Radiographic Measures of Lateralization and Distalization Do Not Correlate with Intraoperative Soft Tissue Tension Measurement During Reverse Total Shoulder Arthroplasty

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INTRODUCTION:

The final tension of the soft tissue envelope in reverse total shoulder arthroplasty (RTSA) is thought to influence range of motion (ROM), pain, dislocation rate, and risk for acromial stress fracture. Recent papers have focused on radiographic measurements of lateralization and distalization of the humeral component as a surrogate for soft tissue tension in an attempt to correlate these measurements with clinical outcomes¹. However, given the variability of human anatomy it is unknown if these radiographic measures correlate with the actual tension placed on the soft tissue envelope in the operating room. A popular method of determining intraoperative tension in RTSA is the lateral thrust test, where the surgeon uses their finger to push the humeral prosthesis laterally off the glenosphere to quantify the soft tissue tension and stability of the construct². Recently, the primary author has been using a dynamometer to determine the maximum force needed to dislocate the humeral component laterally off the glenoid while performing an intraoperative lateral thrust test. The purpose of our study was to determine if radiographic measures of lateralization and distalization correlate with an intraoperative measurement of soft tissue tension.

METHODS:

This was a prospective study of twenty-five consecutive patients undergoing primary RTSA with a single surgeon (n = 25). All patients greater than 18 years of age undergoing primary RTSA for either rotator cuff arthropathy or osteoarthritis with rotator cuff tear were considered for inclusion. Exclusion criteria included revision, tumor, infection, or fracture procedures, or unwillingness to consent to the study. Participants underwent RTSA via a deltopectoral approach. Once the final implant was placed, a dynamometer was attached to a sterile bone hook and placed around the humeral neck to perform the lateral thrust test. The arm was placed in 20-30° of abduction and neutral rotation. Gentle direct lateral tension was applied with the bone hook until the humeral component dislocated laterally off the glenosphere [Figure 1]. The maximum force was recorded in Newtons (N). Two fellowship trained shoulder surgeons reviewed pre and postoperative radiographs on two separate occasions. Measurements included preoperative acromial-humeral distance (AHD), postoperative AHD, the difference in AHD, lateralization shoulder angle (LSA), and distalization shoulder angle (DSA). Inter and intra rater correlation was determined using concordance correlation coefficients (CCC). Correlation between radiographic measurements and final intraoperative tension was determined using linear regression models. RESULTS:

Mean maximum force for the lateral thrust test was 125 N (\pm 20 N). There was no significant correlation between any radiographic measure and the mean maximum force [Table 1]. Intra and inter-rater correlation coefficients were 0.92 indicating excellent agreement among the surgeons.

DISCUSSION AND CONCLUSION:

This study indicates that there may not be a significant correlation between radiographic measurements of lateralization and distalization and the actual tension on the soft tissue envelope during RTSA. This has significant implications for scientific studies attempting to correlate radiographic measures with clinical outcomes, as well as the ability of preoperative planning software to determine clinical outcomes.

1) Boutsiadis A, Lenoir H, Denard PJ, Panisset JC, Brossard P, Delsol P, Guichard F, Barth J. The lateralization and distalization shoulder angles are important determinants of clinical outcomes in reverse shoulder arthroplasty. Journal of Shoulder and Elbow Surgery. 2018 Jul 1;27(7):1226-34.

2) Javed S, Imam MA,	Monga P.	Intraoperative stability	assessment in reverse	shoulder arthroplasty	. Journal of Clinical
Orthopaedics	&	Trauma.	2019	May	1;10(3):617-9.

Figure 1:



p-value 0.08 Pre AHD vs MF 0.16 0.01 Post AHD vs MF 0.68 0.06 Difference in AHD vs MF 0.23 <0.01 LSA vs MF 0.76 DSA vs MF AHD: Acromial Humeral Dista Maximum Force Recorded 0.89 < 0.01 ulder Angle, MF: ler Angle, DSA: Distalization Sho e, LSA: Lateralization Shou

Table 1: Association of Radiographic Measurements and Maximum Force

Intraoperative Measurement of the Lateral Thrust Test with a Sterile Dynamometer