

Case Study

Use of INnate™ Intramedullary Threaded Nail for K-wire Revision in a Two-Metacarpal Gunshot Wound Injury



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Dr. Wilson is an orthopedist at Fort Sam Houston Texas and is affiliated with Brooke Army Medical Center. He received his degree from Uniformed Services University of the Health Sciences F Edward Herbert School of Medicine and has been in practice for over 15 years. His subspecialties include elbow and hand surgery.

Case Presentation

Patient was a 30-year-old right-hand dominant male military police officer who suffered a self-inflicted gunshot wound to his left hand. He was initially treated with incision and drainage (I&D) and closed reduction percutaneous pinning (CRPP). The K-wires were removed as planned at six weeks. Range-of-motion progression was delayed due to pins and then due to persistent radiographic lucency and persistent tenderness on exam. Pending nonunion with a bony defect was diagnosed at eight weeks and revision surgery planned.

The gunshot wound caused oblique, base fractures with comminution to the third and fourth metacarpals. Revision was required at 10 weeks with iliac crest bone graft augmentation due to the nonunion with bony defect following K-wire fixation. The nonunion with deficit led to the recommendation of utilizing an intramedullary (IM) approach with an implant that provided more rigidity and cortical fixation for stabilization.

Preop Plan

K-wires were not considered due to the associated complications and plates and screws were also dismissed because a minimally invasive approach without soft tissue disruption was desired. Dr. Wilson considered headless compression screws but wanted to avoid complications such as shortening caused by compression and implants that were not appropriately sized to fit the narrow isthmus and achieve adequate endosteal purchase at both the distal and proximal ends. He decided to use an intramedullary approach with INnate™ because of the non-compressive and purpose-built design that maintained anatomic length and achieved canal fill, respectively, providing stable fixation for early range of motion.

Operative Findings and Approach

Dr. Wilson used a percutaneous approach to access the metacarpals. An additional open approach was used to bone graft the defects around the percutaneously placed INnate devices. Once reduction was achieved, he made a small stab incision on the dorsal third of each metacarpal head and inserted the provided guidewire across the fracture site under fluoroscope. Dr. Wilson then used the INnate™ depth gauge to determine that a 4.5 mm diameter threaded nail was needed for both metacarpals. He again used the depth gauge to determine that a 55 mm and a 45 mm nail were needed for the third and fourth metacarpals, respectively. Dr. Wilson proceeded to use the cannulated drill to drill over the guidewire and to implant the cannulated INnate nail until the trailing end was beneath the articular cartilage, to achieve distal purchase in the subchondral bone. Proximal purchase was achieved at the isthmus level within the IM canal with a metacarpal INnate instrumentation time of 20 minutes. Additional time was needed in this case for bone graft harvest, nonunion takedown, and grafting.

Preoperative



Postoperative



Follow-up

At two weeks postop, a full 12 weeks from injury, the patient was finally allowed immediate active and active assisted range of motion with weight-bearing restrictions of five pounds. At four weeks postop, now four months from injury, the patient progressed to weight bearing as tolerated with full range of motion. At six weeks postop, radiographic evidence of union and anatomic restoration across all the fracture sites was achieved, with the patient returning to full duty without any restrictions.

Discussion

Dr. Wilson feels the delays to anatomic and functional restoration of the metacarpals would have been avoided if an intramedullary approach with INnate had been utilized in conjunction with the Masquelet technique. Unlike k-wires and hand fragment plates, the INnate allows for immediate to early range of motion thanks to its stability. The dual-diameter design and robust length offerings ensure cortical fixation in the isthmus, proximal, and distal cortex, resulting in canal fill and stable fixation. In Dr. Wilson's opinion, this allows patients to minimize their downtime and return to work or daily activities faster than other implants and surgical approaches.



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