**BRACHIORADIALIS LOAD AND FOREARM POSITION AFFECT THE STABILITY OF DISTAL RADIUS FRACTURES**

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**INTRODUCTION:** Displacement of distal radius fractures is common with cast immobilization. It has been suggested that these fractures should be treated by bracing in supination, to limit deforming forces applied to the fracture fragment by the brachioradialis muscle. However, this effect has yet to be quantified experimentally. The purpose of this in-vitro study was to determine the influence of both brachioradialis load and the position of forearm rotation on the fracture stability of a simulated extra-articular distal radius fracture treated with a “Pi” plate.

**METHODS:** Eight previously frozen cadaveric upper extremities were mounted in a custom designed wrist loading apparatus. A Colles’ fracture was simulated by removing a 1 cm wedge from the dorsal aspect of the distal radius, and fixed using a “Pi” plate (Synthes, Canada Ltd.). Pneumatic actuators from the loading device applied independent, computer-controlled loads to various forearm tendons. The forearm was maintained in either pronation or supination by loading the pronator teres or the biceps tendon, respectively. The hand was lifted against the force of gravity to a neutral position by applying a balanced wrist load to the tendons of flexor carpi radialis, flexor carpi ulnaris, extensor carpi radialis longus, and extensor carpi ulnaris. Loads ranging from 0 to 60 N, in 15 N increments, were then applied to the brachioradialis tendon. Receivers of an electromagnetic tracking device (Flock of Birds, Ascension Technology, VT, USA) were rigidly fixed to the distal fragment and the proximal radius to measure motion across the fracture site. Resulting fragment motion was analyzed statistically using a two-way repeated measure analysis of variance with Student-Newman-Keuls multiple comparisons procedures (n=0.05).

**RESULTS:** Figure 1 shows the dorsal-volar (D-V) angulation of the distal fragment relative to the proximal radius plotted versus the magnitude of brachioradialis load. The fragment motion measured with the forearm in pronation was significantly larger than with the forearm in supination (p=0.003). A similar finding was found when measuring radial-ulnar (R-U) deviation of the fragment (p=0.02) (Figure 2). There was no significant effect of forearm position on the magnitude of internal-external (I-E) fragment rotation (p=0.06) (Figure 3).

For each of the three directions of fragment motions measured, there was a significant increase in fragment motion with increasing brachioradialis loads (p<0.0001; p<0.0001; p=0.023).

**DISCUSSION:** The brachioradialis is the only muscle to insert on the distal radius fracture fragment. Therefore, it is not unexpected that loads applied to this tendon directly influence fragment motion. The importance of the brachioradialis muscle on the stability of Colles’ fractures was described by Sarmiento et al., who concluded that immobilization in supination rather than pronation minimized the forces applied by this muscle to the fracture fragment. They suggested that with the forearm in supination, the brachioradialis muscle is in a relatively shortened position so its resting tension and tendency to produce dorsal and ulnar fragment subluxation is reduced. Pronation stretches the brachioradialis muscle due to the longer distance from origin to insertion, thereby increasing the resting tension on the distal radial fragment. Their prospective review concluded that 85% of patients in their series with displaced extra-articular fractures showed excellent or good anatomical results when treated with a functional brace in supination, compared to 67% for those treated in pronation. The findings of this study support these clinical results, by showing decreased fragment motion with the forearm maintained in supination. In this in-vitro investigation, fractures were treated with the distal radius “Pi” plate, which previous research conducted in our laboratory has shown to be a very stable technique for fixing Colles’ fractures. Thus, since testing with the “Pi” plate represents a best-case scenario, the effect of brachioradialis loading would likely be greater for cast immobilization or less rigid types of internal fixation. It is concluded that unstable distal radius fractures may benefit from immobilization in supination to decrease the possibility of fracture displacement prior to union.

**REFERENCES:**