INTRODUCTION: Wrist instability is a cause of long term pain and disability in many people in the United States, negatively impacting upon their productivity and quality of life. The conditions which cause the two types of instability (dynamic and static) between the scaphoid and lunate are not clearly understood. Ligamentous damage is required for both, but it has been surgically demonstrated that development of static wrist instability requires repetitive cyclic forces on the wrist. Dynamic instability may be a precursor to static instability, and presumably can only be observed while the wrist is moving and loaded. The purpose of this biomechanical project was to determine the effect of sectioning two carpal ligaments and the effect of cyclic physiological loading on the motion of the scaphoid and lunate and the pressure distribution in the radiocarpal and ulnocarpal joints.

METHODS: On each of six fresh cadaver upper extremities, Fastrak 6 degree of freedom motion sensor were attached to the scaphoid and lunate, to the third metacarpal (to define global wrist motion), and to the distal radius. The Fastrak electromagnetic source was attached to the proximal radius by a Plasticlass platform. A capsulotomy was made in the wrist and a 0.1mm thick, flexible pressure sensor was inserted into the radiocarpal and ulnocarpal joints. The sensor was secured by sutures placed through the sensor and volar capsule and tied to anchors in the volar capsule of the distal radius. Each forearm, including the elbow joint, was then placed in a wrist joint simulator, and loaded. The purpose of this biomechanical project was to determine the effect of sectioning two carpal ligaments and the effect of cyclic physiological loading on the motion of the scaphoid and lunate and the pressure distribution in the radiocarpal and ulnocarpal joints.

RESULTS: Sectioning the SLIL did affect the position of the scaphoid and lunate during wrist motion. At maximum wrist flexion, the scaphoid and lunate were flexed more by 5°, and pronated more by 8°. At maximum wrist ulnar deviation, there was no statistical changes in scaphoid and lunate. The scaphoid flexion and extension during wrist flexion/extension. When the wrist was moving in the plane of radial/ulnar deviation. Although not statistically significant, the incremental increases in carpal motion between ST sectioning and 1000 cycles of motion were greater than the incremental changes between SLIL sectioning and ST sectioning during wrist flexion. In many specimens there was diastasis between the scaphoid and lunate with contact between the capitale and radius. Examination of the pressure data showed a large change in the pressure distribution in the radiocarpal and ulnocarpal joints. (Fig. 2: pressure distribution after sectioning both the SLIL and ST and after 1000 cycles of motion). The pressure was concentrated in small portions of the radioscaphoid and radiolunate fossa.

CONCLUSION: Sectioning of the SLIL or SLIL and ST resulted in changes in the position of the carpal bones, which would be analogous to the dynamic instability seen clinically. The addition of repetitive cyclic motion resulted in a static deformity with a large diastasis of the scaphoid and lunate, which changed little with wrist motion. We believe that this study is the first to show the importance of cyclic loading in the production of static scapholunate instability.

![Graph showing changes in scaphoid flexion and extension during wrist radial and ulnar deviation](image)

**FIG. 1**

- Intact
- SLIL Cut
- SLIL & ST Cut
- SLIL & ST Cut after 1000 cycles

**FIG. 2**

- Intact
- SLIL & ST Cut after 1000 cycles

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