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Comparison of Failure Strengths of Conventional Rotator Cuff Repairs to a Technique Using a Combination of Trans-Osseous Sutures and Suture Anchors

Repair of a full-thickness rotator cuff tear usually involves reattachment of the supraspinatus portion of the tendinous cuff to bone of the greater tuberosity. Typically this is achieved by directly suturing tendon to bone using either trans-osseous tunnels or bone/suture anchors. Using a cadaveric load-to-failure model, this study compared the failure strength of each of these two techniques (trans-osseous suture-only fixation; anchor-only fixation) to an advanced technique combining *both* trans-osseous sutures and bone/suture anchors.

Nine pairs of cadaveric shoulder specimens (mean age: 62 years, range 55-77) were sorted into three groups after examination of each proximal humerus for bone quality using radiographic densitometry. Consequently, between-group differences in patient age and bone quality were minimal and not statistically significant ($p > 0.1$). Three techniques were used to reattach the supraspinatus tendon into a shallow roughened trough made with a burr in the area of the tendon's anatomic insertion site into the greater tuberosity: 1) trans-osseous suture with a single knot and use of a modified Mason-Allen stitch; 2) bone/suture anchor with a single knot and use of a horizontal mattress stitch; and 3) trans-osseous suture *plus* anchor, double-knot technique in which the same suture from the anchor which affixes the tendon at the medial edge of the sulcus (the first knot) is also weaved through the remaining distal tendon using a modified Mason-Allen stitch technique and then tied (the second knot). Mitek Rotator Cuff suture anchors (Mitek Surgical Products Inc., Ethicon Inc., Westwood, MA) and number 2 non-absorbable braided sutures were utilized in all specimens. Using a servo-hydraulic testing machine, each specimen was loaded to failure by pulling on the tendon at a rate of 6mm/minute.

Failure occurred at similar mean loads in both the transosseous suture-only group (237.9N) and in the anchor-only group (215.2N) ($p > 0.1$) (range of peak failure loads, both groups: 116.8 - 344.8N). Using the trans-osseous suture *plus* anchor, double-knot (TOAKK) technique (group 3), three of the six specimens failed at the suture/anchor construct at loads that were substantially greater than the other groups (60.8% greater than transosseous suture-only group, $p = 0.055$; 77.8% greater than anchor-only group, $p < 0.01$). The remaining 3 specimens of Group 3 also failed at relatively higher loads (at least 26% greater than the other groups), but failed near the musculo-tendinous junction and *not* at the tendon-bone construct.

These data demonstrate that the described TOAKK technique has greater initial mechanical strength than fixation using only trans-osseous sutures or only bone/suture anchors.

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