KINEMATIC AND TORQUE-RELATED EFFECTS OF DORSALLY ANGULATED DISTAL RADIUS FRACTURES ON THE DRUJ

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Introduction
Dorsal angulation of the distal radius post-fracture is known to affect the constraints of the distal radioulnar joint (DRUJ). The purpose of this study was to examine the torque required to achieve a full range of motion with increasing dorsal angulation. Results would present a criteria for performing corrective osteotomy.

Materials and Methods
Nine normal human cadaveric forearm specimens were dissected, leaving the soft tissue of the wrist, elbow, and IOM intact. PQ, PT, FCR, Supinator, Biceps, ECRL and ECRB tendons were prepared and loaded. Unloaded and resistive muscle loading conditions were simulated throughout a complete pronation-supination motion on a custom forearm simulator (Fig. 1). A torque cell was used to measure the torque required to create and resist motion of the DRUJ. Data was collected in the intact state, and after increasing degrees of distal radial fracture realignment: 0°, 10°, 20°, 30°, and 40° dorsal tilt. The malunion model was stabilized via fixators (Fig. 2). After measurements of torque with TFCC intact, the TFCC was sectioned and the distal radius angulation sequence was repeated. Dynamic data were normalized for each specimen’s full range of motion and compared at 80% and 100% of the motion in each direction. Data were compared using a one factor ANOVA with a post-hoc Tukey test.

Results
The torque across the DRUJ was affected by the degree of simulated malunion, TFCC presence, and muscle loading. With muscles unloaded and the TFCC intact, there was statistically increased torque at the DRUJ with greater than 30° malunion (Fig. 3). The result was the same after the TFCC was divided (Fig. 4).

With resistive loading and the TFCC intact, there were torque changes to achieve a full range of motion with greater than 40° angulation in pronation, and 30° angulation in supination (Fig. 5). After the TFCC was cut, with resistive loading, the torque data showed the same tendency, however there were no significant differences.

Discussion
This study showed that dorsal angulation of the distal radius is associated with increased resist torque at the DRUJ. With a malunion of more than 30° dorsal angulation, the required torque across the joint increased even with the muscles unloaded. After the TFCC was cut, our results show that the required torque to achieve full motion tended to decrease. This shows once again that the TFCC is one of the most important stabilizers of the DRUJ, in that it provided suspension between the bones even in a severely malunited model.

With active load in supination, more than 30° dorsal malunion and more than 40° in pronation produced increased torque at the DRUJ. Moreover, patients who have a dorsally angulated malunion can’t achieve as much supination as pronation. Our results showed this matter clearly. Although significance was not noted, results indicate torque changes with as little as 10° malunion. Thus, it might be better to have correction osteotomy even with 10° malunion if patients want and need greater activity.

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References