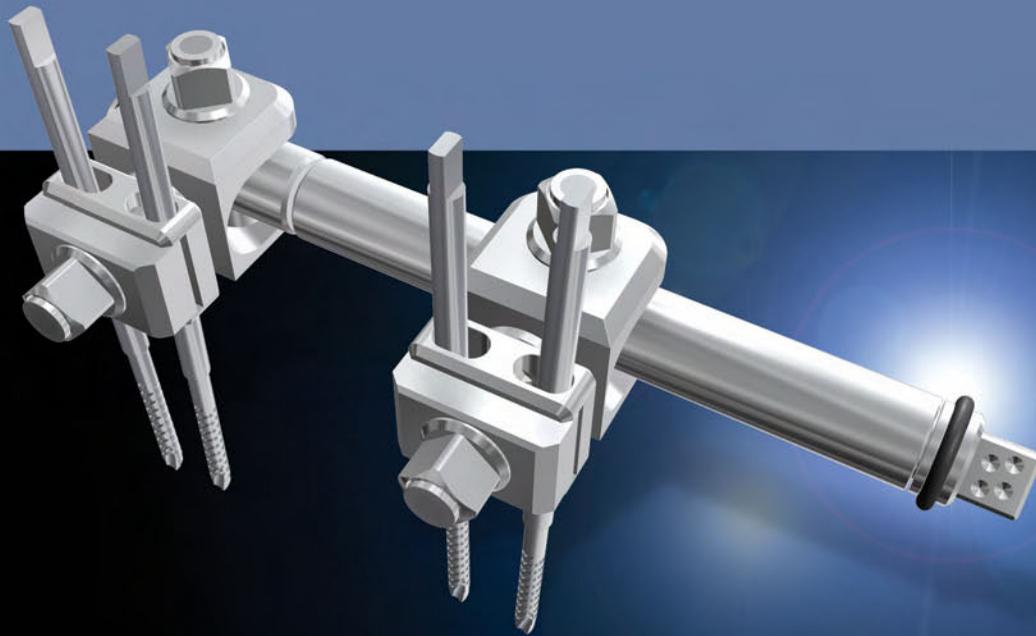


Hoffmann® II Micro™ Lengthener

Operative Technique

Small Bone Lengthening
Fracture Compression/Distraction



Indications & Contraindications

Indications

The indications for use include, but are not limited to:

- **Bone fracture fixation**
- **Osteotomy**
- **Arthrodesis**
- **Correction of deformity**
- **Revision procedure where other treatments or devices have been unsuccessful**
- **Bone reconstruction procedures**
- **Nonunions and delayed unions**
- **Compression / Distraction**
- **Lengthening**

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 judgment 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.

Introduction & Features

Based on the unique Hoffmann® II Micro™ System for fracture management, Stryker has developed the Hoffmann® II Micro™ Lengthener for metacarpal, metatarsal, or phalangeal lengthening. For arthrodesis or non union cases, it may also be used for compression.

The Lengthener offers the same versatility and ease-of-use that makes the Hoffmann® II Micro™ System a leader in External Fixation for the hand, foot and mandible.



The design of the Pin Clamps allows a minimum pin distance of 2-4 mm, allowing very small segments of bone to be lengthened.

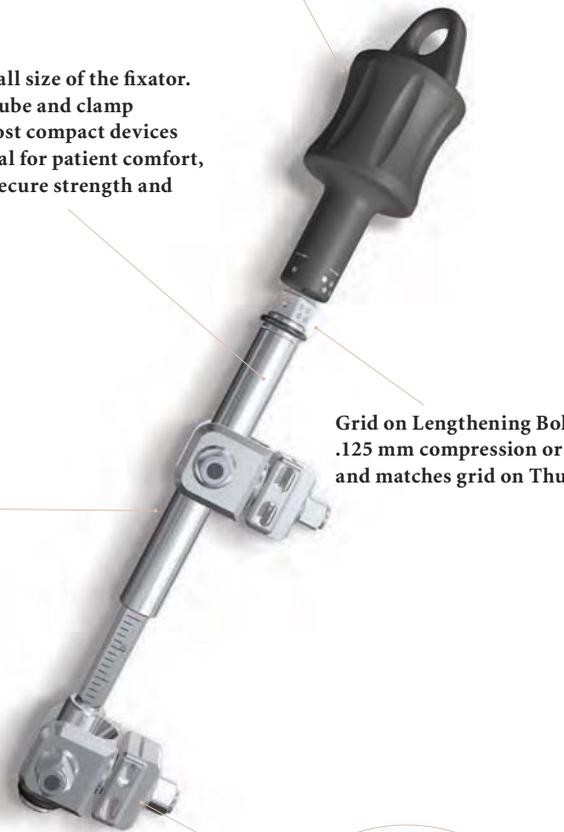
The Micro™ Lengthener is completely compatible with the Hoffmann® II Micro™ System instruments. There are no extra tools needed to assemble the frame.

An advantage is the overall size of the fixator. The low-profile Ø6 mm tube and clamp assembly is one of the most compact devices offered today. This is ideal for patient comfort, while still maintaining secure strength and durability.

Stryker offers an optional Thumbwheel for the patient to use throughout the lengthening process. This tool will help the patient follow the regime of daily lengthening.



The clamps can be positioned in a variety of ways, which allows optimal pin placement, easy frame adaptability, and access to the locking nuts.



Grid on Lengthening Bolt indicates .125 mm compression or distraction and matches grid on Thumbwheel.

The clamps allow insertion of the Apex® Pins in parallel, convergent or divergent directions. Due to the clamp's oblong pin holes, the surgeon can easily insert pins while avoiding soft tissues or obtaining optimal pin/bone interface. It also works well when there is only limited space to insert the pins, which can be the case in phalangeal lengthening.



Operative Technique

Lengthener Technical Details

The Lengthener can distract up to 3.0 Centimeters. This is marked on the inner-tube in millimeter increments (Figure 1).

Tip: If additional lengthening is required, the following procedure may be followed. Loosen Nut B on the distal pin clamp, turn the lengthening bolt to shorten the lengthening tube. Holding the Pin Clamp/Pins stable, allow the lengthening tube to slide within the Pin Clamp. Retighten Nut B and resume lengthening.

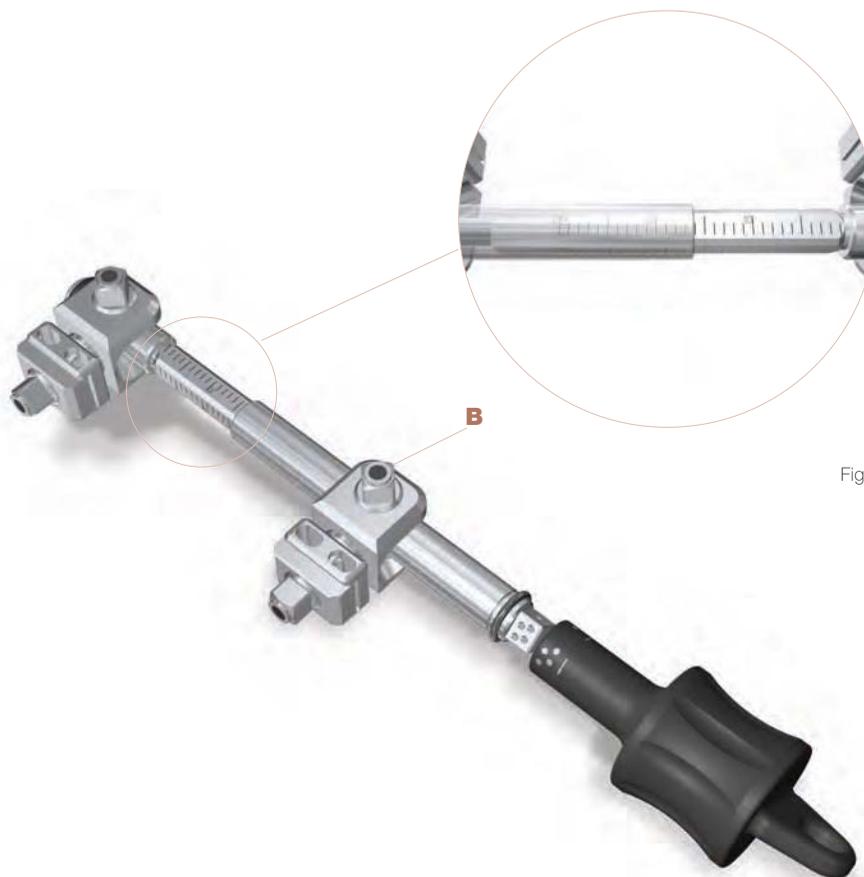


Figure 1

One full turn of the Lengthening Bolt creates 0.5 mm of lengthening. The bolt is marked with a grid to help the patient follow the daily lengthening regimen, as shown (Figure 2).

Suggested procedure for lengthening 1 mm/daily:

- **Morning:** turn two places on grid
- **Noon:** turn two places on grid
- **Dinner:** turn two places on grid
- **Bedtime:** turn two places on grid

Note:

The Thumbwheel should only be used with the Lengthening Bolt. **Do not use it to tighten the multi-pin clamps as it does not supply enough torque.**

The Thumbwheel helps the patient with his or her daily regimen. The grid on the Lengthening Bolt matches the markings on the Thumbwheel for an easy connection and correct rotation.

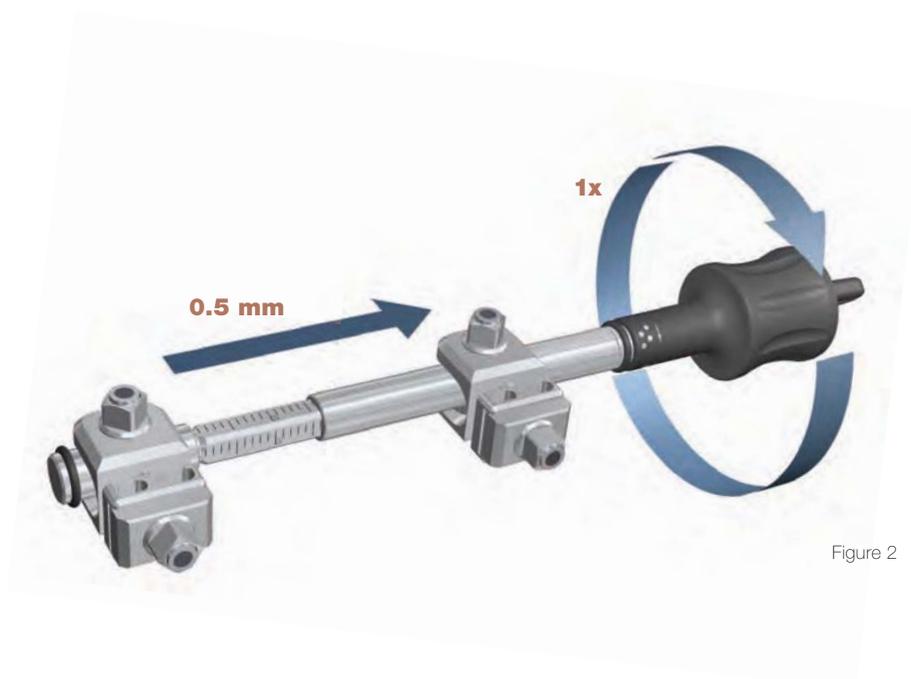


Figure 2

Operative Technique

Pin Insertion Guidelines

Two types of Apex® Half Pins are offered in the system: Blunt/Self-Tapping and Self-Drilling/Self-Tapping. Pre-drilling is necessary when using Blunt/Self-Tapping Half Pins. It is optional to pre-drill when using Self-Drilling/Self-Tapping Half Pins in dense cortical bone (Figure 3).

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

Blunt/Self-Tapping Half Pins are offered in 2.0 mm thread diameter only. Self-Drilling/Self-Tapping Half Pins are offered in 2.0 mm and 1.65 mm thread diameters. All Half Pins have a 2.0 mm shaft diameter.

A (mini) open insertion technique is recommended to avoid unnecessary damage to soft tissue and to ensure central, bicortical, pin placement. A Drill/Insertion Guide is provided in the system to facilitate this technique.

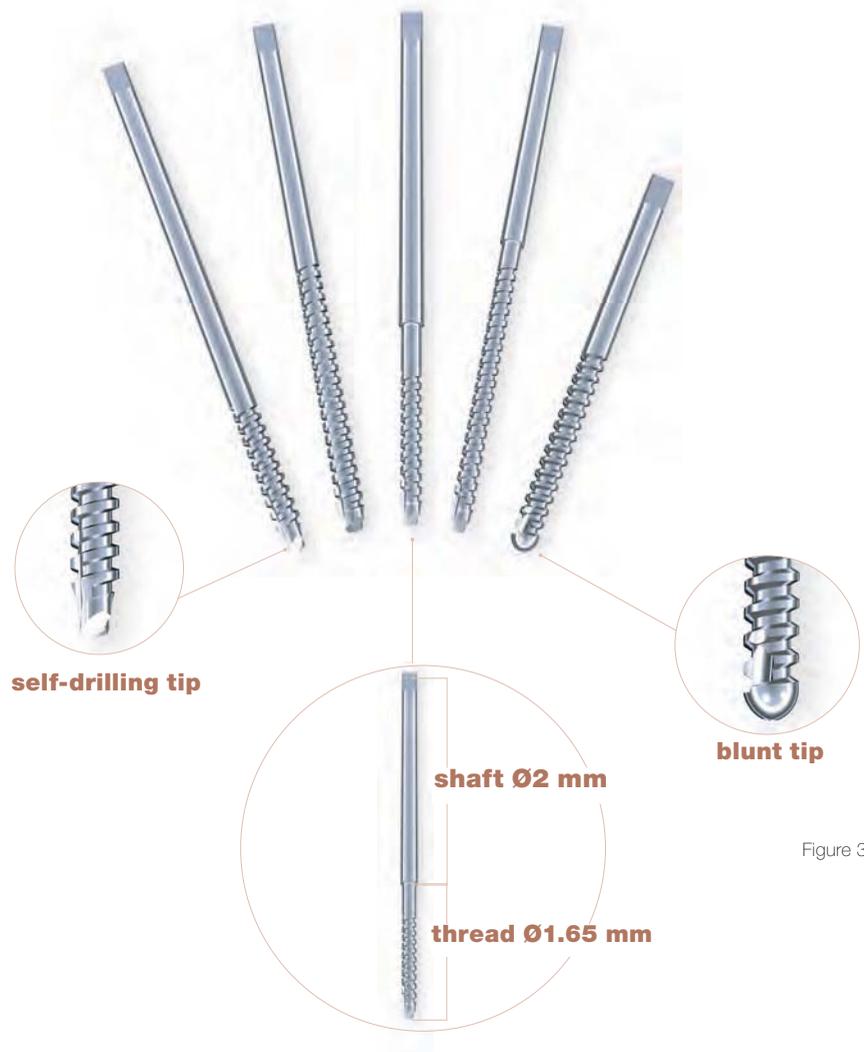


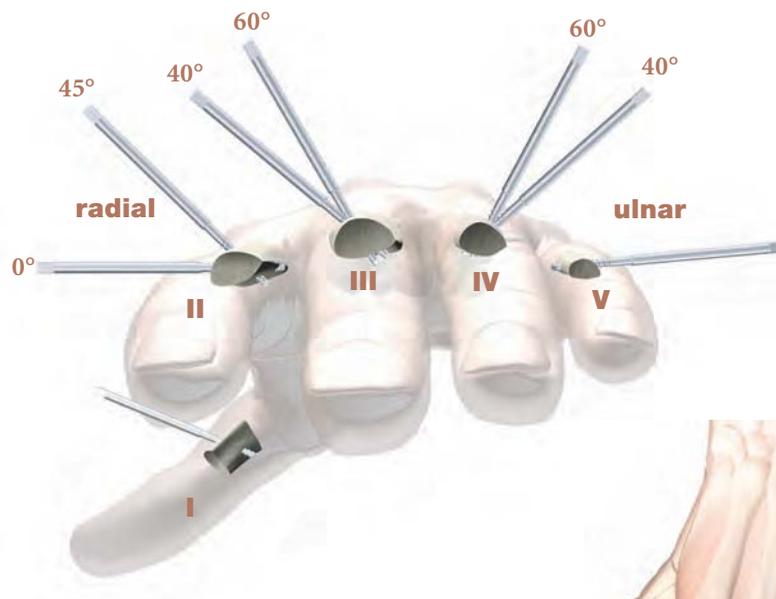
Figure 3

Operative Technique

Hand

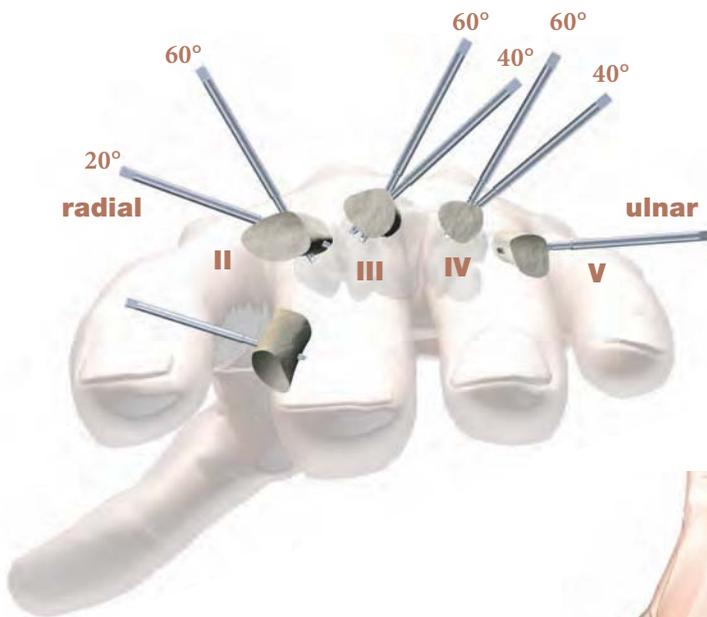
Placement in the Phalanges

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



Note:

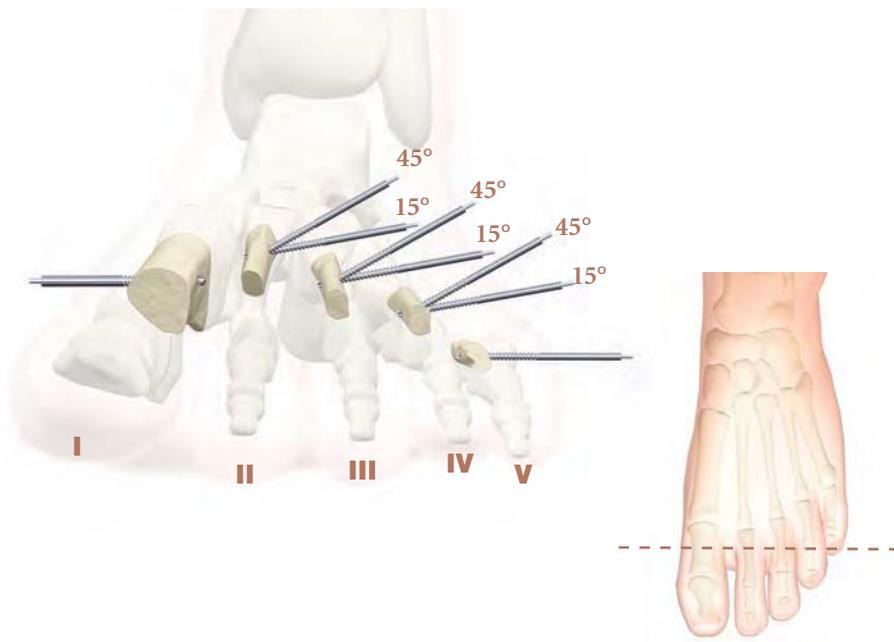
When inserting pins, ensure bicortical purchase.

Operative Technique

Foot

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.

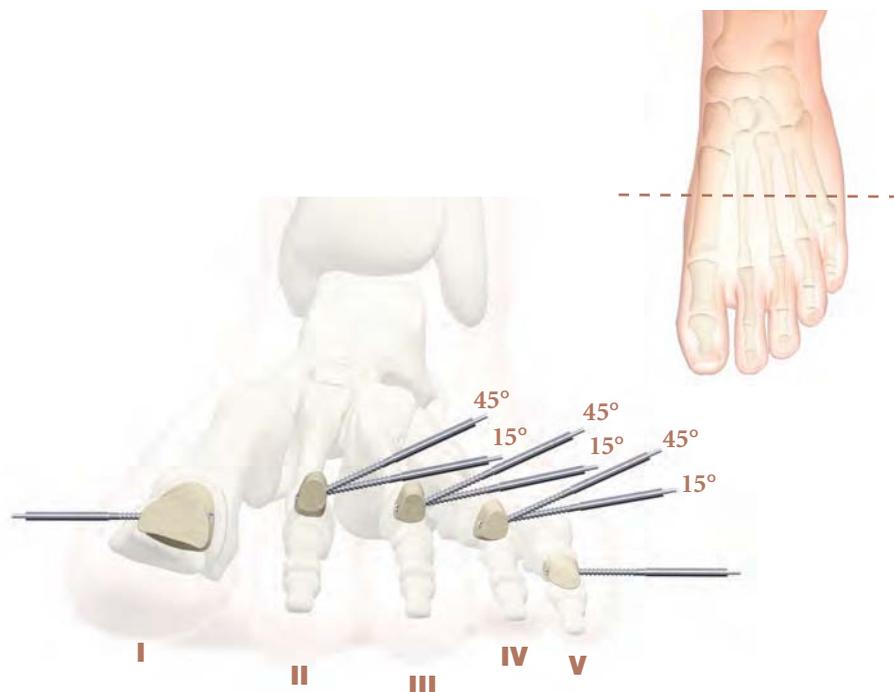


Note:

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

Placement in the Metatarsals

- 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.

Operative Technique

Lengthening of the 1st Metacarpal

Step 1

Create a single longitudinal incision that will allow pin placement at either end of the incision and central osteotomy of the bone to be lengthened. The periosteum is then sharply incised with a scalpel and carefully retracted to identify the boundaries and contour of the bone (Figure 4).

Note:

Preoperative flap coverage may be used if there is poor skin distally to ensure viable vascular skin.

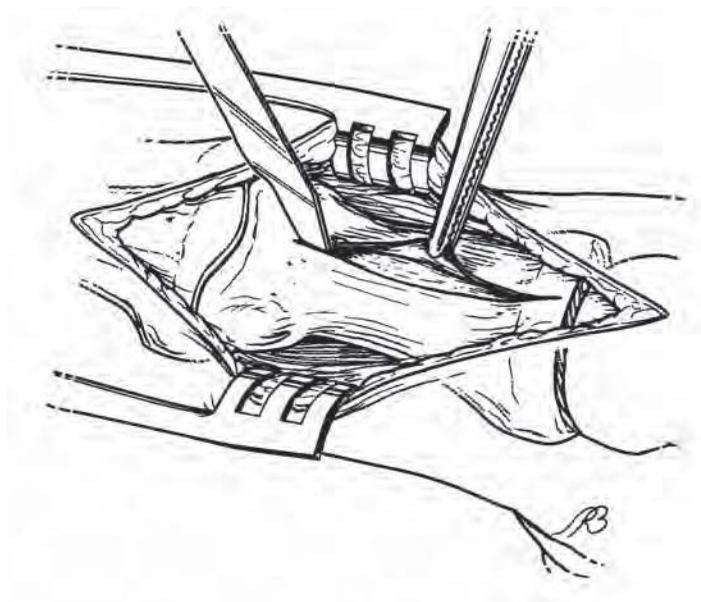


Figure 4

Step 2

Drill the first proximal hole at least 5 mm from the planned osteotomy site using the Drill/Pin Insertion Guide and the 1.5 mm 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 (Figure 5).

Pre-Drilling Tip: Insert one Drill Bit under power, using the Drill Guide, and leave it in place. A second Drill Bit is passed, again using the Drill Guide and the Multi-Pin Clamp as a guide, through two cortices of bone and removed. Next, an appropriate-sized Apex® Half Pin is inserted into the second drill hole and left in place, at which point the initial drill bit is removed and replaced with an Apex® Half Pin. This technique assists in finding the drill hole with small diameter (2 mm) Half Pins.¹



Figure 5

Manually insert the Half Pin (Blunt or Self-Drilling/Self-Tapping) using the 2 mm Pin Driver and Drill/Pin Insertion Guide (Figure 6).

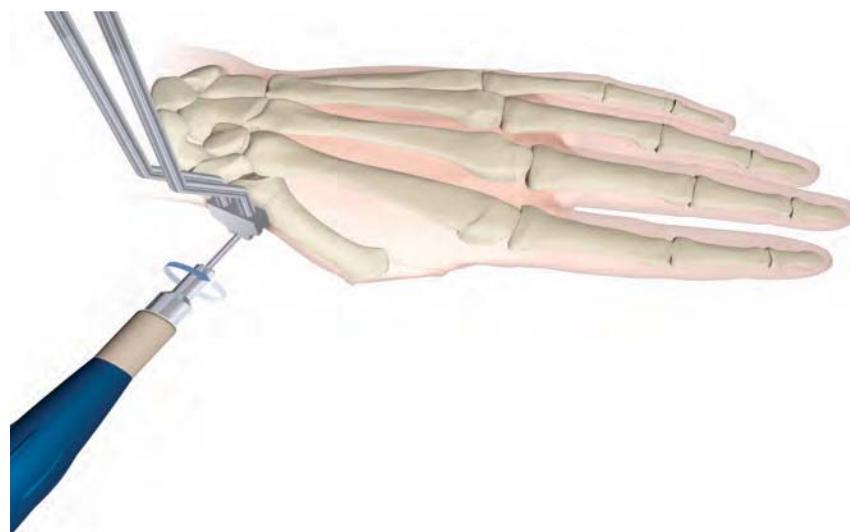


Figure 6

Operative Technique

Using the Multi-Pin Clamp of the Lengthener as a template, and the Drill/Pin Insertion Guide to protect soft tissue, manually insert the second 2 mm Half Pin through the Multi-Pin Clamp (Figure 7).

Insert the Apex® Half Pins on the distal side of the planned osteotomy following the steps above (Figure 8). Once the Half Pins are in place, the Multi-Pin Clamp and Lengthener are removed (Figure 9).

Step 3

Perform an osteotomy within the periosteal sleeve with either an osteotomy in adults or a blunted scalpel in younger children.² It is not recommended to use a power saw. Careful attention to detail should preserve the periosteum so it may be closed over the osteotomy site as this will aid regenerate bone formation (Figure 10).

Tip: Correct angular deformity with a closing wedge osteotomy.



Figure 7



Figure 8

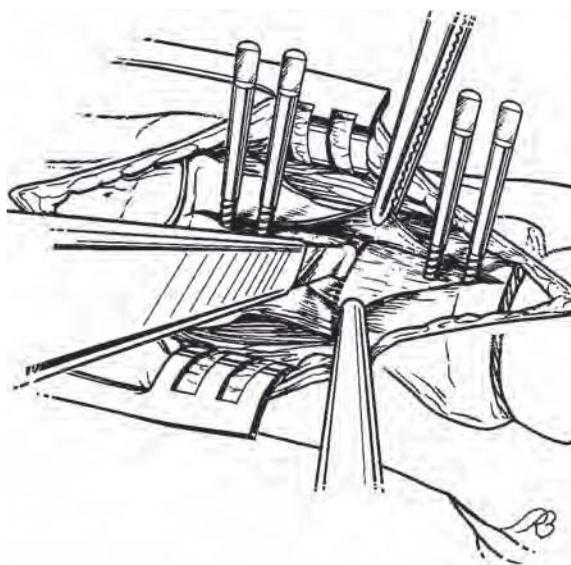


Figure 10



Figure 9

Operative Technique

Step 4

Before device assembly and after checking pin position, soft tissue closure is performed.

Step 5

Assemble the Multi-Pin Clamps and Lengthening Assembly over the pins, ensuring that the Lengthener is parallel to the long axis of the bone (Figure 11).

Tip: Placing a central K-Wire may prevent angular deviation, especially in the thumb.



Figure 11

Step 6

After proper alignment is made, tighten Bolts A and B on both clamps using the 4 mm Nut Wrench. The 4 mm Nut Wrench is designed to allow the proper torque needed to properly tighten Bolts A and B. Take care not to over-torque the bolts when tightening with a Spanner Wrench (Figure 12).

Step 7

The lengthening process commences from the fifth day after surgery for children and the seventh day for adults. Four daily increments of .25 mm each are generally performed for a total of 1 mm per day.

Radiographic evidence of consolidation of at least three cortices should be obtained before device removal.³ This may be detected on radiograph, or more recently through ultrasound. In general, fixation should be maintained for at least twice the original duration of lengthening in children and three times that duration in adults. For example, if 30 mm of length is obtained over 30 days, an additional 60 days in children and 90 days in adults will generally be needed before consolidation is complete and the bony architecture is stable enough to remove the Lengthener.

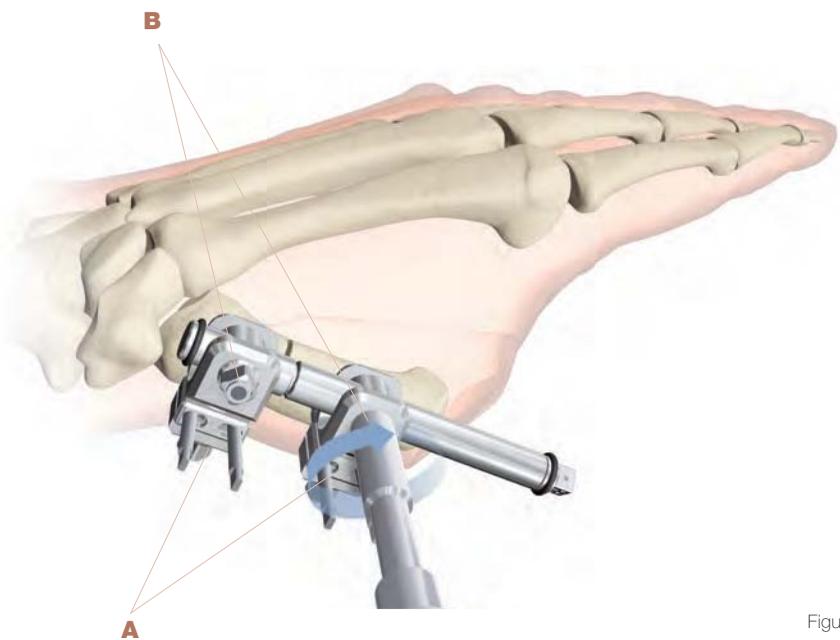


Figure 12

Operative Technique

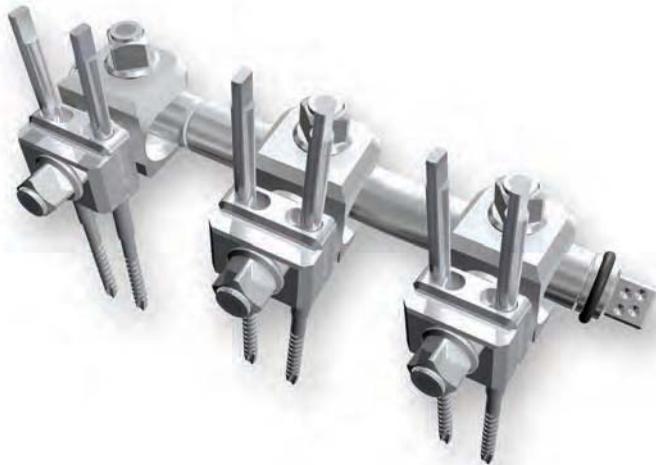
Lengthening Across the Metacarpophalangeal (MCP) Joint

Lengthening across the Metacarpophalangeal (MCP) Joint is also possible. Some degree of joint distraction is frequently seen, but this has been found to aid in the rapid return of functional motion and can avoid the problems of MCP subluxation if the joint capsule is lax proximally and the soft tissues tight distally.⁴



Additional Frame Options

A Periarticular Pin Clamp is also available and allows perpendicular pin placement. This is often useful for lengthening the first metacarpal or in short bone segments.



It is possible to add static stabilizing pins with an outrigger to unstable adjacent joints.⁵

Ordering Information - Implants

Hoffmann® II Micro™ System Couplings and Clamps

	Catalog No.	Description	Diameter mm
	4960-1-010	Rod-to-Rod Coupling*	3/3 mm
	4960-1-020	Pin-to-Rod Coupling*	1.5-2 mm/3 mm
	4960-1-060	Rod-to-Rod Coupling*	5 mm/3 mm
	4960-2-020	Multi-Pin Clamp*	
	4960-2-030	90° Multi-Pin Clamp*	
	4960-3-020	Micro™ Lengthener Multi-Pin Clamp	
	4960-3-025	Micro™ Lengthener Periarticular Pin Clamp	
	4960-3-015	Optional O-Ring for Micro™ Lengthener Tube	
	4960-3-000	Micro™ Lengthener Assembly	

*Not compatible with Micro™ Lengthener

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

Hoffmann® II Micro™ System Connecting Rods

	Catalog No.	Description	Diameter	Total Length
	5079-6-030	Carbon Connecting Rod	3 mm	30 mm
	5079-6-040	Carbon Connecting Rod	3 mm	40 mm
	5079-6-050	Carbon Connecting Rod	3 mm	50 mm
	5079-6-060	Carbon Connecting Rod	3 mm	60 mm
	5079-6-090	Carbon Connecting Rod	3 mm	90 mm
	5079-6-120	Carbon Connecting Rod	3 mm	120 mm
	5079-6-150	Carbon Connecting Rod	3 mm	150 mm
	5079-5-030	Stainless Steel Connecting Rod	3 mm	30 mm
	5079-5-040	Stainless Steel Connecting Rod	3 mm	40 mm
	5079-5-050	Stainless Steel Connecting Rod	3 mm	50 mm
	5079-5-060	Stainless Steel Connecting Rod	3 mm	60 mm
	5079-5-090	Stainless Steel Connecting Rod	3 mm	90 mm
	5079-5-120	Stainless Steel Connecting Rod	3 mm	120 mm
	5079-5-150	Stainless Steel Connecting Rod	3 mm	150 mm

Blunt Self-Tapping Apex® Half Pins

	Catalog No.	Description	Total Length	Thread Length
	5065-3-615	2 mm, Stainless Steel	36 mm	15 mm
	5065-4-520	2 mm, Stainless Steel	45 mm	20 mm
	5065-9-020	2 mm, Stainless Steel	60 mm	20 mm
	5065-9-015	2 mm, Stainless Steel	90 mm	15 mm

Self-Drilling/Self-Tapping Apex® Half Pins

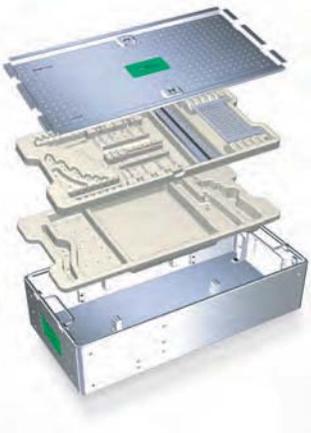
	Catalog No.	Description	Total Length	Thread Length
	5080-2-012	2 mm, Stainless Steel	45 mm	12 mm
	5080-2-020	2 mm, Stainless Steel	45 mm	20 mm
	5080-1-612	1.65 mm, Stainless Steel	45 mm	12 mm
	5080-1-620	1.65 mm, Stainless Steel	45 mm	20 mm

K-Wires

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

Ordering Information - Instruments

Standard Instruments

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

References:

1. **Seitz WH Jr**, Froimson AI: Digital Lengthening Using the Callotasis Technique. Orthopedics 8:129-138, 1995
2. **Seitz WH Jr**, Dobyns JH: Digital Lengthening with Emphasis on Distraction Osteogenesis in the Upper Limb. Hand Clinics 4:699-706, 1993
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5. **Seitz WH Jr**, Distraction Lengthening For Reconstruction Of Severe Hand Trauma. In: Weinzweig N and Weinzweig J eds. The Mutilated Hand. Philadelphia: Elsevier 2005
6. **Seitz WH Jr**, Distraction Treatment of the Hand. In Buck-Gramcko, D, Editor. Congenital Malformations of the Hand and Forearm. New York: Churchill Livingstone, 1998: 119-128

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