Biomechanical Analysis of All-Suture Anchor Fixation for Rotator Cuff Repair

Eamon Bernardoni, MS[1], Rachel M. Frank, MD[2], Shreya S. Veera, BS[3], Justin W. Griffin, MD[4], Brian Robert Waterman, MD[5], Elizabeth Shewman, MS[6], Brian J. Cole, MD, MBA[1], Anthony A. Romeo, MD[1], Nikhil N. Verma, MD[1]

[1]Midwest Orthopaedics at Rush, Chicago, IL, USA, [2]University of Colorado School of Medicine, Aurora, IL, USA, [3]Rush University, Chicago, IL, USA, [4]Rush University Medical Center, Chicago, IL, USA, [5]Wake Forest University School of Medicine, Winston Salem, NC, USA, [6]Rush Medical Center, Chicago, IL, USA.

Objectives: Suture anchors are commonly utilized during arthroscopic rotator cuff repair (RCR). Recently, all-suture suture-anchor (ASSA) constructs have been introduced for RCR; however, the biomechanical properties of these implants are poorly understood. The purpose of this study was to compare the biomechanical properties of ASSA to conventional suture anchor (CSA) fixation during RCR.
Methods: Fourteen fresh-frozen matched pair human cadaveric shoulders (average age 52 ± 13 years) with no documented prior rotator cuff tears or shoulder surgery were dissected. The supraspinatous tendon was isolated and detached from its footprint, and then was repaired in an anatomical position. Specimens were randomized into two repair constructs: Q-FIX double-loaded ASSA (N=7) and TWINFIX double-loaded conventional suture anchor (CSA) (N=7) (Smith & Nephew, Andover, MA). Each construct was cyclically loaded from 10 to 160N for 100 cycles at 100N/s, and then pulled to failure at 1mm/s starting from the zero position. Load, crosshead displacement, failure mode, and time were recorded. Correlations between BMD, tendon gage length, maximum load, and stiffness were assessed. The groups were statistically analyzed with independent samples t-test, Fisher's exact test, and a linear regression analysis, with $p<0.05$ considered significant.
Results: There was no statistically significant difference in maximum load (ASSA: 617.73±177.8, CSA: 545.13±212.98 N, p=0.339), cyclic extension (ASSA: 7.88±1.33, CSA: 8.49±2.14 mm, p=0.117), construct stiffness (ASSA: 62.43±11.06, CSA: 68.14±10.77 N/mm, p=0.973), or extension at maximum load (ASSA: 17.03±4.73, CSA: 15.45±1.73 mm, p=0.122) between the ASSA and CSA groups. Failure modes consisted of suture tearing out of the tendon (ASSA: N=3, CSA: N=3) and anchor pull out (ASSA: N=4, CSA: N=4), with no difference in failure mode between groups (p=0.99). An association trended towards significance between higher BMD and higher maximum load in the CSA group (p=0.053) but not the ASSA group (p=0.125)
Conclusion: ASSA constructs for RCR have similar biomechanical properties compared to CSA constructs. Additional clinical data is necessary to determine if these biomechanical results can be translated clinically.

The Orthopaedic Journal of Sports Medicine, 6(7)(suppl 4)
DOI: 10.1177/2325967118S00175