

# **A Biomechanical Study Comparing Uniplanar and Multiplanar Wrist Motion in Two Positions of Four Corner Fusion**

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**Introduction:** Partial wrist arthrodesis is mainstay treatment for advanced wrist arthritis. Four-corner fusion (4CF) involves scaphoid excision and fusion of the capitate, lunate, hamate and triquetrum.

Some surgeons consider ulnar translation of the capitate to cover the distal lunate surface as a critical step as it maximizes contact, increasing the likelihood of successful union. This reduction maneuver may also be necessary in those with capitate proximal migration. The purpose of this study is to compare range of motion (ROM) in 4CF performed in anatomic and radial-aligned fusion positions.

**Methods:** Six fresh-frozen cadaveric upper extremity specimens were tested using a custom active ROM wrist simulator. Baseline measurements for flexion, extension, radial/ulnar deviation, and circumduction were tested in native arms. A two-stage protocol of scaphoidectomy and 4CF was performed in “anatomic” fusion and “radial-aligned” capitollunate borders. Fusion was achieved with five 0.062” Kirshner wires.

**Results:** Overall circumduction area with fusion in the anatomic and radial-aligned positions were reduced by  $53\pm 25\%$  and  $59\pm 38\%$ , respectively, compared to native. This reduction was similar between groups ( $p=0.90$ ). Wrist extension in the radial-aligned group was significantly reduced compared to native ( $p=0.04$ ). Flexion and extension in anatomic 4CF were similar compared to control and radial-aligned 4CF. Radial and ulnar deviation remained similar between all groups.

**Discussion:** This *in-vitro* model confirms there is a significant reduction in wrist ROM after 4CF compared to native, which was similar between fusion positions. Radial 4CF resulted in reduced wrist extension. Radial-ulnar deviation was similar between groups. Clinical studies are required to further delineate the effect of capitate ulnar translation in 4CF.