Reverse Total Shoulder Arthroplasty Utilizing Lateralized Glenoid Baseplates Have Superior Patient-Determined Outcome Scores at Short-Term Follow Up

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INTRODUCTION:

There are a variety of baseplate options when performing reverse total shoulder arthroplasty (RTSA). First generation reverse total shoulder arthroplasty (RTSA) systems utilized baseplates without augmentation or lateralization. Newer generation reverse arthroplasty systems include augmented and/ or lateralized baseplates. The theoretical benefits of augmented/lateralized baseplates include less glenoid reaming, enhanced ability to correct pathologic version or inclination, decreased scapular notching, improved impingement-free range of motion, and increased tensioning of the deltoid and remaining rotator cuff to improve strength and stability. Theoretical concerns with augmented / lateralized baseplates include aseptic glenoid loosening and acromial stress fractures. The hypothesis of this study was that the use of lateralized baseplates would improve patient-determined outcome scores and postoperative range of motion after RTSA compared to standard baseplates without increasing the risk of complications.

METHODS: Patients undergoing RTSA were stratified into a standard baseplate group (SBG) and the lateralized baseplate group (LBG). The LBG included 3 mm lateralization, 6 mm lateralization, and full wedge augmentation which provided 8 mm of lateralization. Preoperative 3D CT planning was used to 1) measure preoperative version, inclination, and humeral subluxation and 2) predict the postoperative medial to lateral arm change position (BACP), depth of reaming, and glenoid baseplate seating ratio. Preoperative and postoperative radiographs were used to calculate the 1) actual medial-to- lateral arm change position using the measurement of the lateral edge of the greater tuberosity to the lateral edge of the acromion (RACP-LHO) and 2) the change in center of rotation (COR). The Western Ontario Osteoarthritis Score (WOOS), American Shoulder and Elbow Surgeons score (ASES), Single Assessment Numeric Evaluation (SANE), Simple Shoulder Test (SST), and Shoulder Activity Level (SAL) were recorded at baseline, 1 year, and 2 years. Differences in complications between groups were recorded. $P<0.05$ was utilized to determine statistical significance.

RESULTS: The LBG included 187 patients (mean age 72±8) and the SBG included 51 patients (mean age 71±9; p=0.27) [Table I]. Preoperative glenoid retroversion was greater in the LBG group (8.8±9.4º) than the SBG group (5.7±5.9º; p=0.03). There was no difference in preoperative inclination (9.1±6.6º vs. 7.8±7.7º; p=0.23) or posterior humeral subluxation (60±13% vs. 58±12%; p=0.20). Planned depth of reaming was greater in the SBG compared to LBG (1.6±1.1 mm vs. 1.2±2.1 mm; p=0.03) to obtain similar baseplate seating ratios (97±6% vs. 97±4%; p=0.36). Planned arm change position was on average lateralized by 3.5±4.5 mm in the LBG and medialized by 1.2±5.6 mm; p<0.0001 in the SBG. The actual RACP-LHO was greater in the LBG compared to the SBG (1.7±7.8 vs. -2.0±6.6 mm; p=0.003). The LBG had less medialization of the COR compared to the SBG (17±7.0 vs. 22±17 mm; p<0.0001). There was no difference in any patient-determined outcome score or range of motion metric at one-year follow up. At two years there were greater WOOS (84±16 vs. 74±19; p=0.01), ASES (81±15 vs. 70±20; 0.001), SST (8.0±2.4 vs. 6.6±2.6; p=0.007), and SANE (82±17 vs. 68±25; p=0.0005) in the LBG. The improvement in SST (5.0±2.7 vs. 3.3±3.6; p=0.02) and SANE (54±26 vs. 37±30; p=0.004) at 2 years compared to baseline was greater in the LBG compared to the SBG [Table II]. There was no difference in any range of motion metric between groups [Table III]. Total complications were similar between LBG (21/187; 11.2%) and SBG (6/51; 11.7%; p=0.91). Acromial stress fractures [3.7% (7/187) vs 3.9% (2/51); p=0.48] and dislocations [3.2% (6/187) vs 3.9% (2/51); p=0.46] were similar between LBG and SBG respectively. Scapular notching was more prevalent in the SBG [7.8% (4/51) vs. 1.6% (3/187); p=0.01]. One patient in the LBG had aseptic glenoid baseplate loosening (0.5%) compared to none in the SBG (p=0.61).

DISCUSSION AND CONCLUSION: The lateralized baseplate group had better patient-determined outcome scores compared to the standard baseplate group at 2-year follow up with a similar rate of overall complications but a lower rate of scapular notching. At short-term follow up there was no difference in aseptic baseplate loosening or acromial stress fractures between groups. Lateralization of the baseplate did not provide superior postoperative range of motion compared to a standard baseplate.

Table I. Patient enrollment and follow-up metrics

Outcome		SBG	LBG			
1 year ROM		All	All	3 mm	6 mm	Full Wedge
	All enrolled patients	51	187	15	23	149
	Patients with ≥1 year follow-up	45	155	12	17	126
	Deceased during follow-up	0	6	0	0	6
	Diagnosed with ALS during follow-up	0	1	0	0	1
	Loss to follow-up	4 (8.9%)	22 (14%)	0	2	20
	Final Follow-up	41 (91%)	126 (81%)	12	15	99
1 year PROMs						
	All enrolled patients	51	187	15	23	149
	Patients with ≥1 year follow-up	45	155	12	17	126
	Deceased	0	6	0	0	6
	Diagnosed with ALS during follow-up	0	1	0	0	1
	Loss to follow-up	3 (6.7%)	12 (7.7%)	0	3	9
	Final Follow-up	42 (93%)	136 (88%)	12	14	110
2 year PROMs						
	All enrolled patients	51	187	15	23	149
	Patients with ≥2 year follow-up	35	109	8	16	85
	Deceased- during follow-up	1	6	0	0	6
	Diagnosed with ALS during follow-up	0	0	0	0	0
	Loss to follow-up	0	5 (4.6%)	0	2	3
	Final Follow-up	34 (97%)	98 (90%)	8	14	76

SBG = standard baseplate group; LBG = lateralized baseplate group; ROM = range of motion; PROMs = patient reported outcome measure; ALS= amyotrophic lateral sclerosis

Table II. Differences in patient-determined outcomes between patients with a lateralized baseplate compared to the standard baseplate

	Lateralized Baseplate	Sample Size	Standard Baseplate	Sample Size	P value
WOOS	Mean ± standard deviation		Mean ± standard deviation		
1 year	82±15	86	79±19	31	0.30
Change from baseline to 1 year	46±18	83	40±20	31	0.98
2 years	84±16	76	75±19	29	0.01*
Change from baseline to 2 years	47±19	72	41±23	28	0.24
ASES					
1 year	79±16	134	79±19	42	0.84
Change from baseline to 1 year	39±22	132	44±21	41	0.25
2 years	81±15	97	70±20	34	0.001*
Change from baseline to 2 years	40±22	95	39±23	33	0.79
SANE					
1 year	81±18	136	80±23	42	0.80
Change from baseline to 1 year	53±28	134	50±24	42	0.60
2 years	82±17	98	68±25	34	0.0005*
Change from baseline to 2 years	54±26	95	37±30	34	0.004*
SST					
1 year	8.0±2.9	73	7.7±2.6	29	0.59
Change from baseline to 1 year	5.0±3.4	70	4.5±3.1	29	0.45
2 years	8.0±2.4	81	6.6±2.6	30	0.007*
Change from baseline to 2 years	4.9±2.7	70	3.3±3.6	28	0.02*
SAL					
1 year	8.1±4.6	133	8.5±4.8	42	0.62
Change from baseline to 1 year	1.9±4.3	125	2.8±6.1	40	0.28
2 years	7.6±4.3	97	7.4±4.7	34	0.80
Change from baseline to 2 years	0.8±5.0	93	0.6±5.1	34	0.87

*reaches the level of statistical significance (p<0.05)

Table III. Differences in range of motion metrics between patients with a lateralized baseplate compared to the standard baseplate

	Lateralized Baseplate	Sample Size	Standard Baseplate	Sample Size	P value
Preoperative	Mean ± standard deviation		Mean ± standard deviation		
Flexion	93±44	186	86±39	48	0.27
External Rotation	19±21	159	32±15	46	0.59
Abduction	86±47	176	83±38	31	0.79
Abduction External Rotation	51±30	169	45±28	30	0.28
Abduction Internal Rotation	14±26	167	16±29	29	0.84
Internal Rotation	2.7±1.9	176	2.4±1.7	32	0.46
1 year after surgery					
Flexion	136±26	126	141±21	41	0.45
External Rotation	52±17	123	54±20	41	0.49
Abduction	132±26	125	134±26	41	0.92
Abduction External Rotation	73±19	125	72±27	40	0.77
Abduction Internal Rotation	25±25	124	24±23	41	0.83
Internal Rotation	2.7±2.2	123	2.3±2.0	40	0.23

*reaches the level of statistical significance (p<0.05)