BIOMECHANICAL COMPARISON OF AN INTRA- CORTICAL FIXATION ANCHOR VERSUS STANDARD ANCHOR FIXATION FOR ROTATOR CUFF REPAIR

^Darin Allred, *^Andrew Mahar, ^Gaurav Abbi,
*Michelle Wedemeyer, ^Robert Pedowitz
^Department of Orthopaedics, University of California, San Diego, San Diego, CA, USA
*Department of Orthopedics, Children's Hospital, San Diego, San Diego, CA, USA

INTRODUCTION

The integrity of the rotator cuff after repair is a major determinant of a good functional result. Clinical studies have demonstrated that greater than fifty percent of repairs involving more than just the supraspinatus tendon have residual deficiencies.

Many different modes of failure of suture anchors have been identified. Failure may occur by anchor displacement or pullout, suture breakage, knot slippage, or suture pulling though the tendon. New devices and suture material are under development to eliminate the clinical problems mentioned above. This study compares the fixation strength of an anchor designed for intra-cortical fixation to the fixation strength of standard anchors used for rotator cuff repair.

METHODS

Four types of suture anchors (n = 8 per group) were inserted into human cadaveric humeri in random order: the Arthrex FT (cortical fixation anchor), Mitek Fastin RC, Linvatec Super Revo and Smith and Nephew Twin Fix Ti 5.0. Anchors were placed in the human cadaver supraspinatus footprint to the manufacturer's recommended depth. After preconditioning to 10N, each construct was cycled between 10N and 60N for a maximum of 500 cycles at 0.5 Hz using a materials testing machine. If still intact, constructs were loaded at 0.5 mm/sec to failure.

Force (N) and displacement (mm) were recorded throughout the experiment. The number of cycles, mode, magnitude, and location of failure was recorded for each specimen. The rotation (degrees) and displacement (mm) of the anchor within the bone was measured with image intensified fluoroscopy employing a radio-opaque device for image calibration. All mechanical and fluoroscopic data was analyzed using a one-way ANOVA ($p<0.05$) with a Tukey's *post-hoc* correction for multiple comparisons.

RESULTS

The intra-cortical fixation anchor had the greatest number of cycles to 3mm of failure (380±160). This was not significantly different than the Smith and Nephew anchor (331±190), however both values were significantly greater than both the Linvatec (114±47) and Mitek (54±53) anchors ($p<0.002$).

The intra-cortical fixation anchor (Arthrex FT) had a statistically significant greater failure load (140N±23) than the other devices ($p<0.02$). There was no significant difference in failure load between the other three anchors.

For the rotation calculated from fluoroscopy, there was no statistically significant difference between the anchors tested. The anchors exhibited a wide variability in angular change with a range from 1 to 70 degree change. Overall, the combined angular change for anchors was 16 ± 17.8 degrees.

There was no statistically significant difference between the anchors tested for total displacement change with a range of 1.24 mm to 2.48 mm. Overall the average displacement across anchors was 1.7 ± 1.6mm.

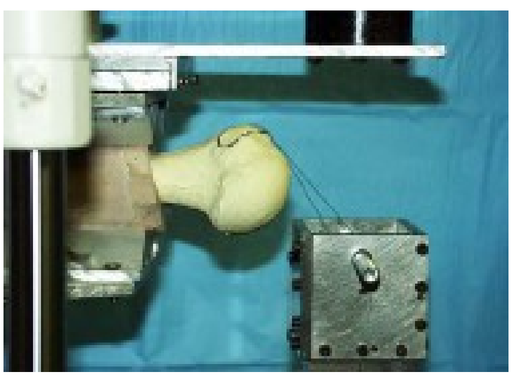
Despite the new suture material used in the Arthrex anchors, each type of anchor failed primarily by suture breakage or knot failure. Failure by the anchor pulling out of bone only occurred in approximately 20% of all tests.

DISCUSSION

Intra-cortical fixation performed well compared to sub-chondral fixation in human cadaver bone. This anchor incorporates a recessed suture eyelet loop, which allows anchor placement flush with the cortical surface. Most previous studies utilize straight pull-out loads to test anchor fixation, however physiologic suture loads are oblique to the direction of anchor placement. In the present study, a clinically-relevant oblique cyclic loading protocol resulted in significant angular displacement as well as anchor translation with all of the anchors tested. This observation could explain some cases of early gap formation after rotator cuff repair.

ACKNOWLEDGEMENTS

This study was funded in part by an unrestricted research grant from Arthrex.



Experimental set up