Superior Migration of the Humeral Head Does Not Significantly Affect Outcomes at an Average of 11 years After Total Shoulder Arthroplasty

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INTRODUCTION: Superior migration of the humeral head has been linked with poor rotator cuff function in previous literature. Studies have also shown an association between glenoid loosening and superior migration of the humeral head. We aimed to determine if superior migration of the humeral head was associated with poor outcomes following anatomic total shoulder arthroplasty (TSA).

METHODS: We retrospectively reviewed all patients undergoing TSA by a single surgeon at an urban, academic hospital. Patients with rheumatoid arthritis or avascular necrosis, without X-rays, and with less than five years of follow-up were excluded from the study. The clinical variables included forward elevation (FE), internal rotation (IR), external rotation (ER), visual analog scale (VAS), American Shoulder and Elbow Surgeons (ASES) shoulder score, and simple shoulder test (SST) score. Postoperative range of motion (ROM) and patient reported outcomes (PROs) were based on the most-recent follow-up visit. Radiographic variables included immediate postoperative and long-term follow up acromiohumeral interval (AHI), lateral humeral offset (LHO), and glenoid loosening. To study the effect of superior migration on TSA outcomes, we stratified the cohort by ≥ and < 7 mm of AHI at most recent follow-up and compared ROM and PROs.[1] Additionally, we plotted AHI against ROM and PROs to visualize the data.

RESULTS: After applying exclusion criteria, 121 TSAs were included in our study. The mean age was 63.9 years (SD 9.5), and 66 TSAs (55%) were in male patients. The mean follow-up for our cohort was 11.2 years (SD 4.9), and 9 shoulders underwent revision surgery. All ROM and PROs improved significantly from preoperative to the most recent postoperative follow-up. The mean AHI immediately following surgery was 10.9 mm (SD 4.1) while the mean AHI at most recent follow-up was 8.4 mm (SD 3.5). Glenoid loosening was observed in 29 (23.8%) shoulders at the most recent follow-up appointment. After stratifying the cohort by ≥ and < 7 mm of AHI, FE was the only outcome that differed significantly between the two groups (Table 1). Patients with ≥ 7 mm AHI had 7.9 degrees more FE on average (152.0 vs. 144.1 degrees; p=0.045). Although AHI seemed to correlate weakly with FE when plotting the data, we did not observe a clear threshold of migration which led to degraded function (Figure 1). Rather, 33/42 patients (78.6%) with < 7 mm AHI had FE > 130 degrees. None of IR, ER, VAS, ASES, SST, or revisions were significantly different between patients with less than and greater than 7 mm of AHI.

DISCUSSION AND CONCLUSION: Although superior migration of the humeral head has been associated with poor shoulder function in prior studies, we did not find that a low AHI led to poor shoulder outcomes in our study. While FE was decreased in patients with < 7 mm AHI, all other measures of shoulder function, outcomes, glenoid loosening, and revisions were not significantly different. From our data, TSA showed durable improvements to pain, function, and patient reported outcomes despite changes to the acromiohumeral interval over long-term follow up.

Table 1. Radiographic and clinical outcomes at the most recent follow-up visit stratified by AHI greater than or less than 7 millimeters.

	≥7 mm (n = 79)	<7 mm (n = 42)	P-value
Follow-Up Time (Years)	11.12 (5.06)	12.53 (4.33)	0.129
Range of Motion			
Forward Elevation (Degrees)	152.05 (16.85)	144.12 (25.24)	**0.045**
External Rotation (Degrees)	55.19 (16.64)	54.74 (14.88)	0.886
Internal Rotation	10.79 (T12)	10.49 (L1)	0.679
Patient Reported Outcomes			
Visual Analog Scale	1.96 (2.75)	2.05 (2.28)	0.858
ASES Shoulder Score	76.72 (24.45)	73.00 (22.49)	0.440
Simple Shoulder Test Score	8.63 (3.39)	8.03 (3.28)	0.371
Glenoid Loosening	0.85 (1.73)	1.10 (1.92)	0.471
Revision	4 (5.1%)	5 (11.9%)	0.371

Figure 1. Plot showing the association between AHI and FE at the most recent follow-up visit.