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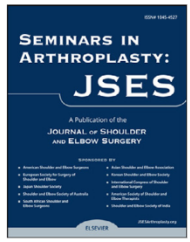

Are the best anatomic total shoulder arthroplasties better than the best reverse total shoulder arthroplasties?

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ABSTRACT

Background: Surgeons often state anecdotally that their best anatomic shoulder arthroplasties (TSAs) do better than their best reverse shoulder arthroplasties (RSAs). Limited data exist comparing patients at the upper limits of outcomes between RSA and TSA.

Methods: A retrospective study was performed in patients undergoing TSA and RSA with minimum 2-year follow-up. Baseline patient demographic information as well as preoperative and postoperative active range of motion, American Shoulder and Elbow Surgeons (ASES) score, Single Assessment Numeric Evaluation, and Visual Analog Scale score for pain were collected. Patients in the top 20% of postoperative ASES scores were identified as those with the best outcomes. Descriptive statistics, univariate, and multivariate analyses were performed to evaluate differences between patients in the top 20% of ASES scores undergoing TSA and RSA.

Results: A total of 40 TSAs and 88 RSAs were included in the top 20% of each group, from a total of 205 TSAs and 447 RSAs, with a mean postoperative follow-up of 33 ± 14 months. Baseline patient-reported outcome measures and range of motion did not differ between groups ($P > .05$). There were no significant differences in the change of preoperative to postoperative Visual Analog Scale-pain ($P = .539$), Single Assessment Numeric Evaluation ($P = .388$), ASES ($P = .912$), and forward elevation ($P = .439$). The median (interquartile range) change in external rotation (40° [30°, 50°] vs. 30° [20°, 50°]; $P = .017$) and internal rotation (4.0 [2.0, 6.0] vs. 2.0 [1.0, 4.0]; $P = .005$) was statistically different between the TSA and RSA groups, respectively. A minimal clinically important difference for ASES was achieved by 100% of patients in both groups. A substantial clinical benefit was achieved by 100% of patients in the TSA group and 98% (n = 86) of patients in the RSA group.

This study was approved by the Institutional Review Board of the New England Baptist Hospital, project # 1745821.

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Conclusion: While there is a common notion that patients treated with TSA have a greater potential for excellent outcomes, our findings show that clinical outcomes of the best TSAs are comparable to those of the best RSAs. Longer follow-up is needed to identify long-term differences in outcomes including revision and implant durability.

Level of evidence: Level III; Retrospective Case Control Study Design

Since its approval by the U.S. Food and Drug Administration in 2003 as a treatment for rotator cuff arthropathy (RCA), indications for reverse shoulder arthroplasty (RSA) have expanded to other pathologies of the shoulder including primary glenohumeral osteoarthritis (GHOA), proximal humerus fracture, chronic dislocations, revision arthroplasty, tumor resections, and pseudoparalytic shoulders without advanced arthritis.[3,10,15,18,20,22] Heterogeneity of patients receiving RSA, associated surgical learning curves, and incremental prosthesis design changes have resulted in variable published accounts of outcomes, complication rates, and longevity.[19,25,26] Perceptions of surgeons toward RSA performance is likely influenced by available literature, individual experience, and practice setting.

Surgeons often state that their "best"-performing total shoulder arthroplasties (TSAs) achieve superior outcomes when compared to their "best"-performing RSAs despite lack of quantitative evidence in this cohort. These perceptions may influence surgical decision-making and implant choice, particularly in classically younger patients with primary glenohumeral arthritis.[23,24] In this study, we sought to compare the best-performing TSAs to the best-performing RSAs in order to evaluate whether a clinical difference exists as well as to define and evaluate the "best"-performing TSA and RSA patients through analysis of American Shoulder and Elbow Surgeons (ASES) scores at 2-year follow-up. Secondary outcomes included comparison of Single Assessment Numeric Evaluation (SANE) scores, Visual Analog Scale (VAS) pain scores, and range of motion (ROM) between implant cohorts and determining patient characteristics that influence achieving the "best" outcomes. We hypothesized that patient-reported outcome measures (PROs) would be similar between the RSA and TSA groups.

Methods

Patient selection

Following approval from the institutional review board (#1745821), a retrospective review of a prospectively maintained institutional database (OBERD, Columbia, MO, USA) was performed to identify all patients who underwent primary shoulder arthroplasty between 2015 and 2018. All procedures, either TSA or RSA, were performed consecutively by a single, fellowship-trained shoulder surgeon. The decision to use TSA or RSA was based on surgeon preference. In general, the surgeon preferred to use TSA in younger patients with primary GHOA, no evidence of rotator cuff deficiency, and glenoid wear patterns without significant bone loss requiring the use of augmented glenoid components or excessive reaming as per surgeon understanding of preoperative anatomy. Rotator cuff integrity was determined through physical examination, evaluation of proximal migration on static anteroposterior shoulder radiographs, evaluation of integrity on magnetic resonance imaging scans or computed tomography scans, and evaluation at the time of surgery. Conversely, the surgeon preferred to use RSA in older patients, patients with rotator cuff deficiency, or patients with glenoid wear and bone loss that was deemed too considerable to be addressed by a primary anatomic TSA component. All patients receiving RSA used the same implant system (DJO Surgical, Lewisville, TX, USA) without the use of augmented glenoid baseplates or bone grafting. For TSAs, 18 patients (45%) received a Zimmer stemmed implant (Warsaw, IN, USA), 17 patients (42.5%) received a DJO AltiVate implant (Lewisville, TX, USA), and 5 patients (12.5%) received a Tornier stemmed implant (Memphis, TN, USA). The use of varying implants for TSA is due to a shift in surgeon preference during the study period, whereas the surgeon's preference for RSA implant was consistent throughout. Patients that underwent primary TSA or RSA with a minimum clinical follow-up of 2 years and with complete preoperative and postoperative functional outcome scores were included for analysis. Postoperative radiographs, including shoulder Grashey, axial, and humerus anteroposterior views, were assessed at each visit. The "best"-outcome patients for each group were defined as those within the top 20th percentile of postoperative ASES scores in each cohort with the longest clinical follow-up. Dividing patient groups into percentiles has been used previously as a means to distinguish comparative group performance.[5] The top 20th percentile was selected as the cutoff so that the groups would represent the best outcomes while maintaining a large-enough sample size for meaningful analysis.

Clinical outcome assessment

Patient demographic information including age, gender, body mass index (BMI), American Society of Anesthesiologists' (ASA) Physical status classification, and comorbidities was collected. Clinical examination was conducted by the senior surgeon preoperatively and at the most recent postoperative visit used for analysis. Active ROM including forward elevation (FE), external rotation (ER) with the arm at the side, and internal rotation (IR) to the uppermost vertebral level of the

spine reached by the thumb of the examined arm was assessed with the use of a goniometer by the principal investigator (A.J.). IR levels were converted to a numeric scale as previously described.[21] PROs included ASES score, SANE score, and VAS for pain. All PROs were analyzed and recorded using a proprietary electronic software program (OBERD, Columbia, MO, USA). PROs and ROM are recorded at the preoperative visit and postoperatively at 2 weeks, 6 weeks, 3 months, 6 months, 1 year, and 2 years.

Statistical analysis

Descriptive statistics were recorded and analyzed for patient demographics and preoperative and postoperative clinical outcomes. Unpaired T-test and Mann-Whitney U-Test for continuous data and 2-proportion Z-Test and the chi-squared Test for categorical data were performed, depending on distribution. Two separate binary logistic regression analyses were performed to assess patient-related demographic factors that predict being in the top 20% of TSA and RSA outcomes. Preoperative to postoperative improvements in ASES score were compared to threshold minimal clinically important difference (MCID) (10.3, standard deviation 3.3) and substantial clinical benefit (SCB) (25.9, standard deviation 2.9) values for both groups.[27,28] All statistical analyses were performed using the R statistical software (Version 1.2.1335; R, Vienna, Austria).

Results

Patient demographics

The initial database query yielded 652 patients (205 TSA and 447 RSA) with minimum 2-year follow-up. Of the initial patients, 200 TSA patients (98%) and 440 RSA patients (98%) met the inclusion criteria of complete functional outcome scores. Forty TSA and 88 RSA patients were included for final analysis as the top 20th percentile of ASES scores. The cumulative mean follow-up was 33.2 ± 13.7 months (Table I). Patients in the TSA group had longer clinical follow-up than patients in the RSA group ($P < .001$). Every patient in the TSA group had a primary diagnosis of GHOA. In the RSA group, 64 patients (73%) had a primary diagnosis of GHOA, 19 (22%) had a primary diagnosis of RCA, 2 (2.2%) had an irreparable rotator cuff tear, 2 (2.2%) had postcapsulorrhaphy arthropathy, and 1 (1.1%) had avascular necrosis. Patients undergoing TSA were younger than patients undergoing RSA ($P < .001$). The ASA score differed between groups, with a larger percent of patients having an ASA score of 3 in the RSA group ($P = .033$) (Table II).

In the TSA group, there were 5 patients (12.5%) with prior ipsilateral shoulder surgeries including 4 débridements (10.0%) and 1 arthroscopic capsulorrhaphy (2.5%). Sixteen patients (19.2%) in the RSA group had prior ipsilateral shoulder surgeries including 6 débridements (6.8%), 3 arthroscopic capsulorrhaphies (3.4%), 2 arthroscopic rotator cuff repairs (2.3%), 2 open Bankart repairs (2.3%), 2 open rotator cuff repairs (2.3%), and 1 local melanoma excision (1.1%). No patients in the TSA group sustained a perioperative complication. In the RSA group, 1 patient sustained an acromion stress fracture, 1 developed a hematoma, and 1 developed a major medical complication postoperatively (Table II).

Table I – Whole-cohort patient demographic information.

Factor	n (%) or Average ± SD
Total	128
Age (yr)	68.6 ± 7.3
Sex	
Female	63 (49.2)
Male	65 (50.8)
Follow-up (mo)	33.2 ± 13.7
BMI	29.6 ± 5.7
ASA	
1	5 (3.9)
2	104 (81.3)
3	19 (14.8)
Comorbid conditions	
Depression	28 (21.9)
Diabetes	14 (10.9)
Obesity	34 (26.6)
Smoker	69 (53.9)
Current	4 (3.1)
Former	65 (50.8)
Prior surgery	21 (16.4)

SD, standard deviation; *BMI*, body mass index; *ASA*, American Society of Anesthesiologists' classification of Physical Health.

Patient-reported outcomes

There were no significant differences in preoperative VAS-pain score ($P = .561$), SANE score ($P = .599$), and ASES score ($P = .751$) between the groups (Table III). Both the TSA and RSA groups

Table II – Patient demographic information.

Factor	TSA	RSA	*P* value
No. of patients	40	88	N/A
Age (yr)	62.3 ± 6.2	71.5 ± 5.8	<.001*
Mean clinical follow-up (mo)	40.4 ± 16.2	30.0 ± 11.1	<.001*
Sex, n (%)			
Female	21 (53)	42 (48)	.757
Male	39 (47)	46 (52)	
BMI	28.4 ± 3.7	30.1 ± 6.3	.051
ASA comorbidity score, n (%)			
1	3 (7.5)	2 (2.3)	.033*
2	35 (88)	69 (78)	
3	2 (5)	17 (19)	
Primary diagnosis, n (%)			
GHOA	40 (100)	64 (72.7)	<.001*
RCA	0	19 (21.6)	
RCT	0	2 (2.2)	
Other	0	3 (3.4)	
Prior surgery, n (%)	5 (12.5)	16 (19.2)	.607
Complications, n (%)	0	3 (3.4)	.581

TSA, total shoulder arthroplasty; *RSA*, reverse shoulder arthroplasty; *N/A*, not applicable; *BMI*, body mass index; *ASA*, American Society of Anesthesiologists' classification of Physical Health; *GHOA*, glenohumeral osteoarthritis; *RCA*, rotator cuff arthropathy; *RCT*, Rotator cuff tear.

* Signifies statistical significance of $P < .05$.

Table III – Influence of arthroplasty type on clinical outcomes.

Outcome	TSA (n = 40)	RSA (n = 88)	P value
VAS-pain Score			
Preop	6.0 (4.0, 7.0)	6.0 (4.0, 8.0)	
Postop	0 (0, 0)	0 (0, 0)	
Δ	−6.0 (−7.0, −4.0)	−6.0 (−8.0, −4.0)	.539
SANE score			
Preop	30.0 (20.0, 50.0)	32.5 (19.5, 50.0)	
Postop	100.0 (100.0, 100.0)	100.0 (96.5, 100.0)	
Δ	70.0 (50.0, 80.0)	62.5 (49.7, 80.5)	.388
ASES score			
Preop	40.0 (28.0, 49.6)	38.0 (27.0, 48.1)	
Postop	100.0 (100.0, 100.0)	100.0 (98.3, 100.0)	
Δ	60.0 (50.4, 72.0)	61.0 (50.0, 71.7)	.912
MCID, n (%)	40 (100)	88 (100)	1.000
SCB, n (%)	40 (100)	86 (98)	1.000
Forward elevation (degrees)			
Preop	90 (90, 103)	90 (90, 110)	
Postop	150 (140, 160)	150 (135, 155)	
Δ	60 (45, 65)	50 (30, 65)	.439
External rotation (degrees)			
Preop	25 (20, 30)	30 (20, 30)	
Postop	70 (50, 80)	60 (50, 76)	
Δ	40 (30, 50)	30 (20, 50)	.017*
Internal rotation†			
Preop	0.0 (0.0, 2.0)	0.0 (0.0, 2.0)	
Postop	6.0 (2.8, 6.3)	4.0 (2.0, 6.0)	
Δ	4.0 (2.0, 6.0)	2.0 (1.0, 4.0)	.005*

TSA, total shoulder arthroplasty; *RSA*, reverse shoulder arthroplasty; *VAS*, Visual Analog Scale; *SANE*, Single Assessment Numeric Evaluation; *ASES*, American Shoulder Elbow Surgeon score; *MCID*, minimal clinically important difference; *SCB*, substantial clinical benefit.

* Denotes statistical significance.

† Sequential point system with 0 representing rotation to the buttocks/hip, 1 representing sacrum, 2 representing L5, and so on.

Table IV – Preoperative factors associated with top 20% TSA.

Factor	OR	95% CI Lower	95% CI Upper	P value
Sex (refence: male)	1.04	0.49	2.20	.917
Age	0.96	0.90	1.02	.190
ASA (reference: 2)				
1	0.70	0.16	2.96	.625
3	0.55	0.11	2.72	.467
BMI	0.90	0.82	0.98	.022*
Diabetes	0.65	0.13	3.27	.600
Smoking status (reference: never)				
Previous	1.53	0.70	3.36	.289
Current	0.50	0.06	4.52	.538
Prior surgery	0.24	0.08	0.70	.009*

TSA, total shoulder arthroplasty; *OR*, odds ratio; *CI*, confidence interval; *ASA*, American Society of Anesthesiologists' classification of Physical Health; *BMI*, body mass index.

* Signifies significance with alpha risk set at 0.05.

demonstrated improvements in PROs. ASES scores increased by a median (interquartile range) of 60.0 (50.4, 72.0) and 61.0 (50.0, 71.7) for TSA and RSA, respectively. SANE scores increased by a median of 70.0 (50.0, 80.0) for TSA and 62.5 (49.7, 80.5) for RSA. VAS pain scores decreased by a median of −6.0 (−7.0, −4.0) for TSA and −6.0 (−8.0, −4.0) for RSA. There were no differences between groups in the change from preoperative to postoperative ASES score ($P = .912$), SANE score ($P = .388$), or VAS-pain score ($P = .539$). MCID for ASES was achieved by 100% of patients in both groups. SCB for ASES was achieved by 100% of TSA patients and 98% (n = 86) of RSA patients.

Range of motion

Preoperative FE ($P = .623$), ER ($P = .189$), and IR ($P = .201$) were similar between groups (Table III). Both TSA and RSA cohorts improved in measurable ROM postoperatively. FE increased by a median (interquartile range) of 60° (45°, 65°) and 50° (30°, 65°) for the TSA and RSA groups, respectively. ER increased by a median of 40° (30°, 50°) for the TSA group and 30° (20°, 50°) for the RSA group. IR increased by a median of 4.0 (2.0, 6.0) for TSA and 2.0 (1.0, 4.0) for RSA. The TSA group demonstrated a larger change than the RSA group in ER ($P = .017$) and IR ($P = .005$).

Patient factors contributing to outcomes

After controlling for potential confounding variables in the binary logistic regression model, factors independently associated with outcomes not in the top 20% of TSA patients included higher BMI (odds ratio [OR] 0.90; 95% confidence interval [CI], 0.82-0.98; $P = .022$) and prior ipsilateral shoulder surgery (OR 0.24; 95% CI, 0.08-0.70; $P = .009$) (Table IV). Factors independently associated with outcomes not in the top 20% of RSA patients included female sex (OR 0.40; 95% CI, 0.23-0.67; $P = .001$) and prior ipsilateral shoulder surgery (OR 0.37; 95% CI, 0.20-0.71; $P = .003$). Having a primary diagnosis of massive rotator cuff tear without arthritis was a significant negative predictor of outcomes in the top 20% of RSA patients (OR 0.15; 95% CI, 0.03-0.71; $P = .016$) (Table V).

Discussion

Since 2016, RSA has become the most utilized method of shoulder arthroplasty.[4,26] Evidence toward its use for primary glenohumeral arthritis has led to comparisons of clinical outcomes between TSA and RSA.[32] Published evidence of variable recovery periods for RSA when compared to TSA, as well as discrepancy in final ROM, has contributed to perceptions of RSA inferiority.[7,10,29] Pervasive, anecdotal discussions among surgeons illustrate that surgeons believe their "best"-performing cohort of TSAs are superior to "best"-performing RSAs. Our findings demonstrate similar outcomes at minimum 2-year clinical follow-up between the "best" TSAs and RSAs, defined as the top 20% of patients in each cohort by postoperative ASES score.

Defining representative patient populations by percentile has been previously used for poor outcomes, and as such, we

Table V – Preoperative factors associated with top 20% RSA.

Factor	OR	95% CI		P value
		Lower	Upper	
Sex (refence: male)	0.40	0.23	0.67	.001*
Age	0.99	0.95	1.03	.467
ASA (reference: 2)				
1	1.08	0.20	5.86	.926
3	0.80	0.41	1.56	.515
BMI	0.98	0.94	1.03	.406
Diabetes	0.69	0.32	1.47	.417
Smoking status (reference: never)				
Former	1.63	0.97	2.74	.066
Current	0.78	0.20	0.70	.729
Prior surgery	0.37	0.20	0.71	.003*
Diagnosis (reference: RCA)				
GHOA	1.00	0.54	1.89	.979
RCT	0.15	0.03	0.71	.016*
Other	0.55	0.14	2.08	.378

RSA, reverse shoulder arthroplasty; *OR*, odds ratio; *CI*, confidence interval; *ASA*, American Society of Anesthesiologists' classification of Physical Health; *BMI*, body mass index; *RCA*, rotator cuff arthropathy; *GHOA*, glenohumeral osteoarthritis; *RCT*, rotator cuff tear.

* Signifies significance with alpha risk set at 0.05.

replicated this for the upper limits of performance.[5] Our cohorts were derived from the top ASES scores, as ASES has proven to be valid, reliable, and responsive for both TSA and RSA.[17] The psychometric properties and pain descriptors provided by the ASES were felt to most accurately represent what constituted the "best"-available outcomes. Nearly all patients in both groups achieved both MCID and SCB for ASES scores at 2-year follow-up. Based on our study cohort, the "best"-performing RSA patients were clinically equivalent to the "best"-performing TSA patients despite generally being older and having greater medical complexity.

Patients undergoing TSA demonstrated a larger change in ROM than patients undergoing RSA ($P < .05$); however, these differences in ROM may not be clinically significant. Prior studies have shown TSA and RSA produce comparable postoperative ROM.[16,18,30] Alternatively, Kiet et al reported greater ER but similar FE and IR for TSA when compared to RSA for rotator cuff tear arthropathy.[14] The discrepancy in ROM in our study could be explained by the difference in preoperative diagnosis between the 2 cohorts. We did not match glenoid morphology or preoperative diagnosis between groups in an effort to provide a more holistic representation of implant performance and address the hypothesis. Our RSA cohort comprised 72.7% GHOA and 21.6% RCA diagnoses, potentially influencing final postoperative ROM. Previous reports demonstrate that patients undergoing shoulder arthroplasty for GHOA with an intact rotator cuff report similar ROM for both TSA and RSA.[12] Forlizzi et al reported that a preoperative diagnosis of GHOA was predictive of superior outcomes for patients treated with RSA.[8] In addition to rotator cuff status, Friedman et al reported that postoperative ROM was greatly influenced by preoperative ROM.[9] Although comparative postoperative changes were greater for external and IR in the TSA group as measured at the last follow-up, this amounted to less than 10 degrees of ER and around 1.5 vertebral levels of IR. Although measured consistently by the same senior author, there remains inherent error in these measurements greater than the reported difference between groups.[21] Ultimately, the ROM achieved in each group was within the functional range as evidenced by high ASES scores, which include patient perception of functional ROM.

Our subanalysis to evaluate preoperative patient characteristics associated with patients obtaining optimal outcomes found that having no prior ipsilateral shoulder surgery was an independent predictor for both TSA and RSA. Lower BMI was a predictor of being in the top 20% of TSAs while male sex and rotator cuff integrity were predictors of being in the top 20% of RSAs. Recent literature also reported prior surgery as predictor of poor outcomes following shoulder arthroplasty.[5,13,31] We believe these findings will help with preoperative patient education, as well as with the shared patient-provider surgical decision-making.

Strengths of this study include relatively large cohort sizes from a consecutive series with prospectively collected outcomes data and a uniform mean follow-up of 2.75 years. Furthermore, confounding factors were minimized due to a consistent operative technique and an evaluation procedure by a single surgeon and shoulder arthroplasty service (eg, protocols and rehabilitation). Although we did not control for diagnosis or glenoid morphology, our comparisons were also strengthened by the 73% overlap in GHOA diagnosis between groups. Interestingly, 3 complications occurred in the "best"-performing RSA group, including an acromial stress fracture which can significantly reduce outcomes.[6] Although our study was not powered toward complications, it is important to consider that patient perceptions of outcome can differ from objective findings. Despite our cohort of RSA having diagnoses that classically carry variable outcomes and increased complication profiles, our cumulative "best" RSAs were clinically nondifferent from a respective TSA cohort. Surgeons anecdotally relying on individual experiences and variable literature reports should consider the similarity between these treatment modalities and provide appropriate preoperative counseling toward the potential for excellent outcomes.

This study has several limitations. While the data were prospectively collected and stored in a database, the retrospective study design and analysis may introduce biases. All procedures in the study were performed by a single fellowship-trained surgeon with extensive experience in both TSA and RSA, which may limit the generalizability of the study to other surgeons and institutions. The surgeon used the same implants for all RSA cases, but halfway through the study period, the surgeon transitioned to new implants for the TSA cases, which may limit generalizability as a learning curve might impact TSA outcomes. Although ASES is a widely used performance metric, when considering all 200 TSA and 440 RSA patients, >15% of both groups reached the highest possible score of 100 at 2-year follow-up. This "ceiling" effect has been demonstrated in other performance metrics at varying time points.[30] The granularity of the ASES psychometric properties likely contributes to this and may influence our null hypothesis. Unfortunately, widely used metrics may not account for subtle variations in perceptible outcomes in

top-performing patients, and surgeons should be aware of this. The groups in the study were fairly heterogeneous, as shown by differences in age, follow-up, and diagnosis (Table II), all of which can affect clinical outcomes.[8,18,20] This heterogenicity is, in part, due to the surgeon's decision criteria and practice patterns. Our early follow-up is limited, and longer term follow-up may identify significant differences in outcomes between TSA and RSA, including revision rates and implant durability. Recent registry data suggest that contemporary TSA and RSA have similar survivorship at 4 years postoperatively of 5.6% and 2.5%, respectively.[11] Because of the anecdotal perception that "best" TSA performs better than RSA, this may lead surgeons to favor the use of TSA and justify a revision to RSA if failure occurs. Unfortunately, a recent consecutive series of 127 revisions of TSA to RSA by Bartels et al show a 17% glenoid baseplate mechanical failure rate at 35 months (range, 24 to 84 months) of follow-up.[2] Both TSA and RSA can provide reliable midterm to long-term outcomes when appropriately indicated.[1,16] Our study provides additional consideration that excellent, equivalent outcomes can be achieved through RSA when compared to TSA in the early postoperative period and that implant selection need not be a consideration to this end. Surgeons should carefully consider complication profiles between implant types with the understanding of the potential for excellent outcomes in both groups.

Conclusion

The "best" outcomes in TSA and RSA, defined as patients achieving the upper 20% of ASES scores at minimum 2-year follow-up, are clinically similar. Nearly all patients in both cohorts met MCID and SCB values at 2-year follow-up. Prior ipsilateral shoulder surgery negatively influenced outcomes in both cohorts, while a diagnosis of rotator cuff tear arthropathy negatively influenced RSA outcomes in top performers. Longer follow-up and varied performance metrics are needed to determine significant differences in patients achieving top PROMs.

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