

Limited Wrist Fusion Using a New Memory Staple

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Abstract

Obtaining osseous union in limited intercarpal arthrodesis is challenging. While many methods are available, there seems to be shortcomings in these methods. The ideal method for small bone fusion was developed and is presented here.

Indications for limited arthrodesis in the wrist

Localized wrist arthritis can occur with many different conditions. Young, active people can injure the intercarpal ligaments resulting in altered kinematics and shifting positions of the small bones in the wrist. This condition will accelerate abnormal wear and result in painful wrist arthritis by a predictable pattern. The Scapho-Lunate interosseous Ligament (SLIL) and scaphoid fracture nonunions are perhaps the most common and often results in Dorsal Intercalated Segmental Instability (DISI) deformity which ultimately wears out the cartilage in the midcarpal joint. Another common injury is intra-articular distal radius fractures. Volar fixed-angle plating has improved our ability to reduce and stabilize the articular surface but imperfect reductions still occur for a number of reasons resulting in radiocarpal arthritis. This spares the midcarpal joint.

Treatment for these conditions include resection arthroplasty, replacement arthroplasty, limited and complete radiocarpal arthrodesis. With the good long-term outcomes of knee and hip replacements, the population is seeking durable, motion preserving procedures. Proximal row carpectomy results in mismatched opposing surfaces and will wear out over time and is not indicated in patients under 35 years or laborers. Total wrist arthroplasty as yet has not proven durable in the carpal component and should not exceed 25 pounds of force also making it a poor choice for the young or laborers. While highly durable, total wrist arthrodesis does eliminate wrist flexion –extension and radioulnar deviation, failing to meet the patient's desire for motion preservation.

Methods of effecting Limited arthrodesis

Limited arthrodesis satisfies both the durability and motion preservation issue when successful. Historically, this has been challenging to achieve. K-wires and cast immobilization offers no ability for compression and the prolonged immobilization needed to reliably achieve union are poorly tolerated. Headless compression screws lose compression after about 2 week and insertion without affecting the articular cartilage is difficult at best. The first advancement in limited arthrodesis was a conical or bowl-shaped plate. While the concept of focal fixation is an improvement, obtaining proper placement of the implant is quite challenging. The implant must be seated deeply enough to prevent impingement but this also removes the very bone needed to achieve union. Staples are an improvement on this to limit the bony resection and the use of memory metal and design modifications improves the constant compression and stability of the implant.

Case Series

From January 2008 to December 2013, ten patients underwent limited wrist fusions. Six were men and four were women. Their average age is 55 ranging from 48 to 68. There was a minimum of 6 months follow up ranging from 6 to 45 months. Four-Corner fusion was performed in nine of the patients and one had a Radio-Scapho-Lunate fusion bilaterally. All patients were immobilized postoperatively for at least 4 weeks. Removable splinting was used in reliable, low-demand patients.

Outcomes

At last follow up, 100% went on to union within 10 weeks. Grip strength was measured at last follow up and averaged 90% of the unoperated wrist. Range of motion averaged 55 degrees in Flexion-Extension arc with a range from 45-80 degrees. All patients were satisfied with their outcomes. Two patients had implant removal, one for breakage after re-injury. The other was a work comp patient who had ongoing ulnar sided wrist pain but gained no improvement after hardware removal. Osseous union was confirmed at both of these procedures.

Discussion

Limited arthrodesis with a low-profile staple provides continuous compression to foster rapid osseous union. There is minimal bone resection to allow the greatest cross-sectional area to foster union and the memory metal provides constant compression which also encourages bone healing. Although this is a small series by just one surgeon, excellent results have thus far been achieved. Further study is under way gathering data from multiple surgeons. Additional sites of use to date include Scapho-Trapezoid-Trapezoidal arthrodesis and Fourth-Fifth Carpometacarpal stabilization.

Disclosures

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