Secondary And Tertiary Axial Stabilization Of The Forearm, A Biomechanical Study Of The Interosseous Membrane And Triangular Fibrocartilage Complex

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Introduction: The Essex-Lopresti injury is a complex clinical condition with a spectrum of injuries to the radial head (RH), triangular fibrocartilage complex (TFCC), and interosseous membrane (IOM) at presentation. IOM reconstructions have been reported(1). Following RH resection and loss of the primary axial stabilizer, we hypothesize the IOM is the secondary stabilizer, the TFCC is tertiary, and IOM reconstructions restore axial stability of the forearm.

Methods: 8 frozen cadavers were acquired from our institutional specimen bank. Ulnohumeral articulations were fused and a k-wire was placed through the capitellum along the axis of the radial canal. Radial heads were resected at the proximal margin of the bicipital tuberosity. Specimens were potted, aligned in a custom testing device, and loaded with 160N through the wrist in supination, neutral and pronation. The TFCC was released and then the IOM was cut or vice versa. All 8 specimens were tested with both structures cut. Subsequently, IOM repairs were performed utilizing a reported bone-ligament-bone (BLB) technique. Measurements were made using a digital caliper and are reported in (Supination, Neutral, and Pronation) mm ± standard error.

Results: Significant differences were shown from the native state (2.3 ± 0.2, 2.7 ± 0.4, 2.1 ± 0.2mm) when only the IOM was released in the supination and neutral positions (8.1 ± 1.1, 8.4 ± 0.9mm, p<0.05), but not the pronated position (7.3 ± 1.1mm, p = 0.12). No differences were noted when the TFCC alone was cut(2.6 ± 0.4, 3.0 ± 0.4, 2.2 ± 0.2mm, p>0.9). Complete radioulnar dissociation (16.6 ± 2.0, 17.7 ± 2.4, 15.3 ± 2.8mm) was significantly different than any other testing scenario (p<0.02) [Figure 1].

Repairs with a BLB allograft(9.2 ± 0.9, 8.2 ± 1.1, 6.7 ± 1.0mm) showed significant improvements over the modeled Essex-Lopresti injury (p<0.0001), but were not statistically equivalent to the native state (p<0.0002) [Figure 2].

Discussion: Further study is warranted to evaluate the role of the BLB and other reported reconstruction techniques in conjunction with the role of TFCC repair and the subsequent effects on RH mechanics.

Significance: A complete transection of the IOM is significantly worse than loss of the TFCC with respect to axial stability. Significant restoration of axial stability was possible with BLB reconstruction, although not equivalent to the native state.
**Soft Tissue Forearm Stability**

![Graph showing Soft Tissue Forearm Stability](image)

Figure 1: Error bars denote standard error of mean. Lowercase letters indicate the result of Student t Least Squares of mean. Columns with letters in common are not significantly different with p < 0.05.

**Contribution of BLB to Axial Stability**

![Graph showing Contribution of BLB to Axial Stability](image)

Figure 2: Error bars denote standard error of mean. Lowercase letters indicate the least square of means post hoc comparison following repeated measures analysis of variance. Columns with letters in common are not significantly different with p < 0.05.

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