The Latest Innovations in Upper Extremity Solutions

Treatment of Hand Fractures

Featuring

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Introduction

Since introducing the Acutrak® Headless Compression Screw nearly 30 years ago, Acumed has built a legacy of innovation with purpose and developed a comprehensive portfolio of fracture solutions to treat indications of the upper extremity. Now with the addition of ExsoMed™ products, Acumed offers even more minimally invasive options for fracture fixation of the hand and wrist. This booklet is a quick and simple resource to present some of the latest solutions that have demonstrated remarkable effectiveness in treating metacarpal, proximal phalanx, and hand trauma.

IM Fixation of Metacarpal Fractures Using the INnate™ IM Threaded Nail

Figure 1 – Noncompressive, Dual Diameter IM Nail

The INnate IM Threaded Nail system features a dual diameter, stainless steel nail to achieve canal fill and stable fixation of metacarpal fractures. It delivers minimal soft-tissue damage and early to immediate range of motion without complications due to early rehabilitation. The robust length and diameter offering allows for precise anatomic reduction of all fracture types since its noncompressive design avoids inadvertent shortening in oblique and comminuted fractures.

IM fixation with INnate is a simple, minimally invasive approach that can address all types of metacarpal fracture patterns. This percutaneous approach offers great benefits to the growing active patient population that requires an earlier return to daily activities and the workforce. Unlike traditional approaches such as casting, K-wires, or plates and screws, IM fixation with INnate does not require a lengthy immobilization period that may lead to complications such as stiffness, infection, and tendon rupture.[1,2]

The Use of Closed Reduction Intramedullary Fixation for Midshaft Oblique Fractures in Three Metacarpals

Marc J. Richard, MD
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Case Introduction
Patient was an 18-year-old high school senior lacrosse player who fractured three of his metacarpals in a collision during a game. Initially, he was concerned that he would miss the remainder of his senior season.

Case Presentation
Patient had midshaft oblique comminuted fractures to his 3rd, 4th, and 5th metacarpals. He needed stable fixation and rotational alignment to mobilize as soon as possible if he hoped to return for the final games of his high school career.

Preop

Preop Plan
Dr. Richard chose closed reduction intramedullary fixation (CRIF) with INnate™ because the nails were long and wide enough in diameter to fill the canal, providing stable fixation for rotationally unstable fractures. Alternative implants would not have allowed immediate mobility, thereby preventing a quick recovery.

Operative Findings and Approach
Dr. Richard first performed longitudinal traction in the operating room to restore alignment and then used a percutaneously-applied pointed reduction clamp to maintain the reduction, until he placed the guide pin. He used a percutaneous approach with INnate to stabilize the multiple metacarpal fractures and measured 4.5 mm for each of the diameters. Dr. Richard again used the INnate depth gauge to determine that a 50 mm length threaded nail was needed for the 3rd metacarpal. He made a 2 mm incision on the dorsal third of the metacarpal head and inserted the provided K-wire across the fracture site under fluoroscope.He then used the cannulated drill to drill over the guide wire and threaded the cannulated INnate nail until the head was beneath the articular cartilage, to achieve distal purchase in the subchondral bone.

The same approach was used for the fourth and fifth metacarpals, however, 45 mm length threaded nails were used.

Proximal purchase was achieved at the isthmic level within each intramedullary canal, with a total surgery time of 25 minutes.

Postop

Follow-Up
The patient was pain-free at his 2-week follow-up visit and was able to return to the field for the final games of his high school career. At 8 weeks follow-up, he had symmetric range of motion to the opposite hand and both clinical and radiographic evidence of union.

Discussion
A non-compression nail with canal-fill allows the surgeon to address spiral oblique fractures to maintain height and provide rotational stability. INnate has various lengths and diameters that allow canal-fill and affords excellent fixation and rotational stability. The implant does not require additional resources and follow-ups are typically easy and straight-forward because patients often do not need formal therapy because mobilization is immediate. This allows patients to minimize their downtime and return to work or daily activities faster than other surgical approaches.

IM Fixation of Proximal Phalanx Fractures Using the InFrame™ Intramedullary Threaded Micro Nail

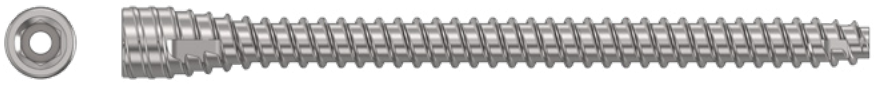

Figure 2 – Noncompressive, 2.0 mm Diameter Micro Nail

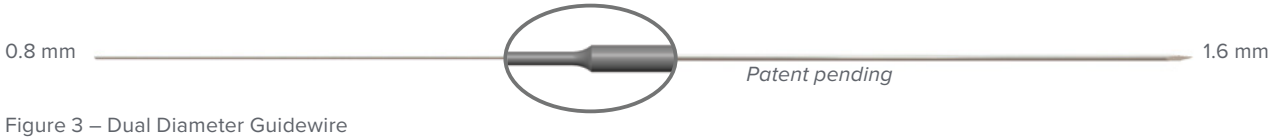

Figure 3 – Dual Diameter Guidewire

The InFrame Intramedullary Threaded Micro Nail System features a 2.0 mm diameter, stainless steel micro nail with a noncompressive design to achieve various implantation constructs for phalangeal fractures (Figure 4 & 5). It provides superior rotational and bending stability and intramedullary fixation. Delivery via an innovative dual diameter guidewire removes the need for a dedicated reamer and enables a more precise implant placement.

Figure 4
InFrame “X” Construct

Figure 5
InFrame “V” Construct

InFrame provides surgeons with a simple and efficient intramedullary fixation approach that can be performed in a minimally invasive fashion for all proximal phalanx fracture patterns since its noncompressive design avoids inadvertent shortening in oblique and comminuted fractures. The immediate mobilization achieved with InFrame prevents stiffness that often occurs with other techniques and offers patients the ability to return to their daily activities faster. Unlike conventional approaches such as K-wire or plate and screw fixation, IM fixation with InFrame does not require immobilization or extensive surgical exposure that may lead to stiffness and soft-tissue injuries, respectively.[3,4] Biomechanical testing has demonstrated the superior bending and rotational stability of InFrame compared to K-wires, plates and screws, and headless compression screws. (Table 1)

Table 1 - Apex Volar 4-Point Bending and Torsion Bench Test Data*

		K-Wires (2 x 0.045)	Dorsal Plates & Screws	Lateral Plates & Screws	Headless Compression Screws
Bending Stability	InFrame X Construct	+97%	+473%	+91%	+48%
	InFrame V Construct	+14%	+232%	+11%	=
Rotational Stability	InFrame X Construct	+341%	+166%	+98%	+1533%
	InFrame V Construct	+368%	+182%	+110%	+1633%

*Based on internal bench testing.

Use of the InFrame™ IM Threaded Micro Nail for Percutaneous Proximal Phalanx Fracture

Lloyd Champagne, MD
Arizona Center for Hand Surgery

Case Presentation
26 year old male presenting with a little finger proximal phalanx fracture from a ground level fall while playing sports. He was placed into a splinter in the E.R and told to follow up with a hand surgeon. He presented post injury day 5 with an oblique little finger angulated, unstable proximal phalanx fracture.

Preop

Treatment
With an angulated unstable proximal phalanx fracture, options included the possibility of a closed reduction and immobilization vs operative fixation. Due to the instability pattern of the fracture, operative fixation was chosen. Consideration was for K-wires, vs. plating vs. InFrame fixation. The initial first choice was to use an intramedullary technique using InFrame to avoid scars from incisions, to speed up operative time, and to avoid tissue interaction with the device as occurs with K-wires and plates.

The procedure was performed on post-injury day six. Intra-operative fluoro helped define and understand the fracture pattern as short oblique with very little comminution. No other fractures were identified.

The fracture reduced easily in a closed fashion so two InFrame devices were placed in a percutaneous fashion. The first was placed extra-articular on the flare of the phalanx base across the oblique fracture. The guidewire placement is shown. Due to the oblique nature of the fracture, the easiest placement of the second guidewire and device was from the same phalanx base. A second guide wire was placed after the first InFrame had been seated then the second guide wire and InFrame was then placed in a slightly different plane as the first InFrame. The approach from the other side base of the phalanx would have been possible but I felt that it would be more difficult. Notice that the InFrame devices travel the length of the intramedullary canal of the phalanx and either seat against cortex or slightly penetrate cortical bone. The devices measured 36 mm and 34 mm. Two devices were used to control rotation.

Postop

Postoperative Care/Follow-up
Post-operative care include immediate unrestricted aggressive active motion in the recovery room. Minimalistic bandages are usually placed and, in this case, include only Band-Aids. Buddy taping is also sometimes used. In this case the patient had near normal motion in the recovery room. He was released to full activities except sports or activities that might create great forces especially torsional forces. His final result was anatomic fracture healing with normal digital range of motion, an excellent result for proximal phalanx fixation.

Discussion
Just like the INnate nail, the InFrame cannulated micro nail helps the reduction of the fracture. Once the construct was completed, it was found to be quite rigid and stable. The intramedullary approach to fracture reduction allows for immediate flexion and extension. The benefit of the nail being titanium is that it creates a very stable and rigid construct to maintain the fracture reduced. The second nail allows for there to be additional rotational stability at the fracture site.

Small Fracture Fixation Utilizing The NanoPhix™ Lag Screw

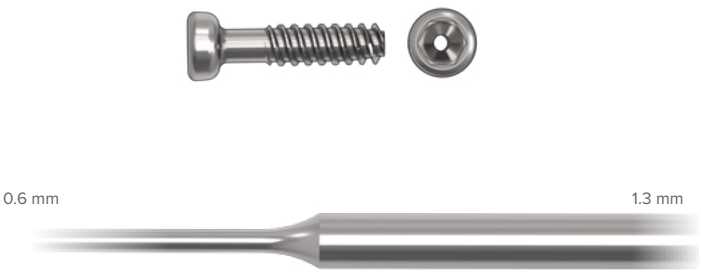

Figure 6 – Dual Diameter Guidewire

Figure 7 – Avulsion Fracture

The NanoPhix Lag Screw is a cannulated screw that was purposefully designed to specifically address avulsion, condylar, and small fracture fragments. Thanks to the 1.5 mm diameter design, the NanoPhix Lag Screw achieves fixation of small fracture fragments, widening addressable fracture types. The cannulated, compressive design achieves accurate and precise placement without loss of reduction. Specifically sized to allow various constructs that achieve optimal fit, which may result in faster time to union and return to normal activities. Finally, the dual diameter guidewire removes the need for a dedicated reamer, allowing ease of use and accurate placement.

Use of the NanoPhix™ Compression Screw for an Avulsion Fracture to the Fourth Distal Phalanx

Dane N. Daley, MD
Medical University of South Carolina

Case Presentation

The patient is a 42-year-old, right-hand dominant male who presented with a left ring finger injury following a forceful pulling injury on a tree branch. Denies previous injuries or surgeries to the left ring finger. On presentation, the left ring finger distal interphalangeal joint is swollen, resting in a hyperextended posture with extensive ecchymosis about the finger Preoperative radiographs demonstrate a displaced left ring finger distal phalanx intra-articular volar fracture consistent with a Jersey finger.

Preop

Preop Plan

Pre-operative plan is for open reduction internal fixation (ORIF) of the distal phalanx of the left ring finger with NanoPhix compression screws via a direct volar approach with a Bruner incision.

Operative Findings and Approach

At the time of surgery, the patient was found to have a Leddy Packer Type IV Jersey Finger (intra-articular distal phalanx avulsion fracture with associated flexor digitorum profundus [FDP] avulsion with retraction). The plan remained the same with the addition of suture anchor fixation of the tendon to the distal phalanx after ORIF of the fragment. The distal phalanx fracture was fixated with three NanoPhix cannulated screws and the tendon was then repaired through the fragment to the remaining distal phalanx with two micro suture anchors. Total surgical time (start of tourniquet to final splinting and dressings) was 60 minutes.

Postop

Follow-Up

At two weeks follow-up, the patient experienced no pain and had his finger resting in a flexed posture. Radiographs confirmed stability, leading to initiation of occupational hand therapy with a dorsal blocking splint. At six weeks follow-up, the patient continued therapy and returned to gym activity with a brace. He experienced no pain but started getting PIP stiffness and was placed into an LMB splint temporarily. At three months follow-up, the patient completed all therapy and was completely healed. His flexion contracture was approximately 10 degrees of PIP and 15 degrees of DIP joint with approximately 3 mm tip-to-palm distance compared to adjacent digits. At this point, the patient had resumed all daily activities without any issues or limitations.

Discussion

NanoPhix allowed Dr. Daley to achieve his operative goal of stable fixation, early mobilization, and minimal to no soft tissue damage. The 1.5 mm diameter cannulated design allowed him to effectively and efficiently fixate the avulsion fracture while the unique dual diameter delivery mechanism simplified a more precise and efficient implant placement. His patient experienced anatomic and functional restoration of his distal phalanx, thereby returning to his daily activities faster than with other implants and surgical approaches.

Treatment of Complex Hand Fractures Using the OsteoMed® Hand Plating System

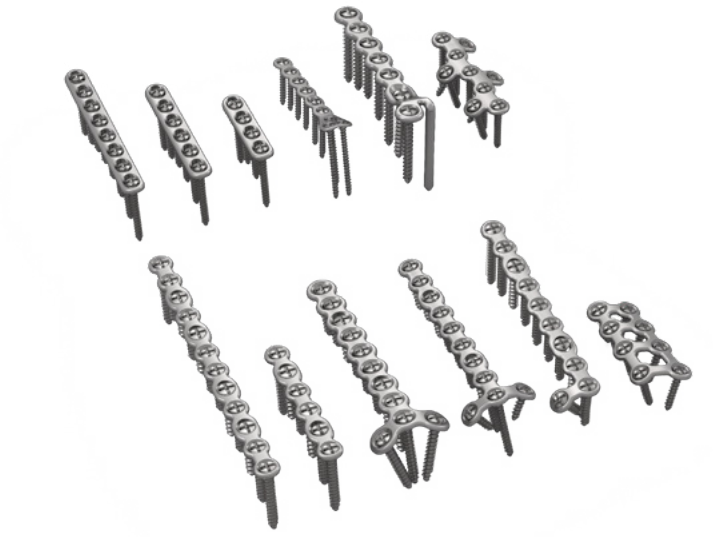

Figure 6 – Modular, low-profile plates

The OsteoMed Hand Plating System (HPS) features instrumentation and low-profile implants designed specifically to treat hand trauma. Created to reduce soft tissue irritation, HPS offers a full range of low-profile plates in four size modules: 1.2, 1.6, 2.0, and 2.4 mm, and hand fusion and cannulated compression screw modules. Its proprietary angled-locking technology accepts up to four screw options in every circular hole to allow versatility in achieving multiple plate and screw configurations for stable, anatomic reconstruction of complex fracture patterns for everything from carpals to fingertips. The plating system also offers specialty plates for specific indications.

Use of the OsteoMed® Hand Plating System (HPS) to Treat Closed, Comminuted Fracture of the Fifth Proximal Phalanx

Jonathan Tueting, MD
Rush Copley Medical Center, Chicago, IL

Case Presentation

The patient was a 20-year-old female, Division I collegiate volleyball player, who sustained an injury from a hard spike. Radiographs confirmed a closed, comminuted, fifth proximal phalanx fracture in six fragments, spanning the phalangeal base and extending beyond the midshaft. Stable fixation with early range of motion (ROM) was the highest priority as the Big Ten Conference Championship was less than three weeks away.

Preop

Preoperative Plan

While the use of K-wires or percutaneous lag screw fixation was possible, Dr. Tueting ultimately chose to use the OsteoMed Hand Plating System as he felt that this system would provide a comprehensive, creative solution that could treat this complex fracture and allow a quicker return to sport. His surgical goals included: anatomic alignment and absolute stability of the comminuted segments; lag screw and cannulated screw fixation both inside and outside of the plate where needed; and locking plate and screw combinations for rotational control and additional stability.

Operative Findings and Approach

Performing an ulnar wrist block for intraoperative pain control, Dr. Tueting used a two-inch ulnar midaxial approach that allowed access to the fractured proximal phalangeal segments and hardware placement that would minimize the potential for extensor tendon irritation or injury. Longitudinal traction, derotation, and a minimal touch technique reduced the fracture. A 1.2 mm straight L-plate was cut and contoured to span the proximal phalanx. Through the plate, a combination of cortical compression, lag fixation, and locking screw fixation was used to stabilize the comminuted fracture.

Postop

Follow-Up

At the one-week postop, the patient revealed mild swelling with only minimal pain. A week later, the patient was able to make a full composite fist and fitted with a custom hand-based padded ulnar gutter splint to allow blocking and hitting with her dominant hand. She returned to volleyball practice, and at four weeks postop, she competed with her protected hand to help her team win the Big Ten Championship.

Discussion

The Osteomed Hand Plating System provided a comprehensive and versatile solution to treat and reduce this complex multifragmented fracture of the proximal phalanx. The system allowed Dr. Tueting to use lag screws, compression screws, and locking screws with a 1.2 mm straight L-plate. The plate was anatomically cut and contoured to fit the patient's proximal phalanx to minimize tendon irritation and enable early ROM.

Learn More About Complete Range of Solutions for Hand Fractures at **go.acumed.net/Hand**

References

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