Dramatically Improved Strength of Proximal Humeral Fixation with a Tuberosity-Specific Fixation Plate

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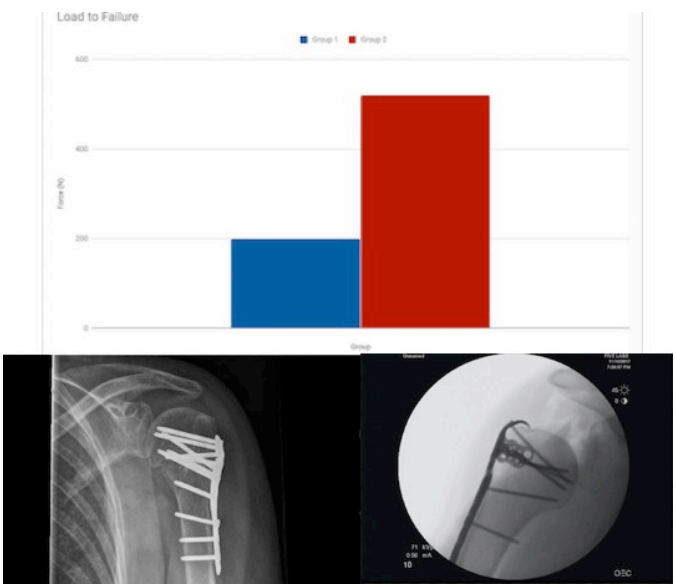
Purpose: Current proximal humeral locking plates are unable to secure the greater and lesser tuberosities securely and have a high incidence of fixation failure, nonunion, and rotator cuff dysfunction. This study evaluates a proximal humeral plate specifically designed to capture the greater and lesser tuberosities, which may improve tuberosity fixation. The purpose of this biomechanical study was to determine if the new plate design reduces greater tuberosity displacement and increases the load to failure compared to a standard proximal humeral locking plate.

Methods: Six matched cadaveric humerus specimens were acquired and randomized to receive either standard humeral locking plate (Group 1) or tuberosity-specific plate fixation (Group 2, Figure). Specimens were skeletonized with the exception of the rotator cuff insertion on the greater tuberosity. A reproducible 3-part osteotomy was performed for each cadaver. Plate fixation was performed and augmented with standard suture augmentation through the rotator cuff. The construct was loaded at 45° to the greater tuberosity fragment thereby putting the most stress at this fracture fragment. In each trial, fracture displacement, load to failure, number of cycles endured, stiffness, and mechanism of failure were calculated. Calipers and photographs of pins on either side of the osteotomies were used to measure the displacement of each site (surgical neck, greater tuberosity base, and greater tuberosity proximal aspect).

Results: Mean load to failure in Group 1 was 200.8 ± 163.9 N and Group 2 was 520.3 ± 203.6 N, respectively (P = 0.049, Fig. 3). Most specimens failed by avulsion of the greater tuberosity segment.



Conclusion: Group 2 (mean 520 N) had a higher load to failure than Group 1 (mean 200 N). The tuberosity- specific plate design dramatically increased the strength of fixation of the greater tuberosity and humeral head. This may decrease the high rate of tuberosity-related complications seen clinically, and translate into improved functional outcomes.