications following SCR for the treatment of massive rotator cuff tears were included. Study quality was assessed via the Newcastle−Ottawa Scale and the National Institutes of Health Quality Assessment. The mean change from preoperative to postoperative values (delta) was calculated for each outcome. **Results:** Seventeen studies, consisting of 519 patients were identified. Mean duration of follow-up ranged from 24 to 60 months. Mean reduction in visual analog scale pain score ranged from 2.9 to 5.9 points following use of dermal allograft, and 3.4 to 7.0 points following TFL autograft reconstruction. Mean improvements in American Shoulder and Elbow Surgeons score were similar between groups (dermal allograft: 28.0-61.6; TFL autograft: 24.7-59.3). The mean increase in forward flexion ranged from 31° to 38° with dermal allograft, versus 19° to 69° with TFL autograft. Average improvement in active external rotation with dermal allograft ranged from −0.4° to 11° and from 2° to 22.4° using TFL autograft. A similar change in acromiohumeral distance following SCR (dermal allograft: 0.9-3.2 mm; TFL autograft: 0.3-3.6 mm) was appreciated. The rate of complications within the dermal allograft group ranged from 4.5% to 38.2% versus 13.3% to 86.4% following TFL autograft. Failure rate ranged from 4.5 to 38.2% following dermal allograft versus 4.5 to 86.4% with TFL autograft. **Conclusions:** Acellular dermal allograft versus TFL autograft for SCR both demonstrate improved VAS and American Shoulder and Elbow Surgeons scores, with increased values in flexion and external rotation, and increased visual analog scale, although with high variability. Both grafts demonstrate high rates of complications and failures at minimum 2-year follow-up. **Level of Evidence:** IV; systematic review of level II-IV studies.

Massive, irreparable rotator cuff tears lead to severe pain and shoulder dysfunction while posing a substantial treatment challenge.[1] Superior capsular reconstruction (SCR) was developed as a salvage surgical strategy to reduce pain and improve function in patients with irreparable rotator cuff tears.[2-4] The goal

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of SCR is to restore the superior capsule, maintaining the anatomic relationship between the humeral head and glenoid through use of a soft-tissue graft fixed medially to the superior glenoid and laterally to the greater tuberosity.[5] In doing so, SCR creates an "inverted trampoline" effect to prevent superior humeral head translation during the initiation of shoulder abduction, thereby improving the moment arm and overall biomechanical function of the shoulder.[6] Biomechanical studies assessing SCR outcomes have observed greater muscle strength and normalized shoulder mechanics postoperatively.[7,8] Although recent studies have shown substantial improvements in patient-reported outcomes, significant variability in surgical technique and graft type exists.[9,10]

In their initial description of SCR, Mihata et al.[6,11] reported on the biomechanics and clinical outcomes associated with use of a 6- to 8-mm thick tensor fascia lata (TFL) autograft. Subsequently, a variety of SCR grafts have been evaluated.[12,13] Among these, use of an acellular dermal allograft with a thickness ranging between 2 and 4 mm represents the most common alternative graft.[9] Patient satisfaction, evaluated through reduced pain and improved functionality, has been observed along with restoration of normal acromiohumeral distance (AHD) following use of an acellular dermal allograft.[14] Functional scores, active range of motion (ROM), and shoulder strength also been shown to improve following SCR with significant continued postoperative progression.[15] Despite favorable clinical outcomes, postoperative complications and adverse events have been associated with SCR procedures. Graft failure and inadequate graft healing are among the highest-reported complications following SCR.[16,17] Aside from the risk of a new traumatic injury, tearing of the subscapularis tendon, anchor pullout, and single-row graft fixation have been correlated with greater rates of graft failure.[1,18] Other common clinical complications following SCR include shoulder stiffness with loss of ROM, and persistent biceps pain.[9] Despite the variability in graft options associated with SCR, investigations directly comparing the efficacy between the 2 most frequently employed graft types, TFL autograft and acellular dermal allograft, are scarce. The purpose of this systematic review is to compare clinical and radiologic outcomes following SCR using dermal allograft versus TFL autograft for massive rotator cuff tears with a minimum 2-year follow-up. We hypothesized that both surgical techniques would show similar results.

Methods

Search Strategy and Eligibility Criteria

A systematic review was performed in accordance with the 2020 Preferred Reporting Items for Systematic Review and Meta-Analysis guidelines.[19] A comprehensive literature search was conducted by 2 independent authors (G.J., T.T.) by querying Scopus, EMBASE, and PubMed computerized databases from database inception through September 25, 2022, for studies reporting outcomes and complications following arthroscopic SCR. The search criteria included the following search terms combined with Boolean operators: 'Superior Capsule Reconstruction,' 'Superior Capsular Reconstruction,' 'SCR,' and 'Rotator Cuff Tear.' Inclusion criteria consisted of Level I to IV clinical studies written in English or with an English translation, reporting on outcomes and complications following SCR using either a dermal allograft or a TFL autograft with a minimum 2-year follow-up. Nonclinical studies, such as cadaveric or biomechanical, studies failing to report clinical or radiographic outcomes, as well as studies with less than 2-year follow up, were excluded.

Data Extraction

Data was extracted from the selected studies and entered into a spreadsheet using Microsoft Excel, version 16.63 (Microsoft Corp., Redmond, WA) for further analysis. Collected data consisted of the lead author's name, publication year, level of evidence (as reported by Wright et al.[20]), patient demographics, graft type, graft thickness, surgical techniques, presence/absence of concomitant procedures, patient-reported outcomes scores, AHD, ROM in forward flexion and external rotation, failure rates (defined by the need for revision surgery), reoperations, and all complications. Postoperative complications were categorized into the following: pseudoparalysis, persistent shoulder pain, hardware failure, deep infection, hematoma, donor site pain, adhesive capsulitis. Complications not fitting into the listed categories were identified as "other." Revision surgery was identified as subsequent conversion to reverse total shoulder arthroplasty (rTSA), revision SCR, latissimus dorsi tendon transfer, arthroscopic debridement, or capsulotomy.

Risk of Bias Assessment

To evaluate risk of bias, 2 investigators (S.S. and J.C.) independently performed a methodological quality assessment using the Newcastle–Ottawa Scale for studies of Level I-III evidence and the National Institutes of Health Quality Assessment for level IV evidence studies (Appendix Tables 1 and 2, available at www.arthroscopyjournal.org). Disagreements were resolved by a third investigator (T.T.), during which time no disagreements were encountered.

Statistical Analysis

Data pooling was avoided due to the increased heterogeneity of the included studies. Descriptive summary statistics were used to report data outcomes. Patient outcomes and complications were reported as

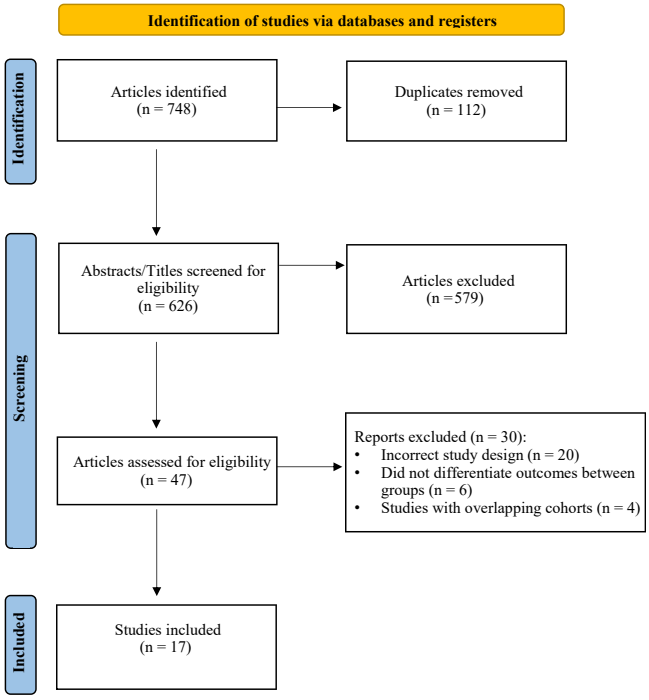

Fig 1. Preferred Reporting Items for Systematic Review and Meta-Analysis (PRISMA) diagram demonstrating study selection process.

means with standard deviations and ranges when reported within the included literature. Forest plots were generated using Review Manager 5 (The Nordic Cochrane Center, Copenhagen, Denmark) for outcomes reported as mean and standard deviation by three or more studies within both the acellular dermal allograft and tensor fascia allograft subgroups. Heterogeneity of these outcomes was assessed using the I^2 statistic.

Results

Study Participants

The initial search yielded 748 articles. Following a screening of title and abstracts, a total of 47 full-text articles were evaluated for eligibility (Fig 1). Following the full-text screening and data extraction, 17 studies, consisting of a total of 519 patients (n = 520 shoulders), meeting inclusion/exclusion criteria were identified. Of these, 9 studies[3,21-28] (n = 234 patients) reported on SCR using an acellular dermal allograft (mean age range, 53-66 years) and 8 studies[2,29-35] reported on SCR using a TFL autograft (n = 285 patients; mean age range, 61-71.3 years). In studies reporting on the use of TFL autograft, graft thickness ranged from 5 to 8 mm, whereas graft thickness ranged from 3.0 to 3.5 mm in studies reporting on dermal allograft. Mean duration of follow-up for the acellular dermal allograft and TFL autograft groups ranged from 24 to 40.8 months and 29.4 to 60 months, respectively. Subscapularis repairs were reported in 6 studies[3,22,23,26-28] in the acellular dermal allograft group and 7 studies[16,30-35] in the TFL autograft group (Table 1).

Patient-Reported Clinical Outcome Scores

Nine studies[3,22,23,27,29,31,32,34,35] (n = 303 patients) consisting of 115 patients who received dermal allograft and 158 patients who received TFL reported preoperative and postoperative visual analog scale (VAS) scores. The reported mean improvement in VAS score within the dermal allograft patients ranged from 2.9 to 5.87 points, versus 3.4 to 7 points following TFL autograft reconstruction. Fourteen studies[2,3,22-31,34,35] (n = 446 patients) consisting of 211 patients who received dermal allograft and 235 patients who received TFL reported a mean delta American Shoulder and Elbow Surgeons (ASES) score. The reported mean delta ASES score within the dermal allograft patients ranged from 28 to 61.6, versus 24.7 to 59.3 following TFL autograft reconstruction (Table 2). A forest plot comparing ASES scores between the acellular dermal allograft subgroup and the TFL autograft subgroup revealed significant postoperative increases in ASES scores from baseline for both groups. However, there was significant heterogeneity in both groups, and thus comparative statistics between the subgroups were not warranted (Fig 2).

ROM Outcomes

Twelve studies[2,3,21,23,25,29-35] (n = 402 patients) consisting of 117 patients who received dermal allograft and 285 patients who received TFL reported preoperative and postoperative forward flexion and external rotation measurements. The mean increase in forward flexion ranged from 31° to 38° in the patients who received dermal allograft and 19° to 69° in the patients who received TFL autograft. Mean improvement in active external rotation within the dermal allograft patients ranged from −0.4° to 11° and ranged from 2° to 22.4° within the TFL autograft patients (Table 3).

Radiologic Outcomes

AHD was evaluated in nine studies[22,23,26,29-32,34,35] (341 patients). In the acellular dermal allograft group, the mean delta AHD ranged from 0.9 to 3.2 mm, as reported in 3 studies[22,23,26] (95 patients). The mean delta AHD was reported in 6 studies[29-32,34,35] (246 patients) within the TFL autograft group and ranged from 0.3 to 3.6 mm (Table 4). A forest plot comparing the AHD changes between the acellular dermal allograft and TFL autograft subgroups revealed nonsignificant overall postoperative changes in AHD. In addition, there was significant heterogeneity in both groups, and thus comparative statistics between the subgroups were not warranted (Fig 3).

Table 1. Patient Demographics

Study	LOE	Patient No.	Shoulder No.	Mean Age, y	Mean Follow Up, m	Sex (M/F)	Graft Thickness, mm	Concomitant Procedures
Acellular dermal allograft group								
Makki et al., 2020[21]	4	23	23	66 (49-80)	24	17/8	3.5	Biceps tenotomy (n = 25); Partial infraspinatus repair (n = 5)
Hirahara et al., 2017[22]	4	8	8	61.33 (47-78)	32.38 (25-39)	6/2	3.3 ± 0.7 (1.5-3.5)	Biceps tenotomy (n = NR), Subscapularis repair (n = NR), infraspinatus repair (n = NR)
Burkhart et al., 2020[23]	4	41	41	64 ± 1.4 (39-78)	34 ±1 (24-50)	33/8	3	Biceps tenodesis (n = 16); biceps tenotomy (n = 8); Subscapular is tendon repair (n = 30); Infraspinatus partial repair (n = 10)
Ulrich et al.[3] (2022)	4	32	32	57.3	38.4	28/4	3	Subscapularis tendon repair (n = 19)
Lee et al., 2022[24]	4	7	7	53 ± 7.3 (43-62)	40.8 (24-74.4)	6/1	3.5	Biceps tenodesis (n = 2)
Cha et al., 2022[25]	4	21	21	64 (46-75)	36.9	19/2	3	Biceps tenodesis (n = NR)
Ciccotti et al., 2021[26]	3	46	46	57 ± 7	33.6 (24-56.4)	32/14	3	Biceps tenodesis (n = 26); Subscapularis tendon repair (n = 3)
LaBelle et al., 2021[27]	3	34	35	62.5 ± 6.9	24 (24-41)	23/11	—	Biceps tenodesis (n = 11); Subscapularis tendon repair (n = 5)
Lacheta et al., 202s[36]	3	22	22	56 (41-65)	25.2 (24-36)	13/9	3	Biceps tenodesis (n = NR); Subscapularis tendon repair (n = NR)
TFL autograft group								
Kholinne et al., 2021[29]	3	73	73	64.9 ± 4	44.7 ± 17.5	26/47	≥6	Biceps tenotomy (n = NR)
Mihata et al., 2018[30]	4	88	88	65.6 (43-82)	60 (35-110)	—	6-8	Biceps tenodesis (n = 7); Biceps tenotomy (n = 1); Subscapularis tendon repair (n = 21); Acromioplasty (n = 88)
Baek et al., 2022[31]	3	22	22	64.8 ± 5.8	39.3 ± 5.2 (26-49)	12/10	≥6	Biceps tenotomy (n = NR); Subscapularis tendon repair (n = NR); Acromioplasty (n = NR)
Takayama et al., 2021[2]	3	20	20	69.1 ± 4.8	36.5 (24-66)	11/9	8 ± 1	Biceps tenotomy (n = NR); Subscapularis tendon repair (n = 8)
Alarcon et al., 2021[32]	4	31	31	61 (47-76)	35 (24-51)	9/22	6	Biceps tenotomy (n = 27); Subscapularis repair (n = NR)
Azevedo et al., 2020[33]	4	19	19	64.8 ± 8.6 (47-77)	36	15/7	5-8	Biceps tenotomy (n = 10); Subscapularis tendon repair (n = 7)
Ozturk et al., 2021[34]	2	20	20	61.8 ± 9.1	30.6 ± 4.4 (24-44)	6/14	5	Biceps tenodesis (n = 2); Biceps tenotomy (n = 18); Subscapularis tendon repair (n = 5)
Kocaoglu et al., 2020[35]	2	12	12	71.3 ±5.1	29.4 (24-37)	3/9	8	Subscapularis tendon repair (n = NR)

F, female; LOE, Level of Evidence; M, male; NR, not reported; TFL, tensor fascia lata.

Table 2. Patient-Reported Outcome Scores

	VAS			ASES		
Study	Preoperative	Postoperative	Delta	Preoperative	Postoperative	Delta
Acellular dermal allograft group						
Hirahara at al., 2017[22]	6.25 ± 1.56 (4-8.5)	0.38 ± 1.06 (0-3)	−5.87	41.8 ± 12.7	86.5 ± 12.7	44.7
Burkhart et al., 2020[23]	4.6 (3.8-5.4)	0.7 (0.4-1)	−3.9	52 (46-57)	89 (86-92)	37
Ulrich et al., 2022[3]	5.3	2.4	−2.9	44	78	34
Lee et al., 2022[24]	–	–	–	59.9 (49.9-78.3)	87.9 (71.6-100)	28
Cha et al., 2022[25]	–	–	–	38.4 ± 22.2	100.0 ± 0.0	61.6
Ciccotti et al., 2021[26]	–	–	–	54.3 ± 16.3	85.4 ± 16.5	31.1
LaBelle et al., 2021[27]	6.6 ± 1.7	2.3 ± 2.8	−4.3	28.3 ± 10.1	68.2 ± 19.2	39.9
Lacheta et al., 2020[28]	–	–	–	51.9	82.6	30.7
TFL autograft group						
Kholinne et al., 2021[29]	5.5 ± 1.3	2.1 ± 1.0	−3.4	49 ± 15.8	77 ± 12.5	28
Mihata et al., 2018[30]	–	–	–	35 ± 16.9	94.3 ± 9.5	59.3
Baek et al., 2022[31]	4.0 ± 1.6	1.8 ± 2.4	−2.2	52.1 ± 14.4	76.8 ± 20.3	24.7
Takayama et al., 2021[2]	–	–	–	52.4 ± 12.6 (47.6-57)	86.1 ± 13.8 (79.6-92.6)	33.7
Alarcon et al., 2021[32]	7.7 (5-10)	0.7 (0-5)	−7	–	–	–
Ozturk et al., 2021[34]	8.2 ± 1.3	1.4 ± 1.1	−6.8	23.2 ± 12.7	81.7 ± 12.3	58.4
Kocaoglu et al., 2020[35]	8.0 ± 2.5	1.6 ± 2.4	−6.4	48.5 ± 15.5	82.6 ± 15	34.1

ASES, American Shoulder and Elbow Surgeons; SANE, Single Assessment Numeric Evaluation; TFL, tensor fascia lata; VAS, visual analog scale.

Complications

The overall reported incidence of complications ranged from 4.5% to 38.2% within the dermal allograft patients and 15% to 86.4% within the TFL autograft patients. Complications are reported in Table 5. The reported failure rate varied considerably, ranging from 4.5% to 38.2% in the patients who received dermal allograft and 4.5% to 86.4% in the patients who received TFL autograft.

Revision Surgery

Revision surgery was reported following both grafts, with a reported incidence rate ranging from 4.5% to 14.3% in the patients who received dermal allograft and 0% to 5.7% in the patients who received TFL autograft. The most commonly reported revision surgery in the dermal allograft patients was rTSA, with a reported incidence rate ranging from 0 to 23.1%. Arthroscopic debridement was the most commonly reported revision surgery in the TFL autograft patients which ranged from 0 to 5.3%.

Discussion

This systematic review suggests that SCR for massive, rotator cuff tears using both acellular dermal allografts and TFL autografts results in similar improvement

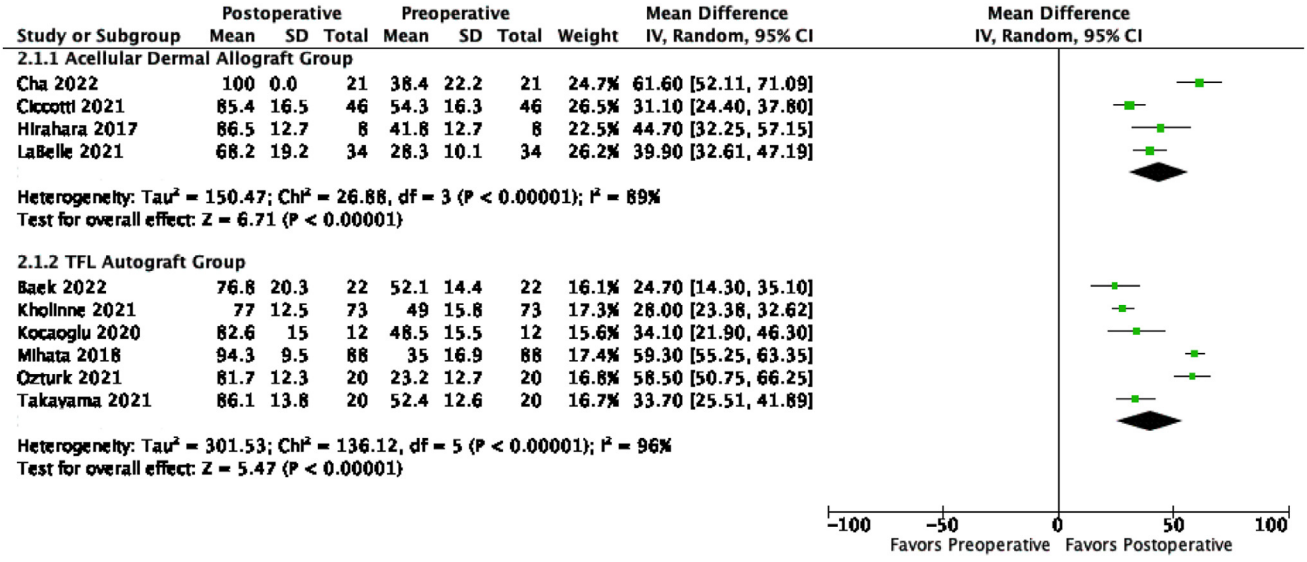

Fig 2. Forest plot comparing ASES scores. (ASES, American Shoulder and Elbow Surgeons; CI, confidence interval; IV, inverse variance; SD, standard deviation; TFL, tensor fascia lata.)

Table 3. Range of Motion Outcomes

Study	Forward Flexion, °			External Rotation, °		
	Preoperative	Postoperative	Delta	Preoperative	Postoperative	Delta
Acellular dermal allograft group						
Makki et al., 2020[21]	80	118	38	30	37	7
Burkhart et al., 2020[23]	140 (120-159)	172 (168-176)	32	37 (29-44)	48 (42-53)	11
Ulrich et al., 2022[3]	116	147	31	37 (29-44)	48 (42-53)	11
Cha et al., 2022[25]	111.7 ± 31.2	148.8 ± 14.4	37.1	28.7 ± 8.2	28.3 ± 7.6	−0.4
TFL autograft group						
Kholinne et al., 2021[29]	101 ± 26.5	139.5 ± 23.5	38.5	37.6 ± 13.5	47 ± 12.5	9.4
Mihata et al., 2018[30]	96.5 ± 23	155.9 ± 24.6	59.4	27.2 (−60 to 80)	42.8 (0 to −90)	15.6
Baek et al., 2022[31]	126.4 ± 54.5	145.5 ± 32.3	19.1	28.6 ± 11.2	41.1 ± 7.0	12.5
Takayama at al., 2021[2]	101 ± 45 (80-122)	146 ± 35 (129-162)	45	45 ± 24 (33-56)	47 ± 20 (38-56)	2
Alarcon et al., 2021[32]	115 (45-170)	171 (135-180)	56	33 (0-80)	50 (0-80)	17
Azevedo et al., 2020[33]	74.8 ± 55.5 (0-180)	143.8 ± 31.7 (80-180)	69	13.2 ± 18.4 (0-70)	35.6 ± 17.3 (0-60)	22.4
Ozturk et al., 2021[34]	101.7 ± 40.7	162.5 ± 30.4	60.8	15.2 ± 7.7	30.5 ± 6	15.3
Kocaoglu et al., 2020[35]	136.2 ± 24.4	160 ± 14.5	23.8	38 ± 15	50.3 ± 23.4	12.3

TFL, tensor fascia lata.

ASES scores, pain, AHD and ROM, but with significant variability which compares favorably with existing literature. SCR has demonstrated promising short-term improvements in patient-reported outcomes and range of motion for the treatment of massive, irreparable rotator cuff tears in select patient populations. Among graft choices, the TFL autograft was initially popularized by the biomechanical and clinical work of Mihata et al.[6,11] showing restoration of rotator cuff function by preventing superior translation of the humeral head with significant improvements in ASES scores, AHD, and forward flexion. Meanwhile, the use of acellular dermal allograft was developed as an alternative graft to mitigate the associated donor-site morbidity with TFL autograft and simplify the surgical procedure.[38,39] Acellular dermal allografts have similarly yielded favorable early clinical results with respect to ASES scores, AHD, forward flexion, and external rotation.[14,17] However, there is a paucity of data directly comparing the efficacy of acellular dermal allograft and TFL autograft at mid- and long-term follow-up. Previous studies have demonstrated improvements in pain, ROM, and other patient reported outcomes with low rates of SCR graft failure irrespective of graft type in the short term.[1,18,40-43] With a minimum follow-up of 2 years, the present systematic review adds to the current literature supporting these promising findings while also updating our understanding of longer-term outcomes of SCR irrespective of graft type.

Table 4. Acromiohumeral Distance

Study	AH Distance, mm		
	Preoperative	Postoperative	Delta
Acellular dermal allograft group			
Hirahara et al., 2017[22]	4.50 ± 2.25	7.7 ± 2.08	3.2
Burkhart et al., 2020[23]	7 ± 0.4	8 ± 0.4	1
Ciccotti et al., 2021[26]	7.4 ± 2.9	8.3 ± 3.2	0.9
TFL autograft group			
Kholinne et al., 2021[29]	4.3 ± 1.1	7.9 ± 2.3	3.6
Mihata et al., 2018[30]	4.4 (0.6-9)	6.6 (2.3-15.9)	2.2
Baek et al., 2022[31]	6.9 ± 2.8	7.2 ± 2.6	0.3
Alarcon et al., 2021[32]	6.1 (2-11)	8.6 (2-12)	2.5
Ozturk et al., 2021[34]	7.1 ±2.1	7.5 ± 2.1	0.4
Kocaoglu et al., 2020[35]	7.8 ± 2.8	9.3 ± 3	1.5

AH, acromiohumeral; TFL, tensor fascia lata.

In their 2019 qualitative review, Galvin et al.[42] evaluated 5 biomechanical and 5 clinical SCR studies and reported improvements in patient-reported outcomes, VAS, and ROM. However, they also noted 8-mm TFL grafts resulted in improved glenohumeral stability and reduced subacromial contact pressures when compared with 4-mm acellular dermal allografts. They concluded this based on the biomechanical cadaver tests conducted by Mihata et al.,[44,45] which show that a thicker graft results in improved restoration of glenohumeral mechanics, decreased thinning, and decreased elongation. Long-term monitoring of graft healing is necessary, as thicker grafts may not fully integrate, resulting in graft failure after initial healing.

Despite discrepancies discovered in biomechanical investigations, the present systematic review demonstrates how both grafts may be viable alternatives for SCR with improved ASES, VAS, AHD, and ROM. More recently, Smith et al.[41] observed in their systematic review, consisting of 16 clinical studies, similar improvements in ASES, VAS, FF, and ER between TFL autografts and dermal allografts. However, the minimum follow-up in the included studies required only 1 year follow-up, whereas our analysis reported on 18 clinical studies with a minimum follow-up of 2 years, where similar improvements patient-reported outcomes and ROM were appreciated. Although other systematic reviews performed in 2019 evaluating TFL

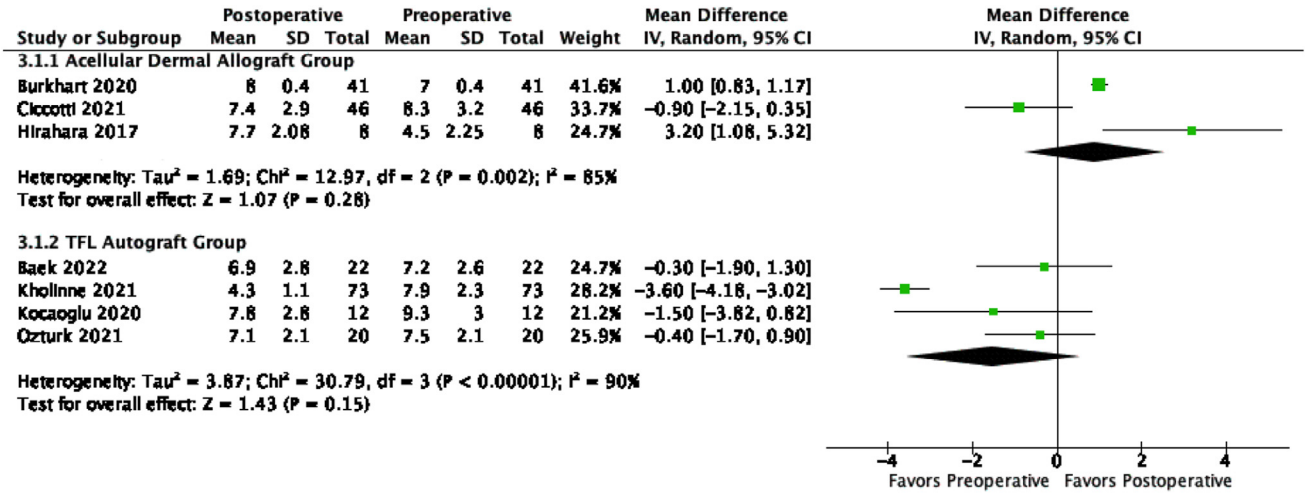

Fig 3. Forest plot comparing AHD (AHD, acromiohumeral distance; CI, confidence interval; IV, inverse variance; SD, standard deviation; TFL, tensor fascia lata.)

autograft and dermal allograft for SCR have demonstrated similar improvements in patient reported outcomes and ROM, these studies were limited to 1-year follow-up.[1,18,40,43] The present study expands our understanding of clinical outcomes associated with each graft type out to minimum 2-year follow-up.

Irrespective of graft type, SCR has demonstrated variable rates of graft failure ranging from 4.5% to 86.4.%. It is theorized that by reconstructing the superior capsule of the shoulder with a TFL autograft or dermal allograft, one is removing a number of biologic patient-related factors, including tear size, degree of muscular atrophy, degree of fatty infiltration, linked to slower healing and greater retear rates while still maintaining the rotator cuff force couples.[1]

When comparing graft failure rate by graft type, Smith et al.[41] reported greater failure rates in dermal allografts versus TFL autografts (16.7% and 9.2%, respectively). Notably, our review found a larger range of failure rates in studies using TFL autografts when compared with acellular dermal allografts (4.5% to 86.4% vs 4.5% to 38.2%, respectively). This may be due to more challenging incorporation of the thicker fascia lata autograft, but heterogeneity limited the ability to investigate predictors of failure after SCR. Complication rates ranged from 4.5% to 38.3% and 13.3% to 86.4% for dermal allografts and TFL autografts, respectively, which is a larger when compared with previous studies. Smith et al.[41] reported a complication rate of 5.6%, whereas Sochacki et al.[1]

Table 5. Postoperative Complications

	n	Incidence, %	n	Incidence, %
	Acellular Dermal Allograft Group		TFL Autograft Group	
Total complications	46/234 (n = 9 studies)	4.5-38.2	79/285 (n = 8 studies)	15-86.4
Total failures	39/234 (n = 9 studies)	4.5-38.2	55/285 (n = 8 studies)	4.5-86.4
Pseudoparalysis	4/57 (n = 2 studies)	3.1-12	3/108 (n = 2 studies)	2.3-5
Persistent shoulder pain	1/32 (n = 1 study)	3.1	3/51 (n = 2 studies)	5-6.5
Anchor displacement	—	—	4/119 (n = 2 studies)	3.2-3.4
Deep infection	0/234 (n = 9 studies)	0	3/285 (n = 8 studies)	0-5.3
Hematoma	0/234 (n = 9 studies)	0	2/285 (n = 8 studies)	0-5
Donor-site pain	—	—	5/107 (n = 2 studies)	1.1-21.1
Adhesive capsulitis	—	—	4/108 (n = 2 studies)	3.4-5
Other*	2/32 (n = 2 studies)	6.3	—	—
Revision surgery	23/234 (n = 9 studies)	4.5-14.3	7/178 (n = 5 studies)	0-5.7
rTSA	16/234 (n = 9 studies)	0-23.1	1/178 (n = 5 studies)	0-5
SCR	4/234 (n = 9 studies)	0 − 4.5	0/178 (n = 5 studies)	0
LDTT	1/234 (n = 9 studies)	0 − 2.9	—	—
Arthroscopic debridement	2/234 (n = 9 studies)	0 − 5.8	3/178 (n = 5 studies)	0 − 5.3
Capsulotomy	—	—	1/178 (n = 5 studies)	0 − 3.4

LDTT, latissimus dorsi tendon transfer; rTSA, reverse total shoulder arthroplasty; SCR, superior capsular reconstruction; TFL, tensor fascia lata.
*Exacerbation of pre-existing cervical myelopathy (n = 1), significant weakness and anterior escape (n = 1).

reported a rate of 3.8%. Compared with patients younger than 60 years undergoing rTSA, complication rates have been reported to be as high as 39%.[46] Having said that, failure of SCR should be defined as a complication as it may require further surgery.

As the surgical technique for SCR has continued evolved since its first description in 2012, so too have the clinical indications for its use. Early clinical outcomes following SCR suggest that the procedure is optimally indicated in patients with irreparable rotator cuff tears and several additional characteristics, including Hamada stage I or II, preserved passive range of motion, and an intact or repairable subscapularis.[4,47] Our review collates all data generated since the inception of the SCR technique and, consequently, a refinement in clinical indications may, at least in part, account for the wide variation reported in multiple clinical outcomes. Moreover, geographic-based variations in clinical practice patterns may further affect clinical outcomes stratified by graft type. For example, the clinical outcomes reported by Mihata et al. using a TFL autograft were derived primarily from a Japanese patient population, whose anatomy, patient expectations, and activity levels may differ greatly from those of a Western patient population, where dermal allograft has been used more frequently.[11]

Limitations

This study is not without limitations. First, the majority of the included studies were of Level III and IV evidence, prohibiting a statistical comparison of continuous variables such as patient-reported outcomes. Second, the maximum follow-up within the TFL autograft group was longer than the dermal allograft group. Since the risk of SCR failure increases with time, the increased duration of follow-up may account for discrepancies in failure rates and/or complication rates between grafts. In addition, the wide range of reported outcomes may be explained by the wide range of follow-up time in the included studies. Furthermore, our study does not account for the degree of rotator cuff disease, patient age, or patient activity level before surgical intervention. The authors also queried that major complications such as deep infection and hematoma would have been documented if they had occurred in studies reporting complications but were not explicitly reported as absent in 15 of the 17 studies. Lastly, we acknowledge that our search strategy and eligibility criteria may have unintentionally omitted data from relevant cohorts, although we ensured that this risk was minimized by reviewing references from each included study.

Conclusions

Acellular dermal allograft versus TFL autograft for SCR both demonstrate improved VAS and ASES scores, with increased values in flexion and external rotation, and increased AHD, although with high variability. Both grafts demonstrate high rates of complications and failures at minimum 2-year follow-up.

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Appendix Table 1. Quality Assessment of the included studies by the Newcastle–Ottawa Scale (NOS)

	Selection				Comparability		Outcome			
Study	Representativeness of Treated Cohort	Selection of Comparative Cohort	Ascertainment of Treated Cohort Records	Outcome of Interest Was Not Present at Start	Controls for Age/Sex	Controls for Any Additional Factor	Assessment of Outcome	Long Enough Follow-Up	Adequacy of Follow-Up	Total Quality Score
Ciccotti et al., 2021[26]	★	★	★	★	★	★	★	★	★	9
LaBelle et al., 2021[27]	★	★	★	★	★	★	★	★	★	9
Lacheta et al., 2020[28]	★	★	★	★	★	★	★	★	★	9
Kholinne et al., 2021[29]	★	★	★	★	★	★	★	★	★	9
Baek et al., 2022[31]	★	★	★	★	★	★	★	★	★	9
Takayama et al., 2021[2]	★	★	★	★	★	★	★	★	★	9
Ozturk et al., 2021[34]	★	★	★	★	★	★	★	★	★	9
Kocaoglu et al., 2020[35]	★	★	★	★	★	★	★	★	★	9

NOTE. Each study was evaluated on 3 broad perspectives: the selection of study groups; the comparability of the groups; and the ascertainment of the outcomes measured. A star indicates that the study met the requirements for the characteristic in question. A maximum of 9 stars can be awarded to each study.

Appendix Table 2. The National Institutes of Health Quality Assessment Tool Assessing the Quality of Studies Included in the Systematic Review

Study	Was The Research Question or Objective in This Paper Clearly Stated?	Was the Study Population Clearly Specified and Defined?	Was the Participation Rate of Eligible Persons at Least 50%?	Were All the Subjects Selected or Recruited From the Same or Similar Populations?	Was a Sample Size Justification, Power Description, or Variance and Effect Estimates Provided?	For the Analyses in This Paper, Were the Exposure(s) of Interest Measured Prior to the Outcome(s) Being Measured?	Was the Timeframe Sufficient So That One Could Reasonably Expect to See An Association Between Exposure and Outcome If It Existed?	For Exposures That Can Vary in Amount or Level, Did the Study Examine Different Levels of the Exposure?	Were the Exposure Measures (Independent Variables) Clearly Defined, Valid, Reliable, and Implemented Consistently Across All Study Participants?	Was the Exposure(S) Assessed More Than Once Over Time?	Were the Outcome Measures (Dependent Variables) Clearly Defined, Valid, Reliable, and Implemented? Consistently Across All Study Participants?	Were the Outcome Assessors Blinded to the Exposure Status of Participants?	Was Loss to Follow-Up After Baseline 20% or Less?	Were Key Potential Confounding Variables Measured and Adjusted Statistically for Their Impact on the Relationship? Between Exposure(s) and Outcome(s)?	Summary Quality
Makki et al., 2020[21]	✔	✔	✔	✔	✔	✔	✔	NA	✔	✔	✔	NA	✔	✔	12
Hirahara et al., 2017[22]	✔	✔	✔	✔	X	✔	✔	NA	✔	✔	✔	NA	✔	✔	11
Lacheta et al., 2020[28]	✔	✔	✔	✔	X	✔	✔	NA	✔	✔	✔	NA	✔	✔	11
Burkhart et al., 2020[23]	✔	✔	✔	✔	✔	✔	✔	NA	✔	✔	✔	NA	✔	✔	12
Ulrich et al., 2022[3]	✔	✔	✔	✔	✔	✔	✔	NA	✔	✔	✔	NA	✔	✔	12
Cha et al., 2022[25]	✔	✔	✔	✔	✔	✔	✔	NA	✔	✔	✔	NA	✔	✔	12
Mihata et al., 2018[30]	✔	✔	✔	✔	X	✔	✔	NA	✔	✔	✔	NA	✔	✔	11
Alarcon et al., 2021[32]	✔	✔	✔	✔	✔	✔	✔	NA	✔	✔	✔	NA	✔	✔	12
Azevedo et al., 2020[33]	✔	✔	✔	✔	✔	✔	✔	NA	✔	✔	✔	NA	✔	✔	12
Mihata et al., 2019[37]	✔	✔	✔	✔	X	✔	✔	NA	✔	✔	✔	NA	✔	✔	11

NOTE. Quality was rated as 0 for poor (0-4 of 14 questions), i for fair (5-10 of 14 questions), or ii for good (11-14 of 14 questions).
NA, not applicable.