Backside Polyethylene Wear in Reverse Shoulder Arthroplasty
Michael Schwartz BS, Chelsea Koch BS, Michael Hendel MD, Xiang Chen MS, Andreas Kontaxis PhD, Timothy Wright PhD, Lawrence Gulotta MD
Hospital for Special Surgery, New York, NY, USA

DISCLOSURES: Michael Schwartz (N), Chelsea N. Koch (N), Michael Hendel (N), Xiang Chen (N), Andreas Kontaxis (N), Timothy Wright (N), Lawrence Gulotta (Biomet: Paid consultant; Paid presenter or speaker)

INTRODUCTION: Indications for Reverse Shoulder Arthroplasty (RSA) have expanded considerably in recent years. Younger and more active patients are now considered for RSA to achieve better joint stability and muscular function, which increases the demands of inverse prostheses for longevity and durability. Primary RSA has been associated with high complication rates, ranging from 4.5% to 37.5%, with impingement, instability, implant loosening, and mechanical failure, among others. Polyethylene damage on the articular (frontside) surface of RSA liners has been previously investigated. No literature to date reports evidence of damage to the backside of these liners which may be a contributing factor to these complications which included the polyethylene particles created from the wear causing local osteolysis. The purpose of this study was to evaluate a group of retrieved RSA polyethylene liners for both articular and backside surface damage.

METHODS: A set of 22 retrieved RSA humeral polyethylene liners were collected for analysis (period 2007-2014, IRB #24097). The set included: i) 10 Comprehensive Reserve Shoulder System (Biomet, Warsaw, IN), ii) 8 Delta CTA Reversed Shoulder Prosthesis (Depuy, Warsaw, IN), iii) 2 Equinox Reverse Platform (Exactech, Gainesville, FL), and iv) 2 Anatomical Reverse Shoulder (Zimmer, Warsaw, IN). Patient charts were reviewed and demographic data including length of implantation (LOI), body mass index (BMI), gender, and reason for revision were collected. Liners were examined under light microscopy (10x to 30x magnification) by two independent graders. The articular and backside surfaces were graded using a modified Hood scoring system for 9 damage modes (scratching, pitting, burnishing, abrasion, delamination, deformation, embedded debris, focal wear, and fracture) across 4 quadrants (anterior, posterior, superior, inferior).

RESULTS: Damage was observed on both the articular surface (all 22 liners), and the backside (20 liners). Scratching was the most common damage modality on both the articular surface. The average total damage score was significantly higher on the articular surface than the backside (16.27 ± 6.92; 4.65 ± 3.27; p<0.001). Average damage score at the superior quadrant of the backside surface was higher (but not significant) compared to the other quadrants (1.59, p=0.24). The damage was most severe at the inferior aspect of the front articular, which is consistent with the high prevalence of scapular notchling found in previous studies. There was no correlation between the average backside damage score and the average articular damage score on the entire surface (R² = 0.06). No correlation was found between backside damage score and other demographic parameters, such as BMI and length of implantation. However, on the backside, the Biomet model (10 retrievals) on average had significantly higher damage score (6.85 ±3.27) compared to the Delta models (2.72 ±2.85, p<0.05).

DISCUSSION: The most common damage modality on the backside was scratching, and was found on the majority (20) of the examined implants. The prevalence of wear on the superior quadrant of the backside and the inferior quadrant of the articular surface may indicate a rocking type of motion in vivo. The results of this study suggest that different fixation mechanisms of the humeral polyethylene bearing adopted by different RSA designs play an important role in the severity of the backside damage of the polyethylene. Further investigation is needed to identify a mechanism that minimizes backside wear without compromising the strength of fixation.

SIGNIFICANCE: This study demonstrated the prevalence of backside wear in retrieved RSA humeral polyethylene bearings. The results of this study could help further development of long lasting humeral implant.


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