CONTRIBUTION OF DISTAL RADIO-ULNAR JOINT CONSTRAINT FROM THE INTEROSSEOUS MEMBRANE
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INTRODUCTION
The interosseous membrane (IOM) has been considered as a contributing stabilizer of distal radioulnar joint (DRUJ), but less so than the triangular fibrocartilage complex (TFCC). Previous studies have concentrated on the role of the IOM as a longitudinal stabilizer of the forearm. Although IOM injuries occur, they are difficult to diagnose. The results from previous studies have shown that disruption of the TFCC must occur in order for the DRUJ to dislocate, but no information is available regarding the role of the IOM in DRUJ dislocation. Palmer discovered that after resecting the TFCC with an intact IOM that dislocations of the radius relative to the ulna were possible in all positions and directions except dorsally in pronation[2]. Kihara demonstrated that dislocations occurred with compromise of both the TFCC and the entire IOM[1]. Viegas has described an extensive tear of the distal IOM is associated with diastases of the DRUJ [4]. Previous studies have not clarified the IOM’s role in restraining the DRUJ. Therefore, it remains difficult to assess the status of the IOM clinically, even in the face of a dislocated DRUJ. We evaluated the role of isolated regions of the IOM related to dislocatability of the DRUJ in a cadaveric study.

MATERIALS AND METHOD
Eight fresh-frozen upper extremities (range, 72-90 years) were used in this experiment. Each specimen was transected at the junction of the middle and distal thirds of the humerus. Skin, muscles and tendons were removed, but the soft tissues associated with the wrist and elbow joints and IOM were preserved. Each specimen was mounted on a specially designed adjustable jig that allowed the radius to move freely around the fixed ulna with the elbow flexed 90°. The specimens were tested in 3 forearm positions: neutral rotation, 60°-pronation and 60°-supination. Testing was performed by palmarly, and dorsally translating the radius related to the ulna based on the coronal plane of the radius at each sequential sectioning step.

1. Manual translation test
A simulation of clinical examination of DRUJ stability was completed by holding ulnar head and distal radius at the DRUJ with fingers and thumb of both hands while translating the radius relative to the ulna. The resulting dislocatability of the DRUJ was assessed.

2. Quantitative translation test
Quantitative testing was performed using a force-displacement probe consisting of a linear potentiometer (model-TR50A502, Novotech, Germany) and force transducer (model-MLP25, Transducer Techniques, California). The probe was attached to the distal radius and was used to manually translate the radius relative to the ulna while monitoring the force and translation limit.

3. Testing group
The IOM was divided into three parts. The Distal IOM (d-IOM) was defined as the region of the IOM distal to the descending fibers. The middle IOM (m-IOM) was defined as the region of the IOM between descending and proximal fibers. The proximal IOM (p-IOM) was defined as the region of the IOM proximal to the proximal fibers. Specimens were divided into two groups based on the order of IOM sectioning. For group 1, the order of sectioning was d-IOM, m-IOM and p-IOM. For group 2, the order of the first and third sectioning was reversed.

4. Data analysis
A comparison of displacement distances of the radius related to the ulna at the force of 6.7 N was completed. Calculated differences were tested using paired t-test with a one-sided test of hypothesis.

RESULTS
1. Manual test
After disarticulation and sectioning of DRUJ structures (IOM intact), only palmar dislocation was seen except in pronation. After d-IOM sectioning both dorsal and palmar dislocation was seen, most notably in the dorsal direction. Global loss of constraint of the DRUJ was found after sectioning the d-IOM and m-IOM. No obvious changes in either palmar or dorsal laxity was seen after isolated sectioning of p-IOM. An intact d-IOM prevented dorsal dislocation of the radius but not palmar dislocation.

DISCUSSION
From these studies, we conclude that a palmar dislocation of the radius relative to the ulna implies a completely compromised TFCC but does not require an IOM injury, while a dorsal dislocation of the radius implies both a TFCC and distal IOM compromise. Disengagement of the DRUJ implies an extended IOM compromise including both distal and middle regions.

Viegas has been shown to be fault throughout forearm rotation. In supination, the p-IOM cannot maintain DRUJ congruence due to laxity, especially in the dorsal direction. In pronation, isolated p-IOM may contribute to prevention of dorsal displacement of the radius because of tautness in the p-IOM. In pronation, excessive palmar translate of the radius is limited due to abutment of the radial tuberosity with the proximal ulna. This abutment phenomenon may prevent palmar translation of the radius, even after total compromise of the IOM.

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REFERENCES