

Case Study

The Use of Closed Reduction Intramedullary Fixation for K-wire Replacement in a Four-Metacarpal Crush Injury



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Dr. Lesley received his fellowship in hand/upper extremity and microsurgery from the prestigious Brown University. He also is a fellow of the American Academy of Orthopedic surgeons. Board certified, he specializes in hand, wrist, and elbow.

Case Presentation

Patient was a 54-year-old male who crushed his hand between a forklift and a wall, while at work. He sustained open fractures to his non-dominant hand that were initially pinned with K-wires.

Patient was referred to Dr. Lesley at six weeks after complications, including accidental removal of one of the pins in his index finger.

The crush injury caused four metacarpal fractures: spiral fractures of the second and fifth, an oblique fracture of the third, and a transverse fracture of the fourth metacarpal. These fractures had been previously pinned with K-wires by another surgeon, but during his initial exam with Dr. Lesley, the patient had minimal digital range of motion (ROM) of all the digits.

X-rays did not show clear evidence of osseous unions of any of the digits, leading to the recommendation that the index finger would need to be addressed. Additionally, Dr. Lesley recommended radiographic evaluation of the remaining metacarpals while in the OR. The patient consented to proceed with fixation of all non-united fractures because he needed to get back to work as soon as possible.

Preop Plan

Plates and screws were considered but would have required multiple incisions, tissue dissection, and screw implantation. Dr. Lesley felt this approach would allow the hand to heal, but was extremely concerned that the patient would have to be limited to no motion, postop. To minimize operative dissection and to expedite ROM of the digits, Dr. Lesley planned to proceed with INnate™ fixation. After thorough radiographic evaluation, he planned to debride all non-union sites, using no more than two longitudinal incisions in an attempt to minimize soft tissue trauma.

Operative Findings and Approach

Dr. Lesley made minor incisions between the second and third metacarpals and between the fourth and fifth metacarpals to dissect down to the fracture site. He debrided the fibrous union to confirm whether the fracture had healed and found that nonunion had persisted.

Preoperative



Postoperative



Then he used the INnate™ depth gauge to determine that 4.5 mm diameter threaded nails were needed (40 mm length for the fifth metacarpal, 45 mm length for the fourth, and 50 mm length for the third and second). He made small puncture incisions at the center of each metacarpal head, allowing insertion of the 4.5 mm INnate nail over the guide wire. He then used the cannulated drill to drill over the guide wire and threaded the cannulated INnate screw until the head was beneath the articular cartilage, to achieve distal purchase in the subchondral bone. Proximal purchase was achieved at the isthmic level within the intramedullary canal. The use of INnate allowed Dr. Lesley to complete the desired goals of minimizing soft tissue trauma; achieving stable, rigid fixation; and allowing the patient to begin immediate range of motion. The total operative time, including debridement of each nonunion site, was less than one hour.

Follow-up

The patient was allowed to begin immediate ROM with a therapist. He achieved osseous union of all fractures and returned to full work activities at six weeks. His range of motion at that time was approximately 0–60 degrees for all MCPs. At three months, the patient reported no pain, exhibited ROM of approximately 0–75 degrees, and was discharged from Dr. Lesley's care.

Discussion

Although the patient did not achieve full range of motion, in Dr. Lesley's opinion the outcome was much better than any alternative approaches because K-wires did not work for the initial surgery. Plates and screws would have allowed the fracture to heal but would have resulted in minimal to no range of motion. Therefore, INnate was utilized because it allowed Dr. Lesley's patient to rapidly return to normal activities without requiring immobilization. The patient had excellent outcomes and had minimal disruption to his normal life and minimal costs, because post-op activities such as physical therapy were not needed with INnate™.



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