stryker

Trauma

Hoffmann® II Micro™

Small Bone External Fixation System

Operative Technique

Introduction

Stryker Orthopaedics has a long tradition of providing high quality external fixation solutions for complex fractures. Beginning in 1938, Stryker has worked closely with surgeons[1] to improve the original Hoffmann® design and develop the innovative Hoffmann® II and Hoffmann® II Compact™ Systems. These systems signified a giant step forward in the treatment of bone fractures with modular external fixation frames featuring a unique, patented "snap-fit" clamp design.

Today, Stryker continues this tradition with the introduction of the new Hoffmann® II Micro™ for small bone injuries.

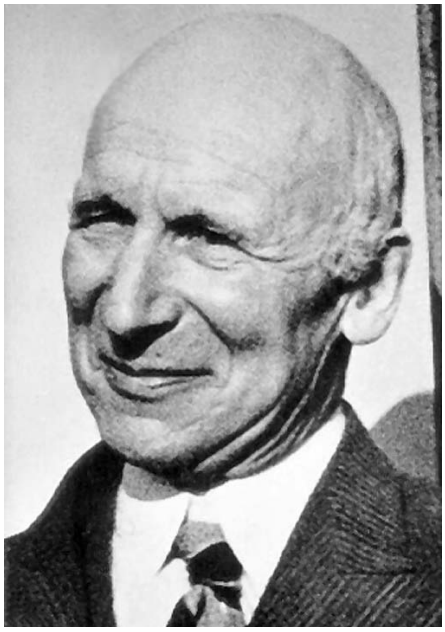
Easy to Use
The Hoffmann® II Micro™ System allows the construction of many frame configurations with only four versatile components and is compatible with a variety of surgical techniques. It's spring loaded, "snap-fit" mechanism allows for easy assembly and provides a non-slip connection.

The Multi-Pin Clamp is designed for ease and precision of pin insertion. The new Clamp design has oval pin slots which allow the Half Pins to be inserted in one plane in a variety of angles.

Patient Comfort
It is small and light-weight to comfortably fit on the patient's hand or foot.

Compatibility –
Compatibility with the Hoffmann® II & Hoffmann® II Compact™ External Fixation Systems allows the surgeon to treat upper or lower extremity injuries with one frame, making this a Total External Fixation Solution.

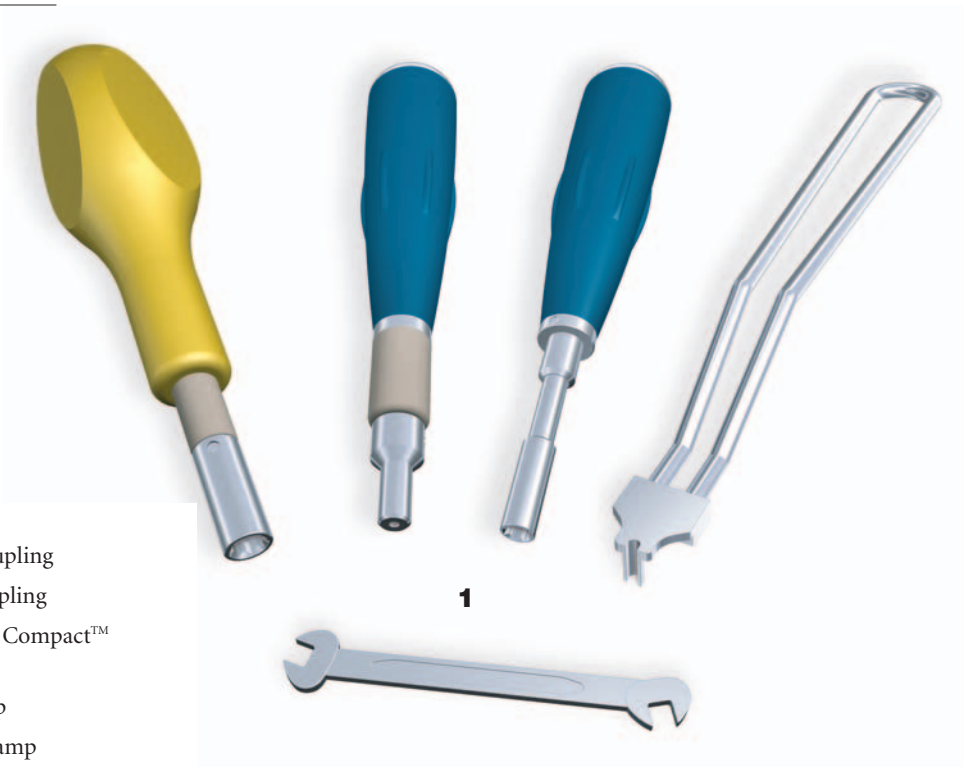
Modular
The Hoffmann® II Micro™ System's modular design allows the surgeon to build the frame around the fracture, and facilitates fracture alignment and reduction after frame assembly.



Raoul Hoffmann

1 Dr. Gernot Asche, Andy Burgess M.D., Prof. Franz Burny, Mr. Charles M. Court-Brown, Prof. Erkki O. Karaharju, Loren Latta Ph.D., Prof. David Seligson M.D., Dr. Gregory Zych M.D., William Seitz, M.D.

Components



1. Standard Instruments
2. Hoffmann®II Micro™ Rod-to-Rod Coupling
3. Hoffmann®II Micro™ Pin-to-Rod Coupling
4. Hoffmann®II Micro™ to Hoffmann®II Compact™ Rod-to-Rod Coupling
5. Hoffmann®II Micro™ Multi-Pin Clamp
6. Hoffmann®II Micro™ 90°Multi-Pin Clamp
7. Blunt or Self-Drilling/Self-Tapping Half-Pins (1.65 - 2mm)
8. Carbon and Stainless Steel Rods (3mm)

Indications & Contraindications

Indications

The Hoffmann®II Micro™ System is ideal for small bone fractures. It is particularly suited for the following indications:

- Small bone fracture fixation
- Osteotomy
- Arthrodesis
- Correction of deformity
- Revision procedures where other treatments or devices have been unsuccessful
- Bone reconstruction procedures
- Non-unions and delayed unions

The Hoffmann®II Micro™ System is also approved for use in children and in the maxillofacial area.

Contraindications

Since external fixation devices are often used in emergency situations to treat patients with acute injuries, there are no absolute contraindications for use. The surgeon's education, training and professional judgement must be relied upon to choose the most appropriate device and treatment for each individual patient. Whenever possible, the device chosen should be of a type indicated for the fracture being treated and/or for the procedure being utilized.

Conditions presenting an increased risk of failure include:

1. Insufficient quantity or quality of bone that would inhibit appropriate fixation of the device.
2. Compromised vascularity that would inhibit adequate blood supply to the fracture or operative site.
3. Previous history of infections.
4. Any neuromuscular deficit that would interfere with the patient's ability to limit weight bearing.
5. Any neuromuscular deficit that places an unusually heavy load on the device, during the healing period.
6. Malignancy in the fracture area.
7. Mental, physical or neurological conditions that may impair the patient's ability to cooperate with the postoperative regimen.

Operative Technique

Due to the versatility of the Hoffmann®II Micro™ System, an unlimited number of frame configurations may be constructed, providing surgeons ease of use while treating a variety of conditions.

This Technical Guide provides a step-by-step surgical technique for three basic frame assemblies. These constructs may then be adapted to other indications.

General Half Pin Insertion and Frame Building Guidelines

Frame Building Guidelines

The Hoffmann®II Micro™ Multi-Pin Clamp is designed for ease-of-use and precise pin insertion. The Clamp has oval pin slots that allow the Half Pins to be inserted in one plane in a variety of angles. (Figure 1)

The Hoffmann®II Micro™ Pin-to-Rod Coupling with patented "snap fit" clamp design, offers independent pin placement, which is needed to address the most complex cases. (Figure 2)

Multi-Pin Clamps and Couplings should be placed at least 5mm to 10mm away from the skin to allow for post-operative swelling and proper pin site care.

To reduce forces on the bone, it is recommended to hold the Half Pins with standard surgical pliers while tightening the Clamps and Couplings.

The Hoffmann® II Micro™ System is compatible with the larger Hoffmann® II Compact™ System (accepts 3-4mm pins) allowing easy bridging between systems. The 3mm/5mm clamp is used to connect the systems and can be tightened with the 5mm Wrench 3mm/4mm Pin Driver. (Figure 3)

Figure 1

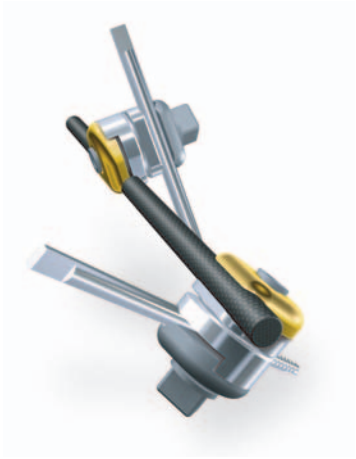


Figure 2

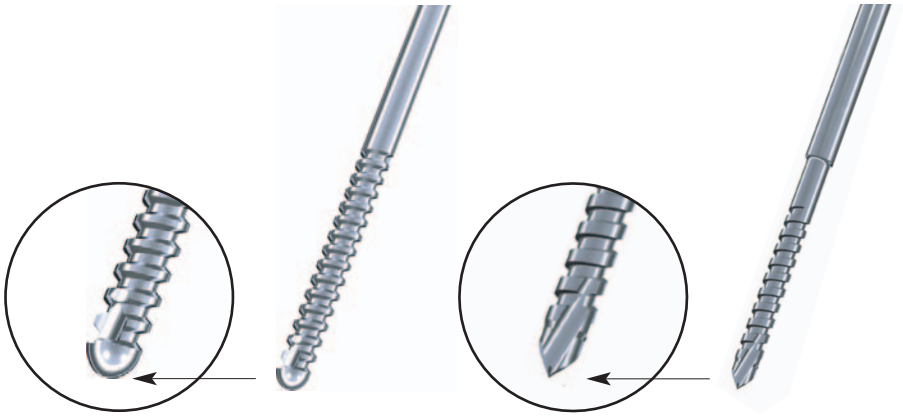
Figure 3

Insertion Guidelines

Blunt or Self-Drilling/Self-Tapping Half Pins are offered in the system. Pre-drilling is necessary when using Blunt/Self-Tapping Half Pins. Half Pins have a 2.0mm shaft diameter.

Note: Use a 1.5mm drill bit to pre-drill a Blunt 2.0mm Half Pin

A (mini) open insertion technique is recommended to avoid unnecessary damage to the soft tissues. A Drill/Insertion Guide is provided in the system to facilitate this technique.

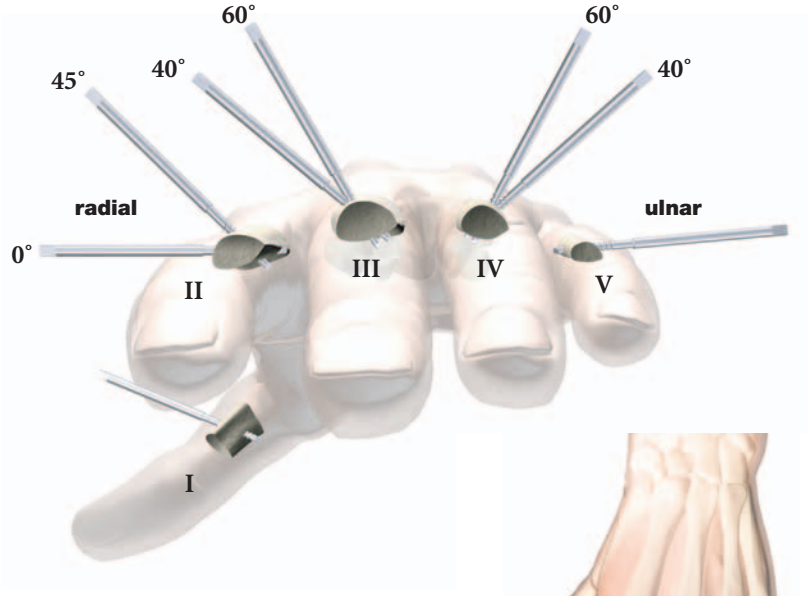


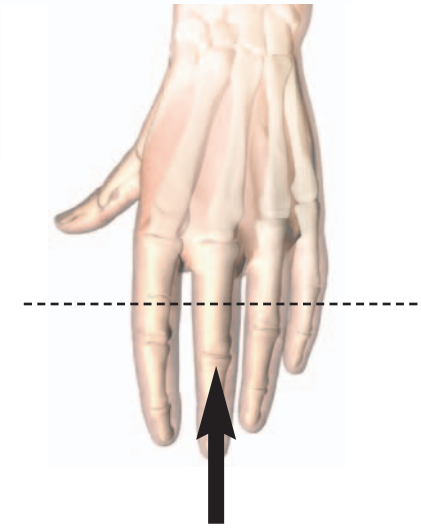
Blunt Tip **Self-Drilling/Self-Tapping**

Hand

Placement in the Phalanges

I: Insert Half Pins from the radial side in the frontal plane.
II: Insert 0° to 45° from the frontal plane on the dorsal-radial side.
III: Insert 40° to 60° from the frontal plane on the dorsal-radial side.
IV: Insert 40° to 60° from the frontal plane on the dorsal-ulnar side.
V: Insert from the ulnar side in the frontal plane.

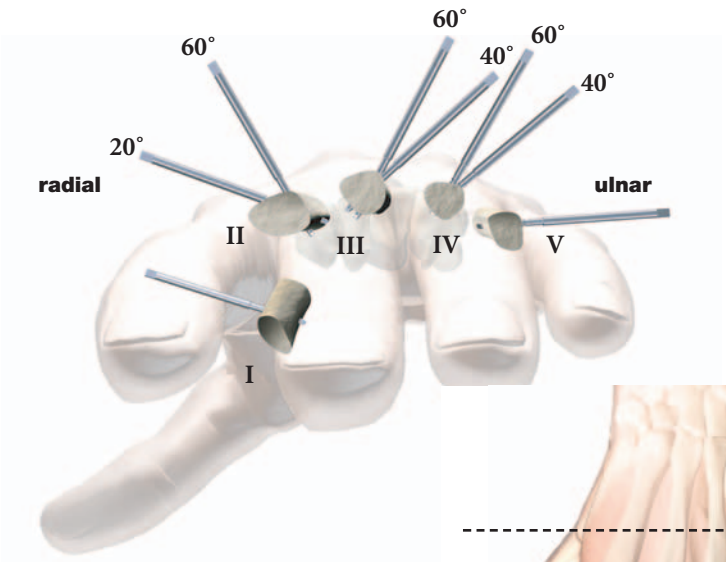


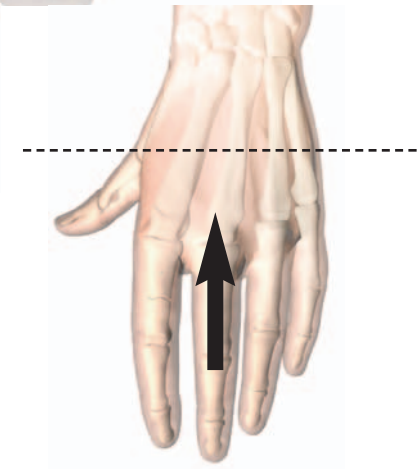


Placement in the Metacarpals

I: Insert Half Pins from the radial side in the frontal plane.
II: Insert 20° to 60° from the frontal plane on the dorsal-radial side.
III: Insert 40° to 60° from the frontal plane on the dorsal-ulnar side.
IV: Insert 40° to 60° from the frontal plane on the dorsal-ulnar side.
V: Insert from the ulnar side in the frontal plane.

Note: When inserting pins, ensure bicortical purchase.



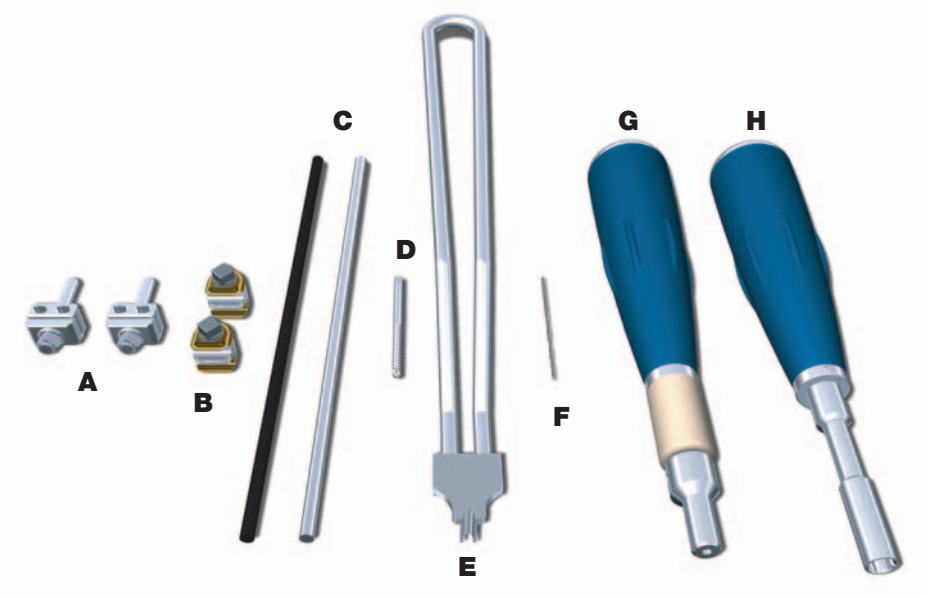


Frame 1

Mid-shaft fracture of the proximal phalanx of the index finger (Digit II).

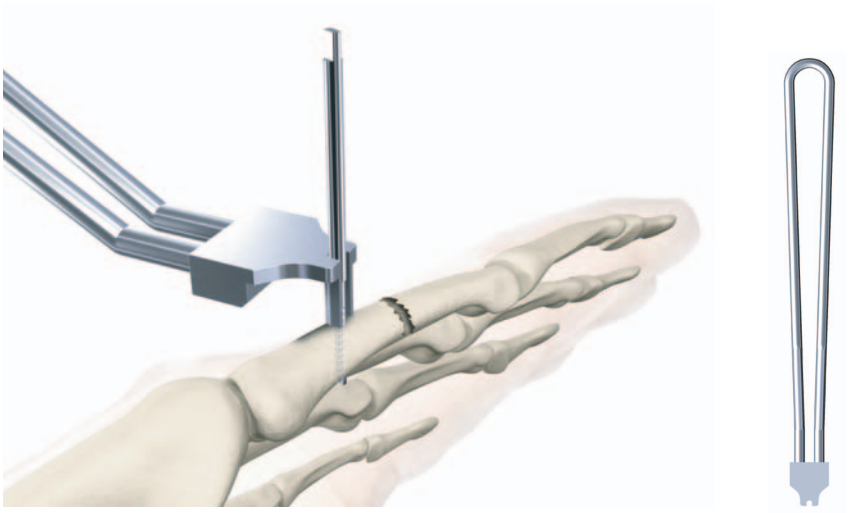
Material used:

A) 2 - Multi-Pin Clamps
B) 2 – Rod-to-Rod Couplings
C) 1 - Connecting Rod (Carbon or Stainless Steel)
D) 4 - 1.65mm or 2mm Apex® Half-Pins
E) 1 - Drill/Pin Insertion Guide
F) 1 - 1.5mm Drill Bit for Blunt Pins
G) 1 - 2mm Pin Driver
H) 1 - 4mm Nut Wrench

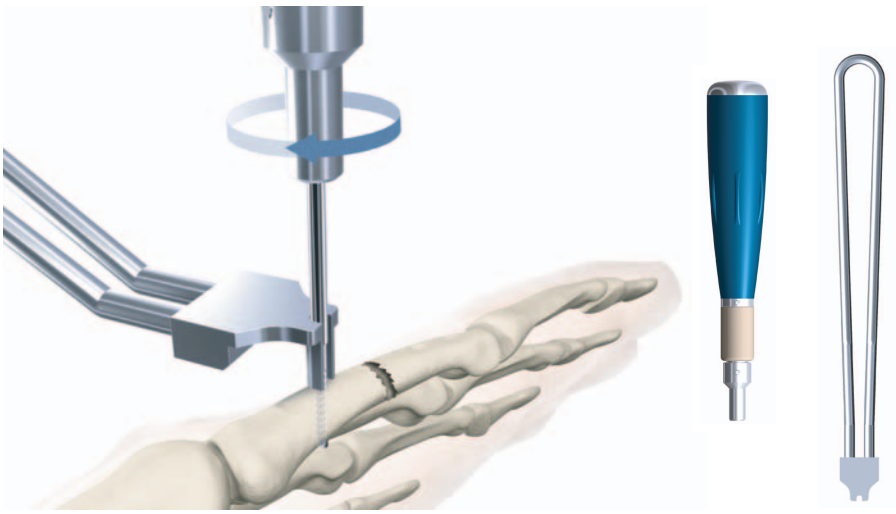


Step 1:
Drill the first proximal hole at least 5mm from the fracture site using the Drill/Pin Insertion Guide and the 1.5mm drill bit. If Self-Drilling/ Self-Tapping Half Pins are used, it is possible to insert the Half Pins without pre-drilling as described in this step.

Note: The drill/ pin insertion angle is 0° to 45° from the frontal plane radially. Use image intensification to determine proper pin placement and to ensure bi-cortical purchase.



Step 2:
Manually insert the Half Pin using the 2mm Pin Driver and Drill/Pin Insertion Guide.

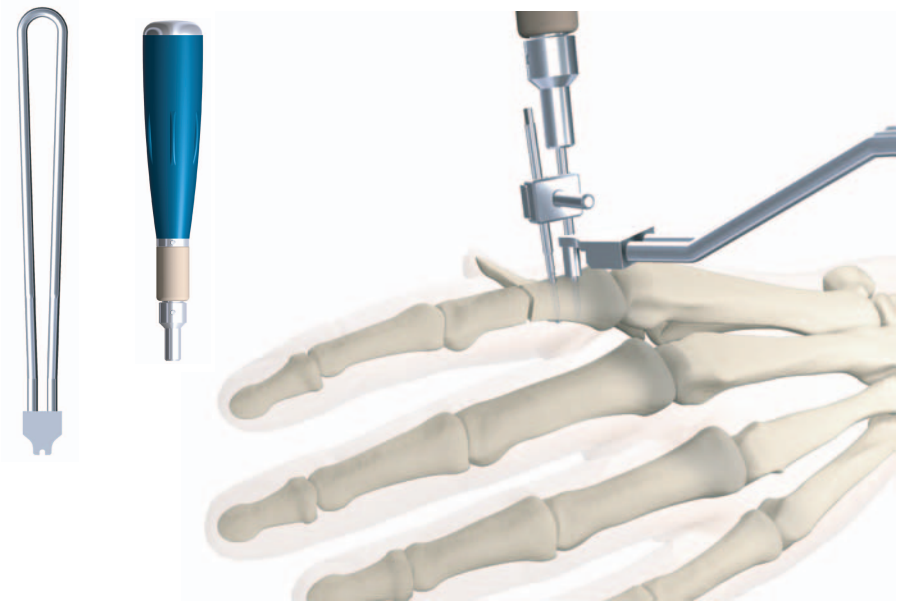


Frame 1

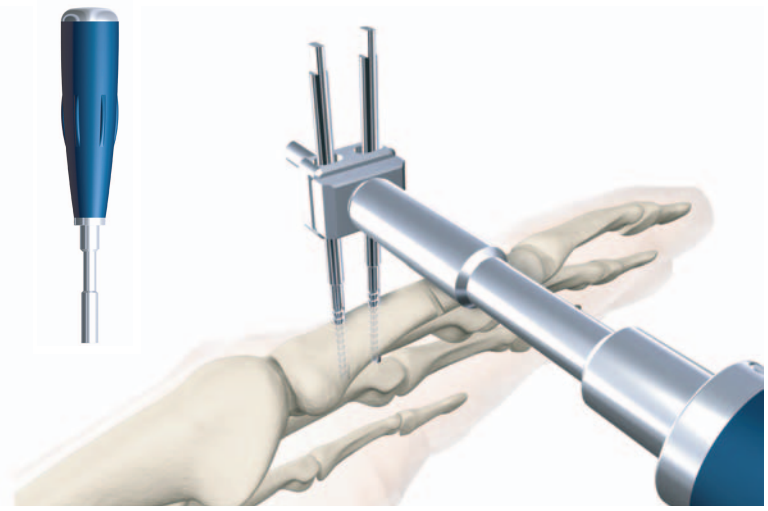
Step 3:
Place one Multi-Pin Clamp over the Half Pin at least 5mm to 10mm away from the skin.

Step 4:
Using the Multi-Pin Clamp as a guide and the Drill/Pin Insertion Guide to protect soft tissue, drill the second proximal hole with the 1.5mm drill bit. If Self-Drilling/Self-Tapping Half Pins are used, it is possible to insert the Half Pins without pre-drilling as described in this step.

Step 5:
Manually insert the second 2mm Half Pin through the Multi-Pin Clamp using the 2mm Pin Driver and the Drill/Pin Insertion Guide.



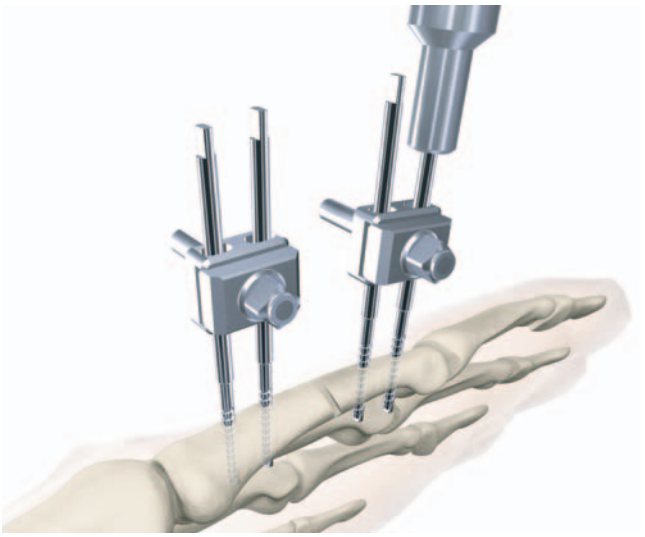
Step 6:
Tighten the Multi-Pin Clamp to the Half Pins at the desired position using the 4mm Nut Wrench.



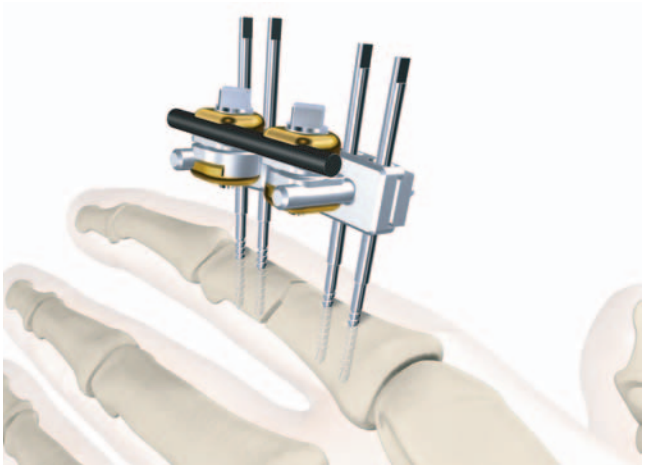
Frame 1

Step 7:
Build the same Pin/Clamp construct on the distal side of the fracture following steps 1 through 6.

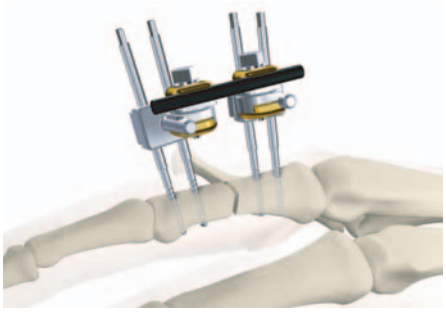
Note: Insert the distal Half Pin closest to the fracture first.

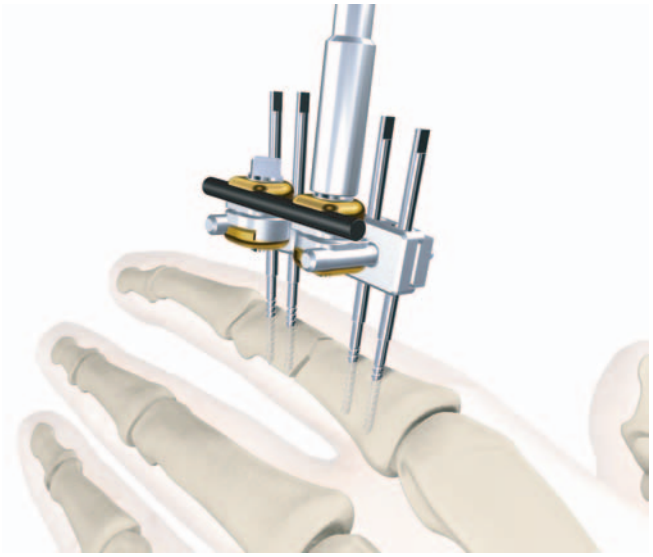


Step 8:
Two Rod-to-Rod Couplings are "snapped" on the clamp posts. The Connecting Rod (carbon or stainless steel) is then "snapped" into the two Rod-to-Rod Couplings and the fracture is reduced manually.



Step 9:
With the fracture reduced, tighten the Rod-to-Rod Couplings with the 4mm Nut Wrench. The frame is now complete.



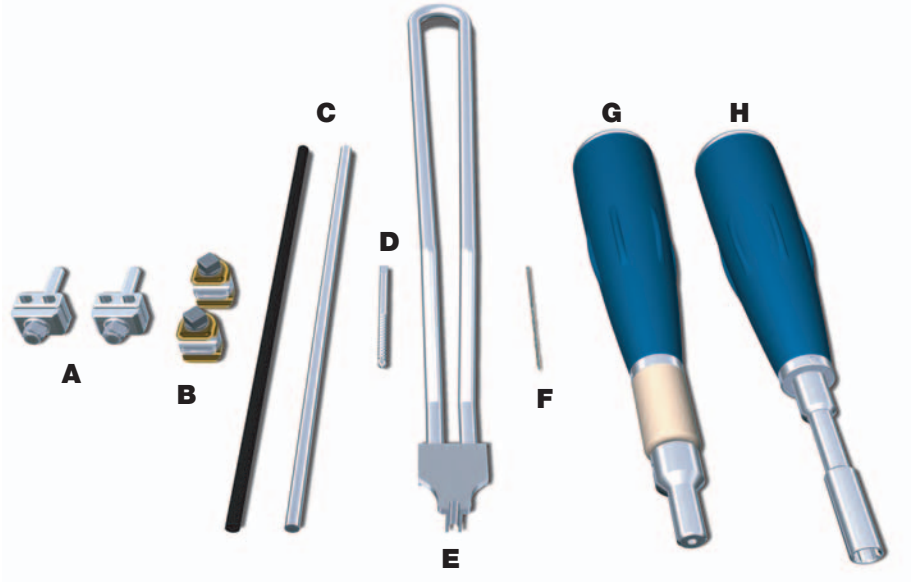


Frame 2

Metaphyseal fracture of the proximal phalanx of the index finger (Digit II).

Material used:

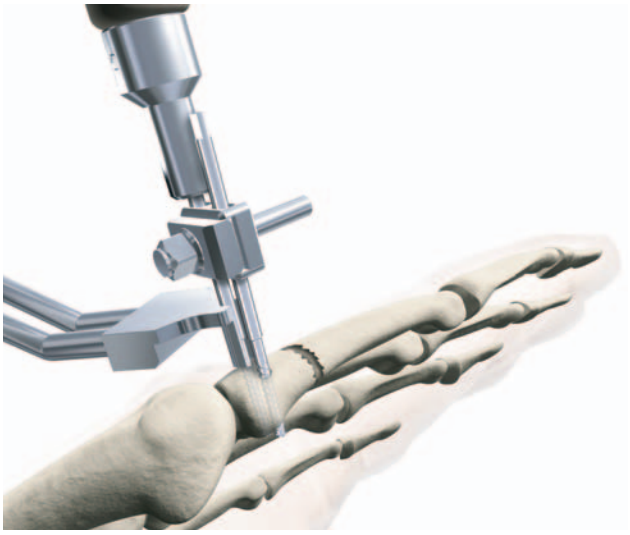
A) 2 - Multi-Pin Clamps
B) 2 - Rod-to-Rod Couplings
C) 1 - Connecting Rod (Carbon or Stainless Steel)
D) 4 - 1.65mm or 2mm Apex® Half-Pins
E) 1 - Drill/Pin Insertion Guide
F) 1 - 1.5mm Drill Bit for Blunt Pins
G) 1 - 2mm Pin Driver
H) 1 - 4mm Nut Wrench



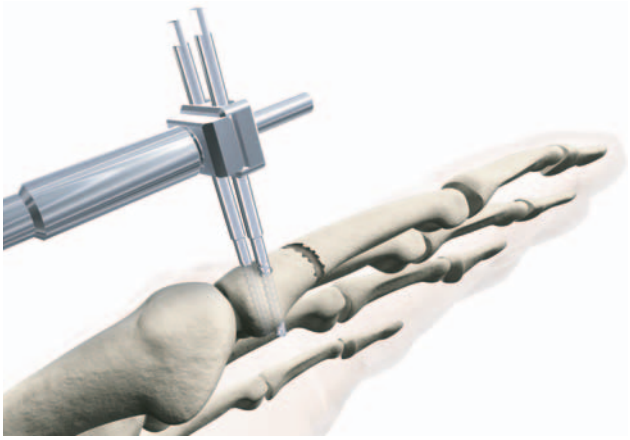
Step 1:
The proximal Half Pins are manually inserted parallel to the joint using the 2mm Pin Driver and Drill/Pin Insertion Guide. Due to the design of the Clamp, the Half Pins can be placed parallel or convergent within the Clamp.

Use the Drill/Pin Insertion Guide and a 1.5mm drill bit to pre-drill the blunt Half Pins.

Note: The drill/insertion angle is 0° to 45° from the frontal plane radially. Use image intensification to determine proper pin placement and to ensure bi-cortical purchase.

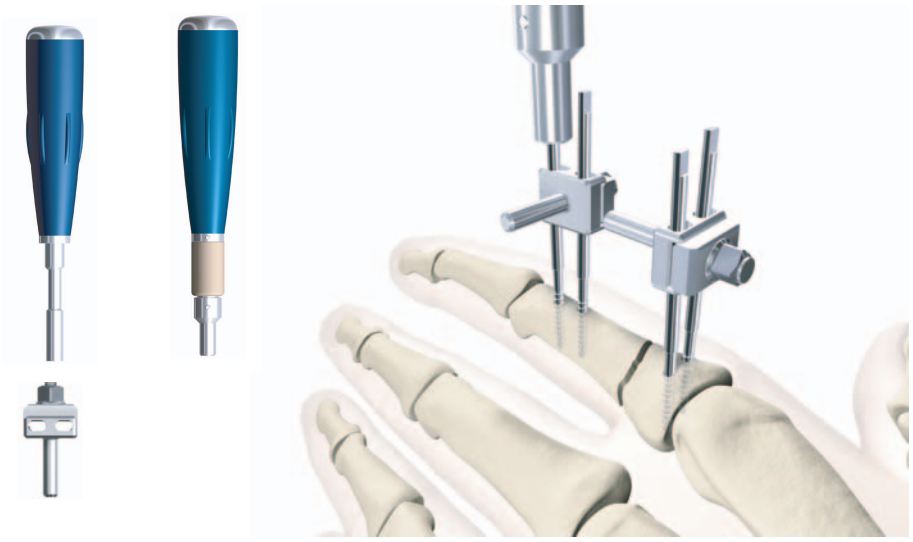


Step 2:
Tighten the Multi-Pin Clamp to the Half Pins at the desired position using the 4mm Nut Wrench.

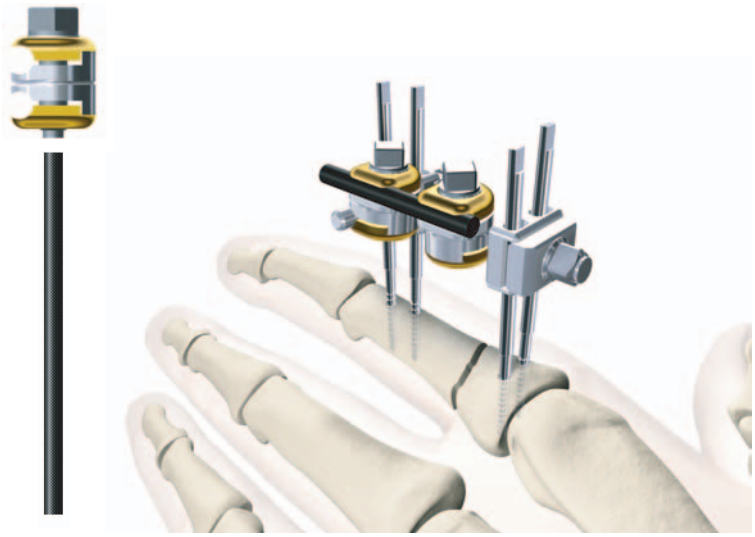


Frame 2

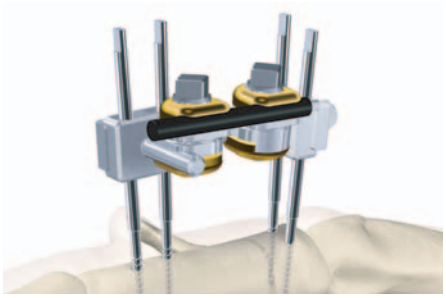
Step 3:
Construct a Half Pin/Multi-Pin Clamp assembly distal to the fracture as shown in the figure. Securely tighten the Clamp onto the Half Pins.

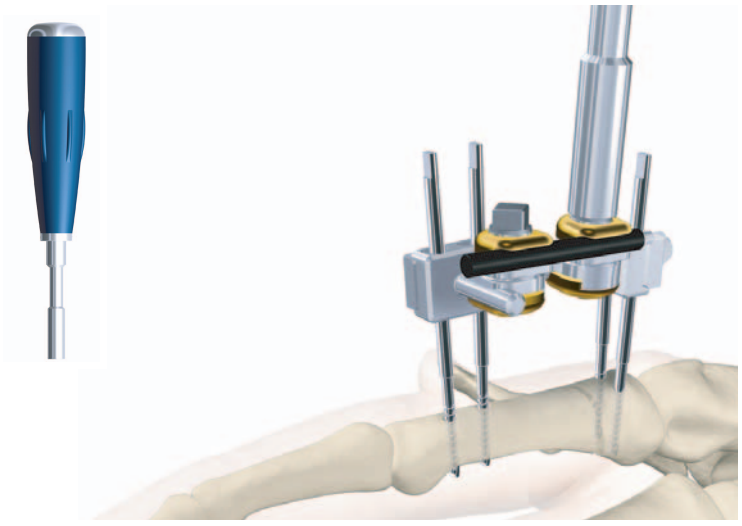


Step 4:
Two Rod-to-Rod Couplings are "snapped" onto each of the clamp posts. The Connecting Rod (carbon or stainless steel) is then "snapped" into the two Rod-to-Rod Couplings and the fracture is reduced manually.



Step 5:
With the fracture reduced, tighten the Rod-to-Rod Couplings with the 4mm Nut Wrench. The frame is now complete.



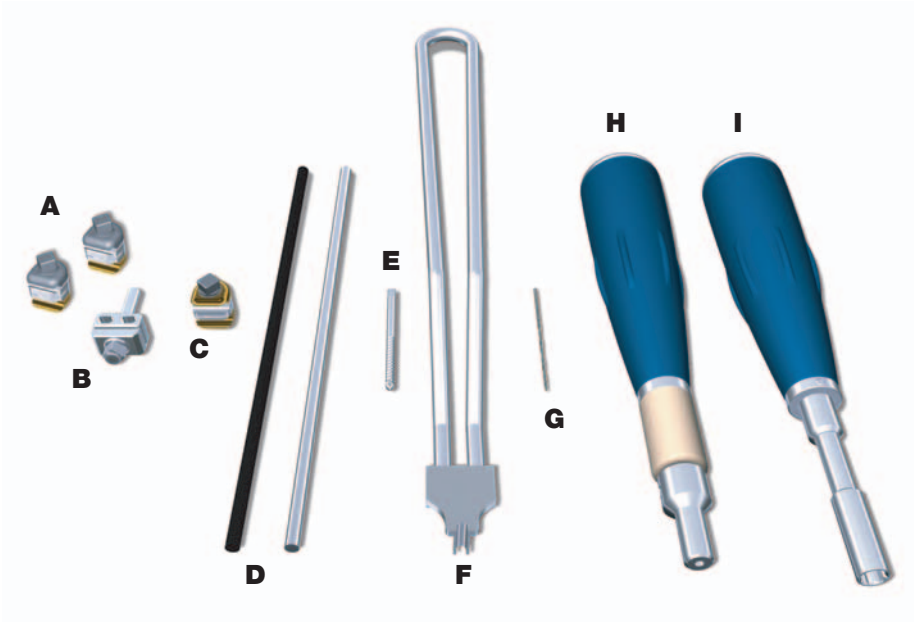


Frame 3

Intra-Articular fracture of the fifth metacarpal with severe soft-tissue damage.

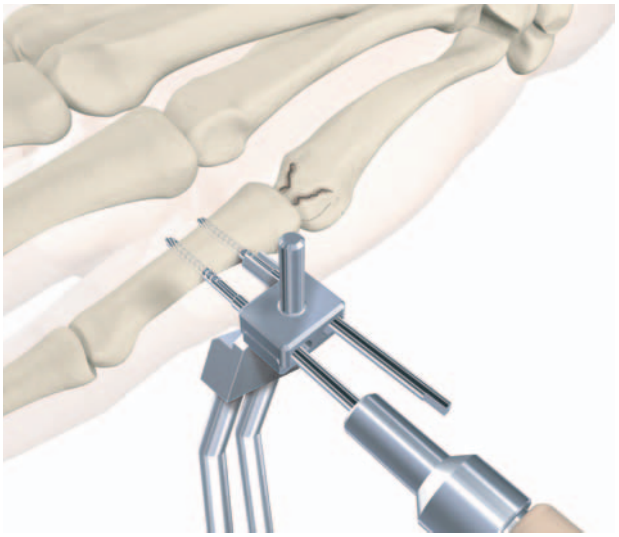
Note: This frame offers additional freedom of independent pin placement, which is dictated by the soft-tissue damage and the fracture. This frame also allows for more accessible wound treatment while the frame is in place.

Material used:
A) 2 - Pin-to-Rod Couplings
B) 1 - Multi-Pin Clamps
C) 1 - Rod-to-Rod Couplings
D) 1 - Connecting Rod (Carbon or Stainless Steel)
E) 4 - 1.65mm or 2mm Apex® Half-Pins
F) 1 - Drill/Pin Insertion Guide
G) 1 - 1.5mm drill bit for Blunt Pins
H) 1 - 2mm Pin Driver
I) 1 - 4mm Nut Wrench



Step 1:
Manually insert the distal Half Pins into the fifth proximal phalanx using the 2mm Pin Driver and the Drill/Pin Insertion Guide.

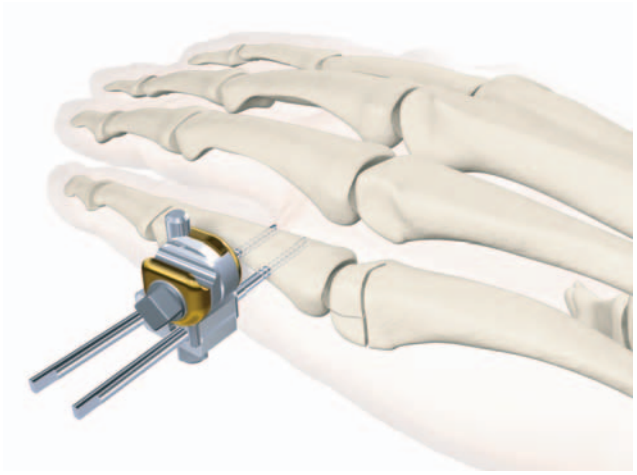
Place the Half Pins and Clamp parallel to the long axis of the bone. Use the Drill/Pin Insertion Guide and the 1.5mm drill bit to pre-drill for the Blunt Half Pins. Insert the Half Pins from the ulnar side in the frontal plane. Use image intensification to determine proper pin placement and to ensure bi-cortical purchase.



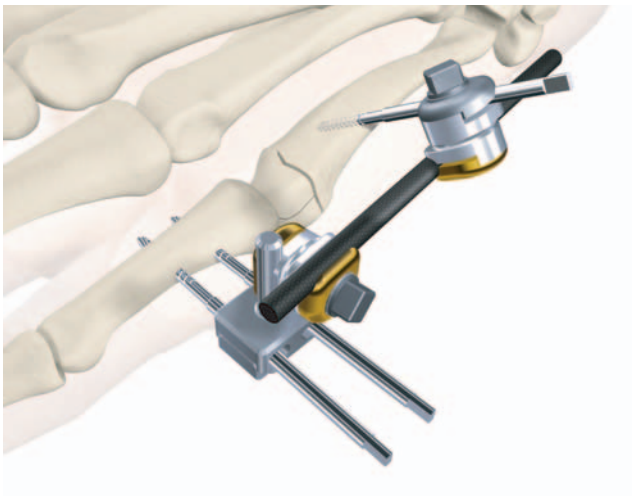
Step 2:
Tighten the Multi-Pin Clamp to the Half Pins at the desired position using the 4mm Nut Wrench.

Frame 3

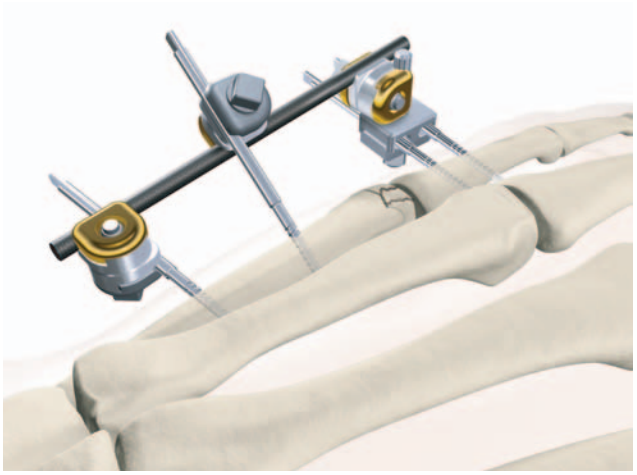
Step 3:
Attach a Rod-to-Rod Coupling to the Clamp.



Step 4:
Insert one Half Pin in the fifth metacarpal proximal to the fracture, careful of any soft-tissue injuries. Attach a Pin-to-Rod Coupling to the Half Pin. "Snap" a 3mm Connecting Rod (carbon or stainless steel) into the Rod-to-Rod Coupling and into the Pin-to-Rod Coupling.

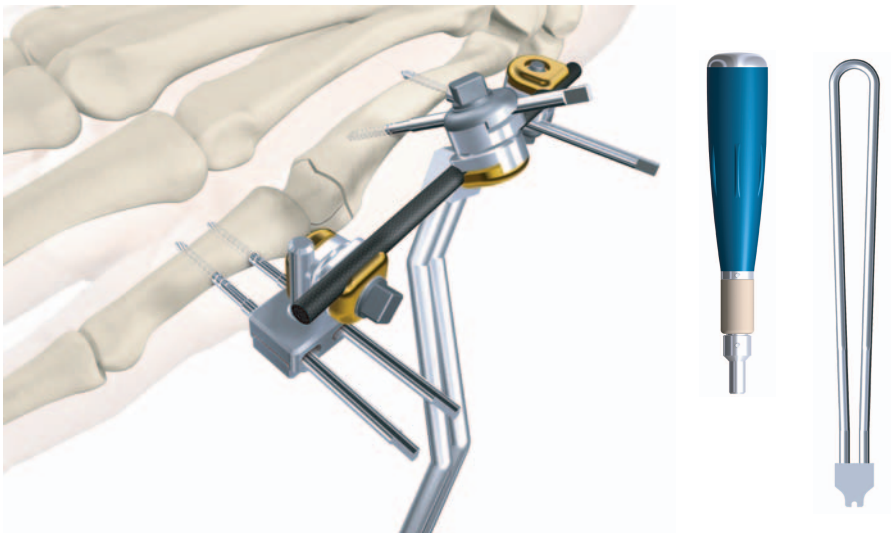


Step 5:
Attach the second Pin-to-Rod Coupling to the proximal end of the Connecting Rod.

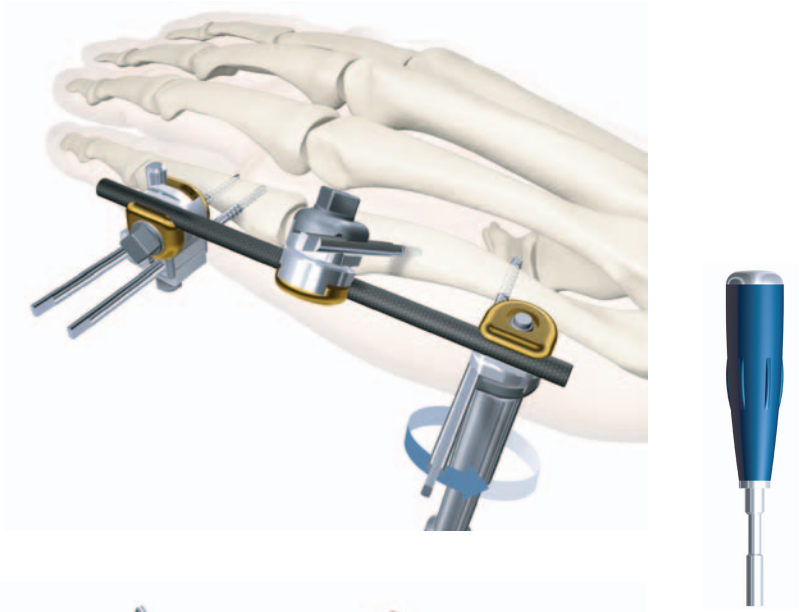


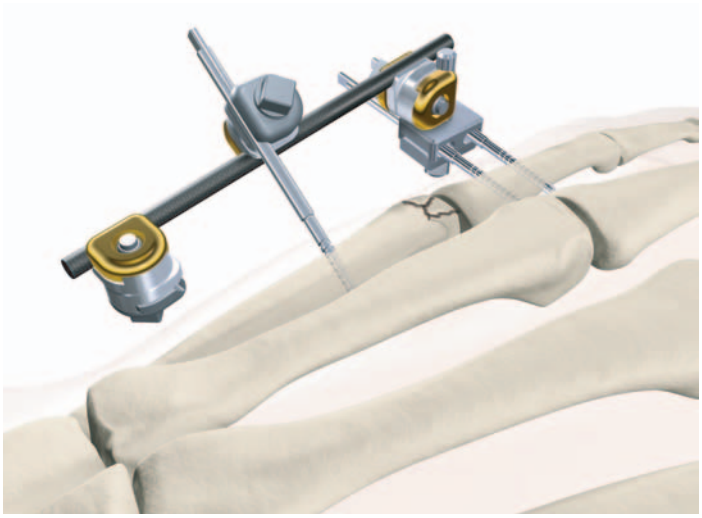
Frame 3

Step 6:
Insert the Half Pin into the shaft of the metacarpal using the Drill/Pin Insertion Guide and the Pin-to-Rod Coupling as guides. Then, manually reduce the fracture.



Step 7:
With the fracture reduced, tighten the Rod-to-Rod Coupling and Pin-to-Rod Couplings using the 4mm Nut Wrench.





The frame is now complete.

Foot

A small, limited, open surgical approach allows central pin placement and may help avoid injury to or impingement of important soft tissue structures (tendons, ligaments, nerves and arteries). Half Pin placement should not interfere with soft tissue excursion during range of motion.

Consideration should also be given to any anatomical changes due to the current injury and to planning for any secondary surgeries that may be needed.

A general recommendation is for the pin size to be 1/3 the diameter of the bone treated. The Hoffmann® II Micro™ System is compatible with the larger Hoffmann® II Compact™ System (accepts 3-4mm pins) allowing easy bridging between systems.

Note: Accurate pin size and placement must be determined by the surgeon on a case by case basis.

Pin Placement in the Phalanges

I: Insert Half Pins from the medial or dorsomedial side 0-115˚ from the frontal plane

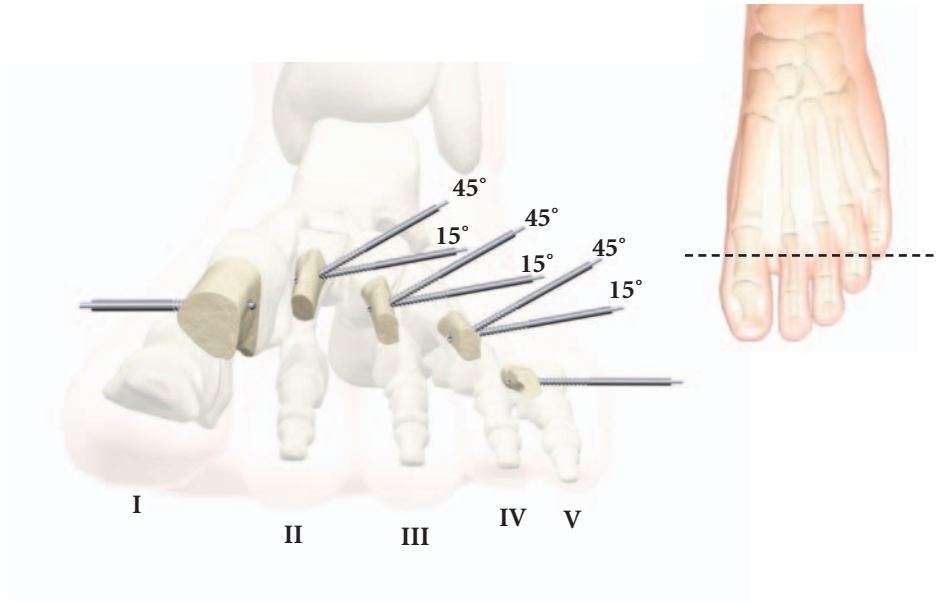
II: Insert Half Pins medially or laterally 15-45˚ from the frontal plane

III: Insert Half Pins medially or laterally 15-45˚ from the frontal plane

IV: Insert Half Pins medially or laterally 15-45˚ from the frontal plane

V: Insert Half Pins from the lateral to dorsolateral side 0-110° from the frontal plane

Note: Caution must be taken to avoid all neurovascular or tendonous structures.



Pin Placement in the Metarsals

I: Insert Half Pins from the medial or dorsomedial side 0-115˚ from the frontal plane

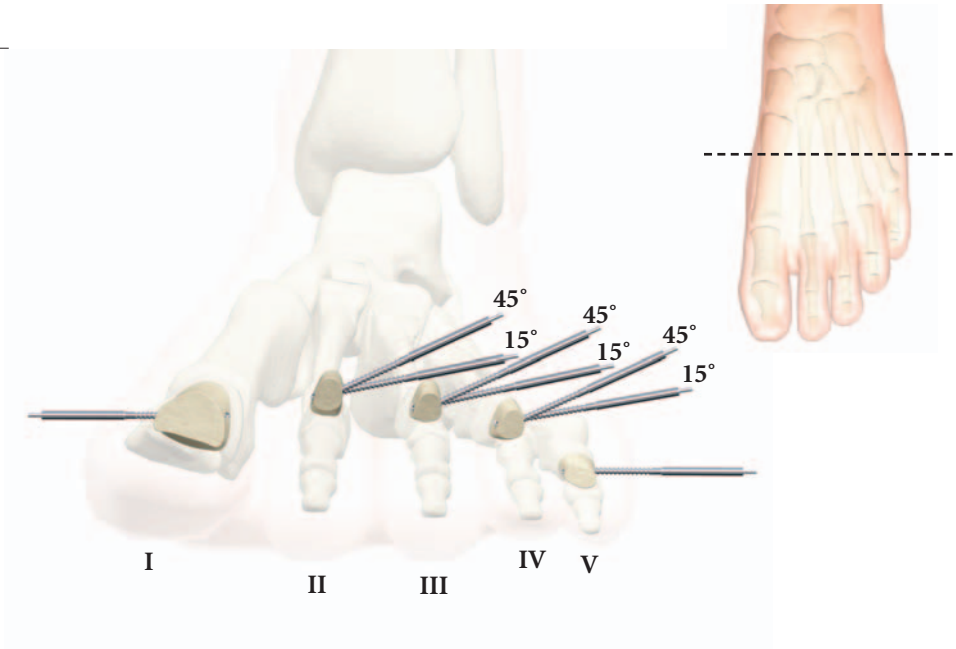
II: Insert Half Pins medially or laterally 15-45˚ from the frontal plane

III: Insert Half Pins medially or laterally 15-45˚ from the frontal plane

IV: Insert Half Pins medially or laterally 15-45˚ from the frontal plane

V: Insert Half Pins from the lateral to dorsolateral side 0-110° from the frontal plane

Note: Caution must be taken to avoid all neurovascular or tendonous structures.



Ordering Information - Implants

Couplings and Clamps

	Catalog No.	Description	Diameter mm
	4960-1-010	Rod-to-Rod Coupling	3/3mm
	4960-1-020	Pin-to-Rod Coupling	1.65-2mm/3mm
	4960-1-060	Rod-to-Rod Coupling	5mm/3mm
	4960-2-020	Multi-Pin Clamp	
	4960-2-030	90° Multi-Pin Clamp	

Warning: Bone Screws referenced in this material are not approved for screw attachment or fixation to the posterior elements (pedicles) of the cervical, thoracic or lumbar spine.

Ordering Information - Implants

Connecting Rods

Catalog No.	Description	Diameter	Total Length
5079-6-030	Carbon Connecting Rod	3mm	30mm
5079-6-040	Carbon Connecting Rod	3mm	40mm
5079-6-050	Carbon Connecting Rod	3mm	50mm
5079-6-060	Carbon Connecting Rod	3mm	60mm
5079-6-090	Carbon Connecting Rod	3mm	90mm
5079-6-120	Carbon Connecting Rod	3mm	120mm
5079-6-150	Carbon Connecting Rod	3mm	150mm

Catalog No.	Description	Diameter	Total Length
5079-5-030	Stainless Steel Connecting Rod	3mm	30mm
5079-5-040	Stainless Steel Connecting Rod	3mm	40mm
5079-5-050	Stainless Steel Connecting Rod	3mm	50mm
5079-5-060	Stainless Steel Connecting Rod	3mm	60mm
5079-5-090	Stainless Steel Connecting Rod	3mm	90mm
5079-5-120	Stainless Steel Connecting Rod	3mm	120mm
5079-5-150	Stainless Steel Connecting Rod	3mm	150mm

Blunt Self-Tapping Apex® Half Pins

Catalog No.	Diameter	Total Length	Thread Length
5065-3-615	2mm, Stainless Steel	36mm	15mm
5065-4-520	2mm, Stainless Steel	45mm	20mm
5065-9-015	2mm, Stainless Steel	90mm	15mm

Self-Drilling/Self-Tapping Apex® Half Pins

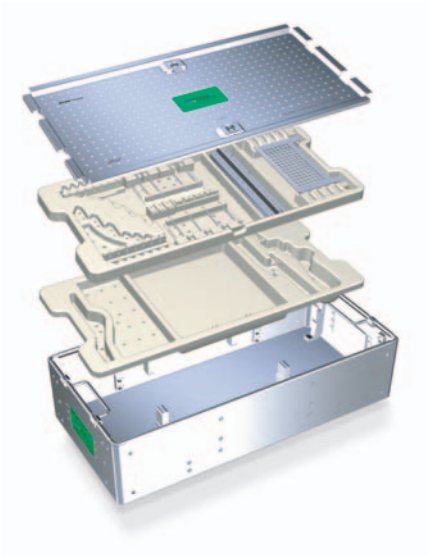
Catalog No.	Diameter	Total Length	Thread Length
5080-2-012	2mm, Stainless Steel	45mm	12mm
5080-2-020	2mm, Stainless Steel	45mm	20mm
5080-1-612	1.65mm, Stainless Steel	45mm	12mm
5080-1-620	1.65mm, Stainless Steel	45mm	20mm

K-Wires

Catalog No.	Description	Diameter	Thread Length
390142	K-Wire	1.0mm	150mm
390152	K-Wire	1.2mm	150mm
390162	K-Wire	1.4mm	150mm
390164	K-Wire	1.6mm	150mm

Ordering Information - Instruments

Standard Instruments

	Catalog No.	Description
	4960-9-040	Drill/Pin Insertion Guide
	4960-9-030	4mm Nut Wrench
	4960-9-020	2mm Pin Driver
	4940-9-030	5mm Wrench/3mm-4mm Pin Driver
	5084-4-044	4mm Spanner Wrench
	4960-9-901	Storage Case Base
	4960-9-902	Storage Case Lower Insert
	4960-9-903	Storage Case Upper Insert
	4960-9-904	Storage Case Lid
	4960-9-905	Drill Bit Holder Insert

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Content ID: H-ST-27, 12-2015 (Former Literature Number : LH2M-OT).
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