SUSTAINED COMPRESSION WITHOUT EXTERNAL FIXATION?

NAILED IT.
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TTC FUSION SYSTEM

DYNANAIL
TTC FUSION SYSTEM
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Tibiotalocalcaneal (TTC) fusion surgery is performed to relieve pain and correct severe foot deformity by achieving solid bony union, often the only remaining treatment option before limb amputation.

According to the Association for the Study of Internal Fixation principles, compression across a fusion site is important for promoting bone healing and achieving a solid union. Compression also provides stability by maximizing bone-to-bone contact and limiting micro-motion. External fixation frames allow for compression to be applied and adjusted during the course of treatment, but these systems are surgically complex, associated with poor patient compliance, and have a relatively high rate of pin tract infections. Intramedullary (IM) nails are a rigid, internal fixation option and are less invasive and technically demanding to implant than external frames. Traditional IM nails apply external compression at the time of surgery, but compression is lost once the instrumentation is removed. Third-generation IM nails contain an internal compression mechanism that helps maintain compression after instrument removal. However, these nail systems lose compression over time post-surgery due to bone resorption and joint settling.¹

The DynaNail TTC Fusion System is the only fusion approach that offers the compression-sustaining performance of an external fixator inside an intramedullary nail. Due to its proprietary internal NiTiNOL element, DynaNail provides sustained, active compression to the bones maintaining them in close apposition while also providing immediate dynamization. After implanting DynaNail, the Compressive Element is stretched 6 mm and fixed in the stretched position with two screws (one posterior-anterior and one lateral-medial) in the calcaneus allowing for 6 mm of post-operative compression. External manual compression can then be applied for an additional 6 mm of adjustment. Two medial-lateral screws are then inserted through the proximal portion of the nail body across the tibia to maintain compression and provide additional stability. Post-surgery once the Targeting Frame is removed, the Compressive Element will hold its stretched activated position until any bone resorption and/or joint settling occurs, whereby the Element will automatically recover its stretched length, maintaining compression across the joints.¹

The DynaNail TTC Fusion System is available in different diameters and lengths to accommodate for varying patient anatomies. The Compressive Element is housed inside a rigid outer titanium body with 7 mm End Cap. The system also features a rigid, radiolucent carbon fiber-filled polyether ether ketone (PEEK) Targeting Frame that is used to precisely position the Nail Implant across the joints, stretch the Compressive Element and then accurately drill and place the screws. Housed in a single sterilization tray, the Frame and accompanying color-coded instrumentation provides the surgeon with a simple, reliable surgical approach.

The DynaNail TTC Fusion System maintains active compression across the joints using its proprietary internal NiTiNOL Compressive Element that automatically responds to changes in loading due to bone resorption or settling. The stretching and unloading of the Compressive Element can be visualized on fluoroscopy via translation of the screw holes in the Sliding Element through the slot in the Outer Body.

### Out of the Package
The Compressive Element is in its unstretched position with the calcaneal screw holes in the Sliding Element positioned proximal in the Nail Body slot.

### During Surgery
The Compressive Element is stretched using the Targeting Frame causing the calcaneal screw holes to shift distally in the Nail Body slot, a distance that corresponds to the amount of desired compression. While the DynaNail Frame holds the Compressive Element in the stretched position, screws are placed in the calcaneus and tibia.

### Immediate Post-Surgery
Once the Targeting Frame is removed, the Compressive Element is now in its stretched activated position with the calcaneal screws oriented in the distal end of the slot and the Sliding Element extending plantarly from the Nail Body.

### Post-Operatively
As the Compressive Element unloads (i.e., recovers its stretched length) in response to bone resorption or settling, the calcaneal screws will progressively shift proximally. The amount of unloading can be measured on radiograph by the position of the screws. The Compressive Element has completely unloaded back to its resting state when the calcaneal screws are at the proximal end of the slot.
**DynaFrame™ CF Targeting System**

Made of high-strength, rigid carbon fiber polyether ether ketone (PEEK) to provide accurate drill targeting and placement of screws along with excellent visibility under fluoroscopy.

**Frame Operational Features**

1. **Cam Lever**: Pull down to stretch the Compressive Element
2. **Stop Wheel**: Turn to set the desired length of Compressive Element stretch (0 - 6 mm)
3. **Manual Compression Knob**: Rotate clockwise to apply external compression
4. **Deployment Base**: Use laser marks to determine amount of manual compression applied (0 - 6 mm)
5. **Compression Tubes**: Contain slots to aid in targeting medial-lateral screws
6. **PA Targeting Arm**: Attach to Compression Tubes to provide accurate placement of Headless PA Screw
7. **Outer Tube Brace**: Provides additional rigidity to the Targeting Frame
8. **Step Numbers**: Indicates order of steps involving the Targeting Frame

**ACCESSORY INSTRUMENTATION**

**Nail Implant**

- **DYNANAIL XL**
  - Distal Diameter: 12.5 mm
  - Proximal Diameter: 10 mm
  - Distal Length: 41 mm
  - 12 x 220 mm

**Technical Specifications**

- **Distal Diameter**: 12.5 mm
- **Proximal Diameter**: 10 mm
- **Distal Length**: 41 mm
- **Total Length**: 6.85 mm
- **Head Length**: 2.5 mm
- **End Cap**
  - Headless PA Screws: Length 65 mm - 110 mm available in 5 mm increments
  - 3.5 mm Hex Head
- **Screws**
  - 20 - 30.5 mm
  - Variance with length
  - Major Diameter: 7 mm
  - Minor Diameter: 5 mm
  - Diameter: 5 mm
  - Length: 65 mm - 110 mm
  - Headed Cortical Screws: Length 20 mm - 60 mm available in 5 mm increments
  - 3.5 mm Hex Head

- **Sliding Element**: Slotted screw hole moves 6 mm during stretching and unloading of Compressive Element

- **Apply up to 6 mm of Manual Compression**
The DynaFrame™ CF Targeting System is made of high-strength, rigid carbon fiber polyether ether ketone (PEEK) to provide accurate drill targeting and placement of screws along with excellent visibility under fluoroscopy.

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**END CAP**
- Total Length: 6.85 mm
- Head Length: 2.5 mm

**SCREWS**

**Headless PA Screws**
- Length: 65 mm - 110 mm available in 5 mm increments
- 3.5 mm Hex Head

**Headed Cortical Screws**
- Length: 20 mm - 60 mm available in 5 mm increments
- 3.5 mm Hex Head

**ACCESSORY INSTRUMENTATION**

The DynaFrame™ CF Targeting System is made of high-strength, rigid carbon fiber polyether ether ketone (PEEK) to provide accurate drill targeting and placement of screws along with excellent visibility under fluoroscopy.
Instrument | Part No. | Qty | Instrument | Part No. | Qty
---|---|---|---|---|---
1. Anvil Attachment | 2200-02-0000 | 1 | 18. 2.0 mm Steinmann Pin | 2200-19-0031 | 5
2. 3 mm Hex Driver, T-Handle | 2200-13-0030 | 1 | 19. Trocar Tipped Guidewire | 2200-18-4031 | 2
3. 9.5 mm Protection Sleeve | 2200-04-0095 | 1 | 20. Bead Tipped Guidewire | 2200-18-5031 | 2
4. 3.3 mm Protection Sleeve | 2200-04-0033 | 1 | 21. Screw Depth Gauge | 2200-10-0000 | 1
5. M6 Connection Screw | 2200-03-0162 | 2 | 22. 5 mm Drill | 2200-09-0050 | 2
6. Trocar Obturator | 2200-15-0000 | 2 | 23. 4 mm Drill | 2200-09-0040 | 3
7. 5 mm Drill Guide | 2200-08-0050 | 2 | 24. 14 mm Protection Sleeve | 2200-04-0140 | 1
8. 4 mm Drill Guide | 2200-08-0040 | 4 | 25. 5 mm Hex Driver Shaft | 2200-12-0050 | 1
9. 8 mm Guide Sleeve | 2200-08-0080 | 4 | 26. 3.5 mm Hex Driver Shaft | 2200-12-0035 | 2
10. 10 mm Reamer Head | 2201-06-0100 | 1 | 27. 9 mm Cannulated Drill | 2200-05-0090 | 1
11. 10.5 mm Reamer Head | 2201-06-0105 | 1 | 28. 7 mm Cannulated Drill | 2200-05-0070 | 1
12. 11 mm Reamer Head | 2201-06-0110 | 1 | 29. Reamer Shaft | 2200-23-0001 | 1
13. 11.5 mm Reamer Head | 2201-06-0115 | 1 | 30. Targeting Frame | 2200-29-0000 | 1
14. 12 mm Reamer Head | 2201-06-0120 | 1 | 31. Blue-Handle Ratchet Driver | 2200-11-0001 | 1
15. 12.5 mm Reamer Head | 2201-06-0125 | 1 | 32. Removal Tool | 2200-14-0000 | 1
16. 13 mm Reamer Head | 2201-06-0130 | 1 | 33. Handwheel Wrench | 2200-16-0000 | 1
17. 13.5 mm Reamer Head | 2201-06-0135 | 1

Note: Additional removal tools available upon request.
The DynaNail TTC Fusion System is indicated for use in tibiotalocalcaneal (TTC) fusion procedures to treat the following conditions:

- Post-traumatic and degenerative arthritis
- Post-traumatic or primary arthrosis involving both ankle and subtalar joints
- Revision after failed ankle arthrodesis with subtalar involvement
- Failed total ankle arthroplasty
- Non-union ankle arthrodesis
- Rheumatoid hindfoot
- Absent Talus (requiring tibiocalcaneal arthrodesis)
- Avascular necrosis of the talus
- Neuroarthropathy or neuropathic ankle deformity
- Neuromuscular disease and severe deformity
- Osteoarthritis
- Charcot Foot
- Previously infected arthrosis with confirmed eradication of infection

**Contraindications**

- Patients with an active local or systemic infection
- Patients with an active soft tissue infection or osteomyelitis of foot and ankle
- Patients with severe peripheral vascular disease
- Patients with an obliterated medullary canal or other conditions that tend to retard healing such as blood supply limitations or previous infections
- Patients with an insufficient plantar pad
- Skeletally immature patients where the implant would cross open epiphyseal plates
- Patients having an intact asymptomatic subtalar joint
- Patients with significant tibial malalignment (>10 degrees in either sagittal or coronal plane)
- Patients with a dysvascular limb
- Patients with severe longitudinal deformity
- Patients with an insufficient quantity or quality of bone to permit fusion of the joints or stabilization of the arthrodesis
- Patients with conditions that restrict his or her ability or willingness to follow postoperative instructions during the healing process
- Patients with foreign body sensitivity, suspected or documented metal allergy or intolerance. Where material sensitivity is suspected, appropriate tests should be conducted and sensitivity ruled out prior to implantation
The following is a general overview of the DynaNail Surgical Technique intended to be used as an easy reference. A more detailed surgical technique including technical tips and pearls is described in the following pages.

Numbers in bold correspond to the numbers marked on the frame and are intended to be used as a guide for the order of steps to be taken with the DynaFrame Targeting System.

1. Assemble Targeting Frame
2. Insert Guidewire into tibial canal
3. Drill entry tunnel with 7 mm and 9 mm Drills
4. Ream to appropriate size using Reamer Shaft and Reamer Heads
5. Load Nail Implant onto Targeting Frame
6. Insert Nail Implant into reamed tibial canal
7. Stretch the Compressive Element by pulling down on Lever [1]
8. Set the amount of compression by turning Stop Wheel [2]
9. Return lever by pulling up when finished [3]
10. Attach Outer Tube Brace and PA Attachment
11. Drill into the calcaneus and insert P-A Headless Screw [4]
12. Drill into the calcaneus and insert L-M Cortical Screw [5]
15. (Optional) Insert most proximal tibial Cortical Screw in DynaNail XL Implants.
   Drill and insert proximal tibial Cortical Screw into proximal interlocking screw hole [8]
16. Insert distal tibial Cortical Screw [9]
17. Release Nail Implant from the Targeting Frame
18. Replace End Cap and close incisions
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16. Insert distal tibial Cortical Screw [9]
17. Release Nail Implant from the Targeting Frame
18. Replace End Cap and close incisions
Patient Positioning
Place the patient in the supine or pseudo-lateral position with the foot at the terminal end of the table. Clear visualization to the plantar aspect of the foot is critical. Be sure to prep and drape above the knee to be able to assess limb rotation. If unaffected, assess contralateral limb for rotational alignment.

TECH TIP

• A trauma triangle with the apex padded or cushioned may be placed under the ankle for ease of drilling and placing screws.

Joint Preparation
Instruments Used:
1. Steinmann Pin (18)*
2. 2.5 mm Fenestration Drill

A range of surgical approaches and incisions may be utilized to access the tibiotalar and subtalar joint. The surgical approach chosen for joint prep and alignment is dependent upon factors such as the local anatomy, type of deformity, and surgeon preference.

Adequate joint preparation and alignment is a critical step for achieving a successful fusion. Denude any remaining cartilaginous surface, paying attention to any angular deformities in the coronal and talocalcaneal joints. If any significant bone gaps are noted, they can be filled with either bone autograft or allograft per surgeon preference. Continue joint preparation until good bone-to-bone apposition is achieved at the talocalcaneal and tibiotalar joints. Meticulous attention should be paid for visual evidence of viable bone on each apposing surface. If in question, the tourniquet should be deflated to evaluate for punctuate bleeding. The 2.5 mm Fenestration Drill may be used to aid in creating viable bleeding bone or feathering the joint surfaces.

Provisional fixation with smooth Steinmann Pins to maintain desired alignment may be performed at this time, paying close attention to all three planes (coronal, sagittal, and rotation). Typically, neutral to 7 degree valgus, neutral dorsiflexion-plantarflexion and rotation comparable to the contralateral side is desired. Avoid varus or excessive valgus positioning. To avoid excessive valgus with a neutral ankle, it is recommended to translate the calcaneus medially under the talus. An excessive valgus or too medial insertion point may affect the placement of the calcaneal PA Screw.
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**TECH TIP**

- A trauma triangle with the apex padded or cushioned may be placed under the ankle for ease of drilling and placing screws.

Nail Entry Site Preparation

Make a plantar incision at least 2 cm in length. The incision can be in the longitudinal or transverse direction, according to surgeon preference. Bluntly dissect the soft tissue down to the surface of the calcaneus. Extreme care must be taken to protect the plantar neurovascular structures throughout the procedure.

Targeting Frame Assembly

Instruments Used:
1. Targeting Frame (30)

To assemble the Targeting Frame, slide the Manual Compression Tubes onto the Deployment Base. Push down on the gold latch on top of the Compression Tube arch to lock it in place (A). The Frame is secured in place when the Manual Compression Assembly no longer slides and the latch pops up to its original position.

BEFORE loading the Nail Implant, be sure to check that:
- The numbered gold Stop Wheel is set to “0” and that the lever is in the upright position to allow the DynaNail Implant to attach to the frame (B).
- The gold Manual Compression Knob is in the starting position by rotating it fully counter clockwise. This sets the Manual Compression Tubes to the “0” position (C).
- If the Stop Wheel is not set to zero: pull the lever down, turn the Stop Wheel to “0,” and return the lever to its upright position.

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**Guidewire Insertion**

**Instruments Used:**
1. Trocar Tipped Guidewire (19)
2. 3.3 mm Protection Sleeve (4)
3. 9.5 mm Protection Sleeve (3)
4. 14 mm Protection Sleeve (24)

Assemble the 3.3 mm, 9.5 mm, and 14 mm Protection Sleeves as shown in Inset A. Place the Protection Sleeve Assembly against the plantar surface of the calcaneus. Insert the Trocar Tipped Guidewire (B) into the 3.3 mm Protection Sleeve, taking care that the guidewire tip is contacting the inferior aspect of the calcaneus. Drill the guidewire through the calcaneus and talus into the tibial medullary canal. With the Protection Sleeve abutted against the bone, confirm proper depth has been reached by reading the lasermarks off the back of the Protection Sleeve (C). When satisfied with the guidewire placement, remove the 3.3 mm Protection Sleeve leaving the Trocar Tipped Guidewire in place.

**TECH TIP**
- Fluoroscopy should be utilized throughout the entire insertion process to ensure centered guidewire placement in the tibial medullary canal on both the anterior and lateral views.
**Initial Drilling**

Instruments Used:
1. Trocar Tipped Guidewire (19)
2. 9.5 mm Protection Sleeve (3)
3. 14 mm Protection Sleeve (24)
4. 7 mm Cannulated Drill (28)
5. 9 mm Cannulated Drill (27)
6. Bead Tipped Guidewire (20)

With the 9.5 mm Protection Sleeve still in place, insert the 7 mm Cannulated Drill over the guidewire and drill into the medullary canal. The Trocar-Tipped Guidewire will come out when removing the 7 mm Drill. Replace the Trocar-Tipped Guidewire with the Bead-Tipped Guidewire. Reconfirm with fluoroscopy that the Guidewire is seated in the same position prior to proceeding with the 9 mm Drill. Repeat drilling using the 9 mm Cannulated Drill. Remove the 9.5 mm Protection Sleeve.

**TECH TIPS**

- It is recommended to drill with the 7 mm Cannulated Drill to just beyond the tibiotalar joint, stopping at the metaphyseal level. Then, drill through the tibial canal using the 9 mm Cannulated Drill.
- A 2nd Bead-Tipped Guidewire can be inserted into the back of the drill and pushed against the inserted Bead-Tipped Guidewire ensuring it remains in place while pulling out the drill.
- Do NOT forget to replace the Trocar-Tipped Guidewire with the Bead-Tipped prior to reaming.
Reaming

Instruments Used:
1. Bead Tipped Guidewire (20)
2. 14 mm Protection Sleeve (24)
3. Reamer Shaft (29)
4. 10 - 13.5 mm Reamer Heads (10 - 17)

Place the 10 mm Reamer Head onto the Reamer Shaft (A). With the 14 mm Protection Sleeve still in place against the calcaneus, slide the Reamer assembly over the Bead Tipped Guidewire. Ream into the tibial medullary canal to the depth recommended for the chosen DynaNail length as determined from Table 1 (as read off the 14 mm Protection Sleeve (B)). Once the recommended depth is reached, replace the 10 mm Reamer Head with the 10.5 mm Reamer Head and repeat.

Using fluoroscopy, continue progressively reaming in 0.5 mm increments until cortical contact is made within the tibia. It is recommended that the final reaming size be 1 - 1.5 mm larger than the selected implant diameter (Table 2). Use fluoroscopy as necessary to be sure the cortical wall is not compromised.

NOTE: The distal end of the DynaNail Implant is larger than the proximal end (12.5 mm), requiring additional reaming on the distal side through both the calcaneus and talus (refer to Table 2).

Table 1. Recommended Tunnel Depth

<table>
<thead>
<tr>
<th>Nail Length (mm)</th>
<th>Reaming Length (mm)</th>
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<tbody>
<tr>
<td>220</td>
<td>250</td>
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<td>260</td>
<td>300</td>
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<td>300</td>
<td>325</td>
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Table 2. Recommended Tunnel Diameter

<table>
<thead>
<tr>
<th>Nail Diameter</th>
<th>Proximal End of Nail</th>
<th>Distal End of Nail To a depth of 75 mm</th>
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<tbody>
<tr>
<td></td>
<td>DynaNail Proximal Diameter (mm)</td>
<td>Reaming Diameter (mm)</td>
</tr>
<tr>
<td>10 mm</td>
<td>10</td>
<td>11</td>
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<tr>
<td>12 mm</td>
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<td>13</td>
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**TECH TIPS**

- For easier accessibility, the Reamer Heads Caddy can be removed from the tray and placed closer to the operating table.
- The Reamer Heads are only retained on the Reamer Shaft by the Guidewire and can fall if not held onto the shaft until the reamer head is securely on the Guidewire.
- Be sure that the Protection Sleeve abuts the calcaneus to ensure accurate depth readings.

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Table 1. Recommended Tunnel Depth

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<thead>
<tr>
<th>Nail Length (mm)</th>
<th>Reaming Length (mm)</th>
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<tr>
<td>260</td>
<td>250</td>
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Table 2. Recommended Tunnel Diameter

<table>
<thead>
<tr>
<th>DynaNail Proximal Diameter (mm)</th>
<th>To a depth of 75 mm</th>
<th>DynaNail Distal Diameter (mm)</th>
<th>Reaming Diameter (mm)</th>
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<td>11.5</td>
<td>13.5</td>
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<td>13.5</td>
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</table>
Implant Attachment

Instruments Used:
1. M6 Connection Screw (5)
2. 5 mm Hex Driver Shaft (25)
3. Blue-Handle Ratchet Driver (31)

Insert the M6 Connection Screw through the inner cylinder of the Targeting Frame (A). Attach the DynaNail Implant onto the Targeting Frame, taking care to correctly align the keyed slots on the Implant with the pegs on the Targeting Frame (B). Attach the 5 mm Hex Driver Shaft onto the Blue-Handle Ratchet Driver (C) and use the Hex Driver to screw the M6 Connection Screw into the distal end of the DynaNail until the Implant is tight on the Targeting Frame.
**Implant Insertion**

Instruments Used:
1. Anvil Attachment (1)

Remove the Bead Tipped Guidewire and insert the DynaNail into the medullary canal, rotating the Targeting Frame to help advance the Implant.

If additional force is required to advance the Implant, slide the Anvil Attachment onto the Targeting Frame (A) and strike the Anvil with a mallet (B). The Anvil Attachment can be removed after the DynaNail Implant is inserted.

**TECH TIPS**

- **Do NOT strike any other part of the frame besides the Anvil Attachment.**
- **Hold at least one side of the anvil down in the slot to ensure that it does not slip out and fail.**
- **Pay attention to rotation of Nail Implant during insertion. Too medial of an entry point combined with internal rotation may affect the position and purchase of the calcaneal PA screw.**

**Nail Placement Guidelines:**

Position the lateral-to-medial calcaneal screw hole as proximal as possible in the calcaneus (after the Compressive Element is stretched in the following step). In this proximal position, the lateral screw gains optimal purchase by targeting the longest possible screw in the widest part of the calcaneus. This proximal position also countersinks the DynaNail as far as possible within the calcaneus. Countersink the distal end of the DynaNail Implant 6 mm in the calcaneus (Refer to X-Ray). The Outer Body will translate distally up to 6 mm as the Compressive Element unloads post-operatively.

**TECH TIP**

- To achieve optimal lateral-to-medial screw positioning after the Compressive Element is stretched, insert the DynaNail implant until the lateral-to-medial screw hole is aligned with the subtalar joint (refer to X-Ray). In this case when the Compressive Element is stretched to the maximum 6 mm (Step 10), this screw hole will translate distally by 6 mm, placing it in the optimal proximal position within the calcaneus.
**Stretch Compressive Element**

Instruments Used:
1. Targeting Frame (30)

Stretch the Compressive Element by pulling the lever into the full downward position (A). Use the Stop Wheel to set the desired amount of compression (up to 6 mm) from the Compressive Element (B, C). For example, setting the Stop Wheel to 6 signifies the Compressive Element is stretched by 6 mm and can therefore unload and maintain compression for up to 6 mm of bone resorption and/or settling.

Flip the lever back up into its relaxed position (D). Note the DynaNail’s calcaneal screw holes have translated distally and are now in their final position. Confirm desired location of screw holes in the calcaneus under fluoroscopy before continuing.
PA Headless Screw Placement

Instruments Used:
1. Targeting Frame (30)
2. 8 mm Guide Sleeve (9)
3. 5 mm Drill Guide (7)
4. Trocar Obturator (6)
5. 5 mm Drill (22)
6. 3.5 mm Hex Driver Shaft (26)
7. Blue-Handle Ratchet Driver (31)
8. Headless PA Screw

Slide the Outer Tube Brace onto the Manual Compression Tubes until it locks in place, ensuring the arrow markings are pointed towards the Targeting Frame (A). Be sure that the holes in the Outer Tube Brace align with the holes in the Manual Compression Tubes.
Attach the Posterior-Anterior (PA) Attachment to the right side of the Targeting Frame. The PA Headless Screw should be aimed toward the calcaneocuboid (C-C) joint. If the calcaneus is deformed such that there is limited purchase for the Headless Screw, externally rotate the Targeting Frame so that the PA Attachment targets towards the desired entry point.

TECH TIP

- A trauma triangle can be used here to keep the foot elevated
Thread the Trocar Obturator into the 8 mm Guide Sleeve (B). Depress the gold trigger on the PA Attachment to insert the Guide Sleeve/Trocar assembly. Make an incision at the Trocar tip and confirm that the Trocar is resting directly against the calcaneus.
Leaving the Guide Sleeve in place, replace the Trocar with the 5 mm Drill Guide (indicated with purple stripe) (C).

**TECH TIPS**

- Leave the Drill Guide just off the bone while drilling to ensure Drill Guide does not push back against the PA Attachment.
- If patient’s leg must be lifted and not using a trauma triangle, hold the leg, NOT the Targeting Frame, to lift.
Insert the 5 mm Drill into the Drill Guide and drill to the desired depth (typically just proximal to the C-C joint). Read the laser markings on the Drill relative to the back of the Drill Guide to determine the appropriate screw length (D).

**TECH TIP**
- After drilling, advance the Drill Guide directly against the bone for accurate screw length measurement.
Attach one 3.5 mm Hex Driver Shaft to the Blue-Handle Ratchet Driver and a second 3.5 mm Hex Driver to a power drill. Remove the 5 mm Drill and Drill Guide from the Guide Sleeve. Insert the Headless PA Screw through the Guide Sleeve using the 3.5 mm Hex Driver loaded on the power drill until the screw has passed through the Nail Implant. Then switch to the Blue-Handle Ratchet Driver to continue to advance the screw until it is flush with the posterior calcaneus (E). Remove the Guide Sleeve from the PA Attachment. Remove the PA Attachment from the Targeting Frame.

**TECH TIP**

- The Headless PA Screw does not provide tactile feedback to indicate when it is fully inserted. Use the laser line on the 3.5 mm Hex Driver to determine if the PA Screw is fully inserted. When the laser line approaches the back of the Guide Sleeve, use lateral fluoroscopy while advancing the final turns, ensuring the screw tip does not breach the C-C joint.
Calcaneal L-M Screw Placement

Instruments Used:
1. 8 mm Guide Sleeve (9)
2. Trocar Obturator (6)
3. 4 mm Drill Guide (8)
4. 4 mm Drill (23)
5. Screw Depth Gauge (Optional) (21)
6. 3.5 mm Hex Driver Shaft (26)
7. Blue-Handle Ratchet Driver (31)
8. Cortical Screw

Thread the Trocar into the 8 mm Guide Sleeve. Insert the 8 mm Guide Sleeve and Trocar assembly into the lateral side of the Targeting Frame. Make an incision at the Trocar tip and abut the Trocar against the calcaneus. Distal retraction of the peroneal tendons can sometimes be done to allow direct contact of the Trocar against bone. Leaving the Guide Sleeve in place, replace the Trocar with the 4 mm Drill Guide (indicated with a green stripe) (A). Ensuring the Drill Guide is NOT resting against the bone, drill bicortical with the 4 mm Drill and measure the screw length off the Drill Guide in the same manner as previously described in Step 11. Alternatively, the Screw Depth Gauge can be used to determine screw length. Note that the Screw Depth Gauge must also be read off of the Drill Guide as it abuts the bone.

TECH TIP

- Due to the soft bone in the medial calcaneus, it might be difficult to determine whether the drill has breached the far lateral cortex through tactile feedback. Assess drill position using fluoroscopy.
Remove the 4 mm Drill Guide. Insert the Cortical Screw through the 8 mm Guide Sleeve using the 3.5 mm Hex Driver as described in Step 11. Use fluoroscopy to determine when desired depth is reached and the screw is fully seated.
Apply External Compression

Instruments Used:
1. 8 mm Guide Sleeve (x 2) (9)
2. 4 mm Drill Guide (x 2) (8)
3. Trocar Obturator (6)
4. 4 mm Drill (23)

Thread the Trocar into the 8 mm Guide Sleeve. Insert the 8 mm Guide Sleeve and Trocar assembly into the more distal tibial interlocking screw hole on the medial side of the Targeting Frame (passing through the Outer Tube Brace). Make an incision at the Trocar tip and advance the Trocar down to bone. Leaving the Guide Sleeve in the Targeting Frame, replace the Trocar with the 4 mm Drill Guide in the Guide Sleeve.

TECH TIPS

- The 4 mm Drill Guide should be placed just off the bone to ensure that the targeting frame is floating freely during drilling.
- Do NOT place the second 4 mm Drill Guide on lateral side of frame (next step) until AFTER advancing the Drill through the nail. The fibula can interact with the lateral Drill Guide, which can push the Targeting Frame out of alignment.
- If not using a trauma triangle, make sure the targeting tubes are not resting on any table or pillows. If using bumps or towels, move them to underneath ankle.

Drilling from the medial side, pass a fresh 4 mm Drill through the tibia and across the Targeting Frame. Thread another 4 mm Drill Guide into a second 8 mm Guide Sleeve and insert the Guide assembly into the distal hole on the lateral side of the Targeting Frame so that it abuts against the bone. Continue to insert the 4 mm Drill into the Drill Guide on the lateral side (A). Leave the drill in place and rotate the Manual Compression Knob clockwise to apply compression across the joint (B). The approximate amount of applied external compression can be determined by reading the lasermarks on the Targeting Frame (C). Leave the Drill in place while proceeding to Step 14.

NOTE: If external compression is not desired, proceed to the Quick Compress Technique on page 35 for tibial screw placement.
Proximal Tibial Screw Placement

Instruments Used:
1. 8 mm Guide Sleeve (9)
2. Trocar Obturator (6)
3. 4 mm Drill Guide (8)
4. 4 mm Drill (23)
5. 3.5 mm Hex Driver Shaft (26)
6. Blue Handle Ratchet Driver (31)
7. Cortical Screw

Thread the Trocar into a third 8 mm Guide Sleeve. Place the 8 mm Guide Sleeve and Trocar Assembly in the most proximal hole on the medial side of the Targeting Frame. Make an incision at the Trocar tip and advance down to bone. Leaving the Guide Sleeve in place, replace the Trocar with the 4 mm Drill Guide (indicated with a green stripe). Drill using a fresh 4 mm Drill, determine appropriate Cortical Screw length, and insert Cortical Screw as described in Step 12. Remove the 8 mm Guide Sleeve from the Targeting Frame.
OPTIONAL Proximal Tibial Screw Placement (for DynaNail XL Implants Only)

Instruments Used:
1. Cortical Screw
2. 4 mm Free-Hand Drill
3. 8 mm Guide Sleeve (9)
4. Free-Hand Screw Depth Gauge
5. 3.5 mm Hex Driver Shaft (26)
6. T-Handle Ratchet Driver (31)

For 260 mm and 300 mm length Implants, a screw may also be free-handed into the most proximal tibial screw hole. This screw can also be a substitute for the tibial screw described in Step 15. Drill using the 4 mm Freehand Drill in the most proximal tibial screw hole using perfect circles technique under fluoroscopy. Determine the appropriate screw length by inserting the Free-Hand Screw Depth Gauge. Insert the Cortical Screw as described in Step 12. Use fluoroscopy to determine when desired depth is reached and the screw is fully seated.
Distal Tibial Screw Placement

Instruments Used:
1. 3.5 mm Hex Driver Shaft (26)
2. Blue Handle Ratchet Driver (31)
3. Cortical Screw

Relieve the compression on the 4 mm Drill by turning the Manual Compression Knob back counter clockwise until it rotates freely (A), but do not force the wheel back until it reads zero. Remove the 4 mm Drill. Determine the appropriate screw length and insert the Cortical Screw as described in Step 11 (B). Confirm screw placement, anatomic alignment, and apposition of fusion surfaces under fluoroscopy prior to removing Targeting Frame.
Release Nail

Instruments Used:
1. 5 mm Hex Driver Shaft (25)
2. Blue Handle Ratchet Driver (31)

Unscrew the M6 Connection Screw using the 5 mm Hex Driver (A) releasing the DynaNail Implant from the Targeting Frame (B).
Add End Cap

Instruments Used:
1. 3 mm Hex Drive, T-Handle (2)
2. End Cap

Thread the End Cap into the distal end of the DynaNail Implant using the 3 mm T-Handle Hex Driver.

Close incisions per surgeon preference.

NOTE: On the final fluoroscopy shot, note the distal position of the Calcaneal Screws in the Sliding Element slots and the Sliding Element protruding plantar from Outer Nail Body, indicating the Compressive Element is in its stretched, activated state.
QUICK COMPRESS TECHNIQUE (OPTIONAL)

If a surgeon would like to bypass external manual compression, the following steps may replace Steps 13-16 described above. Depending upon the choice of tibial screw placement, this alternate technique also allows for additional dynamization even after full recovery of the Compressive Element.

**NOTE:** While the Compressive Element will provide post-operative compression, applying manual compression helps ensure the joints are tightly compressed intra-operatively so that the Compressive Element does not recover until resorption occurs post-surgery. Therefore, it is recommended that this alternate technique only be adopted when the joints appear visually compressed intra-operatively. Indications include if a surgeon wants to avoid the lateral plantar neurovascular bundle, reduce the risk of a stress riser at the screw when drilling in the tibia, or wishes to drill only one tibial screw hole instead of two. Patients with large bony defects who might receive a bulk allograft, or are immunocompromised with poor bone healing capacity might not be suitable for this technique.

**NOTE:** Though not using the Manual Compression feature, the Compression Wheel must still be “zeroed” in order to properly load the Nail Implant.
Compress Arthrodesis Site

Instruments Used:
1. Anvil Attachment (1)

Slide the Anvil Attachment onto the Targeting Frame (A) and strike the Anvil with a mallet to apply compression to the arthrodesis site.

TECH TIP
• DO NOT strike any other part of the frame besides the Anvil Attachment.
Compress Arthrodesis Site

Instruments Used:
1. Anvil Attachment (1)
Slide the Anvil Attachment onto the Targeting Frame (A) and strike the Anvil with a mallet to apply compression to the arthrodesis site.

TECH TIP
• DO NOT strike any other part of the frame besides the Anvil Attachment.

Distal Tibial Screw Placement

Instruments Used:
1. 5 mm Cortical Screw
2. 4 mm Drill (23)
3. 4 mm Drill Guide (8)
4. 8 mm Guide Sleeve (9)

If automatic dynamization is desired, drill a hole from the medial side into the distal tibial oblong slot of the DynaNail Implant until the Drill has breached the lateral side of the tibia. Insert a 5 mm Cortical Screw as described in Step 12.
OPTIONAL: Proximal Tibial Screw Placement

If static locking is desired, drill a hole into one of the proximal tibial screw holes of the DynaNail Implant and insert a 5 mm Cortical Headed Screw as described in Step 12. This step may replace Step 15b such that there is only one screw in the proximal tibial hole, if so desired.

Proceed to Step 17 in the original technique to finish the procedure.
**ORDERING INFORMATION**

**DYNANAIL IMPLANTS**

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<th>Description</th>
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**DYNANAIL SINGLE USE INSTRUMENTS**

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<td>2201-09-0040</td>
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