Biomechanical Analysis of Palmar Midcarpal Instability and Treatment by Partial Wrist Arthrodesis

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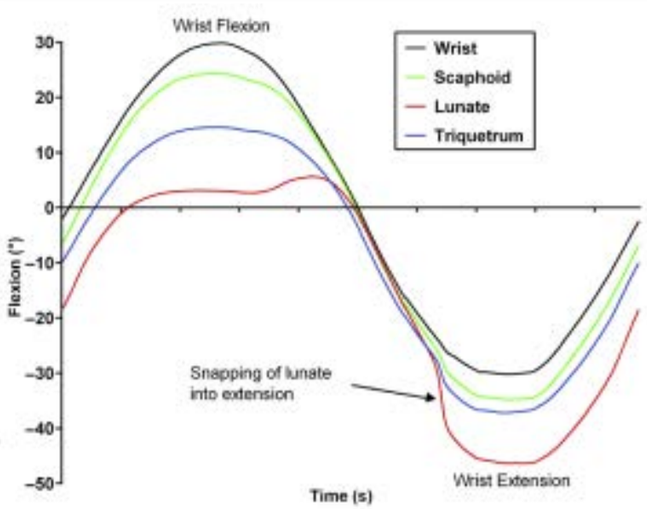
Objectives

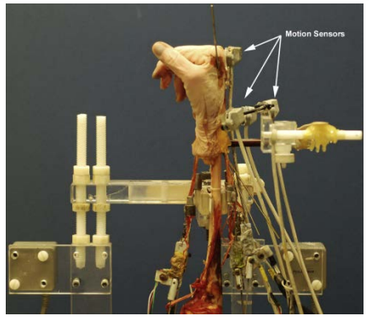
- Palmar midcarpal instability (MCI) is characterized by ulnar wrist pain and “clunking” as the flexed proximal row snaps into extension on movement from radial to ulnar deviation.
- Multiple ligaments are implicated in MCI, including the dorsal radiocarpal (DRC), triquetrohamate (TqH), scaphocapitate (SC), and scaphotrapeziotrapezoid (STT).
- We sought to create a reproducible cadaveric model of MCI by selective sectioning of these ligaments and then to examine the effects of simulated triquetrohamate and radiolunate (RL) arthrodesis on carpal biomechanics in this model.

Methods

- 9 upper extremity specimens were mounted in a wrist motion actuator system , cycled through 3 actuated motions (flexion-extension, radioulnar deviation, dart-throwing) and 2 passive mobilizations (midcarpal shift test and radioulnar deviation).
- Scaphoid, lunate, and triquetrum sensors recorded range and velocity of motion; each wrist was tested intact, with ligaments sectioned, and after K-wire arthrodesis of TqH and RL respectively.



Example of midcarpal instability during which the lunate rapidly moves from flexion to extension during a computer-controlled wrist flexion-extension motion.



Results

- Following sectioning, there was a significant increase in lunate angular velocity, lunate flexion-extension, and dorsal-volar motion of the capitate during passive mobilization , often accompanied by the clinical “clunk” found in MCI. Both TqH and RL arthrodesis eliminated this “clunk”.
- TqH arthrodesis caused significantly more scaphoid flexion and less extension during the wrist radioulnar deviation motion. It also increased the amount of lunate and triquetral extension during wrist flexion-extension.
- Simulated RLA significantly reduced scaphoid flexion during both wrist radioulnar deviation and flexion-extension.

Conclusions

- Both simulated arthrodeses eliminate wrist clunking and may be of value in treating palmar midcarpal instability. Simulated RLA reduces proximal row motion whereas simulated TqHA alters how the proximal row moves. Long-term clinical studies are needed to determine if these changes are detrimental.

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