Surgical Technique

smith&nephew

ILIZAROV™

Foot and Ankle External Fixation

Midfoot deformity correction and fusion with the ILIZAROV method

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Table of contents

Nota Bene

The technique description herein is made available to the healthcare professional to illustrate the author's suggested treatment for the uncomplicated procedure. In the final analysis, the preferred treatment is that which addresses the needs of the specific patient.For more information on the products in this surgical technique, including indications for use, contraindications, effects, precautions and warnings, please consult the products' Instructions for Use (IFU).

Introduction

In patients requiring deformity correction of the foot, the ILIZAROV™ method allows a percutaneous approach and early weight-bearing leading to high fusion rates and improved patient outcomes when compared to traditional internal fixation treatment methods.[7-9]

Ring sizing

Place a full ring over the affected limb. Make sure there is a two finger clearance between the inner diameter of the ring and the soft tissues of the leg and the foot. See **Figure 1**.

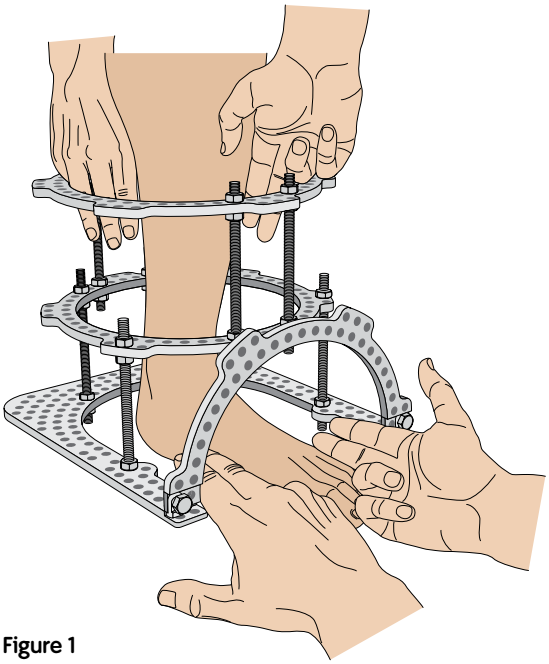

Figure 1

Pre-building the frame

A pre-assembled ILIZAROV™ foot frame may be selected (see **Figure 2**) or a frame may be built by the physician. When building the frame, for the tibia ring fixation block choose two full pre-sized circular rings, one pre-sized foot ring and one half ring, all of the same diameter. Using 10mm nuts, place four 150mm threaded rods equidistant from each other between the two full rings, allowing for maximum separation between the rings. Place two 120mm threaded rods between the foot ring and the tibia fixation block in the posterior aspect of the frame. Leave approximately 15mm to 20mm of thread length remaining proximally to the distal tibia ring to allow for compression or distraction at the ankle joint and for application versatility. Using two male hinges, two bolts and four 10mm nuts, close the open end of the foot ring with the chosen half ring.

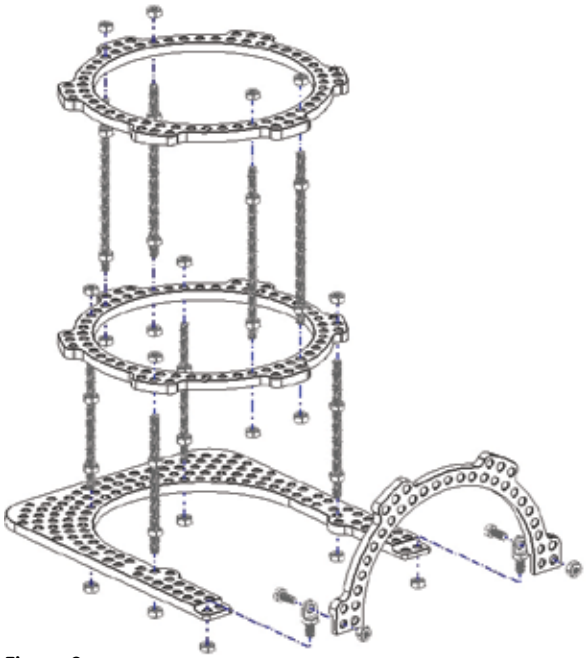

Figure 2

Safe zones in the tibia and foot

Care must be taken to avoid neurovascular structures and intraarticular penetration. **Figure 3** and **Figure 4** show suggested safe pin and wire pathways that allow for minimal transfixion of muscle compartments and neurovascular structures of the lower leg, ankle and foot.

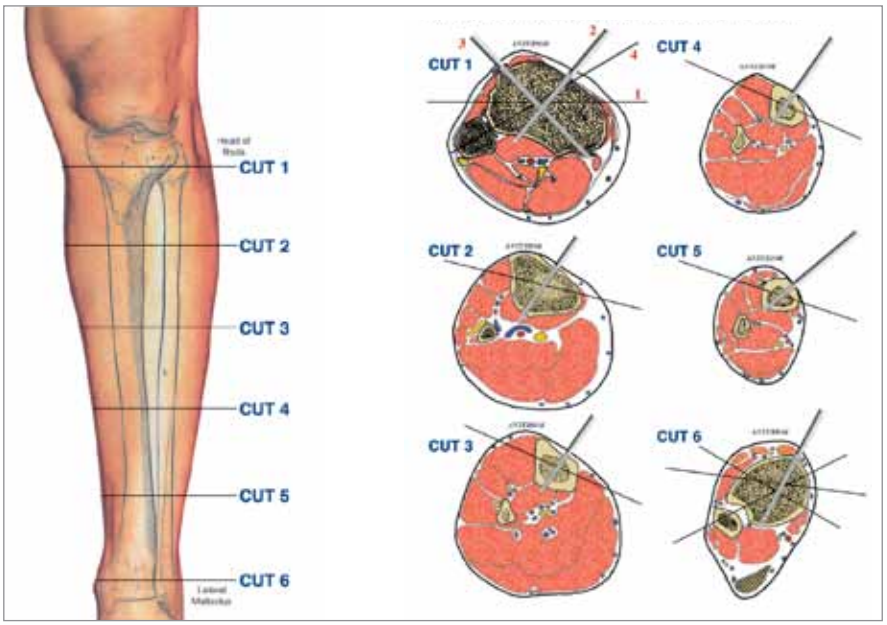

Figure 3

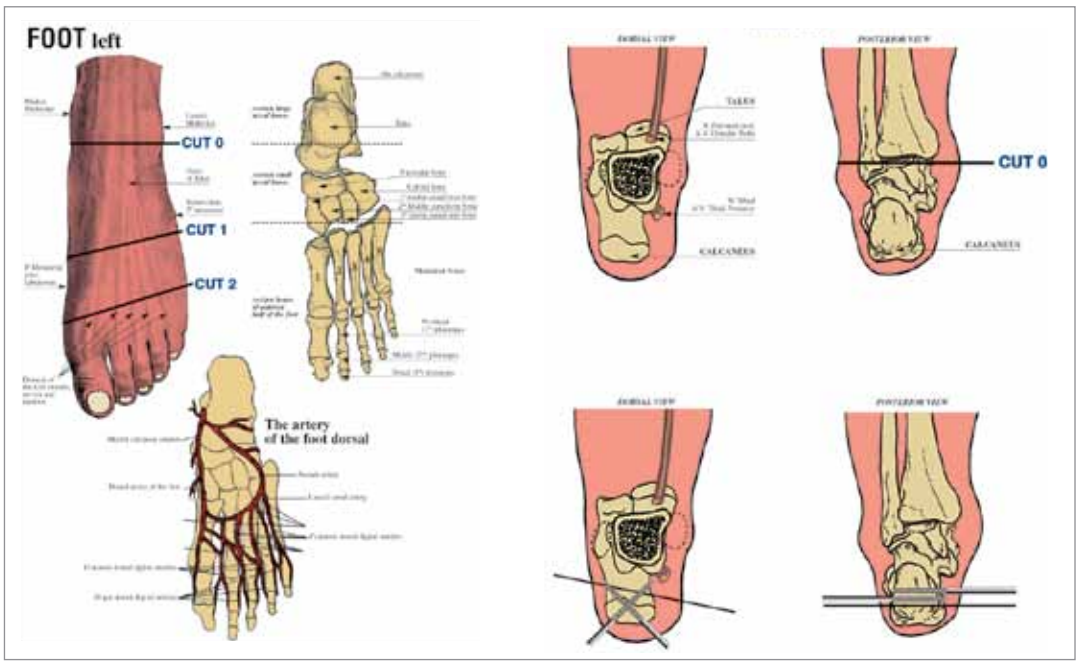

Figure 4

Wire insertion technique

When inserting thin wires it is important to follow the guidelines below.

Step 1
Manually insert the wire to the bone to minimize soft tissue trauma.

Step 2
Only pass wires through muscle compartments in their elongated state to avoid excessive tension. See **Figures 5.1** and **5.2**.

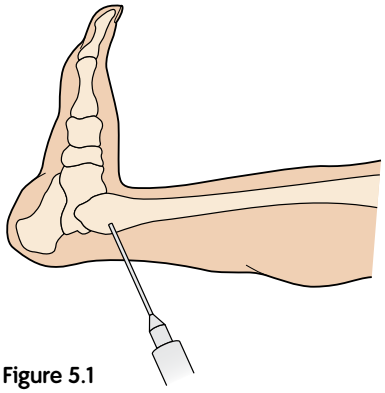

Figure 5.1

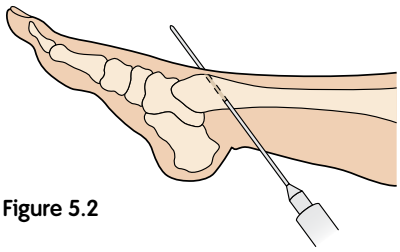

Figure 5.2

Step 3
Consider holding the wire with a wet sponge to dissipate the heat generated from drilling. See **Figure 6**. After drilling the wire through the bone use a mallet to pass wires through the remaining soft tissues to prevent twisting.

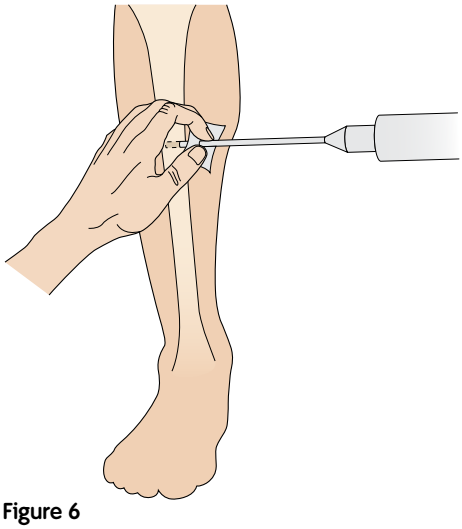

Figure 6

Step 4
Pause frequently when drilling to allow heat to dissipate.

Step 5
Fixate the wire to the frame in its natural resting place to prevent pin site irritation.

Half pin insertion technique

When inserting half pins it is important to follow the guidelines below.

Step 1
Attach a rancho cube to the ring and place a drill sleeve with a trocar through the furthest hole from the ring. See **Figure 7**.

Step 2
Make a skin incision and push the trocar and sleeve down to bone. See **Figure 7**.

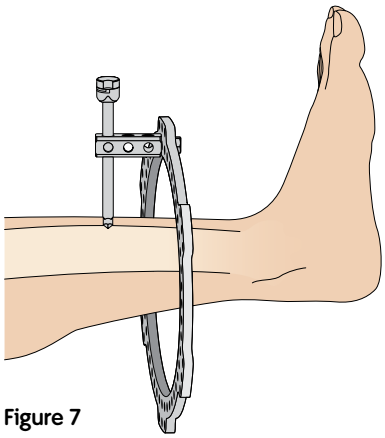

Figure 7

Step 3
Remove the trocar and place the drill through the sleeve. Drill through the bone taking frequent pauses to allow for heat dissipation. See **Figure 8**.

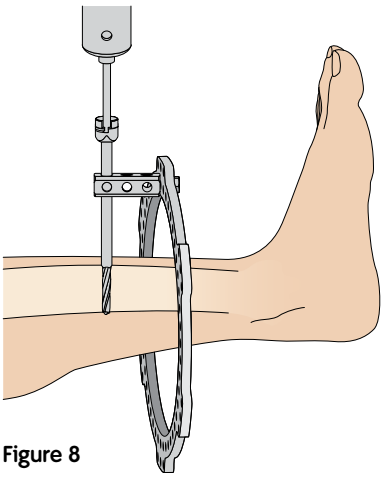

Figure 8

Step 4
Select half pin length and insert through the drill sleeve until bicortical purchase is obtained. See **Figure 9**.

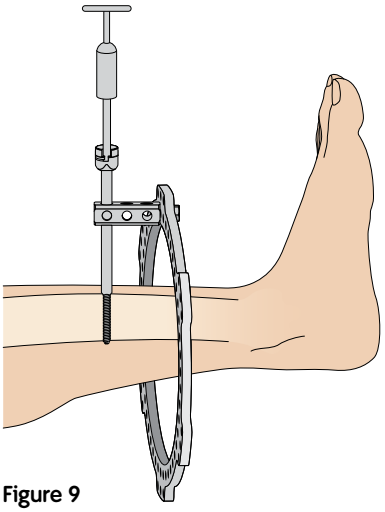

Figure 9

Step 5
Remove the drill sleeve. Insert the proper diameter centering sleeve and lock with a short bolt or set screw. See **Figure 10**.

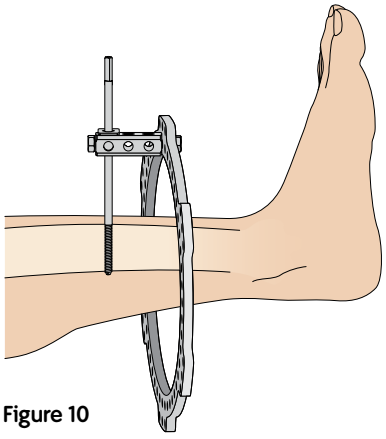

Figure 10

Surgical technique

Step 1
The patient is placed supine on a radiolucent table with the affected side hip bolstered up. The patella should remain pointing to the ceiling without any additional support. See **Figure 11**.

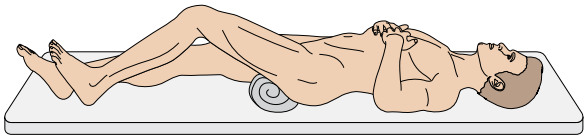

Figure 11

Step 2
Complete the necessary closing wedge osteotomy to correct the deformity and remove any bony protrusions on the plantar surface of the foot. Close all incisions. See **Figures 12.1** and **12.2**.

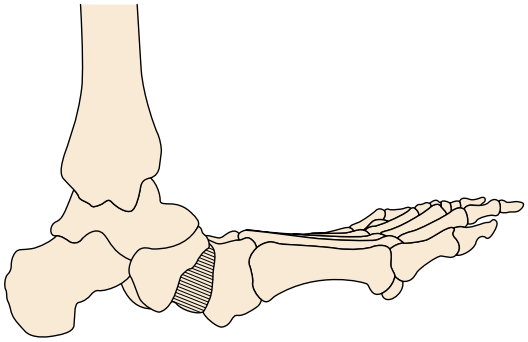

Figure 12.1

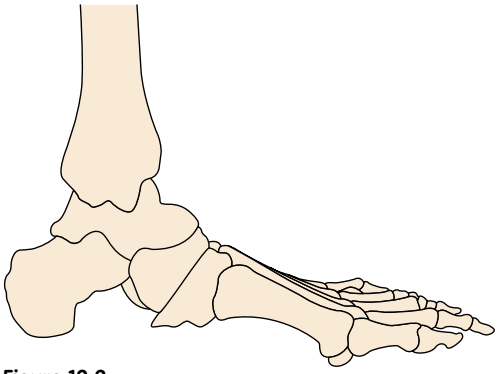

Figure 12.2

Step 3
Provisionally secure the forefoot to the hind foot with Steinman pins. See **Figure 13**.

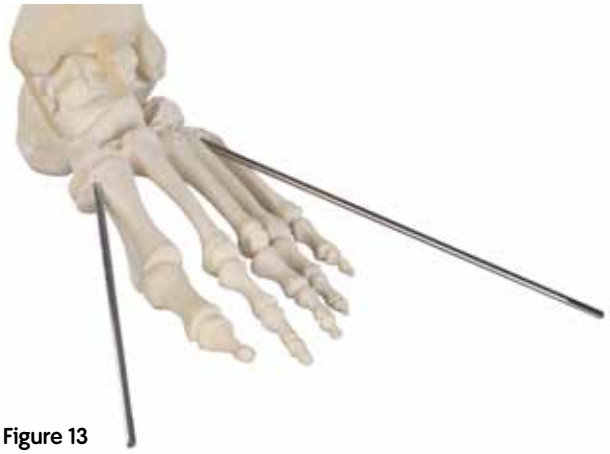

Figure 13

Step 4

Place a bolster under the knee. Then place the pre-assembled frame over the foot and tibia. Place a stack of towels between the posterior aspect of the frame and the posterior aspect of the soft tissues of the tibia and foot until the threaded rods of the frame are parallel to the posterior cortex of the tibia. Adjust the proximal/distal positioning of the frame until the foot ring is at the midpoint of the calcaneus while the ankle is in neutral position. See **Figure 14**.

Figure 14

Step 5

Follow the wire and pin safe zone guidelines and insertion techniques section on pages 5 through 7 for wire and half pin insertion locations. Insert a bicortical reference wire from medial to lateral on the inferior side of the proximal tibial ring that is perpendicular to the axis of the shaft of the tibia. Attach the wire directly to the ring with wire fixation bolts and tension to 130 ft lbs. Verify that the axis of the frame is in line with the axis of the tibia in both the AP and lateral radiograph views. Insert a bicortical wire from medial to lateral on the inferior side of the distal tibia ring. Attach the wire directly to the ring with wire fixation bolts and tension to 130 ft lbs. If a wire is not directly abutting the ring do not pull it to the ring. Washers, hinges or supports can be used in conjunction with the wire fixation bolts to build the frame to the wire. See **Figure 15**.

Figure 15

Step 6
Place two wires on the superior aspects of each tibial ring from anterolateral to posteromedial. Attach the wire directly to the ring with wire fixation bolts and tension to 130 ft. lbs. See **Figure 16**.

Figure 16

Step 7
Place a rancho cube on the anteromedial superior side of the distal and proximal tibia rings. Using the appropriate diameter drill bit for the chosen diameter half pin, drill a bicortical hole for half pin insertion and place the half pin through the centering sleeve until one or two threads have cleared the far cortex. Verify bicortical thread purchase under fluoroscopic radiograph. Lock the half pin into the rancho cube with a short bolt or set screw. See **Figure 17**.

Figure 17

Step 8
Attention is directed to the application of the foot ring. If necessary, Achilles tendon or gastrocnemius lengthening may be performed at this time. Ensure the hind foot and ankle are in neutral position to the tibia and insert an olive wire in the calcaneus from anteromedial to posterolateral on the inferior side of the foot ring. Attach and tension the wire to 90-110 ft lbs. Insert an olive wire in the calcaneus from anterolateral to posteromedial on the superior side of the foot ring. Attach and tension the wire to 90-110 ft lbs. See **Figure 18**.

Figure 18

Step 9
Insert a smooth wire parallel and distal to the osteotomy site. Bend each end of the wire toward and perpendicular to the osteotomy and attach it to the ring. Remove the provisional Steinman pins. Tension the wire until the desired amount of compression is achieved at the osteotomy site. Lock the wire in place. See **Figures 19.1** and **19.2**.

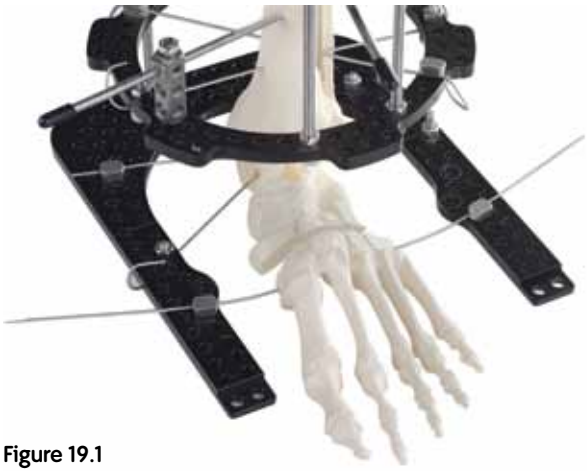

Figure 19.1

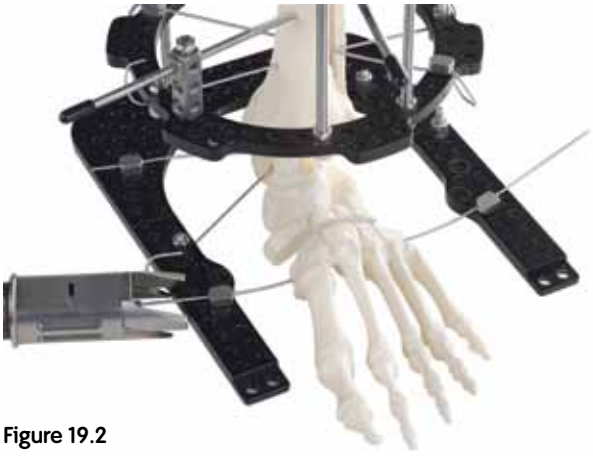

Figure 19.2

Step 10
Insert an olive wire in the first and second metatarsals from medial to lateral and a second olive wire in the fifth to the third metatarsals from lateral to medial. Attach and tension these wires to 90 ft lbs. See **Figure 20**.

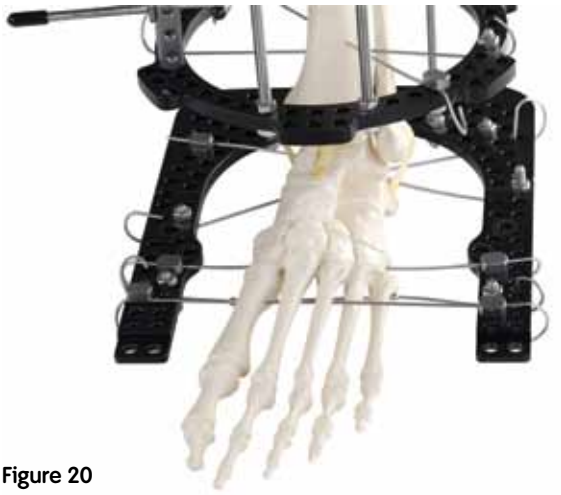

Figure 20

Step 11
Attach two 120mm threaded rods to empty holes in the distal portion of the foot ring. Connect the proximal portion of these to the distal tibia ring with the appropriate length connection plate to stabilize the foot ring to the tibial fixation block. See **Figure 21**.

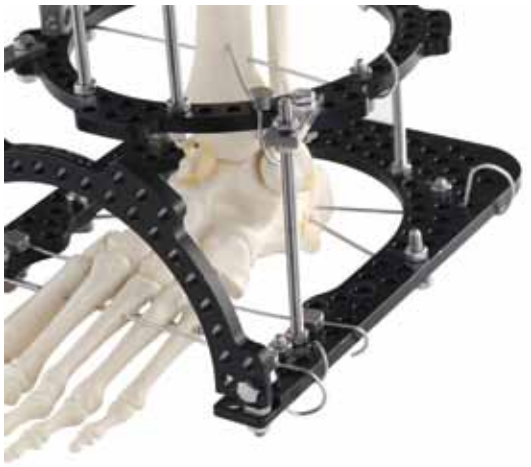

Figure 21

Step 12
Cut half pins with a rod cutter and place protective pin caps on the ends. Check and retighten all nuts and bolts on the frame to ensure stability. See **Figures 22** and **23**.

Figure 22

Figure 23

Alternate osteotomy fixation technique

Change the frame to close the open end of the frame with the half ring in a parallel fashion. Follow steps 1 through 7 as previously described in this surgical technique.

Place extra-long olive wires in a front to back fashion across the osteotomy site. Tension across from the olives to compress across the osteotomy. Take care not to over-compress as the olives can pull through the cortex in poor quality bone. See **Figure 24**. Complete steps 10, 11 and 12.

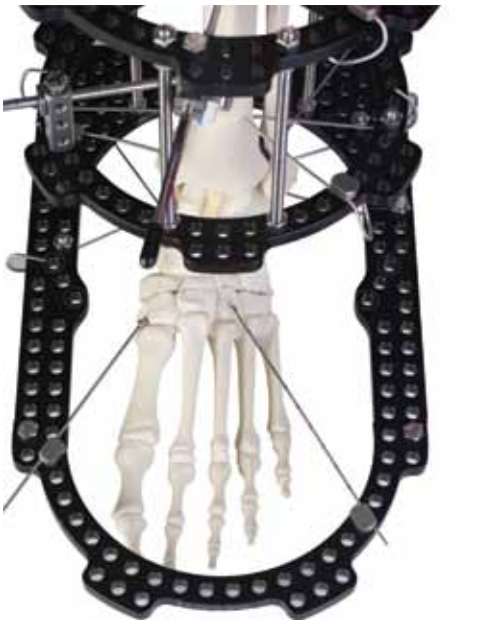

Figure 24

Operative dressings

Apply sterile dressings over surgical incisions. Apply ACTICOAT◊ EXFIX or ILIZAROV™ sponges with disc clips around the pin sites and compressive dressings completely around the leg within the frame. Wrap the exterior of the frame with a long 6-inch Ace® bandage. Leave in place for five to seven days before beginning pin site care. See **Figure 25**.

Figure 25

Postoperative pin care

On postoperative day four initiate routine daily pin site care. Using sterile cotton swabs, clean each pin and wire site with a 1:1 ratio mixture of saline and hydrogen peroxide. After the surgical wounds have healed and the sutures have been removed (two-four weeks) the patient can shower daily with antibacterial soap and should continue routine daily pin site care. See **Figure 26**.

Note Do not cross contaminate pin sites with the cotton swabs.

Figure 26

Catalog information

ILIZAROV™ Foot and Ankle Tray

Set No. 7107-0605

Instruments

Cat. No.	Description	Tray Qty
102905	Combination Wrench, 10mm	2
102911	Fixation Bolt Wrench	1
103101	Dynamometric Wire Tensioner	2
L202002	Combination Wrench, 10mm x 13mm	2

Cat. No.	Description	Tray Qty
112716	Hex Fix Pin Driver/Extractor	1
7107-0344	Wire Cutter	1
102910	10mm Slotted Hexdriver	1

Hardware

Cat. No.	Description	Tray Qty
101800	Short Connector Plate, 3 Hole, 45mm	4
102550	Universal Joint	4
71011000	Adjustable Pin Clamp/Locking Hinge	2
103300	Nut, 10mm	60
103301	Nut, 10mm, Nylon Insert	10
103302	DC Counter, 4 Point	4
101400	Male Support, 2 Hole	4
101401	Male Support, 3 Hole	2
101402	Male Support, 4 Hole	2
102301	Threaded Rod, 80mm	4

Cat. No.	Description	Tray Qty
102302	Threaded Rod, 100mm	4
102303	Threaded Rod, 120mm	4
102304	Threaded Rod, 150mm	4
102305	Threaded Rod, 200mm	4
201700	Conical Washer Couple	16
100600	Wire Fixation Bolt, Cannulated	12
100700	Wire Fixation Bolt, Slotted	12
103405	5mm Centering Sleeve	6
7192-9154	Russian Nuts	6

Hardware – Mayo Tray

Cat. No.	Description	Tray Qty
71070394	Ilizarov Foot and Ankle Mayo Stand Caddy	1
103452	Rancho Cube, 2 Hole	4
103453	Rancho Cube, 3 Hole	4
103454	Rancho Cube, 4 Hole	2
101600	Male Hinge	6
101602	Low Profile Male Hinge	6
103300	Nut, 10mm	40

Cat. No.	Description	Tray Qty
103200	Bolt, 10mm	20
103201	Bolt, 16mm	20
103406	6mm Centering Sleeve	6
100600	Wire Fixation Bolt, Cannulated	12
100700	Wire Fixation Bolt, Slotted	12
102706	Washer, 2.0mm, Fixation Bolt	20
102707	Washer, 4.0mm, Fixation Bolt	20

Wires

Cat. No.	Description	Tray Qty
7107-0390	Wire Caddy	1
102107	Wire with Stopper, 400mm	10
102102	Wire Bay Point Cortical, 370mm	10

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