INTRODUCTION
Longitudinal radioulnar dissociation (LRUD) results when a comminuted radial head fracture is accompanied by proximal dislocation of the radius and tearing of the interosseous ligament (IOL or central band of the interosseous membrane) [1]. Some authors have advocated reconstruction of the IOL to help treat LRUD [2,3]. The IOL normally becomes taut with forearm compression [4]. The objective of this study was to evaluate the effect of reconstruction of the IOL on compressive load transfer through the forearm with the radial head intact.

METHODS
Twelve fresh-frozen forearms were subjected to a previously described forearm compression test in which 3D forces and kinematics in the forearm are measured [4]. An Instron was used to grip the hand and humerus and apply forearm compression (5 N preload, 15N of cyclic preconditioning, and 139N of compressive load). The test was performed in neutral forearm rotation, and repeated with the IOL intact, cut, and reconstructed with single and double bundle flexor carpi radialis (FCR) grafts. The radial head was left intact throughout, and the hand and humerus were held fixed between trials. Reconstructions were performed anatomically using 5mm tunnels drilled across the radius and ulna at points 1/4 and 3/4 along IOL insertions. A special guide was used to inssure tunnels passed from the center of the bones through the interosseous ridge. #2 braided polyester suture was used to secure graft ends to 2.7mm cortical screw posts. Before fixation, grafts were cyclically pretensioned to 90% to remove slack and tied down under maximal manual tension. The distal graft was always placed first. The magnitude of forces in the distal radius/ulna (DR, DU), IOL, and proximal radius/ulna (PR, PU) was expressed as a percentage of applied hand load. Repeated measures ANOVA with multiple contrasts was used to compare force magnitudes, IOL force components, and proximal motion of the radius between intact, cut, and reconstructed states.

RESULTS
Proximal motion of the radius was small in all states and no significant differences were detected (intact 0.2 ± 0.3, cut 0.3 ± 0.3, single 0.1 ± 0.4, double 0.1 ± 0.4, mean ± SD in mm). The radius bore 92-95% of the applied hand load in all states (Table 1). With the IOL intact, load on the radial head was reduced to 75%. With the IOL cut, all load on the distal radius was transferred to the proximal radius. Single and double bundle FCR reconstruction reduced load on the proximal radius to 80% and 74%, respectively. Force in the intact IOL was directed obliquely, with axial (proximal-distal) and transverse (radio-ulnar) components (Figure 2). Transverse forces were directed in such a way as to pull the bones together and compress the distal and proximal radioulnar joints. This effect was lost with cutting of the IOL, and regained with IOL reconstruction (Table 2).

DISCUSSION
In this study the effect of IOL cutting and reconstruction on forearm compressive load transfer was determined. Little changes were seen in proximal motion of the radius, likely because the radial head was left intact. Cutting the IOL resulted in a loss of the radial head unloading and pulling together of the radius and ulna observed for the intact IOL. It was important to account for transverse forces in the forearm, as transverse IOL forces were significant and directed in such a way as to pull the radius and ulna together in the interosseous space when compressive load was applied to the hand. Reconstruction of the IOL with a single bundle FCR graft was insufficient to restore normal forearm mechanics, however, a double bundle FCR reconstruction successfully restored normal forearm mechanics. The technique of FCR for IOL reconstruction has been reported by Skahen et al. [5] and is a convenient graft for surgeries performed in the forearm.

CONCLUSIONS
Double bundle FCR reconstruction restored normal patterns of forearm load transfer. Reconstruction of the IOL unloaded the radial head and restored transverse forces in the forearm.

CLINICAL SIGNIFICANCE
IOL reconstruction may help in the treatment of LRUD, but remains an experimental procedure.

REFERENCES

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