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Survivorship, complications, and outcomes of custom glenoid implants in reverse total shoulder arthroplasty: a systematic review

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Background: Custom glenoid baseplates have emerged to manage severe glenoid bone loss in reverse total shoulder arthroplasty (rTSA). While early clinical and radiographic results are encouraging, complication and failure rates remain poorly characterized. This systematic review aimed to evaluate the survivorship, complications, and clinical outcomes of custom glenoid implants used in rTSA.

Methods: A comprehensive literature search of Cochrane, Embase, and MEDLINE databases was performed to identify studies using custom glenoid baseplates in rTSA. Inclusion criteria encompassed clinical studies reporting complication rates, failure etiology, and functional outcomes. Data extraction included demographics, follow-up duration, failures, complication rates, patient-reported outcome measures (PROMs), and range of motion. Weighted means and standard deviations were calculated using pooled data.

Results: Nine studies encompassing 168 shoulders (63 primary and 105 revision rTSAs) met inclusion criteria. The weighted mean age was 69.7 years with an average follow-up of 31.6 months. The overall failure rate was 3.3%, with glenoid loosening accounting for only 0.6% of cases. The most common failure mechanism was humeral component loosening. The overall complication rate was 30.9%, higher in revision cases (27.8%) than primary (12.9%). There were improvements in PROMs such as the Constant −Murley Score, American Shoulder and Elbow Surgeons score, Disability of the Arm, Shoulder, and Hand score, Simple Shoulder Test, Single Assessment Numeric Evaluatio, and Visual Analog Score scores. Similarly, patients experienced meaningful gains in active forward flexion (+48.3°-+61.4°), abduction (+33.6°-+34.5°), and external rotation (+11.0°-+24.1°), with superior improvements in primary compared to revision procedures.

Discussion and Conclusion: At short term follow-up, custom glenoid components failure rate remained low, with improvements exceeding minimal clinical important differences in PROMs and marked improvement in range of motion. The glenoid loosening rate was 0.6% in patients undergoing rTSA with a custom glenoid component at a weighted average follow-up of 31.6 ± 6.7 months.

Glenoid bone loss is a common challenge orthopedic surgeons face when planning total shoulder arthroplasty (TSA), which may lead to shoulder instability and early loosening of the glenoid baseplate component.[17,29] To combat this, several techniques have been devised to address glenoid deformities and deficiencies, such as glenoid reaming, bone grafting, and patient-specific instrumentation.[16,21,33]

Recently, computer-aided design/computer-assisted manufacturing has utilized computed tomography images of a patient's glenoid to create custom glenoid baseplates for severe glenoid bone deficiency.[7,10,12] This process involves analyzing a 3-dimensional computed tomography model of a patient's scapula to produce a patient-specific glenoid prosthesis for reverse total shoulder arthroplasty (rTSA). The outcomes of this

Institutional review board approval was not required for this study.

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procedure are promising, with both clinical improvement and radiographic stability.[4,27] Despite these advancements, the optimal implant design for achieving the best clinical outcomes in shoulder arthroplasty remains unknown. Several companies offer custom 3-dimensional-printed baseplates, with each one claiming various biomechanical advantages. However, the ideal method of fixation, the optimal degree of lateralization, and their effects on implant longevity—particularly regarding loosening and acromial stress fractures—are still uncertain.

The reported failure and complication rates of custom glenoid baseplates vary widely between studies.[11,18] Thus, it is important to describe the reasons for failure and complications to critically appraise and improve custom glenoid baseplates. There is currently a paucity of literature regarding the reasons for custom glenoid baseplate failure, complication rate, and clinical outcomes.

The purpose of this systematic review is to evaluate the current literature on this topic and elucidate the survivability of custom glenoid implants, with a secondary endpoint of determining the clinical outcomes of these custom implants through patient-reported outcome measures (PROMs) and range of motion (ROM) values. We hypothesize that the most common reason for custom glenoid baseplate failure will be due to periprosthetic loosening, which involves implant components becoming loose and dislodging from the bone, and that custom glenoid implants will result in vast improvements in PROMs and ROM values.

Methods

This review was performed according to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses guidelines for reporting systematic reviews. Before the literature search was conducted, the review was registered on International Prospective Register of Systematic Reviews (CRD42024625569).

Search strategy

A search strategy was created to query the databases of Cochrane, Embase, and MEDLINE with no restriction on publication date. The initial literature search was conducted in September 2024. This search strategy aimed to identify all studies that investigated the utilization of patient-specific or "custom" glenoid baseplates for shoulder arthroplasty. Examples of search terms included "custom glenoid," "patient-specific instrumentation," "complications," "implant," "base," "osteolysis," "bone deficiency," "bone loss," and "failures" to identify the relevant articles. Inclusion criteria were: (i) primary studies that assessed the use of patient-specific glenoid base plates for rTSA, (ii) included the number of complications and stated the specific complication encountered, (iii) included the number of patient-specific glenoid failures with the reasons for failure, (iv) full-text provided, and (v) published in English. Exclusion criteria were: (i) noncustom glenoid baseplate used, (ii) no data provided concerning complication rate or specific complications, (iii) the use of anatomic shoulder arthroplasty, and (iv) no data provided regarding patient-specific glenoid baseplate failure and reasons for failure.

Assessment of eligibility and study selection

The initial database search yielded 3,612 papers matching the keywords found in Figure 1. After removing 1,049 duplicate studies, 2,563 studies were remaining. Two independent reviewers (J.V. and A.S.) applied the aforementioned exclusion criteria to the titles and abstracts of the studies, resulting in 2,515 studies being removed. Following this, full-text review was conducted of the remaining 48 articles, resulting in 9 papers studies that fit the criteria for the systematic review. Any disagreements encountered during this process were resolved by a third independent reviewer (M.H.) A Preferred Reporting Items for Systematic Reviews and Meta-Analyses flowchart detailing the search strategy is included in Figure 1.

Assessment of study quality

Study quality was assessed using the Critical Appraisal Skills Programme checklist.[35]

Data extraction

Extracted data included: (1) study characteristics: title, author, publication year, study design; (2) manufacturer of the patient-specific glenoid implant; (3) technique used; (4) if it was a primary or revision arthroplasty; (5) study population: number of participants, sex, and age; (6) follow-up interval; (7) number of complications; (8) specific complications; (9) number of failures; (10) specific reasons for failure; (11) PROMs; and (12) ROM data. Two independent reviewers (J.V. and A.S.) extracted the data from each article. Disagreements in data collection were resolved by a third independent reviewer (M.H.).

Data analysis

Following data extraction, pooled data analysis was performed using SAS 9.4 (SAS Institute, Cary, NC, USA) to calculate statistics such as weighted means, standard deviations, and confidence intervals (CIs).

Results

Study characteristics and demographics

Table I summarizes the characteristics and demographics of each study. The included 9 studies reported on 168 shoulders (71 males, 97 females). The weighted average age was 69.7 ± 3.8 years, and the weighted average follow-up was 31.6 ± 6.7 months. Custom glenoid implants were used in 63 (38.5%) primary and 105 (62.5%) revision procedures. All cases were rTSA implants.

Critical Appraisal Skills Programme checklist

Scores of the included studies ranged from 9 to 11, with an average score of 9.8.

Failures

There were 6 failures reported across studies for an overall failure rate of 3.3%. There were 3 failures that were secondary to glenoid component dysfunction. Glenoid plate dysfunction was defined as loosening, breakage or damage of the glenoid component, or failure of fixation between the implant and the bone. These glenoid plate dysfunction included infection ($n = 2$) and multiple screw breakage resulting in baseplate loosening ($n = 1$). Three other causes of failure were defined as humeral component loosening.

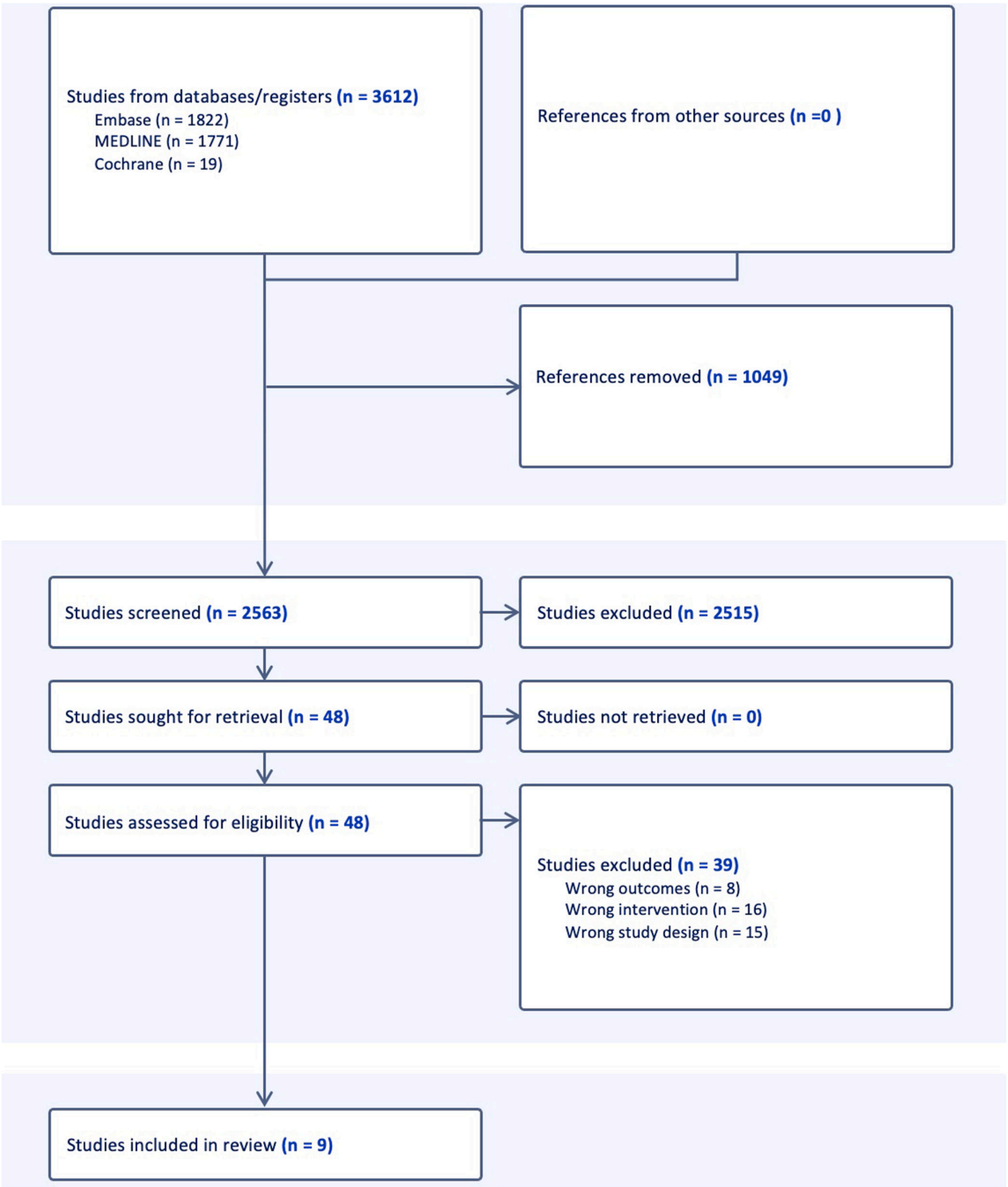

Figure 1 PRISMA flowchart detailing the study selection process. *PRISMA*, Preferred Reporting Items for Systematic Reviews and Meta-Analyses.

Complications

There were 56 complications reported across studies, for an overall complication rate of 30.9%. The most common complications were infection (12), central screw deemed a spinner (8), and greater tuberosity fractures (8). Using studies that stratified complication data by whether procedures were primary or revision procedures, we found a complication rate of 12.9% (4/31)

Table I
Study characteristics and demographics.

Author	Yr	Study design	Technique	System used	Primary/ revision	Number of patients			Average age (yr)	Follow-up (mo)
						Total	Male	Female		
Michelin et al[16]	2024	Case series	rTSA	Comprehensive vault reconstruction system (VRS) (Zimmer Biomet, Warsaw, IN, USA)	Primary	19	9	10	66.6	38.1
					Revision	28	16	12	65.5	39.7
Moran et al[17]	2024	Case series	rTSA	Comprehensive vault reconstruction system (VRS) (Zimmer-Biomet, Warsaw, IN, USA)	Primary	5	3	2	72.6	20.2
					Revision	9	1	8	62.6	30.2
Apiwatanakul et al[2,*]	2023	Case series	rTSA	Comprehensive vault reconstruction system (VRS) (Zimmer-Biomet, Warsaw, IN, USA)	Primary	5	1	4	75.7	43
					Revision	4	3	1	72.6	36.2
Bodendorfer et al[5]	2021	Case series	rTSA	Comprehensive vault reconstruction system (VRS) (Zimmer Biomet, Warsaw, IN, USA)	Primary	7	3	4	67	33
					Revision	5	4	1	69.4	26
DeBeer et al[10]	2019	Case series	rTSA	Glenius glenoid reconstruction system (Materialise NV, Leuven, Belgium)	Primary	5	0	5	71.6	34.6
					Revision	5	3	2	66	26.4
Ortmaier et al[19]	2022	Case series	rTSA	Materialise (Glenius, Materialise NV, Leuven, Belgium)	Revision	10	0	10	76.6	23.1
Porcellini et al[21]	2021	Case series	rTSA	Lima ProMade system, (Lima Corporate, Udine, Italy)	Revision	6	3	3	64	31.7
Rangarajan et al[22]	2020	Case series	rTSA	Comprehensive vault reconstruction system (VRS) (Zimmer Biomet, Warsaw, IN, USA)	Primary	8	4	4	70	14.6
					Revision	10	7	3	64	21.1
Rashid et al[23]	2023	Case series	rTSA	Lima ProMade system, (Lima Corporate, Udine, Italy)	Primary	14	15	27	74	31.6
					Revision	28				

rTSA, reverse total shoulder arthroplasty.
*Included 22 total participants for complication/failure data, but only 9 participants' demographic data were reported.

Table II
Complications.

Author	Primary/Revision	Number of complications	Complications
Michelin et al[16]	Revision	13	-Humeral stem loosening -Infection (4) -Glenosphere dissociation -Acromial stress fracture -Traumatic instability (2) -Atraumatic instability (3) -Humeral cortical perforation by screw
	Primary	3	-Baseplate failure due to multiple screw breakage -Greater tuberosity fracture -Pulmonary embolism
Apiwatanakul et al[2,*]	Unspecified	27	-Greater tuberosity fracture (5) -Greater tuberosity plus proximal humeral shaft fracture -Infection (6) -Scapular spine fracture -Implant toggling (4) -Central screw deemed a spinner (8) -Completely missed screw trajectory (2)
Moran et al[17]	Unspecified	2	-Humeral stem loosening -Radial nerve palsy
Bodendorfer et al[5]	Revision	0	-
	Primary	0	-
DeBeer et al[10]	Revision	1	-Prosthesis dislocation
	Primary	1	-Brachial plexus injury
Ortmaier et al[19]	Revision	0	-
Porcellini et al[21]	Revision	1	-Atraumatic instability
Rangarajan et al[22]	Unspecified	4	-Greater tuberosity fracture -Infection -Atraumatic instability -Humeral cortical perforation
Rashid et al.[23]	Unspecified	4	-Humeral stem loosening (3) -Infection

*Twenty-two patients were included for complication data presented for this paper.

for primary procedures and 27.8% (15/54) for revision procedures.[4,11,18,22,24] Full complication data is found in Table II.

Patient-reported outcomes

Overall

Weighted average PROMs from pre- to postoperation were: Constant–Murley Score (CMS) of 21.1 ± 3.9 (95% CI [20.5, 21.8]) to 51.8 ± 7.3 (95% CI [50.6, 53.1]); American Shoulder and Elbow Surgeons (ASES) score of 26.2 ± 4.5 (95% CI [25.5, 27.0]) to 71.9 ± 6.6 (95% CI [70.8, 72.9]); Disability of the Arm, Shoulder, and Hand (DASH), 58.6 ± 0.7 (95% CI [58.4, 58.7]) to 33.5 ± 2.6 (95% CI [32.9, 34.1]); Simple Shoulder Test (SST), 3.7 ± 0.5 (95% CI [3.6, 3.8]) to 12.9 ± 12.7 (95% CI [10.1, 15.6]); Single Assessment Numeric Evaluation (SANE), 29.6 ± 2.6 (95% CI [29.0, 30.1]) to 70.8 ± 3.9 (95% CI [70.0, 71.6]); and Visual Analog Score (VAS), 7.1 ± 0.6 (95% CI [7.0, 7.3]) to 1.7 ± 0.7 (95% CI [1.6, 1.9]). Full patient-reported outcomes stratified by study are found in Table III.

Table III
Patient reported outcomes (preoperative and postoperative).

Author	OSS		CMS		SSV		ASES		DASH		SST		SANE		VAS	
	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post
Michelin et al[16]	-	-	23.4	53.1	-	-	27.8	69.1	59.9	35.7	3.3	7.6	28.9	66.7	7.1	1.8
Moran et al[17]	-	-	-	-	-	-	-	77.1	-	-	-	-	-	72.1	-	1.3
Apiwatanakul et a.[2]	-	-	-	-	-	-	26.6	68.1	-	-	4	8	34.7	69.6	8.2	1.5
Bodendorfer et al[5]	-	-	-	-	-	-	33	80	-	-	-	-	30	80	-	-
DeBeer et al[10]	-	-	-	41.3	-	-	-	-	-	-	-	47.5	-	-	-	3.3
Ortmaier et al[19]	-	-	10.9	51.7	11.0	52.0	-	-	-	-	-	-	-	-	-	-
Porcellini et al[21]	-	-	15	24.8	-	-	15.3	45.8	-	-	-	-	-	-	8.0	2.3
Rangarajan et al[22]	-	-	24.6	60.4	-	-	32	79	57.4	29.4	4.5	9.3	25.4	72.2	6.2	0.7
Rashid et al[23]	15	36	15	52	-	-	22	71	-	-	-	-	-	-	-	-

OSS, Oxford Shoulder Score; *CMS*, Constant–Murley Score; *SSV*, subjective shoulder value; *ASES*, American Shoulder and Elbow Surgeons; *DASH*, Disabilities of the Arm, Shoulder, and Hand; *SST*, simple shoulder test; *SANE*, single assessment numeric evaluation; *VAS*, visual analog score.

Minimal clinically important difference

MCID values were pulled from previous published studies that had established thresholds. These included CMS (3.5-4.5), ASES (10.7-11.9), DASH (10.83-15), SST (1.1-1.3), SANE (14.9), and VAS (1.6-1.8). No established MCID value was identified for Subjective Shoulder Value, and the only established value for Oxford Shoulder Score was done for anatomic total shoulders.[8,13,20,30,32]

Revision vs. primary

Six studies reported PROMs stratified by whether patients underwent a primary rTSA or a revision rTSA with the placement of a custom glenoid implant.[11,18,22,24,26,27] Table IV compares patients who underwent rTSA with a custom glenoid prosthesis stratified by whether it was a primary or revision surgery. Weighted differences for each PROM from pre- to postop for revision operations were: CMS, +30.6 ± 7.4; ASES, +38.9 ± 6.6; DASH, −25.5 ± 0.1; SST, +4.3 ± 0.4; SANE, +40.0 ± 4.3; VAS, −4.7 ± 0.5. Weighted differences for each PROM from pre- to postop for primary operations were: CMS, +37.7 ± 3.9; ASES, +54.4 ± 4.4; DASH, −24.9 ± 4.1; SST, +4.7 ± 0.1; SANE, +40.6 ± 3.6; VAS, −6.4 ± 0.5.

Range of motion values

Overall

Weighted average ROM values from pre- to postoperation were: active shoulder forward flexion, 64.4° ± 12.8 (95% CI [61.9, 66.8]) to 113.3 ± 16.5 (95% CI [110.6, 115.9]); active shoulder abduction, 47.5° ± 9.4 (95% CI [45.6, 49.4]) to 86.2 ± 12.8 (95% CI [84.0, 88.3]); and active external rotation, 14.2° ± 2.4 (95% CI [13.8, 14.7]) to 31.2 ± 7.0 (95% CI [29.9, 32.5]). Full ROM values stratified by study are found in Table V.

Revision vs. primary

Four studies reported ROM values stratified by whether patients underwent a primary rTSA or a revision rTSA with the placement of a custom glenoid implant.[18,19,24,26] Table VI compares patients who underwent rTSA with a custom glenoid prosthesis stratified by whether it was a primary or revision surgery. Weighted differences for each ROM measurement from pre- to postop for revision operations were: active forward flexion, 48.3 ± 2.5; active abduction, 33.6 ± 1.5; and active external rotation, 11.0 ± 1.0. Weighted differences for each ROM measurement from pre- to postop for primary operations were: active forward flexion, 61.4 ± 1.3; active abduction, 34.5 ± 2.7; and active external rotation, 24.1 ± 1.3.

Discussion

The most important finding of this review was that custom glenoid baseplates have a low failure rate (3.3%) in an average 3-year follow-up, with several reasons for failure. While complication rates were elevated, patient-reported outcomes improved from pre- to postoperation to reach minimal clinical important differences.[8,13,20,30,32]

Custom glenoid baseplates have been developed to address severe glenoid bone loss in primary and revision shoulder arthroplasty. While this is effective in increasing postoperative outcomes for this subset of patients, these implants involve a large financial burden.[19] Therefore, it is important to elucidate the survivorship of custom glenoid implants to justify the associated patient, physician, and facility costs. This review determined that custom glenoid implants have a low failure rate (3.3%) in both primary and revision rTSA in an average 3-year follow-up. This is promising as shoulder arthroplasty has become increasingly more common, and surgeons are going to be performing more revision cases with severe glenoid bone loss.[3]

As the use of custom baseplates become more prevelant, it is vital to recognize that the components of these custom designs are not uniform across manufacturers. The variations are due to the different approaches that each manufacturer has in addressing bone loss. This includes maximizing bony contact, achieving fixation in distal cortical bone through both acromial-spine and coracoid fixation, minimizing bone resection, and optimizing implant orientation. In addition, a variety of surface coatings as used, such as Titanium nitride, calcium phosphate, hydroxyapetite, and porous titanium or tantalum, to increase osseointegration.[6,9,25,36] While there are differences between each manufacturer there is no specific data that shows superiority between different design types.

Overall, the minimal clinically important difference (MCID) was achieved from baseline to final follow-up for each PROM, regardless of whether they underwent primary or revision surgery.[8,30,32] However, there was a notable difference between primary and revision groups when measuring the difference from pre- to postoperation changes in PROMs. For example, patients who underwent a primary operation had a 15-point increase above those undergoing revision surgery (+54.4 vs. + 38.9, respectively) when measuring the change in ASES from baseline to final follow-up. This difference may be explained by the overall increased ROM that primary rTSA patients enjoyed over revision patients. This includes a 13° increase in both forward flexion (+61.4° vs. +48.3°, respectively) and external rotation (+24.1° vs. +11.0°, respectively). Having a robust ROM in these domains is critical, as they are frequently performed in basic activities of daily living and thus allows for better PROMs.

Table IV
Revision vs. primary custom glenoid implant PROMs.

PROM	Revision			Primary		
	Number of patients	Mean* ± SD	95% confidence interval	Number of patients	Mean* ± SD	95% confidence interval
CMS[10,16,19,21-23]						
Preop	82	18.1 ± 4.0	17.3-19.0	41	21.2 ± 6.7	19.2-23.3
Postop	87	48.3 ± 7.0	46.8-49.8	46	57.1 ± 7.4	54.9-59.2
ASES[16,21-23]						
Preop	72	26.5 ± 6.5	25.0-28.0	41	23.7 ± 2.0	23.2-24.4
Postop	72	65.4 ± 7.1	63.7-67.0	41	78.2 ± 3.9	77.0-79.4
DASH[16,22]						
Preop	38	62.0 ± 2.5	61.2-62.8	27	55.1 ± 1.1	54.7-55.6
Postop	38	36.5 ± 2.5	35.7-37.3	27	30.3 ± 3.0	29.2-31.4
SST[10,16,22]						
Preop	38	3.1 ± 0.6	3.0-3.3	27	4.3 ± 0.5	4.1-4.5
Postop	43	12.7 ± 14.7	8.3-17.2	32	14.1 ± 11.9	10.0-18.3
SANE[16,22]						
Preop	38	23.1 ± 0.8	22.8-23.4	27	34.6 ± 3.0	33.5-35.8
Postop	38	63.2 ± 3.5	62.1-64.3	27	75.3 ± 0.5	75.1-75.5
VAS[10,16,21,22]						
Preop	44	6.4 ± 1.0	6.1-6.7	27	7.7 ± 0.2	7.7-7.8
Postop	49	1.9 ± 0.9	1.7-2.2	32	1.5 ± 0.6	1.3-1.7

PROMs, patient-reported outcome measurements; *CMS*, Constant–Murley Score; *SSV*, subjective shoulder value; *ASES*, American Shoulder and Elbow Surgeons; *DASH*, Disabilities of the Arm, Shoulder, and hand; *SST*, simple shoulder test; *SANE*, single assessment numeric evaluation; *VAS*, visual analog score.
*Weighted means ± standard deviation.

Table V
Range of motion (preoperative and postoperative).

Author	Active forward flexion		Active abduction		Active external rotation	
	Pre	Post	Pre	Post	Pre	Post
Michelin et al[16]	63.1°	116.8°	48.1°	76.2°	16.0°	16.1°
Moran et al[17]	62°	106°	41°	100°	11°	36°
Apiwatanakul et al[2]	73.9°	100°	73.9°	95.6°	10.6°	20°
Bodendorfer et al[5]	95°	150°	-	-	13°	40°
Porcellini et al[21]	43°	62°	35°	55°	10°	10°
Rangarajan at al[22]	53°	124°	42°	77°	17°	32°
Rashid et al[23]	-	105°	-	99°	-	-

Table VI
Revision vs. primary custom glenoid implant ROM.

PROM	Revision (N = 53)		Primary (N = 32)	
	Mean* ± SD	95% confidence interval	Mean* ± SD	95% confidence interval
Forward flexion[2,5,16,17,21,22]				
Preop	53.9° ± 8.3°	51.7°-56.2°	68.3° ± 5.9°	66.3°-70.4°
Postop	102.2° ± 15.8°	97.9°-106.4°	129.7° ± 4.0°	128.4°-131.1°
Abduction[2,16,17,21-23]				
Preop	42.5° ± 6.8°	40.6°-44.3°	48.5° ± 3.3°	47.3°-49.6°
Postop	76.1° ± 9.0°	73.7°-78.5°	83.0° ± 15.1°	77.7°-88.2°
External rotation[2,5,16,17,21,22]				
Preop	16.3° ± 3.1°	15.5°-17.2°	13.0° ± 1.4°	12.5°-13.5°
Postop	27.3° ± 6.9°	25.5°-29.2°	37.1° ± 7.3°	34.6°-39.6°

ROM, range of motion; *PROM*, patient reported outcome measures.
*Presented as weighted mean ± standard deviation.

While there were few shoulder arthroplasty failures, etiologies included instability, infection, humeral loosening, and glenoid loosening.[5] This review found the most common reason for arthroplasty failure with the implantation of a custom glenoid component to be humeral component loosening. Causes of humeral component loosening include infection, poor fixation of the humeral stem, proximal humerus stress shielding, and polyethylene debris.[14,15] Those who require custom glenoid components already have poor glenoid bone stock and are likely to have humeral bone loss secondary to previous infection, stress shielding, or stem removal.

The complication rate following shoulder arthroplasty varies, as there are several influencing factors such as indication, technique, age, and the bone stock of the humerus and glenoid.[1,2,23,34] This study found the complication rate following custom glenoid implantation to be roughly 30%, which is higher than the complication rate of primary shoulder arthroplasty.[23] This is likely secondary to the majority (62.5%) of custom glenoid patients in

this study undergoing revision rTSA to place the prosthesis, which had a higher complication rate compared to those undergoing a primary procedure (12.9% vs. 27.8%, respectively). This is clinically meaningful as patients undergoing revision rTSA have complication rates reported as high as 69%, likely due to poor bone stock associated with a previously implanted prosthesis.[28] However, while some studies in this review reported complication rates for revision cases, the majority did not consistently stratify outcomes by primary versus revision surgery. As a result, a direct comparison of complication rates between the two groups could not be reliably performed. Further studies are needed to examine the influence that surgical timing has on the complication rate of patients undergoing placement of custom glenoid prostheses.

Limitations

The main limitation was the heterogeneity of the included studies, which prevented the calculation of comparative statistics and limits the generalizability of the findings, particularly when comparing PROMs and ROM values between those who underwent primary and revision rTSA. There is variability in the accuracy of ROM data collection among patients, which depends on the examiner. In addition, there is no consensus on the definition of complications or standardized criteria for assessing loosening of the baseplates. Another limitation is the short follow-up with a mean of 31.6 months. Known and unknown confounders could also weaken the strength of conclusions drawn and generalizability. Confounding variables include patient age, body mass index, gender, smoking, and preexisting comorbidities such as diabetes or osteoporosis.[31] Despite these limitations, this study offers valuable insight into custom glenoid components of rTSA, which is typically used in a patient population with limited options for restoring shoulder function. It is also important to acknowledge the potential for publication bias, as studies reporting lower revision or failure rates may be more likely to be published, while data from centers with higher complication rates may be underrepresented in the literature. This potential bias could result in an overestimation of the effectiveness of custom glenoid baseplates.

Conclusion

Custom glenoid components failure rate was low, with improvements exceeding minimal clinical important differences in PROMs and marked improvement in ROM for all studies. The glenoid loosening rate was 0.6% in patients undergoing rTSA with a custom glenoid component at a weighted average follow-up of 31.6 $\pm$ 6.7 months.

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