**Introduction** Ulnar minus and ulnar plus variances are predisposing factors which may lead, respectively, to avascular necrosis of the lunate (Kienbock’s disease) and ulnar impaction syndrome. Different joint-leveling procedures have been used for the decompression of carpal bones with good clinical results. These procedures are, however, accompanied by the risk of subsequent disorders of the adjacent distal radioulnar joint (DRUJ)\(^1\) and ulnocarpal impingement\(^2\). The DRUJ is an important joint for wrist stability and forearm rotation but its anatomy have not been fully elucidated and its biomechanics after a joint-leveling procedure has not been established. Our hypothesis is that a joint-leveling procedure will increase the pressure pattern in the DRUJ.

**Purpose** The main purpose of this study was to evaluate the dynamic change of the pressure pattern in the DRUJ after a joint-leveling procedure. Results of this study may suggest modifications to decrease the level of pressure at DRUJ and the risk of subsequent disorders following a joint-leveling procedure.

**Materials and Methods** Thirteen fresh adult cadaveric upper extremities were utilized in this study. The specimens were examined radiographically to rule out any pre-existing pathology. The tendons of the extensor carpi radialis brevis (ECRB), extensor carpi radialis longus (ECRL), extensor carpi ulnaris (ECU), flexor carpi radialis (FCR), and flexor carpi ulnaris (FCU) were identified and transected at their musculotendinous junction for load attachment. The dorsal retinaculum of the extensor tendons at the wrist, the dorsal and volar radioulnar ligaments at the perimeter of the triangular fibrocartilage complex (TFC), and the interosseous membrane were also preserved. The radius was sectioned at its mid-shaft to allow lengthening and shortening via a mini external fixator (Orthofix) attachment. Longitudinal incisions were made over the dorsal and volar aspects of the wrist without violating the TFC. The elbow joint was fixed at 90 degrees of flexion by placing 2 pins through the ulnoulnar joint to allow the radius to freely rotate around the ulna. Proximal end of the humerus was mounted in bone cement and was attached to a specially designed vertical jig. The wrist was maintained in centered rotating grip position by applying finger traps to the index finger and the thumb. Thin malleable pressure sensors were inserted into the DRUJ and the ulnocarpal joint. The pressure sensors were connected to a dynamic pressure measurement system (Tekscan, Inc, Boston, MA). This system monitors continual pressure distribution, the peak pressure, and its location at the joint. Axial loads were applied through strings attached to the ECRL, ECRB, ECU, FCR, and FCU for a total of 89 N. Transverse load of 25 N was also applied in radioulnar direction through a pulley system. Forearm rotation was controlled manually. The dynamic pressure distribution at the DRUJ was recorded from 6 mm of radial shortening to 6 mm of radial lengthening in increments of 1 mm and was statistically analyzed using SAS program.

**Results** Peak pressure of the DRUJ increased significantly when the radius was lengthened 4 mm and more. The peak pressure at 6 mm of radial lengthening averaged 1.9 times higher than that of original position (3.8 MPa vs 2.0 MPa). Peak pressure also tended to increase when the radius was shortened in the specimens with ulna minus variance, but the difference was not statistically significant. Total contact area of the DRUJ decreased by 10% with radial shortening and increased by 20% with radial lengthening when compared with that of the original position. Consistent with this result, maximum force transmitted across the DRUJ increased by 20% with 6 mm of radial lengthening. Peak Pressure at the ulnocarpal joint increased significantly with radial shortening and decreased with radial lengthening.

**Discussion** Results indicated that radial lengthening substantially increases the peak pressure of the DRUJ. Ulnar shortening mimics radial lengthening and may have the same disordering effects. Shortening of ulna over 4mm may results in osteoarthritis of the DRUJ secondary to pressure increase at this joint. Radial shortening did not significantly increase the peak pressure at the DRUJ. This technique, however, transfer more force through the ulnocarpal joint which may cause ulnar impaction syndrome.

**References**