Foot and Ankle Technique Guide
Proximal Inter-Phalangeal (PIP) Fusion

Prepared in consultation with:
Phinit Phisitkul, MD
Department of Orthopedics and Rehabilitation
University of Iowa
Iowa City, IA
HAT-TRICK™
Lesser Toe Repair System

Surgical Technique

Smith & Nephew does not provide medical advice and recommends that surgeons exercise their own professional judgment when determining a patient's course of treatment. This guide is presented for educational purposes only.

HAT-TRICK Orthopaedic Advisory Team
Ned Amendola, MD
Florian Nickisch, MD
Phinit Phisitkul, MD
Charles Saltzman, MD

HAT-TRICK Podiatric Advisory Team
Emily Cook, DPM
Jeremy Cook, DPM
David Edwards, DPM
Mickey Stapp, DPM

Table of Contents

Introduction ........................................................................................................... 3
Position the Patient ............................................................................................... 4
Proximal Inter-Phalangeal (PIP) Fusion Technique ............................................. 4
Exposure and joint preparation ............................................................................ 4
Prepare the pilot holes at the insertion sites ......................................................... 5
Drill the pilot holes .............................................................................................. 6
Tap the middle phalanx insertion site ................................................................. 7
Tap the proximal phalanx .................................................................................... 8
Insert the middle phalanx implant ..................................................................... 9
Insert the proximal phalanx implant .................................................................. 11
Implant removal .................................................................................................. 14
Postoperative care ............................................................................................... 14

Ordering Information ......................................................................................... 15

Indications for Use
The Smith & Nephew HAT-TRICK PIP Fusion Implant Pack is indicated for the fixation of osteotomies and reconstruction of the lesser toes following correction procedures for hammer toe, claw toe, and mallet toe.

Contraindications
• Known hypersensitivity to the implant material. Where material sensitivity is suspected, appropriate tests should be performed and sensitivity ruled out prior to implantation.
• Surgical procedures other than those listed in the “Indications for Use” section.
• Pathological conditions of bone, such as cystic changes or severe osteopenia or osteoporosis, which would compromise secure implant fixation.
• Psychologically compromised patient.
• Physical conditions which would eliminate, or tend to eliminate, adequate construct support or impair healing, e.g., limitation of blood supply, infection, etc.
• Growing patients with open epiphyses.
Introduction

This technique provides a complete description of proximal inter-phalangeal (PIP) fusion using the Smith & Nephew HAT-TRICK™ PIP Fusion System. The system consists of single-use disposable implant packs containing fusion implants of various sizes and a sterilization tray with reusable instruments.

This system may be used in conjunction with the complete HAT-TRICK Lesser Toe Repair System, which also includes the HAT-TRICK MTP Joint Repair System (Bilateral and Unilateral) and the HAT-TRICK Metatarsal Osteotomy Guide.

Standard K-wire treatment is associated with a number of complications, including swelling and pain, pin-tract infection, delayed union, delayed healing of the arthrodesis site due to lack of compression, motion and rotational concerns, and pain upon removal.

Benefits of the HAT-TRICK PIP Fusion System include:

- **PEEK construction**: The implant is made of PEEK (polyetheretherketone), which requires no special handling, including refrigeration or heating.
- **Radiolucent**: The implant is radiolucent for easy viewing on an X-ray.
- **Controlled compression**: Surgeon can dial in the required compression.
- **Easy removal**: Allows straightforward removal of the implant with a 0.5mm bone resection (no window required).

**Note:** 2.7mm x 15mm Proximal Phalanx Implant and 4mm x 9mm Middle Phalanx Implant shown.

Information regarding the instruments used in this procedure can be found in the "Ordering Information" section at the end of this document.
Position the Patient

1. Place the patient in the supine position with the foot at the end of the bed.
2. Apply an ankle tourniquet if necessary.

Proximal Inter-Phalangeal (PIP) Fusion Technique

Prior to performing this technique, consult the Instructions for Use documentation provided with the devices – including indications, contraindications, warnings, cautions and instructions. Concomitant procedures are often required to fully correct lesser-toe deformities; this decision is left to the discretion of the surgeon.

Exposure and joint preparation

1. Make either a ~3cm longitudinal dorsal incision or 2cm transverse converging semi-elliptical incision centered over the PIP joint per surgeon preference. Remove the entire tissue wedge, down to the extensor tendon with the transverse approach (Figure 1).

![Figure 1: Incision](image)

2. Plantarflex the toe 90°. Expose the proximal phalanx head by transversely transecting the PIPJ capsule along the inferior phalangeal head.

3. Sharply transect the collateral ligaments medially and laterally along the proximal phalanx head (Figure 2). Perform a dorsal extensor tenotomy at the level of the proximal phalangeal head, leaving adequate tendon distally for closure.

![Figure 2](image)
Prepare the pilot holes at the insertion sites

1. Use a microsagittal saw to resect the distal condyles of the proximal phalanx. This osteotomy should be perpendicular to the proximal phalanx shaft if using the 0° implant and oriented 10° plantarly if using the 10° implant. The amount of bone resection is left to the discretion of the surgeon but is influenced by many factors including the degree of contracture and the relationship to the neighboring toes (Figure 3).

2. To prepare the middle phalanx, remove only the cartilage while still preserving the subchondral plate in order to optimize implant purchase in the bone.

   **Note:** The saw cuts to the proximal and middle phalanges must be parallel and flat to ensure good bony apposition. Reapproximate the toe to ensure there is good bony apposition and alignment. Reciprocally plane if needed before proceeding (Figure 4).
Drill the pilot holes

1. Use a 1.6mm Drill Tip Wire (REF 71101502) to drill a pilot hole along the central axis of the medullary canal of the middle phalanx (Figure 5). Start this drill hole just above the middle phalanx central axis, leaving at least 3mm between the dorsal cortex and drill hole. This minimizes the chances of creating a dorsally prominent middle phalanx due to differences in the thickness of the proximal and middle phalanges. Drill to a sufficient depth to accommodate the length of the implant.

Figure 5

2. Using a 1.6mm drill tip wire (REF 71101502), drill a pilot hole along the central axis of the medullary canal of the proximal phalanx. Ensure that the 1.6mm pilot hole drilled in the proximal phalanx is parallel to the longitudinal axis of the proximal phalanx. Drill beyond the isthmus of the proximal phalanx to avoid stress risers, and drill to an adequate depth to accommodate the length of the implant (Figure 6).

Figure 6
Tap the middle phalanx

1. Assemble the HAT-TRICK® Modular Handle (REF 72204337) and HAT-TRICK PIP 4.0mm Middle Phalanx Tap (REF 72204362).

   Note: For larger-boned or osteopenic patients, a 5mm middle phalanx implant and tap (REF 72204598) are available.

   Note: In cases where the middle phalanx is too small for the 4.0mm tap, the proximal implant can be used as a one-piece construct. To prepare the site for a one-piece implant, predrill the middle phalanx with the 2.3mm drill (REF 72204599) until the proximal end of the laser mark band on the drill is flush with the bone. Then proceed to the “Tap the proximal phalanx implant” step on page 8.

2. Tap the middle phalanx until the proximal end of the laser mark band on the tap is flush with the bone (Figures 7 and 8).

   Note: Back out the tap often (for example, ¼ turn for every full turn forward) during the tapping process to clear away the bone debris.

3. Record the largest tap size used.
Tap the proximal phalanx

1. Assemble the HAT-TRICK® Modular Handle (REF 72204337) and the HAT-TRICK 2.7mm Proximal Phalanx Tap (REF 72204358).

2. Tap the proximal phalanx until the proximal end of the laser mark band on the tap is flush with the cut surface of the bone (Figures 9 and 10).

   **Note:** Back out the tap often (for example, ¼ turn for every full turn forward) during the tapping process to clear away the bone debris.

3. Continue to tap with progressively larger size taps (3.2mm, REF 72204359; 3.7mm, REF 72204360; and 4.2mm REF 72204361) until the resistance from the cortical bone on the isthmus of the proximal phalanx is detected.

   **Note:** Be careful not to fracture the cortex of the phalanx. Proceed slowly and look for signs of stress riser along the cortical surface.

4. Record the largest tap size used.
Insert the middle phalanx implant

1. Select the implant-size pack based on the largest tap size used in the proximal and middle phalanges.

   **Note:** The proximal phalanx implant is available in two angles: 0° and 10°. Use the appropriate implant in order to achieve the desired alignment as determined by the resection in Step 1 of the “Prepare the pilot holes” section of this technique.

   **Note:** If using the PIP Fusion Implant as a one-piece construct, do not insert the middle phalanx component.

2. Assemble the HAT-TRICK™ Modular Handle and the HAT-TRICK PIP Middle Phalanx Driver.

3. Attach the middle phalanx implant to the driver.

4. Insert the middle phalanx implant into the middle phalanx using a two-finger technique until the implant is flush with or slightly countersunk in the bone (Figures 11–13).

   **Note:** Do not force the implant to be fully seated. If the implant does not seat using a two-finger technique, remove the implant with the driver and re-tap the hole. Proceed slowly and look for signs of stress riser along the cortical surface.

---

**Figure 11:** Assemble the middle phalanx implant to the driver.

**Figure 12:** Insert the middle phalanx implant.

**Figure 13:** Implant inserted flush with or slightly countersunk in the bone.
Insert the proximal phalanx implant

1. Assemble the HAT-TRICK® Modular Handle [REF 72204337] to the appropriate angle-specific HAT-TRICK Driver (0° Driver, REF 72204355; 10° Driver, REF 72204356) for proximal phalanx implants (Figure 14).

Figure 14: Attach the proximal phalanx implant to the driver.
2. Insert the proximal phalanx implant into the proximal phalanx using a two-finger technique until the face of the driver is flush with the bone. (Figures 15 and 16).

Note: For a 10° implant, utilize the laser mark on the 10° driver shaft to achieve the desired orientation.

Note: Do not force the implant to be fully seated. If the implant will not seat using a two-finger technique, remove the implant with the driver and re-tap the hole. Proceed slowly and look for signs of stress riser along the cortical surface.

Figure 15: Insert the proximal phalanx implant.

Figure 16: Insert the implant until the driver face is flush with the bone.
3. Connect and compress the proximal and middle phalanx implants to complete the fusion (Figures 17 and 18).

**Note:** If using the Proximal Phalanx Implant as a one-piece construct, align the 2.3mm hole in the middle phalanx with the barbed post of the proximal phalanx implant, and compress to complete the fusion.
Implant removal

In the unlikely event that the PEEK implant must be removed, use a power saw to cut through the post that connects the implant components at the osteotomy site. Loosen each component and retrieve it. If the components are rigidly fixed, core drill, and then utilize an extractor with reverse threads. Alternatively, a high-speed burr can be used to remove any remaining part of the implant.

Postoperative care*

As with any arthrodesis procedure, a bony fusion is the long-term means of bearing load. The PIP Fusion Implant is designed to hold the bones in apposition to one another during the healing process. Please follow the postoperative instructions below carefully as the PEEK fusion implant is not intended for use under tension or load-bearing conditions.

- 6 weeks: In a postop shoe, crutches, and partial weight bearing as tolerated on heel only.

- 6 to 12 weeks: No postop shoe, weight bear as tolerated with activities limited to walking only.

- >12 weeks: Return to aerobic activities (bike, pool, hiking). No jumping, turning, twisting or high-impact sports.

- >16 weeks: Resume athletic activity if no pain.

* The views and opinions expressed for postoperative care are solely those of the surgeon(s) and do not reflect the views of Smith & Nephew, Inc. In no event shall Smith & Nephew, Inc. be liable for any damages whatsoever (including, without limitation, damages for loss of business profits, business interruption, loss of business information, or other pecuniary loss) arising out of the use of or inability to use the expressed views.
HAT-TRICK™ PIP Fusion System Components

<table>
<thead>
<tr>
<th>Cat. No</th>
<th>Description</th>
<th>Qty</th>
</tr>
</thead>
<tbody>
<tr>
<td>72204303</td>
<td>HAT-TRICK PIP Implant Set</td>
<td></td>
</tr>
<tr>
<td>72204366</td>
<td>PIP Fusion Implant Pack, Proximal Phalanx 2.7mm x 15mm + Middle Phalanx 4.0mm x 9mm</td>
<td>1</td>
</tr>
<tr>
<td>72204367</td>
<td>PIP Fusion Implant Pack, Proximal Phalanx 3.2mm x 15mm + Middle Phalanx 4.0mm x 9mm</td>
<td>1</td>
</tr>
<tr>
<td>72204368</td>
<td>PIP Fusion Implant Pack, Proximal Phalanx 3.7mm x 15mm + Middle Phalanx 4.0mm x 9mm</td>
<td>1</td>
</tr>
<tr>
<td>72204369</td>
<td>PIP Fusion Implant Pack, Proximal Phalanx 4.2mm x 15mm + Middle Phalanx 4.0mm x 9mm</td>
<td>1</td>
</tr>
<tr>
<td>72204370</td>
<td>PIP Fusion Implant Pack, Proximal Phalanx 2.7mm x 15mm, 10° + Middle Phalanx 4.0mm x 9mm</td>
<td>1</td>
</tr>
<tr>
<td>72204371</td>
<td>PIP Fusion Implant Pack, Proximal Phalanx 3.2mm x 15mm, 10° + Middle Phalanx 4.0mm x 9mm</td>
<td>1</td>
</tr>
<tr>
<td>72204372</td>
<td>PIP Fusion Implant Pack, Proximal Phalanx 3.7mm x 15mm, 10° + Middle Phalanx 4.0mm x 9mm</td>
<td>1</td>
</tr>
<tr>
<td>72204373</td>
<td>PIP Fusion Implant Pack, Proximal Phalanx 4.2mm x 15mm, 10° + Middle Phalanx 4.0mm x 9mm</td>
<td>1</td>
</tr>
<tr>
<td>72204374</td>
<td>PIP Fusion Implant Pack, Proximal Phalanx 3.7mm x 15mm, 10° + Middle Phalanx 5.0mm x 9mm</td>
<td>1</td>
</tr>
<tr>
<td>72204375</td>
<td>PIP Fusion Implant Pack, Proximal Phalanx 4.2mm x 15mm, 10° + Middle Phalanx 5.0mm x 9mm</td>
<td>1</td>
</tr>
<tr>
<td>72204376</td>
<td>PIP Fusion Implant Pack, Proximal Phalanx 3.7mm x 15mm, 10° + Middle Phalanx 5.0mm x 9mm</td>
<td>1</td>
</tr>
<tr>
<td>72204377</td>
<td>PIP Fusion Implant Pack, Proximal Phalanx 4.2mm x 15mm, 10° + Middle Phalanx 5.0mm x 9mm</td>
<td>1</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Cat. No</th>
<th>Description</th>
<th>Qty</th>
</tr>
</thead>
<tbody>
<tr>
<td>72204594</td>
<td>HAT-TRICK PIP Fusion Instrument Set</td>
<td></td>
</tr>
<tr>
<td>72204355</td>
<td>HAT-TRICK Driver for PIP Proximal Phalanx, 0°</td>
<td>1</td>
</tr>
<tr>
<td>72204356</td>
<td>HAT-TRICK Driver for PIP Proximal Phalanx, 10°</td>
<td>1</td>
</tr>
<tr>
<td>72204357</td>
<td>HAT-TRICK Driver for PIP Middle Phalanx</td>
<td>1</td>
</tr>
<tr>
<td>72204358</td>
<td>HAT-TRICK Modular Handle 2</td>
<td></td>
</tr>
<tr>
<td>72204359</td>
<td>HAT-TRICK PIP 2.7mm Proximal Phalanx Tap</td>
<td>1</td>
</tr>
<tr>
<td>72204360</td>
<td>HAT-TRICK PIP 3.2mm Proximal Phalanx Tap</td>
<td>1</td>
</tr>
<tr>
<td>72204361</td>
<td>HAT-TRICK PIP 3.7mm Proximal Phalanx Tap</td>
<td>1</td>
</tr>
<tr>
<td>72204362</td>
<td>HAT-TRICK PIP 4.2mm Proximal Phalanx Tap</td>
<td>1</td>
</tr>
<tr>
<td>72204598</td>
<td>HAT-TRICK PIP 4.0mm Middle Phalanx Tap</td>
<td>1</td>
</tr>
<tr>
<td>72204599</td>
<td>HAT-TRICK PIP 5.0mm Middle Phalanx Tap</td>
<td>1</td>
</tr>
<tr>
<td>72204386</td>
<td>HAT-TRICK PIP Fusion Instrument Tray</td>
<td>1</td>
</tr>
<tr>
<td>71101502</td>
<td>1.6mm Drill Tip Wire</td>
<td>6</td>
</tr>
</tbody>
</table>

ORDERING INFORMATION

To order the items used in this technique, call +1 800 821 5700 in the US or contact an authorized Smith & Nephew representative.

Prior to performing this technique or utilizing any product referenced herein, please conduct a thorough review of each product’s indications, contraindications, warnings, precautions and instructions as detailed in the Instructions for Use provided with the individual components.
Notes
References