

Case Study:

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



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Pre-op



Case Introduction

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 6 weeks after complications, including accidental removal of one of the pins in his index finger.

Case Presentation

The crush injury caused 4 metacarpal fractures: spiral fractures of the 2nd and 5th, an oblique fracture of the 3rd, and a transverse fracture of the 4th 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, he 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.

Pre-op 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 limited to no motion, post-op. To minimize operative dissection and to expedite ROM of the digits, Dr. Lesley planned to proceed with INnate™ fixation.

Pre-op (previous surgeon)



After thorough radiographic evaluation, he planned to debride all non-union sites, using no more than 2 longitudinal incisions in an attempt to minimize soft tissue trauma.

Operative Findings and Approach

Dr. Lesley made minor incisions between the 2nd and 3rd metacarpal and between the 4th and 5th metacarpal to dissect down to the fracture site. He debrided the fibrous union to confirm whether the fracture had healed and found that nonunion persisted.

Afterwards he used the INnate depth gauge to determine that 4.5mm diameter threaded nails were needed (40mm length for the 5th, 45mm length for the 4th, and 50mm length for the 3rd and 2nd). He made small puncture incisions at the center of each metacarpal head, allowing insertion of the 4.5mm 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 isthmus 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 6 weeks. His range of motion at that time was approximately 0-60 degrees of all MCPs.

Post-op



Follow-up

At 3 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 motion, his outcomes were 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 result in minimal to no range of motion. Therefore, INnate was utilized because it allowed Dr. Lesley's patient to rapidly return to normal activities because immobilization was not required. 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.