

Paper #61

Unicortical versus Bicortical Button Fixation for Distal Biceps Brachii Tendon Rupture: A Cadaveric Biomechanical Study

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Summary:

Cadaveric biomechanical study comparing unicortical versus bicortical distal biceps button fixation strength and tendon gap formation under cyclic loading, most representative of postoperative physiologic conditions.

Abstract:

Background

Acute distal biceps tendon rupture is an increasingly common and more recognized injury affecting active adults. Operative repair is the preferred treatment, particularly for restoration of elbow function and strength. No prior study has biomechanically compared unicortical versus bicortical distal biceps button fixation under cyclic loading, which is most representative of postoperative physiologic conditions.

Hypothesis

There will be no difference in loss of force, tendon gap formation, or ultimate failure load following cyclic loading between unicortical and bicortical button techniques for the repair of distal biceps tendon rupture.

Study Design: Controlled laboratory study.

Methods

Experimental testing with 13 fresh-frozen matched paired cadaver elbows was conducted. One specimen from each pair was randomized to either unicortical or bicortical distal biceps button fixation techniques, with contralateral specimen assigned to the alternate technique. In both arms of the experiment, the distal 2.5 cm of the biceps tendon was whipstitched and the free suture ends threaded in opposite directions through a 2.6 x 12 mm titanium cortical button. A 3.2 mm guide pin was drilled through the central aspect of the radial tuberosity from anterior to posterior, aiming approximately 20° in the ulnar direction. The button was inserted and deployed for either unicortical or bicortical fixation and the free suture limbs tensioned to advance tendon down to bone for final fixation. Loading was performed using an MTS servohydraulic actuator. A 25-N distal biceps preload was applied and each specimen cycled from full extension to 90° of flexion at 0.5 Hz for 3000 cycles using a displacement controlled protocol. All specimens were subsequently loaded to failure at 2 mm/s to simulate an acute postoperative load. Outcome measures were a loss of force from cycle 5 to cycle 3000, tendon gapping during cyclic loading, and ultimate failure load.

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Results

During cyclic loading, the mean change in force from cycle 5 to cycle 3000 was -0.33 N for the unicortical fixation group and 0.36 N for the bicortical fixation group ($p=0.21$). The increase in tendon gap for the unicortical fixation group was 1.02 mm and for the bicortical fixation group was 1.83 mm ($p=0.37$). During failure loading, the unicortical button fixation group had a mean failure load of 170.45 N and the bicortical button fixation group a mean failure load of 181.25 N ($p=0.89$).

Conclusion

No significant differences exist between the two techniques in loss of force and tendon gap formation under cyclic loading conditions. This indicates that both unicortical and bicortical distal biceps button techniques maintained an equivalent stabilization during a simulated 3 month postoperative healing period.

Additionally, there was no significant difference in failure load between the two groups indicating an equivalent response in the event of an acute injury.

Clinical Relevance:

Distal biceps button fixation strength and tendon gap behavior under physiologic cyclic load support the implementation of early postoperative elbow range of motion, imperative in the prevention of elbow stiffness. Unicortical fixation may be sufficient in facilitating optimal bone-tendon apposition and healing, while minimizing risk of iatrogenic injury associated with bicortical fixation.