



Outcomes of Metacarpal Fracture Fixation Using the ExsoMed INnate Threaded Intramedullary Nail

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Introduction

Metacarpal fractures comprise 30% of all hand fractures and 18% of all below-elbow fractures in the United States.(1) These occur most often in young men (age 10-40),(2) and despite their frequent occurrence, treatment algorithms for metacarpal fractures continue to evolve. While many metacarpal fractures can be treated nonoperatively, there is a growing tendency to choose surgery as it may prevent deformity and mobility deficits in these often young and active patients. (3) Fixation techniques vary by patient characteristics and type of fracture, and include: K-wires, intramedullary nails, cerclage wires, plating, lag screws, tension band wires, and/or external fixators. (4)

Historically, percutaneous K-wires have been used for fixation due to their simplicity. Unfortunately, these wires can tether to surrounding tissue, especially the sagittal bands, and ROM is limited in the early stages (up to 3-4 months) of healing. Pin tract infections also remain a concern in K-wire fixation. (4) Dorsal metacarpal plating has been used as a straightforward alternative to K-wires. Plating offers greater stability, but has been associated complication rates as high as 35% including: adhesion, persistent stiffness, hardware failure, and infection. (1)

Given the limitations of K-wires and dorsal plating, Gonzalez et al. developed a technique using pre-bent, flexible threadless intramedullary nails to achieve internal stabilization in metacarpal fractures. (5) This technique was enhanced by Orbay et al. by adding a locking pin to the proximal end of the nail. (6) This technique led to improved outcomes with average time to union reported from 6.3-8 weeks and 16 days earlier return to work compared to K-wire fixation. (3, 4, 7, 8)

Intramedullary compression screws have more recently been used to hold reduction and prevent rotational instability. These headless screws are buried within the metacarpal and do not need to be removed. Intramedullary compression screws allow for early mobilization (within 5 days) while maintaining comparable fixation strength of traditional techniques. (9) Early studies have shown improved outcomes with these screws. (9-12) While existing reports describing the use of headless intramedullary screws for metacarpal fixation are promising, these screws may not be effective in severely comminuted metacarpals. (9, 10, 12) Compression by the threads of intramedullary screws may shorten the metacarpal in these cases, producing a finger that is not anatomical in length.

Recently, the INnate intramedullary threaded nail (ExsoMed, Aliso Viejo, CA) has been developed with threads spaced further apart to reduce the compressive forces while maintaining the benefits of intramedullary screws. Given that the intramedullary threaded nail is a novel product, we designed a study to assess its efficacy in metacarpal fracture fixation.

Methods

VAS pain scores, current pain medications, percent return to normal activity, range of motion (ROM), and presence/absence of radiographic union were recorded at each postoperative follow up visit. Descriptive statistics were performed to evaluate endpoints.

Results

71 fractured metacarpals were included in our study. The 4th and 5th metacarpals were the most common site of injury. Most common injury mechanisms were blunt object and MVC.

Average time to radiographic union was 8.8 weeks (n = 28, range: 4.1-17.7 weeks). Average VAS pain score was 0.5 (n = 33, range: 0-7) at most recent follow up (mean: 10.2 weeks, range: 0.9-68.7 weeks). Average percentage of normal activity resumed was 87.4% (n = 38, range: 50-100%) at most recent follow up (mean: 10.2 weeks, range: 0.9-68.7 weeks).

At most recent follow up (mean: 10.2 weeks, range: 0.9-68.7 weeks), 52% of patients (13/25) had 100% total active motion (TAM), 32% (8/25) had 75-99% TAM, 8.0% (2/25) had 50-75% TAM, and 8.0% (2/25) had 25-50% TAM. 78.1% of patients (25/32) were able to make a composite fist at most recent follow up (mean: 11.3 weeks, range: 0.9-68.7 weeks).

Discussion

Patients presenting with unstable metacarpal fractures are often young and physically active. In addition to a complication rate of 15%, K-wire fixation requires patient compliance for 6-8 weeks postoperatively. While plate fixation improves stability, complication rates are even higher than K-wire.(1) Intramedullary fixation was first introduced for metacarpal fractures to allow soldiers an early return to full activity. (13)

Early methods of intramedullary fixation utilized threadless nails. Given the lack of rigidity of threadless nail fixation, surgeons began treating metacarpal fractures with intramedullary screws. One study of 91 patients treated with headless intramedullary screws reported that all patients achieved full active MCP motion at most recent follow up, with an average grip strength of 104.1% of the contralateral hand. Active motion was initiated 5 days postoperatively, and average time to radiographic union was 6 weeks (range = 2-10). (10) A separate study of intramedullary headless screws reported a complication rate of 2.5% (4/160 metacarpal fractures). (11)

While headless screws represented a significant improvement over historical fixation techniques, they may be untenable in cases where metacarpal shortening is a concern. The data we present indicates that threaded intramedullary nails provide stability and early return to function, without the concern for excessive compression. Our cohort includes more severe and/or complex injuries than those included in similar published studies. Preliminary results suggest that threaded, intramedullary nails may provide equivalent outcomes across a broader spectrum of fracture and/or concomitant injury patterns.

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