

Influence of Glenosphere Design on Outcomes and Complications of Reverse Arthroplasty: A Systematic Review

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Background: Different implant designs are utilized in reverse shoulder arthroplasty. The purpose of this systematic review was to evaluate the results of reverse shoulder arthroplasty using a traditional (Grammont) prosthesis and a lateralized prosthesis for the treatment of cuff tear arthropathy and massive irreparable rotator cuff tears.

Methods: A systematic review of the literature was performed *via* a search of two electronic databases. Two reviewers evaluated the quality of methodology and retrieved data from each included study. In cases where the outcomes data were similar between studies, the data were pooled using frequency-weighted mean values to generate summary outcomes.

Results: Thirteen studies met the inclusion and exclusion criteria. Demographics were similar between treatment groups. The frequency-weighted mean active external rotation was 24° in the traditional group and 46° in the lateralized group ($p = 0.0001$). Scapular notching was noted in 44.9% of patients in the traditional group compared to 5.4% of patients in the lateralized group ($p = 0.0001$). The rate of clinically significant glenoid loosening was 1.8% in the traditional group and 8.8% in the lateralized group ($p = 0.003$).

Conclusions: Both the traditional Grammont and the lateralized offset reverse arthroplasty designs can improve pain and function in patients with diagnoses of cuff tear arthropathy and irreparable rotator cuff tear. While a lateralized design can result in increased active external rotation and decreased rates of scapular notching, there may be a higher rate of glenoid baseplate loosening.

Keywords: *Shoulder, Rotator cuff, Replacement arthroplasty*

Reverse shoulder arthroplasty is performed to provide improvement in pain relief and restoration of functions in patients with rotator cuff tear arthropathy and massive irreparable rotator cuff tears.¹⁾ Different prosthesis designs exist, all of which increase the deltoid lever arm to provide a stable fulcrum for active elevation in a rotator cuff deficient shoulder.^{2,3)}

The Grammont prosthesis is a traditional implant used in reverse shoulder arthroplasty. This prosthesis is semi-constrained with the center of rotation located at the glenoid bone-prosthesis interface, which reduces torque on the implant.³⁾ Compared to the native center of rotation, the center of rotation of the Grammont prosthesis is more distal and medial. As a result, inferior scapular notching is a well-documented complication that is observed on 16% to 96% of postoperative radiographs^{4,5)} and has the potential to impact clinical outcomes.⁶⁾ Other complications include prosthetic instability, impaired rotational movements, and clinical deterioration over time.^{2,7)}

To address the disadvantages of the Grammont prosthesis, some surgeons have performed reverse shoul-

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der arthroplasty using an implant with a more lateral center of rotation. The advantages of lateralization include that the center of rotation and offset more closely approximate those of the normal glenohumeral joint. Such lateralized designs have shown to decrease scapular notching while potentially improving rotation.^{8,9)} On the other hand, there is some concern that metallic lateralization increases torque and shear forces on the glenoid component, which could lead to glenoid loosening.^{2,7,9)}

The purpose of this study was to review the literature to compare the outcomes of reverse shoulder arthroplasty using a traditional (Grammont) prosthesis and a lateralized prosthesis for the treatment of cuff tear arthropathy and massive irreparable rotator cuff tears. In particular, we investigated to answer the following questions: (1) what are the demographics of patients treated with each implant type? (2) what are the subjective, objective, and radiographic outcomes and are there differences in outcomes according to the implant type? and (3) are there unique complications associated with each implant type?

METHODS

We searched PubMed and Scopus computerized literature databases from January 2004 to July 2014. Articles were identified with use of an electronic search of keyword

terms and their respective combinations (Table 1). Studies were included if they matched the following criteria: (1) English language; (2) a minimum of 10 patients in the series at baseline who underwent reverse shoulder arthroplasty for cuff tear arthropathy or massive irreparable rotator cuff tear; (3) use of either the Delta III (DePuy, Warsaw, IN, USA) or Aequalis (Tornier, Inc., Edina, MN, USA) traditional prostheses or the DJO (DJO Surgical, Austin, TX, USA) lateralized prosthesis; (4) a minimum of 24 months of follow-up. Review articles, case reports, technique articles without patient data, and studies without explicitly stated inclusion criteria were excluded. In addition,

Table 1. Search Terms Used for the Identification of Human Studies*

No.	Search term
1	Reverse shoulder arthroplasty
2	Reverse ball and socket
3	Grammont prosthesis
4	Reverse cuff tear arthropathy
5	Reverse rotator cuff tear

*The search terms were entered into the PubMed and Scopus search engines for the identification of human studies published in English from January 2004 to July 2014.

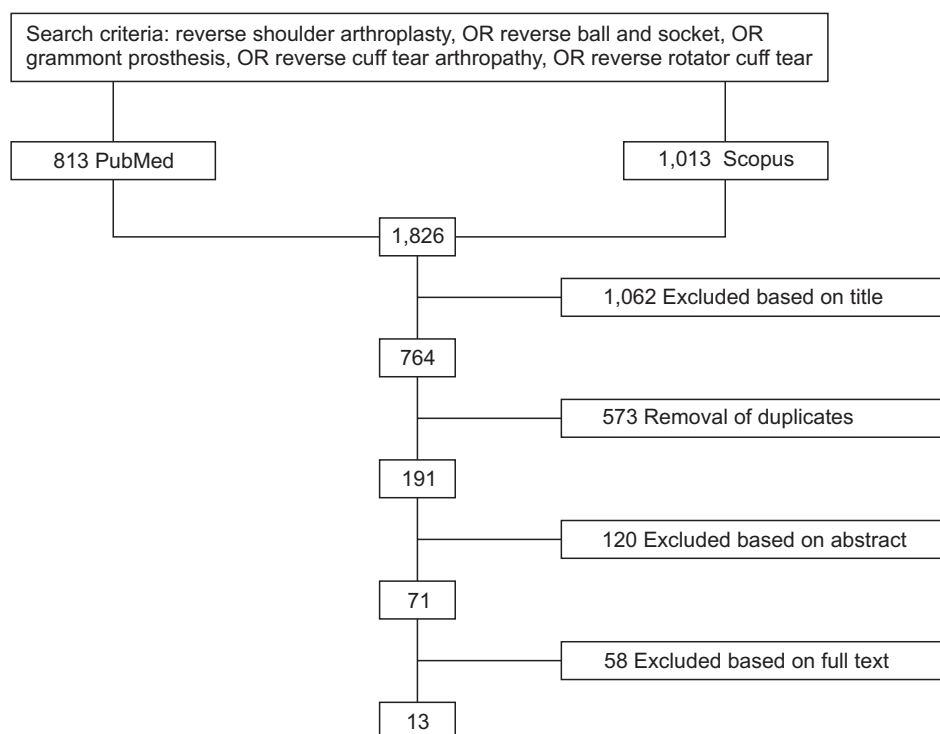


Fig. 1. Flow chart representing the systematic review process used in this study.

tion, studies that included patients with other diagnoses (fractures, instability, etc.) were included only if data for patients with cuff tear arthropathy/irreparable rotator cuff tears were separately reported.

We obtained 813 articles from PubMed and 1,013 articles from Scopus (Fig. 1). Of the 1,826 articles, 1,062 were excluded based on a title that identified the article as a review or an editorial. After removal of 573 duplicates, 191 studies remained for abstract review. Based on a review of abstracts, 120 review articles, case reports, technique articles, small case series (fewer than 10 patients), and/or papers that included patients without a minimum 24 months of follow-up were eliminated. This yielded 71 articles that underwent full-text review. Fifty-eight failed to satisfy inclusion and exclusion criteria, and the qualifying 13 articles were analyzed.

Eight studies included a comparative group (3 studies compared results of patients with and without previous ipsilateral shoulder surgery, 2 studies compared results of patients based on diagnosis, 1 study compared results of patients based on stages of fatty infiltration of the teres minor muscle, 1 study compared results of patients based on

preoperative opioid use, and 1 study compared outcomes to a historical cohort). In 5 of these studies, more than 1 group satisfied the inclusion and exclusion criteria. No study specifically compared results based on implant design. Studies did not include any blinding, randomization, or control for confounders.

Data from individual studies were compiled to report demographic statistics. In cases where outcomes data were consistently reported between studies, results were pooled in order to calculate percentages and frequency-weighted mean values. These frequency-weighted means and grouped standard deviations were used to generate *p*-values using the number of subjects as the number of studies. As a result, the comparative statistics for each variable were reported as mean values that 95% of studies would report.

RESULTS

Thirteen studies were included after fulfilling all inclusion and exclusion criteria. Nine studies included patients with the Grammont prosthesis design (6 Delta III and 3 with

Table 2. Demographics of All Reviewed Studies

Study	Type	Baseline	Final	Age (yr)	Male	Female	Follow-up (mo)
Delta III prosthesis							
Boileau et al. ³⁾	P	21	21	77	2	19	40
Castricini et al. ¹⁶⁾	P	109*	47	72.5*	21*	59*	60.1*
Sadoghi et al. ¹³⁾	P	66	66	66	30	36	42
Simovitch et al. ¹⁴⁾	R	42	42	71	11	31	43
Stechel et al. ¹⁷⁾	P	68*	23	70*	7*	52*	48*
Werner et al. ⁴⁾	NS	58*	17	68*	15*	43*	38*
Aequalis prosthesis							
Morris et al. ¹¹⁾	P	68	59	70.0	29	39	37.8
Walch et al. ¹⁸⁾	P	470*	220	72.6*	102*	378*	38.1*
Young et al. ¹⁵⁾	R	16	16	70.1	2	14	45.6
DJO prosthesis							
Cuff et al. ¹⁹⁾	P	94*	57	70.4*	24*	50*	62*
Frankle et al. ⁸⁾	NS	60	60	71	19	41	33
Holcomb et al. ¹⁰⁾	P	18	18	71	4	14	36.4
Mulieri et al. ¹²⁾	P	69	58	71	16	42	52

P: prospective, R: retrospective, NS: not specified.

*Number includes patients with diagnoses other than cuff tear arthropathy/massive irreparable rotator cuff tear.

the Aequalis studies), and they were considered the traditional group. Four studies included patients with a lateralized prosthesis (DJO) and were considered the lateralized group. Nine studies were prospective, 2 were retrospective, and 2 did not specify the study design. All studies were published between the years of 2005 and 2014. Full characteristics of the 2 groups are presented in Table 2.^{3,4,8,10-19}

Demographics

Eight studies^{3,8,10-15} included data on the baseline number of patients specifically with the diagnoses of cuff tear arthropathy and irreparable rotator cuff tear (Table 3). There were 213 patients at baseline in the traditional group and 136 patients (range, 18 to 69) at baseline in the lateralized group. Eight studies included demographic data on the age and sex of patients with a diagnosis of cuff tear arthropathy or massive irreparable rotator cuff tear.^{3,8,10-15} The frequency-weighted mean age was 69.7 years in the traditional group (range, 43 to 98 years) and 71.0 years in the lateralized group (range, 34.0 to 88.0 years) ($p = 0.28$). The traditional group was reported to contain 74 men (34.7%) and 139 women (65.3%), and the lateralized group was reported to contain 39 men (28.7%) and 97 women (71.3%; $p = 0.24$). Data on the dominant-sided surgery, smoking status, comorbidities, and other demographic variables were not consistently reported to allow for generation of pooled statistics. Similarly, data regarding intraoperative technical parameters, such as cement utilization, were inconsistently reported.

Outcomes

Compared to demographic data ($n = 349$), more patients had outcomes data ($n = 706$) specific for the diagnoses of cuff tear arthropathy and irreparable rotator cuff tear. The analysis of postoperative outcomes included 513 pa-

tients in the traditional group and 193 patients (range, 18 to 60 per study) in the lateralized group (Tables 4 and 5). Patients were followed for a frequency-weighted mean of 41.6 months in the traditional group and 47.6 months (range, 33.0 to 62.0 months) in the lateralized group ($p = 0.15$). Seven studies in the traditional group^{3,11,13,15-18} included postoperative Constant scores, with a frequency-weighted mean Constant score of 65.5. Six studies in the traditional group^{4,11,13,15-17} reported Constant pain subscores, with a frequency-weighted mean Constant pain subscore of 12.2. No studies in the lateralized group reported Constant scores. Four studies in the lateralized group reported total American Shoulder and Elbow Surgeons (ASES) scores,^{8,10,12,19} and 3 studies in the lateralized group reported ASES pain subscores.^{8,12,19} The frequency-weighted mean total ASES score was 74.4, and the frequency-weighted mean ASES pain subscore was 40.4 in the lateralized group. Three studies in the lateralized group reported visual analog scale (VAS) scores for pain,^{8,10,12} with a frequency-weighted mean of 1.9. Three studies in the lateralized group reported simple shoulder test (SST) scores,^{10,12,19} with a frequency-weighted mean of 7.0. Studies in the traditional group did not consistently report ASES scores, VAS pain scores, or SST scores that would allow comparative statistics to be generated. No other instruments of outcomes assessment were consistently reported to allow for pooled or comparative statistical analysis.

Several studies reported range of motion data. Seven studies^{3,4,11,13,15-17} in the traditional group ($n = 251$) and all 4 studies^{8,10,12,19} in the lateralized group ($n = 193$) reported postoperative active forward elevation. The frequency-weighted mean active forward elevation was 134° in the traditional group and 128° in the lateralized group ($p = 0.36$). Seven studies^{3,11,13-17} in the traditional group ($n = 276$) and all 4 studies^{8,10,12,19} in the lateralized group ($n = 190$) reported postoperative active external rotation. The frequency-weighted mean active external rotation was 24° in the traditional group and 46° in the lateralized group ($p = 0.0001$). Other planes of motion were not consistently reported in a manner to allow for compilation of statistics.

Radiographic Complications

Two studies^{13,15} in the traditional group ($n = 78$; frequency-weighted mean, 42.8-month follow-up) and 3 studies^{8,10,12} in the lateralized group ($n = 130$; frequency-weighted mean, 41.6-month follow-up) included postoperative radiographic evaluation specific for the diagnoses of cuff tear arthropathy and irreparable rotator cuff tear. While other studies included radiographic evaluation

Table 3. Pooled Demographics According to Treatment Group

Variable	Traditional group	Lateralized group	<i>p</i> -value
Final no. of patients	213	136	-
Mean age* (yr)	69.7	71.0	0.28
Sex			0.24
Male	74	39	
Female	139	97	
Mean follow-up* (mo)	41.7	47.6	0.15

*Frequency-weighted mean.

Table 4. All Subjective and Objective Outcomes

Study	VAS pain	Total constant	Constant pain	ASES total	ASES pain	SST	AFE (°)	AER (°)
Delta III prosthesis								
Boileau et al. ³⁾	1.7	66	NR	NR	NR	NR	123	14
Castricini et al. ¹⁶⁾	NR	66	14.4	NR	NR	NR	148	37
Sadoghi et al. ¹³⁾	NR	60.1	11.1	NR	NR	NR	125.9	13.9
Simovitch et al. ¹⁴⁾	NR	NR	NR	NR	NR	NR	NR	20.6
Stechel et al. ¹⁷⁾	NR	74	14	NR	NR	NR	134	28
Werner et al. ⁴⁾	NR	NR	12.3	NR	NR	NR	103	NR
Aequalis prosthesis								
Morris et al. ¹¹⁾	1.6	63.4	11.4	70.7	NR	NR	144.6	29.4
Walch et al. ¹⁸⁾	NR	66.8	NR	NR	NR	NR	NR	NR
Young et al. ¹⁵⁾	NR	64.9	13.1	NR	NR	NR	138.6	19.7
DJO prosthesis								
Cuff et al. ¹⁹⁾	NR	NR	NR	77	41.4	7.6	148.3	50.2
Frankle et al. ⁸⁾	2.2	NR	NR	68.2	38.7	NR	105.1	41.1
Holcomb et al. ¹⁰⁾	1.1	NR	NR	83.7	NR	6.67	125	35
Mulieri et al. ¹²⁾	1.9	NR	NR	75.4	41.3	6.5	134	51

VAS: visual analog scale, ASES: American Shoulder and Elbow Surgeons, SST: simple shoulder test, AFE: active forward elevation, AER: active external rotation, NR: not recorded.

Table 5. Subjective and Objective Outcomes According to Treatment Group

Variable	Traditional group		Lateralized group		p-value
	Mean*	95% CI	Mean*	95% CI	
Constant score	65.5	62.3–68.3	-	-	-
Constant pain subscore	12.2	11.4–13.3	-	-	-
ASES score	-	-	74.4	69.7–79.2	-
ASES pain subscore	-	-	40.4	38.6–42.3	-
Simple shoulder test	-	-	7.0	6.2–7.6	-
Active forward elevation (°)	134	126–143	128	111–146	0.36
Active external rotation (°)	24	18–30	46	41–52	0.0001

CI: confidence interval, ASES: American Shoulder and Elbow Surgeons.

*Frequency-weighted mean.

parameters, data were neither stratified by preoperative diagnosis nor specific for the diagnoses of interest. Scapular notching was noted in 44.9% (35/78) of patients in the traditional group compared to 5.4% (7/130) of patients in

the lateralized group ($p = 0.0001$). No further radiographic data were reported from the study in the Delta III (DePuy) group,¹³⁾ and there were no reports of radiolucency in the Aequalis (Tornier) group.¹⁵⁾ Glenoid radiolucency was not-

Table 6. Complication

Study	Neurologic complications	Disconnection of shaft components	Glenoid loosening	Humeral loosening	Dislocation	Infection	Hematoma	Acromion Fx	PreOp. pathologic scapular body Fx	IntraOp. Fx	PeriPros. Fx	Broken center screw	Unspecified	Total
Delta III prosthesis														
Boileau et al. ³⁾	1	0	0	0	1	0	0	0	0	0	0	0	0	2
Castricini et al. ¹⁶⁾	0	0	0	0	1	0	0	0	0	0	0	0	0	1
Sadoghi et al. ¹³⁾	1	0	4	3	0	0	0	0	0	0	0	0	0	8
Simovitch et al. ¹⁴⁾	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	0
Stechel et al. ¹⁷⁾	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	0
Werner et al. ⁴⁾	0	1	0	0	1	3	3	1	0	0	0	0	0	9
Aequalis prosthesis														
Morris et al. ¹¹⁾	0	0	0	0	3	2	0	2	0	2	0	2	0	9
Walch et al. ¹⁸⁾	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	0
Young et al. ¹⁵⁾	1	0	0	0	0	0	0	2	0	3	0	3	0	6
DUJO prosthesis														
Cuff et al. ¹⁹⁾	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	0
Frankle et al. ⁸⁾	0	0	7	0	0	1	0	1	0	0	2	0	2	13
Holcomb et al. ¹⁰⁾	0	0	1	0	0	2	0	1	0	1	1	0	0	6
Mujjeri et al. ¹²⁾	0	0	4	0	1	1	1	1	1	0	2	1	0	12
Traditional total	3	1	4	3	6	5	3	5	0	5	0	0	0	35
Lateralized total	0	0	12	0	1	4	1	3	1	1	5	1	2	31

Fx: fracture, PreOp.: preoperative, IntraOp.: intraoperative, PeriPros.: periprosthetic, NR: not recorded.

ed in 3.1% (4/130) of the patients in the lateralized group.

Clinical Complications/Reoperations

Six studies^{3,4,11,13,15,16} in the traditional group (n = 228; frequency weighted mean, 44.4-month follow-up) and 3 studies^{8,10,12} in the lateralized group (n = 136; frequency weighted mean, 41.6-month follow-up) reported complications specific for the diagnoses of cuff tear arthropathy and irreparable rotator cuff tears (Table 6). Another study from the lateralized group reported complications specifically for the diagnoses of interest; however, the only complications reported were those requiring revision so the data were excluded from our analysis. The total reported complication rate was 15.4% (35/228 patients) in the traditional group and 22.8% (31/136 patients) in the lateralized group ($p = 0.09$). The rate of clinically significant glenoid loosening was 1.8% (4/228) in the traditional group and 8.8% (12/136) in the lateralized group ($p = 0.003$). Dislocation rate was 2.6% (6/228) in the traditional group and 0.7% (1/136) in the lateralized group ($p = 0.26$). The rate of acromial stress fractures was 2.2% (5/228) in the traditional group and 2.2% (3/136) in the lateralized group ($p = 1.00$).

Five studies^{3,4,13,15,16} in the traditional group (n = 169; frequency weighted mean, 46.8-month follow-up) and 4 studies^{8,10,12,19} in the lateralized group (n = 193; frequency weighted mean, 47.6-month follow-up) included data on reoperations. The overall reoperation rate was 7.1% (12/169) in the traditional group and 10.4% (20/193) in the lateralized group ($p = 0.35$).

DISCUSSION

This systematic review demonstrates that both the traditional Grammont and the lateralized offset reverse arthroplasty designs can relieve pain and restore functions in patients with diagnoses of cuff tear arthropathy and irreparable rotator cuff tears. Understanding advantages and disadvantages of each design is important for surgeons as they make implant choices for patients as well as for designers striving to improve prosthesis performance. While further study is necessary to determine long-term differences in clinical results, complication rates, and reoperations between reverse prosthesis designs, the literature examined in this systematic review suggests greater external rotation and lower rates of notching with a lateralized design.

Demographics were similar between the traditional and lateralized groups. The mean age of the patients was similar across all studies, and all studies included a greater number of female patients. The similarities in demograph-

ics were likely a result of analyzing patient populations with primary reverse shoulder arthroplasty for the diagnoses of cuff tear arthropathy and irreparable rotator cuff tears. Thus, the demographics as well as the results may be different in other patient populations. In particular, diagnoses that carry higher complication rates, such as revision arthroplasty and arthroplasty for fracture, may demonstrate larger differences in the outcomes and complications observed among different prosthesis designs. Additionally, the influence of intraoperative technical variations on the outcomes could not be evaluated due to inconsistent reporting. None of the studies analyzed included data regarding intraoperative range of motion, which has been shown to be an important factor in determining postoperative motion.²⁰ Furthermore, although inferior positioning of the baseplate has been shown to reduce the risk of scapular notching, data regarding attempts to place the glenoid baseplate in an inferior position were inconsistently reported.²¹

Similar Constant scores and range of motion were found when comparing the 2 implant types (Delta III and Aequalis) included in the traditional group. The lateralized group utilized different outcome measurements, namely the total ASES score, ASES pain subscore, SST score, and VAS pain score. As a result, self-assessed patient outcomes could not be directly compared between the traditional group and the lateralized group. There were differences in physical exam parameters between the traditional and the lateralized groups. Active external rotation was significantly greater in the lateralized group compared to the traditional group. This finding is contrary to the finding of Henninger et al.²² in a biomechanical comparison of different reverse prosthesis designs: the authors did not find differences in external rotation between the traditional and lateralized designs. It is known that external rotation after reverse arthroplasty can also be influenced by preoperative fatty infiltration or competence of the infraspinatus;²³ however this variable was not reported in the studies included in this systematic review. Additionally, it would not be expected that the 2 groups would be different with regard to this variable given the consistent diagnoses considered. Interestingly, the glenosphere size has been shown in biomechanical study to influence the range of motion in both neutral and lateralized glenosphere designs;²⁴ however, this variable was not consistently reported and could not be analyzed in this systematic review.

Based on the literature review, there appear to be some differences in complications between the 2 implant design types. Scapular notching is a common complication of the traditional Grammont style implant,² and our

analysis demonstrated that scapular notching rates were higher in the traditional group compared to the lateralized group. No study in our radiographic analysis attempted to correlate notching with clinical outcome. While notching rates were higher in the traditional group, this was solely based on the 2 Grammont designs considered in this systematic review. It has been shown that not all Grammont designs result in similar rates of notching.²⁵⁾ Differences may be a result of different morphology of the polyethylene component, different humeral stem neck-shaft angles, and differences in glensphere offset between the Grammont prosthetic systems as well as patient factors such as body mass index and glenohumeral adduction.²⁶⁾ It is important to remember that both Grammont systems evaluated in this systematic review were designed with a 155° neck-shaft angle whereas the lateralized prosthesis was with a 135° angle, which could also explain the higher rates of notching in the traditional group.

Due to the increased torque and shear forces on the glenoid component, there has been some concern about glenoid loosening when utilizing the lateralized implant.^{2,7,9)} Our analysis has found that the rate of glenoid loosening was higher in the lateralized group compared to the traditional group. In a biomechanical study, Harman et al.²⁷⁾ evaluated initial glenoid component fixation of the Delta III (DePuy) and the Reverse Shoulder Prosthesis (Encore Medical Co., Austin, TX, USA at the time of this study; DJO Surgical, now) during physiologic loading and determined how lateral offset of the glensphere and fixation method of the baseplate influences baseplate motion. In the study, lateral offset was found to be a significant factor, affecting the amount of glenoid component motion during physiologic loading. Delta III components fixed with 3.5-mm screws had significantly less motion than the lateralized components fixed with 3.5-mm screws and 5.0-mm non-locking screws. There were no significant differences in component motion when the Delta III components fixed with 3.5-mm screws were compared with the lateralized components fixed with 5.0-mm locking screws. Interestingly, there was a modification to the lateralized DJO implant (DJO Surgical) during the study period evaluated in this systematic review.¹²⁾ Prior to 2004, 3.5-mm non-locking peripheral screws were used to secure the baseplate. In February 2004, the design was modified to have 5.0-mm peripheral locking screws to enhance baseplate fixation. One study in our analysis noted that all of the instances of glenoid loosening occurred prior to the design modification.¹²⁾ Longer-term studies are necessary to determine the influence of lateralization on the rates of radiographic and clinical glenoid loosening; however, it is

clear that more rigid baseplate fixation and/or adequate glenoid bone quality is important when using a lateralized design.

This study has several limitations. The weaknesses of each included study (retrospective design, limited number of patients, short-term follow-up, etc.) translate into limitations of our systematic review. Though we followed the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) guidelines in this systematic review, no study reported any controls for bias, confounding, or chance. Though we were able to compile data for certain demographic and outcomes variables, some important variables (functional outcome scores, pain scores, comorbidities, etc.) were not reported in a consistent manner in all studies and thus could not be evaluated. Additionally, though we utilized two comprehensive search engines and multiple search terms, it is possible that alternative search terms or search engines could have resulted in additional qualifying studies. Our study was limited to two Grammont prosthesis designs and one lateralized prosthesis design. Given the lack of multiple studies that utilized other implant designs, we were unable to expand our analysis to include other prosthetic designs while maintaining our inclusion and exclusion criteria.

This systematic review demonstrates that both the traditional Grammont and lateralized offset reverse arthroplasty designs can improve pain and functions in the settings of cuff tear arthropathy and irreparable rotator cuff tear. We found similar demographic characteristics between the two design groups. While a lateralized design can result in increased active external rotation and decreased rates of scapular notching, there may be a higher rate of glenoid baseplate loosening. Further clinical data are needed to provide guidance to surgeons in deciding between the traditional Grammont and the lateralized offset reverse arthroplasty designs for cuff tear arthropathy and irreparable rotator cuff tears.

CONFLICT OF INTEREST

Gerald R. Williams receives research funding from Depuy and Tornier and royalties from DJO Surgical and IMDS/Cleveland Clinic on the topic of shoulder arthroplasty. Surena Namdari receives research funding from Depuy, Zimmer, and Integra Life Sciences and royalties from DJO Surgical on the topic of shoulder arthroplasty.

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