Early Motion Following Four-Corner Arthrodesis Using Cannulated Compression Screws: A Biomechanical Study

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Introduction:
• Four-corner arthrodesis is a popular surgical option for the treatment of SLAC and SNAC wrist deformities.
• The variable pitch screw provides compression as well as large surface area of bony purchase between sites of fusion.
• Known benefits in scaphoid fracture fixation is early postoperative motion
• Current literature conflicting regarding immediate range of motion versus restricted motion with use in four-corner fusions.
• Postoperative motion ranging from 0-6 weeks.
• Fear of motion at fusion interface.
• Why the conflict?
  - There is no biomechanical study in the literature that evaluates the immobilization strength of headless compression screw fixation for four-corner fusions.
  - No study focusing on early range of motion.

Our Study:
Biomechanical cadaveric analysis of early motion following four-corner fusion using two accepted cannulated compression screw techniques.

Methods:
• 6 matched paired cadaver arms
• Two screw constructs:
  • “A”
    - 3.0mm retrograde LC screw
    - 2.2mm LT, TH screws
  • “B”
    - 2x 2.2mm crossed LC screws
    - LT/TH each with 2x 0.045 K-wires
• Carpal bones tagged and intercarpal gap measurements taken with digital caliper.
• Applied 5000 cycles to the wrist.

Results:

Discussion:
• Recent study of fusion plates vs. K-wire fixation
  - DCP: 0/6 failures, Avg 0.51mm Intercarpal Gap
  - K-Wire: 6/6 failures, Avg 3.58mm Intercarpal Gap
  - Defined significant intercarpal gapping to be > 1.0 mm.
• Our largest avg. intercarpal distance was 0.22mm.
• Both constructs provide rigid fixation throughout 5000 cycles.
  - May allow for immediate post-operative ROM.

References:

NYU Langone Medical Center
Hospital for Joint Diseases • Department of Orthopaedic Surgery