Influence Of Humeral Lengthening On Clinical Outcomes In Reverse Shoulder Arthroplasty

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INTRODUCTION:
Deltoid tensioning secondary to humeral lengthening after reverse shoulder arthroplasty (RSA) is commonly theorized to be crucial to improving range of motion (ROM) but may predispose patients to acromial/scapular spine fractures and neurologic injury. Clinical evidence linking patient outcomes to humeral lengthening is limited. This study assesses the relationship between humeral lengthening and clinical outcomes after RSA.
METHODS:
A single institution review of 284 RSAs performed in 265 patients was performed using a lateralized humeral design. Humeral lengthening was defined as the difference in the subacromial height preoperatively to postoperatively as measured on Grashey radiographs (**Figure 1**). The subacromial height was measured as the vertical difference between the most inferolateral aspect of the acromion and the most superior aspect of the greater tuberosity. The relationship between humeral lengthening and clinical outcomes was assessed on a continuous basis. Secondarily, clinical outcomes were assessed using a dichotomous definition of humeral lengthening (≤25 vs. >25 mm) based on prior clinical and biomechanical work purporting a correlation with clinical outcomes. Improvement exceeding the minimal clinically important difference (MCID) and substantial clinical benefit (SCB) for ROM and outcome scores after RSA were also compared.
RESULTS:
Humeral lengthening averaged 28.0 ± 9.7 mm. Humeral lengthening demonstrated a nonlinear relationship with postoperative ROM, clinical outcome scores, and shoulder strength and their improvement preoperatively to postoperatively. The postoperative Simple Shoulder Test was greater in patients with ≤25 mm of humeral lengthening compared to >25 mm (11 [9-12] vs. 10 [7-12], P = .037); however, all other postoperative ROM measures, outcome scores, and shoulder strength measures did not differ using a dichotomous definition of humeral lengthening (**Figure 2**). Furthermore, there were no differences in improvement in aforementioned clinical outcomes when stratified using the dichotomous definition of humeral lengthening. No difference in the proportion of patients exceeding the MCID or SCB when stratified by humeral lengthening ≤25 vs. >25 mm was found. There was no difference in humeral lengthening in patients with versus without complications.
DISCUSSION AND CONCLUSION:
No clear relationship between humeral lengthening and clinical outcomes was identified. The previously purported 25 mm threshold for humeral lengthening did not predict improved patient outcomes. The mean humeral lengthening was greater in our study compared to previous reports without an increased rate of complications. These results suggest that surgeons may prioritize deltoid tensioning over concern for an increased rate of complications to prevent postoperative dislocation when using a lateralized humerus design. Due to a low incidence of complications in our study and those prior, a large multi-institutional study may be necessary to accurately study the relationship between humeral lengthening and postoperative complications.

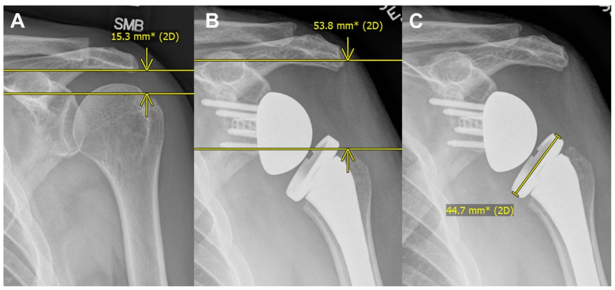

Figure 1. The change in subacromial height was computed as the difference between the preoperative (A) and postoperative (B) subacromial height. Radiographic magnification was corrected for by multiplying radiographic measurements by the ratio of the known to measured adapter diameter (C).

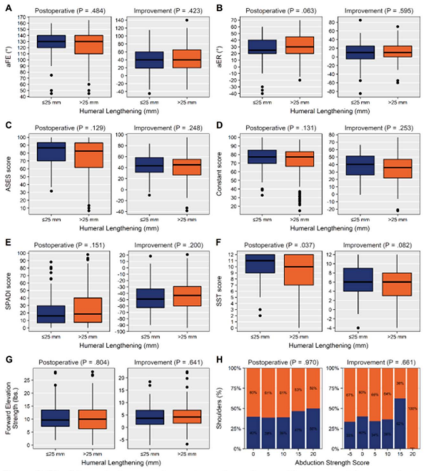

Figure 2. Bivariate analysis comparing postoperative values and improvement (preoperative to postoperative) in ROM, outcome scores, and shoulder strength based on degree of humeral lengthening (≤25 mm vs. >25 mm). *P* values from Wilcoxon rank-sum and Fisher Exact tests are shown. *aER*, active external rotation; *aFE*, active forward elevation; *ASES*, American Shoulder and Elbow Surgeons; *SPADI*, Shoulder Pain and Disability Index; *SST*, Simple Shoulder Test.