The Latest Innovations in Upper Extremity Solutions

Treatment of Hand and Wrist 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 wrist fractures.

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

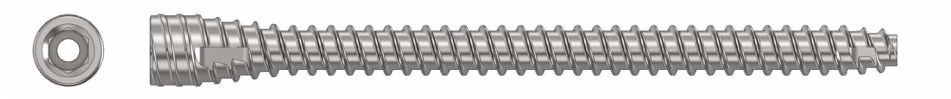


Figure 1 – Noncompressive, 2.0 mm Diameter Micro Nail

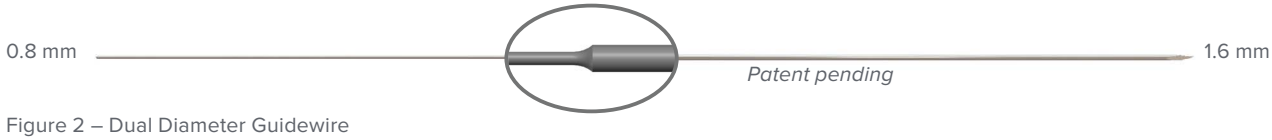


Figure 2 – Dual Diameter Guidewire

The ExsoMed® 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 3,4) 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 3
InFrame “X” Construct

Figure 4
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.[1,2] 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 InFrame™ IM Threaded Micro Nail for Oblique, Comminuted Fractures of the 4th and 5th Proximal Phalanges

Jeffrey Yao, MD
Stanford University Medical Center, Redwood City, CA

Case Presentation

The patient was a 35-year-old male who suffered proximal, oblique fractures with comminution of his fourth and fifth proximal phalanges from a dog leash injury. Both a minimally invasive approach without extramedullary hardware and rotational stability were desired to achieve immediate range of motion (ROM) and return to daily activities.

Preop

Preop Plan

Dr. Yao initially considered K-wires to address the phalangeal fractures due to their minimally invasive approach, but this patient wanted to immediately mobilize to avoid complications such as stiffness. Headless compression screws were also considered, but the diameters were too wide to create a construct that would achieve rotational stability. Dr. Yao decided to proceed with the ExsoMed™ InFrame™ Intramedullary (IM) Threaded Micro Nail because its 2.0 mm diameter design and innovative dual diameter guidewire eliminated the need for reaming and allowed him to precisely place more than one implant to create a fracture-specific construct that would deliver rigid fixation with immediate rotational stability.

Operative Findings and Approach

The patient suffered an ulnar deviation and extension deformity to his fourth and fifth proximal phalanges that needed to be addressed with anatomic reduction. Starting with the fourth proximal phalanx, once reduction was achieved, Dr. Yao inserted the dual diameter guidewire across the fracture site from the ulnar proximal cortex to the radial distal cortex under fluoroscopy to stabilize the fracture and accurately align the desired final implant position. Next, he used the depth gauge to determine that a 30 mm micro nail was needed. The larger diameter end of the guidewire was pushed distally until the smaller diameter end of the guidewire spanned across the fracture site. After threading InFrame over the smaller diameter end of the guidewire, he then inserted the cannulated implant until bicortical purchase was achieved at both the distal and proximal ends of the phalanx, thus correcting the ulnar deviation and extension deformity. Once he verified the final position of the first implant under fluoroscopy, Dr. Yao used the same methodology to place the second 30 mm InFrame micro nail in a different plane from the first implant, creating an “X” construct. He repeated these steps for fixation of the fifth proximal phalanx but used a “Y” construct based on the fracture pattern. The total surgery time was approximately 25 minutes.

Postop

Follow-Up

At the one-week follow-up, the patient did not experience any pain and regained near full ROM but was advised not to lift anything greater than 5 lbs as a precaution. By the two-week follow-up, the patient did so well that Dr. Yao allowed him to resume full daily activities without any restrictions.

Discussion

With its 2.0 mm diameter design and extensive length offering, InFrame enabled Dr. Yao to create fracture-specific constructs, achieving rigid, bicortical fixation and rotational stability in just 25 minutes. Additionally, the delivery mechanism was important to Dr. Yao because it eliminated the need for a dedicated reamer, thereby simplifying the placement while improving accuracy. The resulting stable and strong fixation and earlier ROM allowed his patient to minimize downtime and return to work and daily activities faster than other implants and surgical approaches, thus decreasing the risk of developing digital stiffness.

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

Figure 5 – Noncompressive, Dual Diameter IM Nail

The ExsoMed 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.[3,4]

Use of the INnate™ Intramedullary (IM) Threaded Nail and InFrame™ IM Threaded Micro Nail for Multiple Comminuted Fractures of the Metacarpals and Phalanges

Leslie Sisco-Wise, MD
Ochsner Baptist Medical Center, New Orleans, LA

Case Presentation

Patient was a 30-year-old male who sustained a crush injury to his hand from a trailer. He presented to clinic with midshaft, oblique fractures with comminution to his third and fourth metacarpals, and a comminuted fracture of his second metacarpal head. This complex fracture case also included midshaft to base, oblique fractures with comminution to his third and fourth proximal phalanges. As a manual laborer, the patient wanted a minimally invasive approach that achieved stable fixation for early range of motion (ROM) so that he could return to work quickly.

Preop

Preop Plan

To address the metacarpal fractures, Dr. Sisco-Wise initially considered plates and screws due to their benefit of rigid fixation but wanted to avoid any complications such as tendon adhesions or potential soft-tissue damage from open reduction internal fixation (ORIF) surgery. In addition, the patient had a large degloving injury so soft-tissue coverage was a concern. For the proximal phalanx fractures, she considered K-wire fixation but due to rotational instability, she did not want to immobilize the patient for four weeks. Since the patient needed to return to work and daily activities quickly, Dr. Sisco-Wise chose IM fixation with the INnate IM Threaded Nail for the metacarpal fractures because the implants were long enough in length and wide enough in diameter to fill the canal. This provided the necessary stable fixation that would restore alignment and length of the metacarpals. To treat the proximal phalanx fractures, she also decided to proceed with IM fixation using the InFrame IM Threaded Micro Nail because its 2.0 mm diameter design enabled her to use more than one implant to create fracture-specific constructs that achieved rigid fixation with rotational stability. Additionally, the unique dual diameter guidewire of the InFrame system facilitated the accurate and efficient placement of the fully threaded micro nail by eliminating the need for reaming and allowing the implant to be inserted over the trailing end of the guidewire with ease.

Operative Findings and Approach

Dr. Sisco-Wise first performed longitudinal traction to restore alignment. After she reduced the fracture on the second metacarpal, she made a 2 mm incision on the dorsal third of the metacarpal head and inserted the provided guidewire across the fracture site under fluoroscopy. Dr. Sisco-Wise next measured with the INnate depth gauge to determine that a 4.5 mm x 55 mm implant was needed. She then used the cannulated reamer to drill over the guidewire and inserted the fully threaded INnate nail until the trailing end was beneath the articular surface. Distal purchase was achieved in the subchondral bone while proximal purchase was achieved at the isthmus and in the subchondral bone of the proximal end of the metacarpal. She repeated these steps for the third and fourth metacarpals but used a 3.6 mm diameter nail for the anatomically narrower fourth metacarpal. When the metacarpal fractures were stabilized, Dr. Sisco-Wise proceeded to address the phalangeal fractures.

Starting with the third proximal phalanx fracture, once anatomic reduction was achieved, Dr. Sisco-Wise inserted the dual diameter guidewire across the fracture site from the radial proximal cortex to the ulnar distal cortex under fluoroscopy to stabilize the fracture and accurately align the desired final implant position. Next, she used the InFrame depth gauge to determine that a 30 mm implant was needed. The larger diameter end of the guidewire was pushed distally until the smaller diameter end of the guidewire crossed the fracture site. She then inserted the cannulated InFrame micro nail until bicortical purchase

was achieved at both the distal and proximal ends of the phalanx. Once she verified the final position of the first implant under fluoroscopy, Dr. Sisco-Wise used the same methodology to place a 22 mm micro nail in a different plane from the first implant, creating a "Y" construct based on the fracture pattern. She repeated these steps for the fourth proximal phalanx but used 26 mm and 14 mm implants instead. Total surgery time to provide fracture fixation for the entire hand was approximately one hour.

Postop

Follow-Up

At the two-week follow-up, the patient experienced no pain and could perform early active ROM but was advised to not lift any heavy objects as a precaution. Four weeks postoperatively, the patient was healing so well that Dr. Sisco-Wise cleared him to return to work and daily activities without any restrictions.

Discussion

By using a minimally invasive, percutaneous approach for the entire hand, Dr. Sisco-Wise was able to avoid complications such as stiffness that typically accompanies plate and screw fixation and infections often experienced with K-wire fixation. With INnate, Dr. Sisco-Wise achieved three points of fixation and IM canal fill of the metacarpal due to the implant's innovative dual diameter design, resulting in rigid fixation and early ROM. Similarly, the 2.0 mm diameter design of InFrame allowed more than one implant to fit the narrow IM canal of the proximal phalanx, while its extensive length offering enabled fracture-specific constructs customized to the patient's anatomy. Equally as important to Dr. Sisco-Wise was the unique delivery mechanism of InFrame because it eliminated the need for a dedicated reamer, which simplified the precise placement of the micro nails and reduced time in the operating room. The rigid fixation and early mobilization achieved by both the INnate and InFrame systems ultimately allowed her patient to minimize downtime and return to work and daily activities faster than 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

Th 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

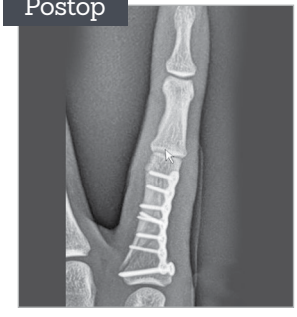
Preoperative Plan

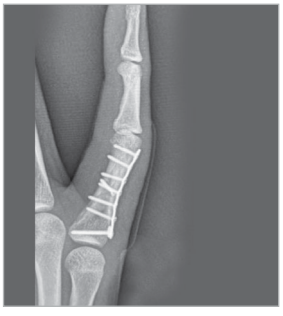
While the use of K-wires or percutaneous lag screw fixation was possible, Dr. Tueting ultimately chose to use the OsteoMed Hand Plating System as he felt that this system would provide a comprehensive, creative solution that could treat this complex fracture and allow a quicker return to sport. His surgical 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.

Treatment of Distal Radius and Ulna Fractures Using the Acumed® Acu-Loc® 2 Wrist Plating System

Figure 7 – Standard Volar Distal Radius (VDR) Plates

Figure 8 – Lateral view of VDR Plate Showing Screw Trajectory

The Acumed Acu-Loc 2 Wrist Plating System offers a complete solution of anatomically contoured plates to give surgeons the flexibility to treat a variety of fracture patterns in the distal radius and ulna regions. Components of this comprehensive system include standard, variable angle-locking, fragment-specific, and extraarticular and extension plates. The advantage to having many plate options is the ability to address multiple different fractures with coverage of the volar/dorsal radius and ulna, and intra-articular fractures. Surgeons have the option of using an intermediate or radial column approach.

Trusted over one million times by surgeons worldwide, Acu-Loc 2 has become a leader in repairing intraarticular fractures, malunions, and nonunions of the distal radius. There are numerous of reasons why this system has built such a following. The precontoured plates of Acu-Loc 2 help minimize the need for intraoperative plate bending, which could streamline the operative procedure. The VDR Plates offer a variety of screw options to accommodate the surgeon's preference for fracture fixation such as the patented Frag-Loc® two-part cannulated screw that compresses dorsal fragments to the volar plate. Additionally, the trajectories of the distal screws provide optimal subchondral support for distal radius fractures. (Figure 8) Finally, innovative instrumentation such as kickstand posts, a radiopaque targeting guide, and a plate positioning handle facilitate fracture reduction and plate placement.

Use of Acu-Loc® 2 VDR Plate For ORIF Revision of Comminuted Distal Radius Articular Fracture

Randy Bindra, MD, FRACS
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Case Presentation

The patient was a 24-year-old right-handed student who sustained a fracture of his left wrist after a fall down a flight of stairs. After receiving treatment at another hospital, he presented to Dr. Bindra two weeks later with increasing median neuropathy. Radiography showed a volar pin plate applied to the tear drop fragment with no internal fixation of the radial column, and a spanning external fixator for the wrist. CT imaging showed impaction and depression of the distal radius articular surface with dorsal tilt and loss of articular congruity.

Preop

Preop Plan

The primary goals of treatment were to reduce the articular alignment, stabilize the fracture, and decompress the median nerve. Dr. Bindra recommended revision ORIF to remove the existing implants, joint reduction via a dorsal approach, and internal fixation with the Acu-Loc® 2 Volar Distal Radius (VDR) Plate. He would then perform neurolysis of the median nerve around the fracture site and release the carpal tunnel.

Operative Findings and Approach

Dr. Bindra used the existing surgical scar to develop a modified Henry approach through the floor of the flexor carpi radialis (FCR) tendon. The median nerve was released, and existing implants were removed. He next made a dorsal incision between the second and fourth extensor compartments after mobilizing the extensor pollicis longus (EPL) tendon. Using transverse arthrotomy, the distal articular surface was carefully disimpacted, reduced, and held with temporary K-wires.

For the volar incision, Dr. Bindra positioned a standard sized Acu-Loc 2 VDR plate to buttress the volar cortex and first placed a nonlocking screw through the slotted shaft hole to secure the plate with the attached targeting guide. After ensuring the distal screws would support the articular surface and that the plate adequately supported the volar ulnar teardrop fragment and radial styloid, he inserted two radial styloid screws to support the radial column. Locking distal screws and nonlocking proximal screws completed the construct. The dorsal metaphyseal defect was then filled with calcium phosphate bone void filler, and the carpal tunnel released through a separate incision in the palm. The surgery took a total of 95 minutes.

Postop

Follow-Up

Postoperatively, the patient reported resolution of neurological symptoms and was placed in a thermoplastic splint for six weeks. Two weeks postoperatively, the patient started wrist and hand rehabilitation and resumed light activities, returning to full function by six weeks. No soft-tissue complications were seen.

Discussion

This challenging case of an ORIF revision presented an unstable radial styloid fragment, median neuropathy, and dorsal comminution and depression of the distal radius articular surface. Dr. Bindra ultimately decided to use the lower profile Acu-Loc 2 VDR Plate because it could buttress the volar fragments and support the articular surface due to its contoured, anatomic shape that allowed it to be placed distally on the radius without putting flexor tendons at risk of irritation. Additionally, its distal position and screw trajectory helped achieve subchondral support and rotational and axial stability of the comminuted fragments.

Learn more about the industry's most comprehensive portfolio of Hand and Upper Extremity solutions at **go.acumed.net/Hand&Wrist**

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