



the **WAVE**[™]
CALCANEAL FRACTURE PLATE
SURGICAL TECHNIQUE

TORNIER



Indications for Use:

The Tornier Calcaneal Fracture Plate System is indicated for fractures and osteotomies of the calcaneus, including, but not limited to extra-articular, intra-articular, joint depression, tongue-type and severely comminuted fractures.

Contraindications:

The Calcaneal Fracture Plate System is contraindicated for the following conditions:

- Sepsis, systemic infection, elevated WBC count, fever and/or local infection or inflammation.
- Persisting skin lesion or poor skin coverage around the ankle that would make the procedure unjustifiable.
- Neuromuscular or psychiatric disorders which might jeopardize fixation and post-operative care.
- Suspected or documented metal allergy or intolerance.
- Inadequate neurovascular status.

One of two surgical techniques can be used to implant the Tornier Calcaneal Plate:

- Less invasive surgical approach (recommended and described on the following pages)
- Extensile approach



Less Invasive Surgical Technique:



Case selected for this surgical technique:

Type II comminuted joint depression fracture with rotation and malposition of the lateral posterior facet fragment, lateral wall blowout and displacement of the sustentaculum relative to the tuberosity.



Step 1

With the patient in the lateral position, prepare and drape using standard operating protocols. Locate the subtalar space. Create an incision from the tip of the 4th metatarsal (5-8 cm). Keep incision dorsal to the peroneal tendons. Avoid the sural nerve.



Step 2

Using a periosteal elevator, carefully release soft tissue from the lateral wall of the calcaneus, being mindful to stay lateral to the fragments. If necessary, use a scalpel to carefully detach the periosteal tendon sheath from the bone surface, taking care not to damage the tendon.



Step 3

Insert the lamina spreader between the shoulder of the talus and Gissane's angle of the calcaneus.

Insert Schanz screw into the posterior tubercle on the calcaneus, aiming toward the posterior facet and using a power driver or the T-handle collet. Use the T-handle for subsequent reduction.

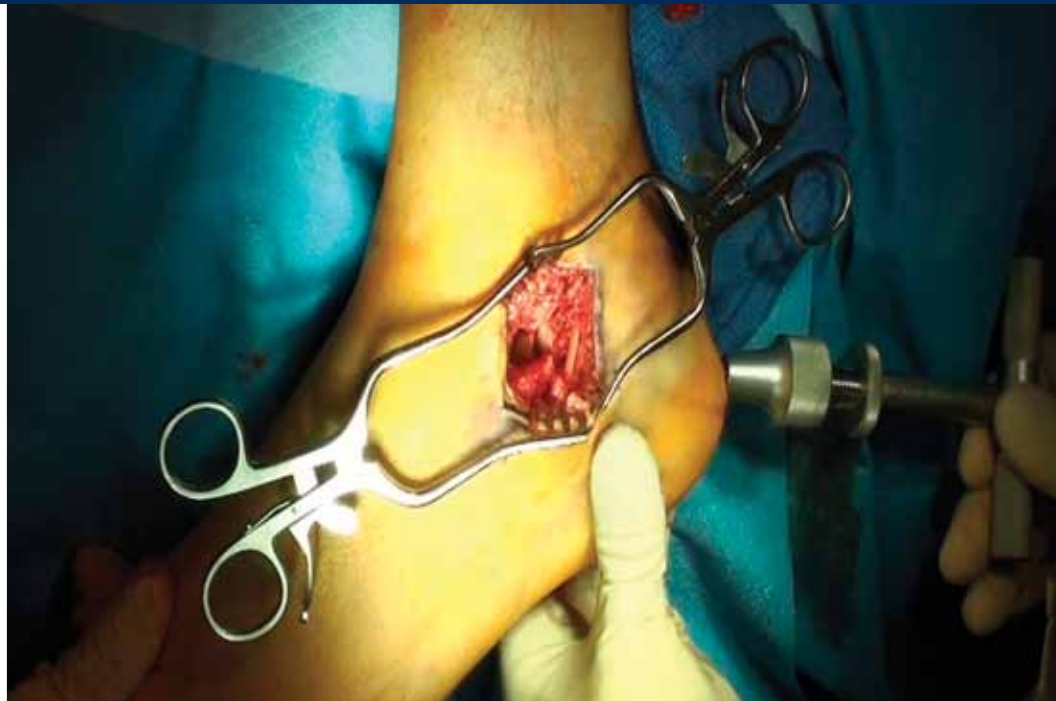
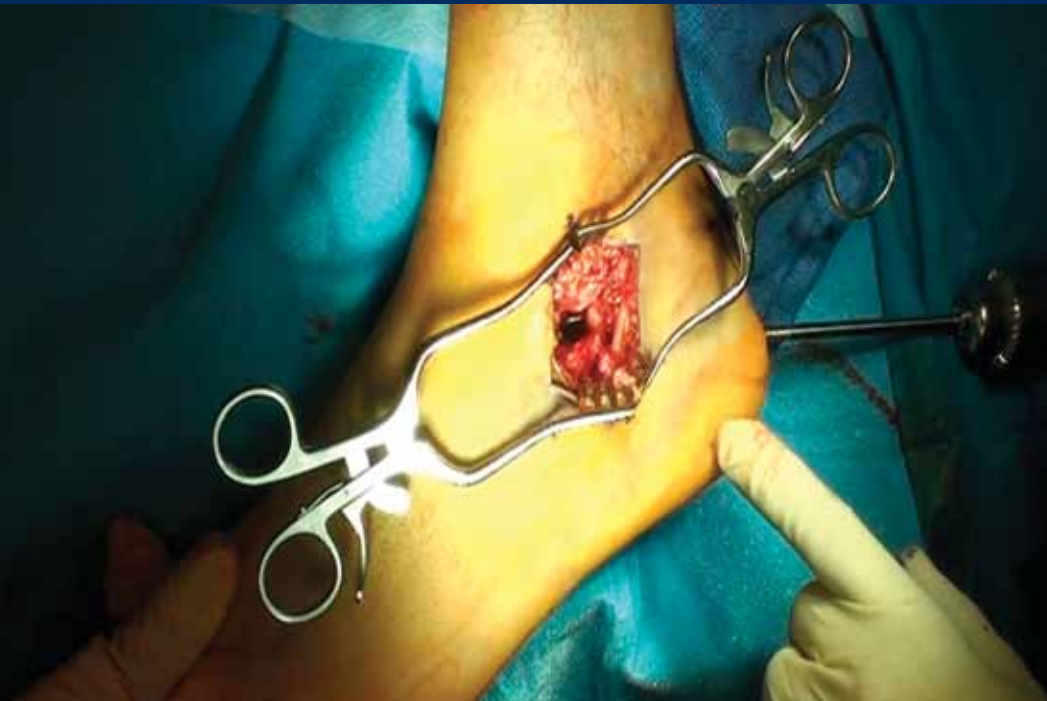


Schanz Screw



T-handle Collet





Step 4

Reduce the Fracture.

- Insert a large periosteal elevator underneath the fragment and free the medial sustentaculum piece from the posterior tuberosity fragment.
- Pull traction on forefoot (supinate and pronate) with counter traction on Schanz screw and leg.
- Bring the heel from varus while pulling traction. Reduce impacted fragments and bring to valgus.
- When the joint surface is reduced, use your thumb under direct visualization to compress the lateral wall back into place while maintaining traction with Schanz screw.

Temporarily Fixate the Reduction.

Provisionally fixate the fracture reduction with temporary guide pins.

Technique note: Surgeon has the option to utilize the plate here to assist with fracture reduction, or to place plate after the fracture is reduced. If plate is to be placed to assist with reduction, be mindful of subsequent plate passage when placing guide pins.

- Drive a pin axially from the posterior tuberosity into the posterior facet.
- A second pin may be introduced from posterior to anterior for additional fixation.
- A pin can also be inserted from lateral to medial to hold the articular reduction.

If this option is chosen, be sure to consider subsequent plate passage.



Guide Pins

Schanz Screw





Step 5

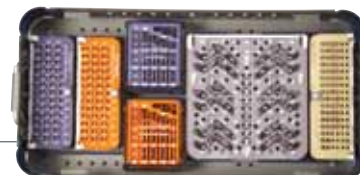
Technique note: As mentioned in step 4, there is the option for plate placement now to assist with fracture reduction. Alternatively, this step can be used after reduction is achieved and secured with temporizing guide pins.

After evaluating appropriate plate size and using the locking drill guide as a handle, insert the plate's posterior end through the incision, under the peroneal tendons onto the posterior tuberosity and along the exposed path. Remove the drill guide, and insert the anterior end of the plate along the exposed path anteriorly. Be sure that all fracture fragments are positioned medial to the plate. This positioning can be facilitated by reinserting the periosteal elevator.

Palpate the plate under the skin and use fluoroscopy to optimize the position.

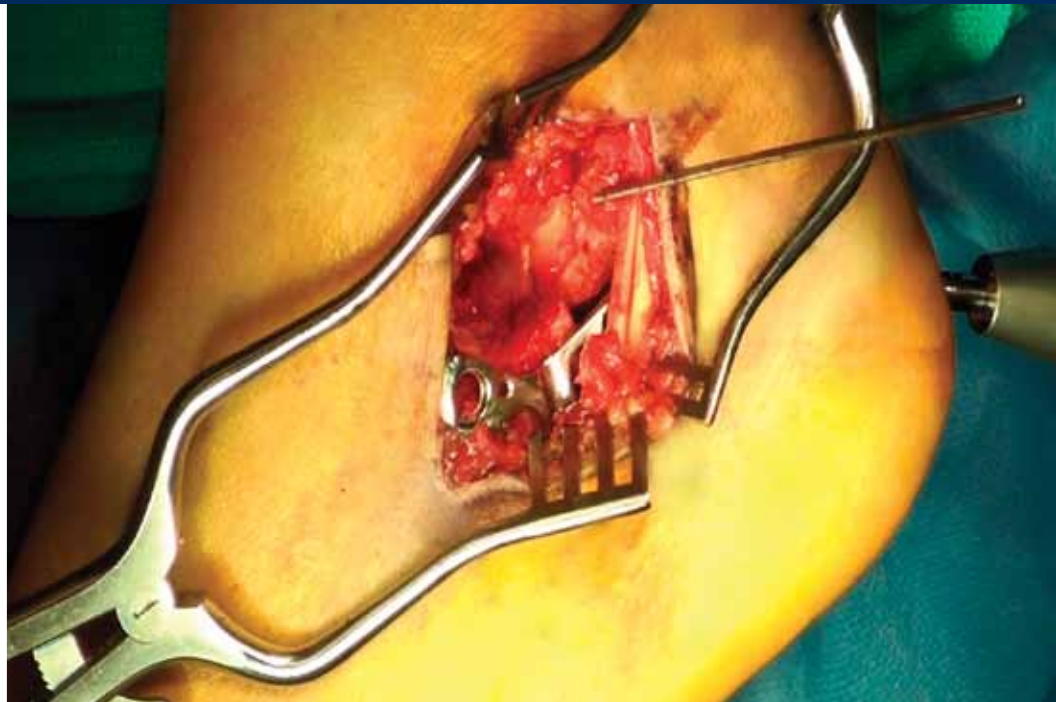
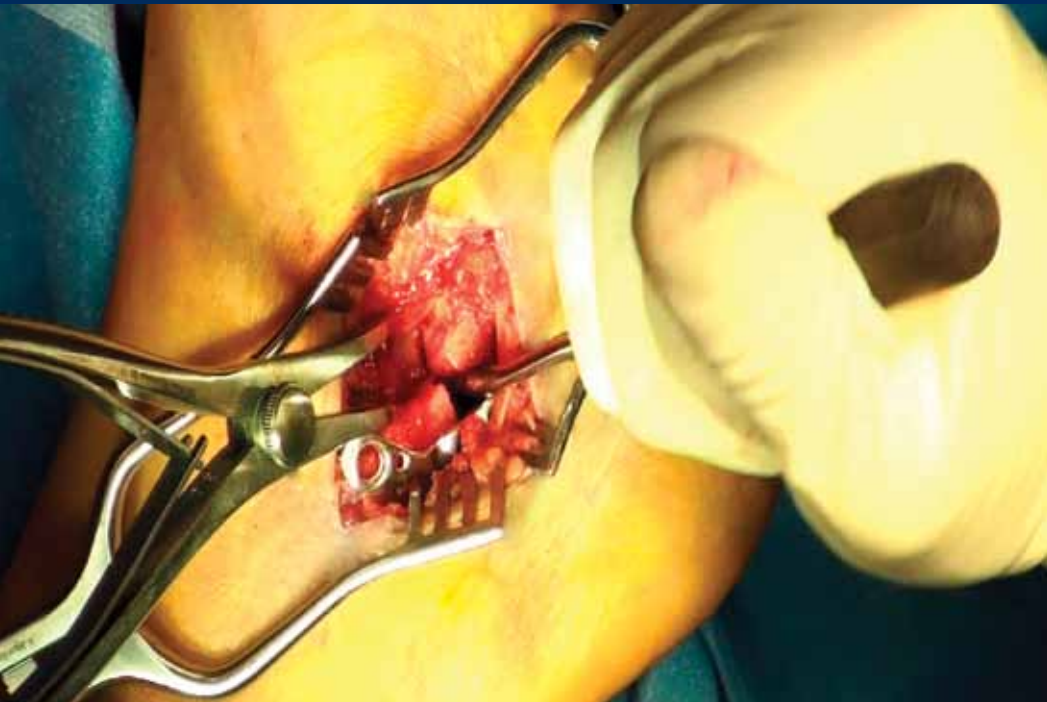


Plate



Locking Drill Guide





Step 6

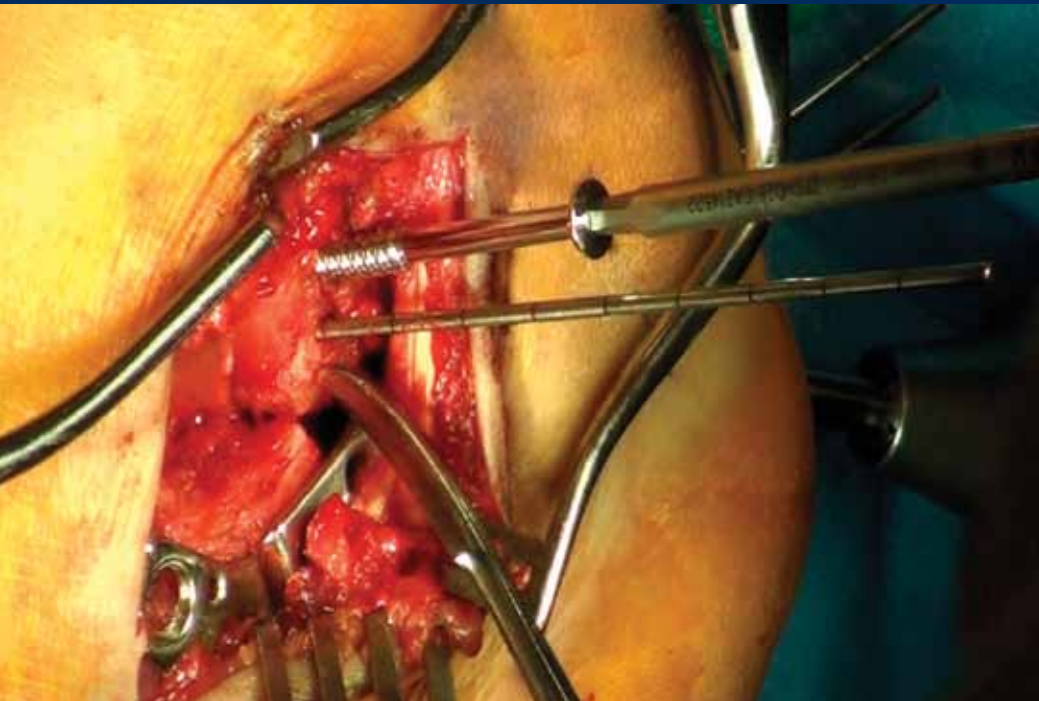
Continue to reduce the posterior facet.

- Reinsert lamina spreader again, and a Freer elevator is used to achieve final joint reduction.
- Compress lateral to medial, and place a pin from the posterior facet to the sustentaculum.



Guide Pins





Step 7

If necessary, off-plate cannulated lag screws can now be placed to stabilize an anatomically reduced joint surface. Utilize the cannulated drill over a guide pin, and place screw with the cannulated driver. Avoid intra-articular or fracture line placement of screws to maximize purchase in bone.

Note: When using the cannulated option on the depth gauge, add 2 mm to select appropriately sized screw.



Cannulated Lag Screw



Dual Depth Gauge



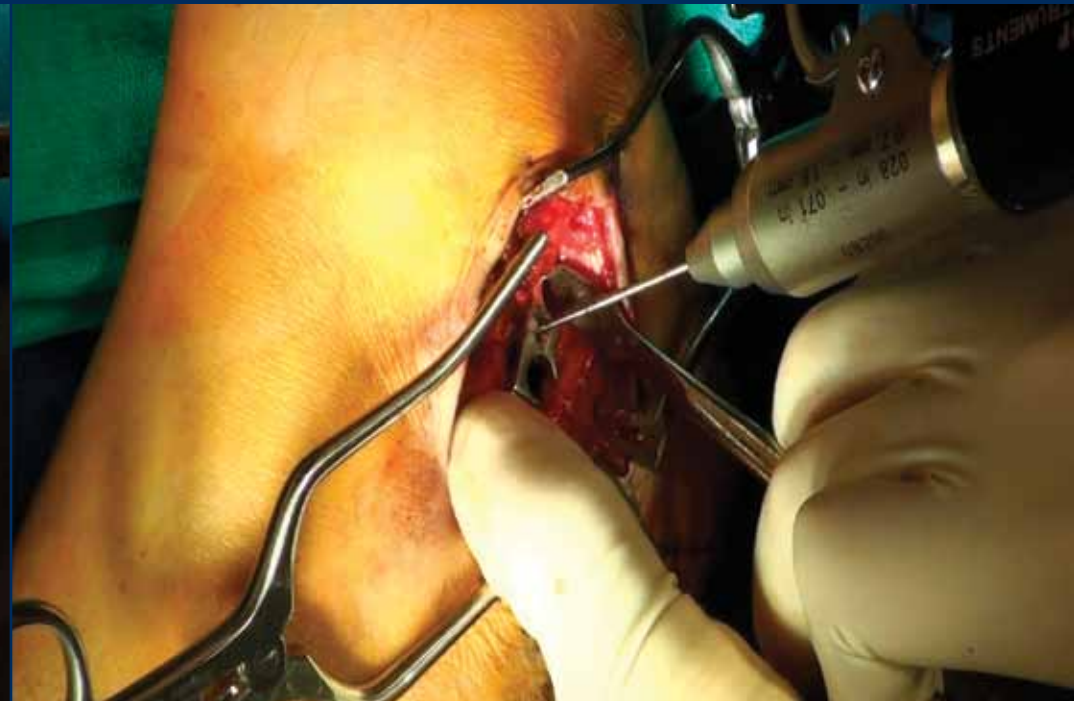
Guide Pins



Cannulated Drill



Non-locking Drill Guide



Step 8

Guide wires can be drilled through the k-wire holes in the plate in order to maintain the plate's optimum position.



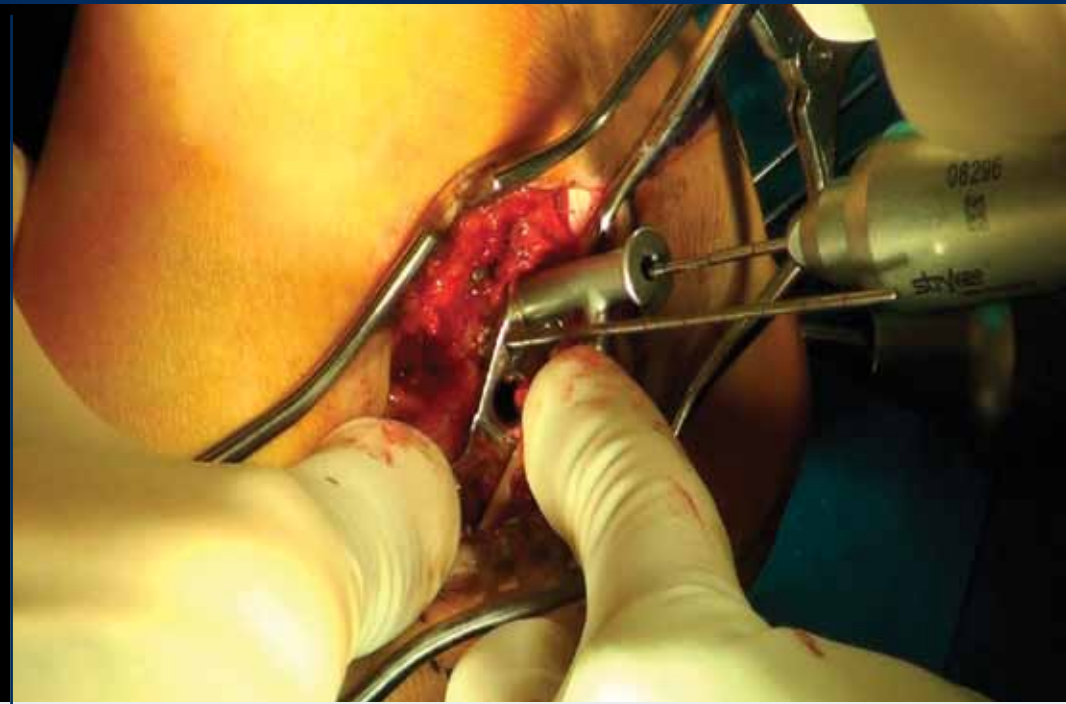
Guide Pins





Step 9

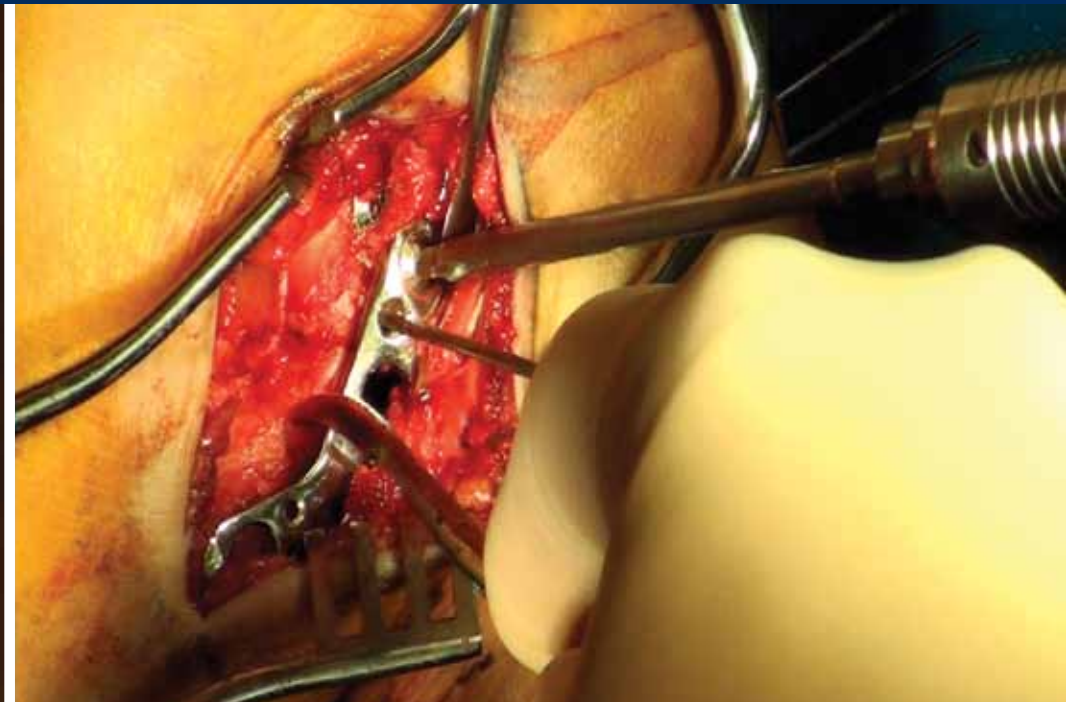
When final position is achieved, confirm anatomic reduction with fluoroscopy.



Step 10

Insert a guide pin into the plate's apex hole using the non-locking pin guide in the direction of the sustentaculum tali. Proper pin placement can be evaluated with fluoroscopy.





Step 11

Use the cannulated drill with the non-locking drill guide to pre-drill a hole for the lag screw into the sustentaculum tali. The desired screw length can be read from the drill inside the non-locking drill guide, or you can use the dual depth gauge probe to measure for the desired screw length. Once selected, insert sustentaculum tali lag screw.

Note: When using the cannulated option on the depth gauge, add 2 mm to select appropriately sized screw.



Cannulated Drill



Non-locking Drill Guide



Dual Depth Gauge





Step 12

Determine the screw type and lengths required and insert anterior screws.

Non-locking screws:

- For a cannulated screw selection, repeat the pin, drill, measure, and screw placement mentioned in step 11.
- For fully threaded solid screws, utilize the solid drill through the non-locking drill guide. Use the dual depth gauge to measure, and place the screw.

Locking screws:

- Attach the locking drill guide.
- Use the solid drill, remove the guide, and measure.
- Place the screw, paying close attention to plate position and screw alignment to the plate.

Note: When using the cannulated option on the depth gauge, add 2 mm to select appropriately sized screw.



Locking Drill Guide



Solid Drill



Non-locking Drill Guide



Dual Depth Gauge





Step 13

Palpate to locate the posterior holes beneath the skin.

Use a guide pin to puncture through to the plate and check the position with fluoroscopy.

Create a small incision (1-2 cm) between the two plate holes, perpendicular to the posterior leg of the plate and parallel to the tendon and nerve.



Lateral



A/P

Step 14

Verify the position of the plate and all of the screws via fluoroscopy with a lateral, A/P, and axial view.

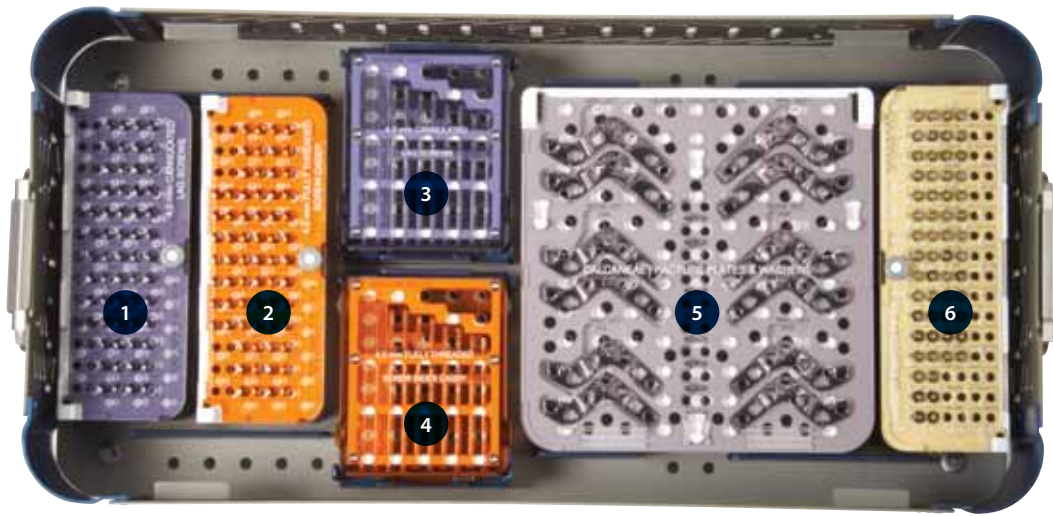


Axial



Step 15

Follow appropriate post-operative regimen of immobilization and rehabilitation protocols (Splint for up to 10 days; brace for 6 to 12 weeks, non-weight bearing until fusion has occurred.)



Bottom Instrument Tray:

Item	Description	Part #	Quantity
4.0 CANNULATED LAG SCREWS 26-50 mm length			
1	4.0 mm Dia Cannulated Lag Screw, 26 mm length	ZPCS26	4
	4.0 mm Dia Cannulated Lag Screw, 28 mm length	ZPCS28	4
	4.0 mm Dia Cannulated Lag Screw, 30 mm length	ZPCS30	4
	4.0 mm Dia Cannulated Lag Screw, 32 mm length	ZPCS32	4
	4.0 mm Dia Cannulated Lag Screw, 34 mm length	ZPCS34	4
	4.0 mm Dia Cannulated Lag Screw, 36 mm length	ZPCS36	4
	4.0 mm Dia Cannulated Lag Screw, 38 mm length	ZPCS38	4
	4.0 mm Dia Cannulated Lag Screw, 40 mm length	ZPCS40	4
	4.0 mm Dia Cannulated Lag Screw, 42 mm length	ZPCS42	4
	4.0 mm Dia Cannulated Lag Screw, 44 mm length	ZPCS44	4
	4.0 mm Dia Cannulated Lag Screw, 46 mm length	ZPCS46	4
	4.0 mm Dia Cannulated Lag Screw, 48 mm length	ZPCS48	4
	4.0 mm Dia Cannulated Lag Screw, 50 mm length	ZPCS50	4

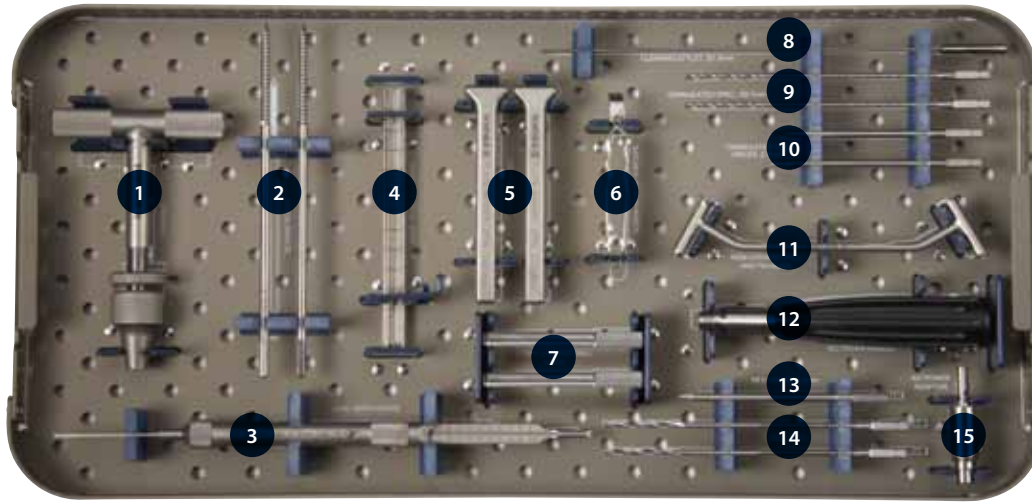
NON-LOCKING FULLY THREADED SCREWS 26-50 mm length			
2	4.0 mm Dia Fully Threaded Screws, 26 mm length	ZPFTS26	4
	4.0 mm Dia Fully Threaded Screws, 28 mm length	ZPFTS28	4
	4.0 mm Dia Fully Threaded Screws, 30 mm length	ZPFTS30	4
	4.0 mm Dia Fully Threaded Screws, 32 mm length	ZPFTS32	4
	4.0 mm Dia Fully Threaded Screws, 34 mm length	ZPFTS34	4
	4.0 mm Dia Fully Threaded Screws, 36 mm length	ZPFTS36	4
	4.0 mm Dia Fully Threaded Screws, 38 mm length	ZPFTS38	4
	4.0 mm Dia Fully Threaded Screws, 40 mm length	ZPFTS40	4
	4.0 mm Dia Fully Threaded Screws, 42 mm length	ZPFTS42	4
	4.0 mm Dia Fully Threaded Screws, 44 mm length	ZPFTS44	4
	4.0 mm Dia Fully Threaded Screws, 46 mm length	ZPFTS46	4
	4.0 mm Dia Fully Threaded Screws, 48 mm length	ZPFTS48	4
	4.0 mm Dia Fully Threaded Screws, 50 mm length	ZPFTS50	4

Item	Description	Part #	Quantity
4.0 CANNULATED LAG SCREWS 55-90 mm length			
3	4.0 mm Dia. Cannulated Lag Screw, 55 mm length	ZPCS55	4
	4.0 mm Dia. Cannulated Lag Screw, 60 mm length	ZPCS60	2
	4.0 mm Dia. Cannulated Lag Screw, 65 mm length	ZPCS65	2
	4.0 mm Dia. Cannulated Lag Screw, 70 mm length	ZPCS70	2
	4.0 mm Dia. Cannulated Lag Screw, 75 mm length	ZPCS75	2
	4.0 mm Dia. Cannulated Lag Screw, 80 mm length	ZPCS80	2
	4.0 mm Dia. Cannulated Lag Screw, 85 mm length	ZPCS85	2
	4.0 mm Dia. Cannulated Lag Screw, 90 mm length	ZPCS90	2

Item	Description	Part #	Quantity
NON-LOCKING FULLY THREADED SCREWS 55-90 mm length			
4	4.0 mm Dia Fully Threaded Screws, 55 mm length	ZPFTS55	6
	4.0 mm Dia Fully Threaded Screws, 60 mm length	ZPFTS60	2
	4.0 mm Dia Fully Threaded Screws, 65 mm length	ZPFTS65	2
	4.0 mm Dia Fully Threaded Screws, 70 mm length	ZPFTS70	2
	4.0 mm Dia Fully Threaded Screws, 75 mm length	ZPFTS75	2
	4.0 mm Dia Fully Threaded Screws, 80 mm length	ZPFTS80	2
	4.0 mm Dia Fully Threaded Screws, 85 mm length	ZPFTS85	2
	4.0 mm Dia Fully Threaded Screws, 90 mm length	ZPFTS90	2

Item	Description	Part #	Quantity
IMPLANTS			
5	Off Plate Screw Washer	ZPW	4
	Calcaneal Fracture Plate, Small, Left	ZPSL	2
	Calcaneal Fracture Plate, Medium, Left	ZPML	2
	Calcaneal Fracture Plate, Large, Left	ZPLL	2
	Calcaneal Fracture Plate, Small, Right	ZPSR	2
	Calcaneal Fracture Plate, Medium, Right	ZPMR	2
	Calcaneal Fracture Plate, Large, Right	ZPLR	2

Item	Description	Part #	Quantity
4.0 mm LOCKING SCREWS			
6	4.0 mm Dia Locking Screw, 14 mm length	ZPLS14	4
	4.0 mm Dia Locking Screw, 16 mm length	ZPLS16	4
	4.0 mm Dia Locking Screw, 18 mm length	ZPLS18	4
	4.0 mm Dia Locking Screw, 20 mm length	ZPLS20	4
	4.0 mm Dia Locking Screw, 22 mm length	ZPLS22	4
	4.0 mm Dia Locking Screw, 24 mm length	ZPLS24	4
	4.0 mm Dia Locking Screw, 26 mm length	ZPLS26	4
	4.0 mm Dia Locking Screw, 28 mm length	ZPLS28	4
	4.0 mm Dia Locking Screw, 30 mm length	ZPLS30	4
	4.0 mm Dia Locking Screw, 32 mm length	ZPLS32	4
	4.0 mm Dia Locking Screw, 34 mm length	ZPLS34	4
	4.0 mm Dia Locking Screw, 36 mm length	ZPLS36	4
	4.0 mm Dia Locking Screw, 38 mm length	ZPLS38	4
	4.0 mm Dia Locking Screw, 40 mm length	ZPLS40	2
	4.0 mm Dia Locking Screw, 42 mm length	ZPLS42	2
	4.0 mm Dia Locking Screw, 44 mm length	ZPLS44	2



Top Instrument Tray:

Item	Description	Part #	Quantity
INSTRUMENTS			
1	T-handle Collet	ZPTDA	1
2	Schanz Screw Ø5.0 mm	ZPSS5	2
3	Dual Depth Gauge	ZPDDG	1
4	Guide Pin 1.6 x 130 mm	ZPGP16	10
5	Plate Benders	ZPPB	2
6	Screw Pick-Up Forceps	NCS-45SF	1
7	Wave Locking Drill Guide	ZPWLDG	2
8	Cleaning Stylet	NCS-45S16	1
9	Cannulated Drill	ZPCDR27	2
10	Cannulated Hex Driver	ZPCHD25	2
11	Non-locking Drill and Pin Guide	ZPDPG	1
12	AO Driver Handle	NCS-DH45	1
13	Solid Hex Driver	ZPHD25	1
14	Ø2.7 Solid Drill	ZPWSDR27	2
15	AO Power Adaptor	NCS-PA45	1





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