Clinical and Radiographic Outcomes Following Anatomic Total Shoulder Arthroplasty Utilizing an Inset Glenoid Component at 2-Year Minimum Follow-Up: A Dual Center Study

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INTRODUCTION:

Anatomic total shoulder arthroplasty (aTSA) is a successful and reproducible treatment for patients with painful glenohumeral arthritis. However, long-term outcomes using traditional onlay glenoid components have been tempered by glenoid loosening. Inset components have been proposed to theoretically minimize glenoid loosening by reducing edge-loading and opposite-edge lift-off forces with humeral translation. Successful short and long-term outcomes have been reported while using inset glenoid implants. The current study is the largest study presenting a minimum of two-year follow-up data following aTSA with an all-polyethylene inset glenoid component (Shoulder Innovations, Holland, MI).

METHODS: A dual center, retrospective review of patients undergoing aTSA by two fellowship-trained shoulder surgeons at two separate institutions from August, 2016 to August, 2019 was performed. Inclusion criteria were patients undergoing primary or revision aTSA with an inset glenoid component. Exclusion criteria were patients who did not have radiographs and preoperative CT sufficient to measure radiographic variables. Minimum follow up was two years. Range of motion (ROM), Visual Analog Pain Scores (VAS), Single Assessment Numeric Evaluation (SANE), and American Shoulder and Elbow Surgeons (ASES) scores were obtained. The presence of either central peg lucency or glenoid loosening was recorded for each patient at final radiographic follow-up. Three independent, fellowship-trained shoulder and elbow surgeons reviewed Grashey and axillary radiographs obtained at the final postoperative clinical encounter. These radiographs were evaluated for 1. the presence of tilt or subsidence of the prosthesis within the glenoid vault and 2. the presence of radiolucent lines, specifically around the central peg, at the bone-cement interface. Central peg lucency was characterized by the presence of greater than 1 mm of periprosthetic lucency. Glenoid loosening was defined as the presence of tilt or subsidence of the implant within the glenoid vault.

RESULTS:

Seventy-five shoulders were included for final analysis. The mean age of the entire cohort was 64 (±11.4) years. Twenty-one (28%) glenoids were type A1, 10 (13.3%) were type A2, 13 (17.3%) were type B1, 22 (29.3%) were type B2, and 6 (8%) were type B3. Three (4%) were type D glenoids. At a minimum follow-up of 24 months (mean 28.7 months), a significant improvement in ROM in all planes was observed. Significant improvements in VAS (5.1 to 0.9, $p<0.001$), SANE (39.5 to 91.2, $p<0.001$) and ASES (43.7 to 86.6, $p<0.001$) scores were observed. There were four (5.3%) cases of radiographic lucency about the central peg of the inset glenoid component and one (1.3%) cases of glenoid loosening. No revisions were performed for glenoid failure.

DISCUSSION AND CONCLUSION:

This retrospective review of 75 patients is the largest series of reported patients undergoing aTSA with an inset glenoid component. At a minimum of two years postoperatively, there were significant improvements in ROM and VAS, SANE, and ASES scores with low rates of central peg lucency and glenoid loosening in patients undergoing aTSA with an inset glenoid component. Further work is needed to determine the long-term benefit of this novel implant.

Characteristic		Value
No. of Patients		75
Follow-Up Duration	*Months, mean (range)*	28.7 (24-42)
Age	*Years, mean (SD)*	64 (11.4)
Sex	*Male, n (%)*	33 (44)
	Female, n (%)	42 (56)
Laterality	*Right, n (%)*	38 (50.7)
	Left, n (%)	37 (49.3)
Diagnosis	*Primary GHA, n (%)*	61 (81.3)
	AVN, n (%)	6 (8)
	RA, n (%)	3 (4)
	Post-Traumatic GHA, n (%)	2 (2.7)
	Instability Arthropathy	1 (1.3)
	Other, n (%)	2 (2.7)
Walch Classification		
A	*A1*	21 (28)
	A2	10 (13.3)
B	*B1*	13 (17.3)
	B2	22 (29.3)
	B3	6 (8)
D		3 (4)

Table 1: Preoperative patient characteristics and glenoid morphology per the Walch classification. No: number; SD: standard deviation; GHA: glenohumeral arthritis; AVN: avascular necrosis; RA: rheumatoid arthritis

Characteristic	Value
Complications*, n (%)	4 (5.3)
Reoperations, n (%)	3 (4)
Central Peg Lucency, n (%)	4 (5.3)
Glenoid Loosening, n (%)	1 (1.3)

Table 4: Data regarding postoperative radiographic outcomes and complications. *Complications excluding central peg lucency or glenoid loosening.

Characteristic		Value
Humeral Stem/Nucleus Model	*Simpliciti, n (%)*	70 (93.3)
	Flex, n (%)	5 (6.7)
Glenoid Model	*Shoulder Innovations, n (%)*	75 (100)
Humeral Stem/Nucleus Size*, Simpliciti	*1, n (%)*	37 (49.3)
	2, n (%)	20 (26.7)
	3, n (%)	10 (13.3)
Humeral Stem/Nucleus Size*, Flex	*3B, n (%)*	2 (2.7)
	3C, n (%)	2 (2.7)
	8A, n (%)	1 (1.3)
Humeral Head Size, Simpliciti	*≥46, n (%)*	43 (57.3)
	<46, n (%)	27 (36)
Humeral Head Size, Flex	*≥46, n (%)*	2 (2.7)
	<46, n (%)	3 (4)
Glenoid Size, Shoulder Innovations*	*≥23, n (%)*	32 (42.7)
	<23, n (%)	38 (50.7)
Complications, n (%)		0 (0)

Table 2: Intraoperative data. *Data regarding the sizes of the humeral stem/nucleus and glenoid were incomplete.

Outcome	Preoperative, mean (SD)	Postoperative, mean (SD)	Δ, mean (SD)	95% CI	p-value
ER, degrees	29.8 (16)	53 (12.9)	23.2 (19.8)	18.4 to 28	***<0.001***
FF, degrees	114.5 (33)	150.1 (24.3)	35.6 (33.3)	27.5 to 43.7	***<0.001***
IR, L5 or higher	27	54	27	-	***<0.001***
VAS	5.1 (2.7)	0.9 (1.6)	-4.2 (2.4)	-4.8 to -3.6	***<0.001***
SANE	39.5 (25)	91.2 (12.6)	51.6 (27.8)	44.6 to 58.6	***<0.001***
ASES	43.7 (17.9)	86.6 (15.2)	42.9 (20.6)	37.9 to 48	***<0.001***

Table 3: Changes in range of motion and patient reported outcomes measures preoperatively to postoperatively. The postoperative scores reported here reflect those obtained at the final follow-up time point. Paired, two-tailed Student's t-test were used to calculate significance for continuous variables. Fisher's exact test was used for categorical variables. Δ: change in means preoperatively to postoperatively; SD: standard deviation; CI: confidence interval. ER: external rotation; FF: forward flexion; IR: internal rotation; VAS: Visual Analog Pain Scale; SANE: Single Assessment Numeric Evaluation; ASES: American Shoulder & Elbow Surgeons Score