FUNCTIONAL BRACING OF THE UNSTABLE DISTAL RADIOULNAR JOINT. A CADAVERIC STUDY

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Introduction:
Instability of the distal radioulnar joint is as relatively common problem to which there is no universal answer. Numerous surgical techniques have been described in order to re-establish stability of the chronically unstable distal radioulnar joint. A review of the literature disclosed no reports describing the use of functional bracing for the chronically unstable distal radioulnar joint. The purpose of this study is to evaluate the efficacy of functional bracing of the unstable distal radioulnar joint.

Methods and Materials:
Eight cadaveric specimens with intact elbows and distal radial ulna joints were utilized. An apparatus was designed to allow stabilization of the humerus with free rotation across the wrist. Rotation through the distal radioulnar joint was achieved utilizing a transfixion pin through the metacarpal heads (Figure 1).

In four specimens the dorsal radioulnar ligament, the dorsal 50% of the triangular fibrocartilage complex (TFCC) and the distal interosseous ligament were cut first and in four specimens the palmar radioulnar ligament, palmar 50% of the TFCC and the distal interosseous ligament was cut first. CT scans were then taken of each specimen in neutral, 90 degrees of supination, and in 90 degrees of pronation with the specimen intact, with either the dorsal or volar ligaments cut, with dorsal and volar ligaments cut, with a custom brace fitted and with a generic ulnar fracture brace fitted. The CT images were filtered so that for each ligament condition the same section of bone was analyzed. Using CT segmentation software (Materialise, Ann Arbor MI), the contour of the ulna and radius was extracted. Principal axes and centroids were calculated from the bone contours, and used to align the specimens for each wrist condition. The radial principal axis from each of the wrist conditions was aligned on a common coordinate system. The anterior/posterior and medial/lateral translation of the ulnar centroid was then calculated and used for further analysis.

Results:
Results were then analyzed utilizing ANOVA to check for statistical significance. The displacement averages shown describe the translation of the radius relative to the ulna. With the specimens in 90 degrees of pronation, significant differences were noted between the intact specimen (ave. 0mm displacement) and the fully sectioned specimen (ave 7.41±3.21mm dorsal displacement) (p < 0.0001) Significant decreases in translation were also noted between the fully sectioned and the specimen fitted with the custom brace (ave 0.36±0.85mm dorsal displacement)(p <. 0181) and the generic ulnar fracture brace (ave 0.93±1.15mm volar displacement)(p < .0001) with the specimens in 90 degrees of pronation. Figure 2 shows the absolute displacement of the radius and ulna relative to each other. Figure 3 displays the true displacement of the radius relative to the ulna, positive displacement representing volar displacement of the radius, and negative values representing dorsal displacement of the radius.

Discussion and conclusions:
Both dorsal and volar ligaments must be sectioned for significant translation to occur. Functional of bracing appears to significantly decrease the dorsal and volar translation of the radius relative to the ulna in full supination and full pronation with the distal radial ulna joint fully destabilized. The study showed no significant differences in the effectiveness of a custom-made forearm brace when compared to a standard off the shelf ulna fracture brace.