COMPARISON OF TWO TECHNIQUES FOR THE REPAIR OF DISTAL BICEPS TENDON RUPTURES

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INTRODUCTION: Avulsion of the distal tendon of the biceps brachii is a treatment challenge The most commonly used technique for repair is the two-incision bone tunnel described by Boyd and Anderson. This method reduces the risk of injury to the posterior interosseous nerve, but complications include heterotopic ossification and decreased elbow range of motion. The use of suture anchors for this repair has been advocated to avoid these complications. The goal of this study was to compare the tensile strength and stiffness of fixation with a one-incision distal biceps repair technique using Mitek G2 suture anchors (Mitek Surgical Products Inc.) to those with the two-incision bone tunnel repair.

METHODS: Twenty-six fresh frozen elbow specimens (12 matched pairs) and two intact control specimens were included. The proximal two-thirds of the radii were used along with their distal biceps tendon attachments. Calibrated radiographs were taken prior to testing for bone density analysis. Biceps tendon ruptures were simulated by transecting each tendon at its insertion. Right and left specimens were randomly selected for the two-incision repair method, and the contralateral radius was repaired using a suture anchor using the one-incision technique. A single surgeon performed all repairs using standard surgical techniques. Number Five Ti-cron sutures were used for the double-incision technique, and #2 Ethibond sutures were used with the suture anchor. The biceps tendon was then clamped 30 mm from the radius, and was pulled perpendicular to the shaft of the radius using an MTS servo-hydraulic load frame. Each specimen was loaded to tensile failure at a rate of 4 mm/sec. Load-displacement data was acquired to determine repair stiffness, yield strength and ultimate strength. .The mode of failure was recorded as either bone or non-bone failure. The repair was considered to have failed after 10 mm displacement at the repair site had occurred

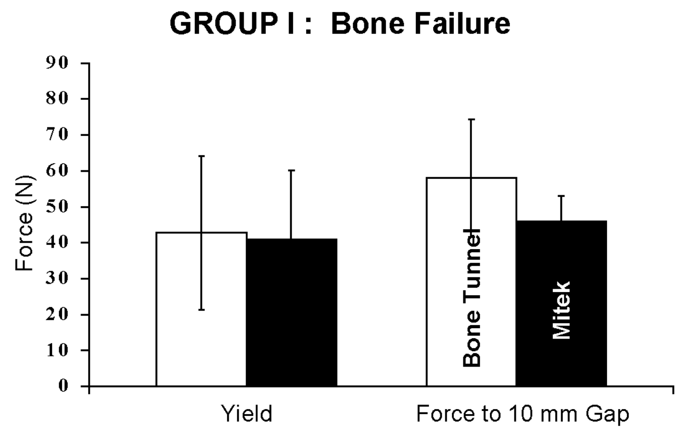
RESULTS: Three varables were used to assess the strength of the repairs: yield strength, load to 10 mm displacement, and ultimate strength. Ultimate strength had little clinical relevance since it was always associated with greater than 15 mm displacement, well beyond clinical failure.

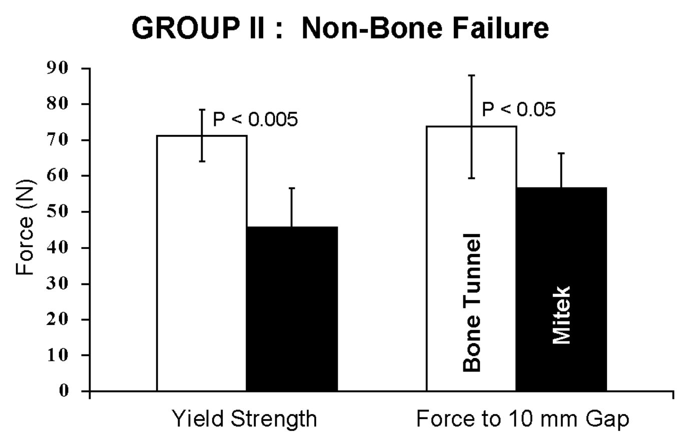
When analyzed according to the mode of failure, 14 of the 24 specimens failed by either the suture anchor or the suture cutting through the radial tuberosity. Radii that failed in this mode (Group I) were from cadavers with an average age of 78 years at death, and included all eight of the elbows which had been found radiographically to be osteopenic. The non-bone failures (Group II) consisted of ten elbows that failed at the suture or by suture pullout through the tendon. These radii were from cadavers with an average age of 56 years at death, and were significantly more dense than those in Group I by radiographic analysis. Older, more osteopenic specimens of Group I were slightly stronger with the bone tunnel repair than with suture anchor repair, although the differences were not statistically significant [$p < .4$]. In the younger, more radiodense specimens of Group II, the bone tunnel method was found to be significantly stronger in average yield strength [$p < .005$] and force to failure (10 mm) [$p < .05$]. The bone tunnel repair was significantly more stiff than the Mitek suture anchor repair for all specimens [$p = .01$]. Group I had much lower yield strength than Group II and also had a lower strength to failure. Regardless of failure mode, the Mitek suture anchor had about the same average yield strength.

DISCUSSION: The ideal distal biceps tendon repair should have high initial fixation strength, allowing minimal gap formation and maintaining mechanical stability throughout healing. Because matched pairs of cadaveric specimens were used in this study, the differences in bone quality could be taken into account. Radiographic bone density correlated with age differences among the specimens, and influenced the yield strength and mode of failure in both repair groups. Regardless of mode of failure, the bone tunnel technique resulted in a significantly stiffer repair than the Mitek suture anchor method in all specimens. The bone tunnel technique also was slightly stronger, though not with statistical significance.

When the elbows were grouped by mode of failure and correlated with radiographic findings, two distinct populations of specimens were noted: an osteopenic group which failed at the bone (Group I); and a non-osteopenic group which failed at the suture/tendon interface(Group II). Younger, non-osteoporotic specimens in Group II showed significantly greater tensile strength when repaired with the bone tunnel method. However, osteopenic elbows in Group I failed to show any significant differences in tensile strength between the two repair types, although Mitek anchors did not resist cutting out through bone better than the #5 Ti-cron suture that was used in bone tunnel repair. The Mitek technique was much weaker in good quality bone. Mitek anchors were almost as strong as the bone tunnel repair in osteopenic bone. The Mitek repair had essentially the same tensile strength whether the bone quality was good (Group II) or bad (Group I)

In summary, while there are surgical advantages to the one incision suture anchor technique, there is a definite reduction in the stiffness and strength of the repair, which may have clinical implications for selecting surgical technique based on patient characteristics and demands as well as on post-operative mobilization following repair.





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References: Berlet et al. Am J Sports Med 26: 428-432, 1998.
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