

The Relationship between Native Glenoid Size and Outcomes with Various Baseplate and Glenosphere Sizes after Reverse Total Shoulder Arthroplasty

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INTRODUCTION: Modern reverse total shoulder arthroplasty (rTSA) platform systems offer multiple baseplate (BP) and glenosphere (GS) options to better fit each patient’s unique anatomy. Patients at extremes of anatomic size may be poorly served with traditional implants. It is imperative to understand the relationship between implant size, native glenoid morphometry, and outcomes after rTSA.

METHODS: A retrospective review of a multicenter, IRB-approved database of a single rTSA system was performed. Primary rTSA with available native glenoid measurements and 2-year minimum follow-up were included. This system offers small and standard baseplate (BP) designs and varying glenosphere (GS) sizes for each baseplate. Two cohorts were formed based on native glenoid width above or below median. Within each of these native glenoid size cohorts, small and standard BP clinical outcomes were compared irrespective of GS size. GS size was then incorporated, resulting in four cohorts for each native glenoid size: A-small BP/small GS-36mm, B-small BP/large GS-40mm, C-standard BP/small GS-36mm/38mm, D-standard BP/large GS-42mm/46mm.

RESULTS SECTION: The clinical outcomes of 1,727 primary rTSA patients (divided into two cohorts based on native glenoid size) were analyzed in this study, with 864 (657F/207M; 359 small BP/505 standard BP) patients in the small native glenoid group, and 863 (275F/588M; 91 small BP/772 standard BP) patients in the large native glenoid group. The small native glenoid group had significantly more females (76.8% vs. 32.1%, p<0.0001) and lower BMI (29.3±6.6 vs. 30.0±5.9, p=0.0247) than the large native glenoid group, with no significant differences in age (71.6±7.3 vs. 71.6±7.9, p=0.9495) or follow-up (34.4±13.5 vs. 34.9±13.6, p=0.3983). When stratified by BP design only, in the small native glenoid group, the small BP patients showed greater pre-to-postop improvement (delta) in Constant score (31.4±17.5 vs. 27.7±17.1, p=0.0323), whereas in the large native glenoid group, the standard BP patients showed greater delta in external rotation, or ER (15.0±19.6 vs. 20.5±21.8, p=0.0399). Otherwise, both native glenoid size cohorts showed no differences in outcomes or prevalence of scapular notching, complications, or revisions (small native glenoid cohort: 7.0%/3.3%/0.8% vs. 6.6%/2.4%/1.4%, p=0.8738/0.4080/0.5351; large native glenoid cohort: 9.5%/7.7%/4.4% vs. 5.9%/4.4%/2.9%, p=0.2676/0.1866/0.3430). When stratified by both BP design and GS diameter, the small native glenoid patients showed better postop abduction in group A vs. B (A:130.5±28.7 vs. B:118.7±34.1, p=0.0246). In large native glenoid patients, Groups C/D demonstrated greater postop abduction and ER vs. Group B (Abduction - B:107.7±39.8 vs. C/D:131.7±29.3/130.3±27.1, p=0.0008/0.0015; ER - B:30.5±19.6 vs. C/D:42.9±18.5/40.2±16.8, p=0.0065/0.0479). For small native glenoids, when implanted with a small BP, the small GS outperformed the large GS, though this difference did not exceed MCID. Conversely, for large native glenoids, the large BP, regardless of GS size, outperformed the small BP and large GS combination, exceeding associated MCIDs.

DISCUSSION: rTSA can produce excellent clinical results in small and large native glenoids. However, greater range of motion was observed using a small baseplate in small native glenoids, while larger native glenoids demonstrated better post-operative abduction and ER when a standard baseplate was used. It should be noted that while other significant differences in postop and delta outcomes were observed between implant groups, these differences were likely owed to preop differences. The preop differences may be a result of selection biases introduced by the surgeons/sites. Further study is needed to identify the optimal glenosphere size cut offs for each baseplate type.

SIGNIFICANCE/CLINICAL RELEVANCE: In conclusion, this large-scale, outcomes study of 1,727 rTSA patients comparing different combinations of BP designs and GS diameters demonstrates that excellent results and a low revision rate can be achieved with each implant group, though some differences in patient selection, utilization, and clinical/radiographic outcomes were observed.

Table 1. Comparison of Postoperative Clinical Outcomes by BP/GS Groups for Small and Large Native Glenoids

Small	Implant Groups				P-values						
	A	B	C	D	All	A:B	A:C	A:D	B:C	B:D	C:D
Abd	130.5 ± 28.7	118.7 ± 34.1	127.1 ± 29.2	127.9 ± 29.8	0.045	0.025	0.598	0.892	0.150	0.201	0.996
FE	141.9 ± 24.0	135.1 ± 29.3	147.7 ± 22.0	140.1 ± 24.9	<0.001	0.185	0.034	0.927	0.001	0.550	0.028
IR Score	4.2 ± 1.5	4.1 ± 1.8	4.6 ± 1.6	4.1 ± 1.7	0.007	0.984	0.049	0.894	0.154	0.996	0.029
ER	42.0 ± 18.0	43.2 ± 16.0	41.8 ± 18.0	41.1 ± 16.2	0.896	0.965	0.999	0.973	0.932	0.874	0.987
Pain	1.3 ± 2.0	1.4 ± 2.3	1.2 ± 2.0	1.4 ± 1.9	0.881	0.996	0.944	1.000	0.925	0.999	0.946
SF	8.4 ± 1.7	8.4 ± 2.1	8.3 ± 1.9	8.1 ± 2.0	0.653	0.999	0.841	0.640	0.972	0.849	0.932
Constant	65.9 ± 12.5	62.6 ± 15.0	68.4 ± 12.7	69.1 ± 15.3	0.007	0.362	0.257	0.269	0.016	0.021	0.978
ASES	81.7 ± 16.6	82.0 ± 19.0	83.1 ± 17.1	82.1 ± 17.8	0.797	0.999	0.777	0.996	0.957	1.000	0.955
SAS	74.7 ± 11.0	72.3 ± 13.6	76.6 ± 12.0	74.0 ± 10.3	0.023	0.477	0.292	0.958	0.039	0.805	0.218
Large	Implant Groups				P-values						
	A	B	C	D	All	A:B	A:C	A:D	B:C	B:D	C:D
Abd	124.8 ± 36.8	107.7 ± 39.8	131.7 ± 29.3	130.3 ± 27.1	0.001	0.100	0.488	0.643	0.001	0.002	0.947
FE	134.5 ± 34.6	123.8 ± 27.2	147.3 ± 24.3	145.2 ± 22.2	<0.001	0.298	0.009	0.031	<0.001	<0.001	0.761
IR Score	4.0 ± 1.8	4.1 ± 1.7	4.3 ± 1.6	3.9 ± 1.6	0.048	0.989	0.576	0.999	0.928	0.958	0.028
ER	40.8 ± 20.4	30.5 ± 19.6	42.9 ± 18.5	40.2 ± 16.8	<0.001	0.104	0.891	0.997	0.007	0.048	0.278
Pain	1.1 ± 2.3	1.3 ± 2.0	0.8 ± 1.7	0.9 ± 1.7	0.366	0.991	0.580	0.817	0.519	0.718	0.824
SF	8.8 ± 2.0	8.2 ± 2.3	8.7 ± 1.8	8.7 ± 1.7	0.561	0.586	0.991	0.998	0.579	0.499	0.995
Constant	63.5 ± 18.1	59.9 ± 15.6	69.9 ± 13.9	72.9 ± 13.5	<0.001	0.809	0.089	0.002	0.014	<0.001	0.125
ASES	84.7 ± 21	80.8 ± 19.6	87.1 ± 15.9	87.7 ± 14.7	0.117	0.736	0.800	0.628	0.206	0.124	0.957
SAS	74.5 ± 15.7	70.1 ± 13.4	77.7 ± 10.0	76.1 ± 10.4	<0.001	0.410	0.320	0.803	0.008	0.049	0.350

Abd – abduction, FE – forward elevation, IR score – internal rotation measured by level of spine reached, ER – external rotation, SF – Shoulder Function, ASES – American Shoulder and Elbow Surgeons score, SAS – Shoulder Arthroplasty Smart score

Table 2. Comparison of Scapular Notching, Complication, and Revision Rates by BP/GS Groups for Small and Large Native Glenoids

<i>Small</i>	Implant Groups				P-values
	A	B	C	D	All
Scapular notching	7.7%	4.6%	7.7%	3.0%	0.363
Complications	3.3%	3.5%	1.3%	5.4%	0.160
Revisions	0.7%	1.2%	0.8%	3.1%	0.057
<i>Large</i>	Implant Groups				P-values
	A	B	C	D	All
Scapular notching	10.0%	8.7%	8.5%	4.3%	0.081
Complications	7.0%	8.8%	5.2%	3.9%	0.613
Revisions	5.3%	2.9%	3.1%	2.7%	0.293