Smith+Nephew

HALLU◊-LOCK

M.T.P. Arthrodesis System

Surgical Technique

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Nota Bene
The following technique is for informational and educational purposes only. It is not intended to serve as medical advice. It is the responsibility of treating physicians to determine and utilize the appropriate products and techniques according to their own clinical judgment for each of their patients. For more information on the product, including its indications for use, contraindications, and product safety information, please refer to the product's label and the Instructions for Use packaged with the product.

Description

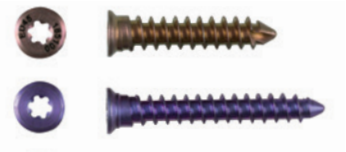
HALLU◊-Lock M.T.P. Arthrodesis System is a comprehensive plate and screw system specifically designed to support surgeons performing arthrodesis of the first metatarsophalangeal (MTP) joint.

Procedural solution packaged in a single instrument tray

- Reamers for joint preparation
- Headless cannulated screws for compression across joint and added fixation
- Angled and contoured plates designed for primary MTP and revision MTP procedures

SURFIX◊ Locking screw system featuring selection of fixed angle and variable angle insertion options

Titanium alloy plates and screws



SURFIX Standard Screw
and Locking Screw

Diameter 2.7mm & 3.0mm

SURFIX Alpha Variable Angle Screw
and Locking Screw

Diameter 2.7mm & 3.0mm

HALLU-LOCK C Plate
MTP Arthrodesis Plate

HALLU-LOCK S Plate
Revision of MTP Arthrodesis Plate

HALLU-REAM
Metatarsal Reamer

HALLU-REAM
Phalangeal Reamer

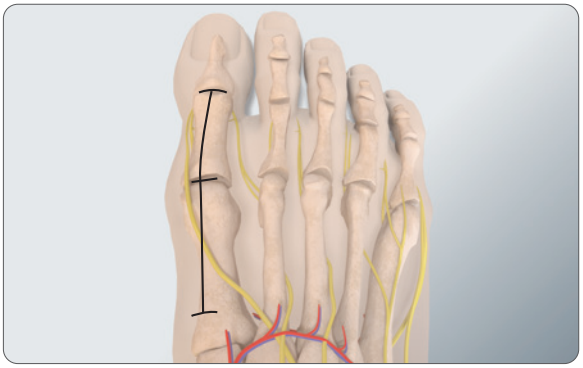


Figure 1-1

Figure 2-1

Step 1 ▪ Incision

1-1 A dorsal longitudinal incision is commonly used. This enables correct exposure of the metatarso-phalangeal joint. The incision is centered just medial to the extensor hallucis longus, and deepened to the joint capsule, through the subcutaneous tissues. The joint capsule is released and retractors are placed to expose the base of the proximal phalanx and metatarsal head.

Step 2 ▪ Preparation of the Joint Surface

2-1 The amount of the bone resection depends upon the desired length of the 1st metatarsal.

Note: Some revision cases will not require extensive resection.

A power saw may be used to resect the base of the proximal phalanx and the articular surface of the 1st metatarsal head.

A cut, resecting a small wafer of bone, perpendicular to the axis of the proximal phalanx is made just distal to the articular surface. A similar cut is made in the metatarsal head perpendicular to the long axis of the metatarsal shaft.

These cuts are made in order to decompress the joint, allowing the use of the reamers. Osteophytes should be carefully removed. Medial exostosis of the 1st metatarsal bone may also be resected.

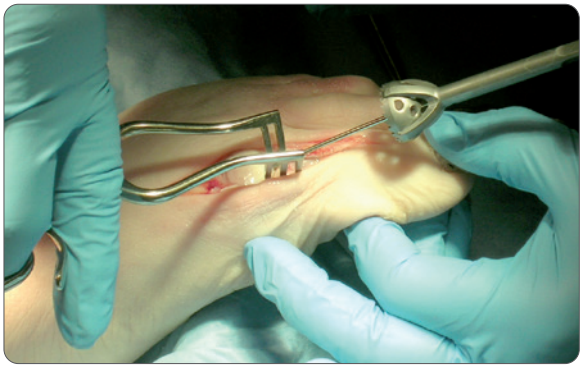


Figure 3-1

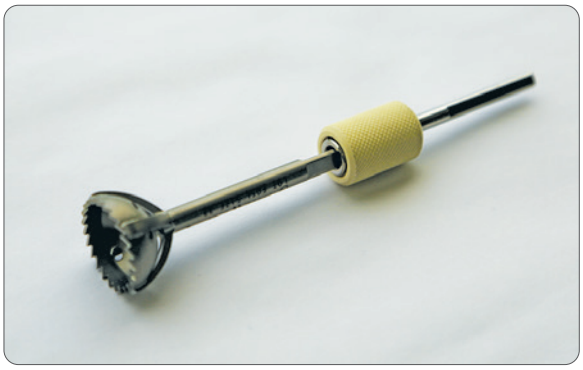


Figure 3-2

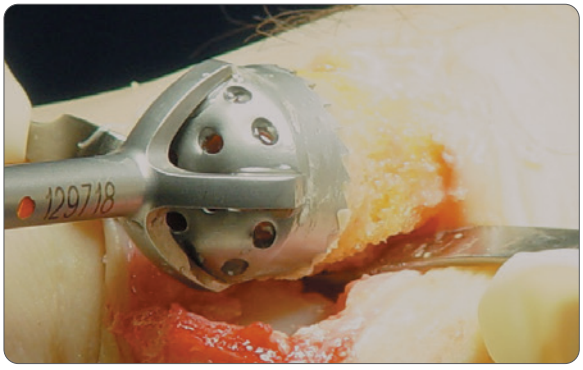


Figure 3-3

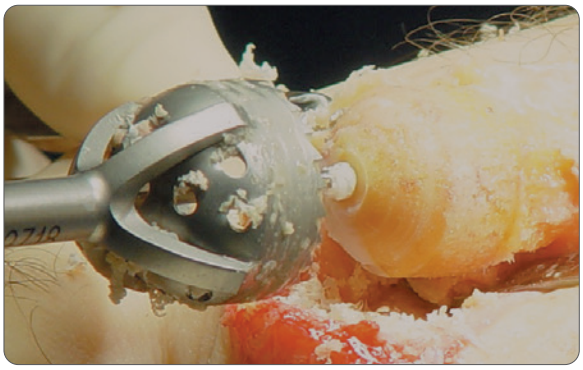


Figure 3-4

Step 3 ▪ Metatarsal Preparation

3-1 The phalanx is plantar flexed to gain access to the metatarsal head. A 1.6mm K-wire (115 116ND) is then introduced into the center of the metatarsal head and driven in a proximal direction along the axis of the diaphysis.

The appropriate size cannulated metatarsal reamer (129 714ND / 129 722ND) is selected by placing a reamer in front of the articular surface of the metatarsal head.

Note: It is advisable to begin by using the largest size reamer, and then downsizing to match the diameter of the metatarsal head.

3-2 Using the quick coupling device (129 710ND) the HALLU◊-REAM reamer is then engaged over the 1.6mm K-wire, and the metatarsal head is reamed. The 2 in 1 metatarsal reamer is bell shaped to allow barrel reaming and articular preparation in one step.

3-3 The metatarsal metaphysis is reduced to a cylinder of constant diameter, while the metatarsal head surface is reamed to a convex cup-shaped surface.

Note: Irrigation is suggested to remove bone debris.

3-4 The metatarsal reamer is removed. The K-wire can be held to elevate the metatarsal head to enable the removal of the bone on the plantar aspect.

Excess bone is removed with an osteotome or a rongeur. Debris and bone fragments are cleaned and irrigated.

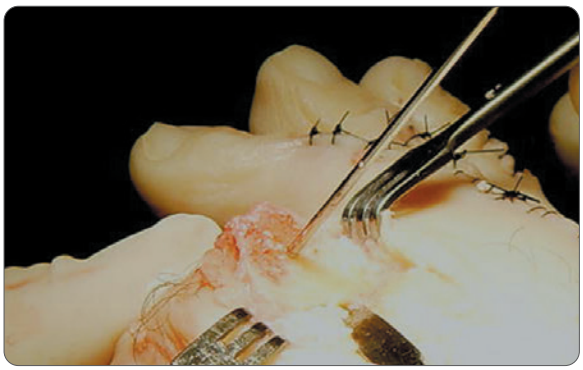


Figure 4-1

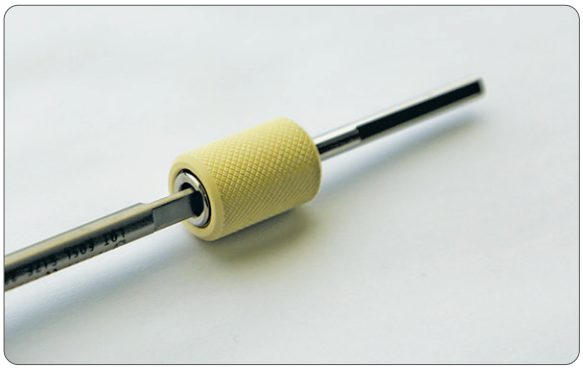


Figure 4-2

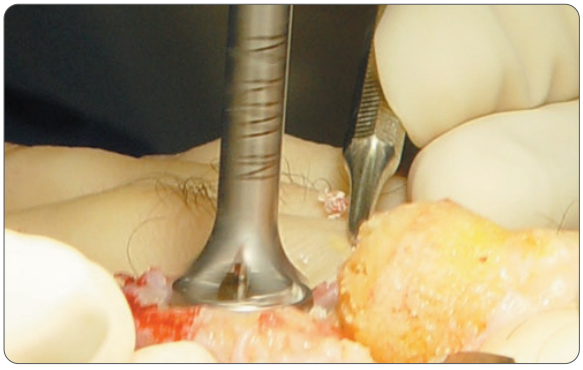


Figure 4-3

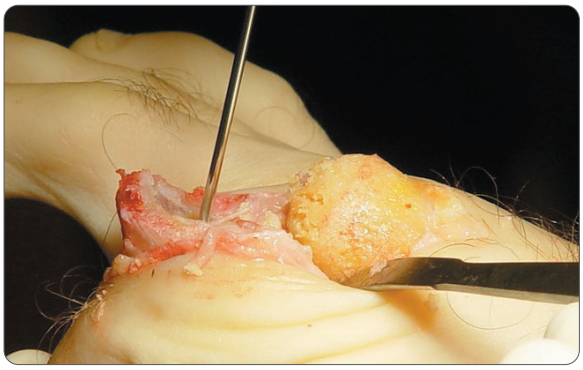


Figure 4-4

Step 4 ▪ Phalangeal Preparation

4-1 The proximal phalanx is plantar flexed. A Hohman retractor usually helps to expose the phalanx. A 1.6mm K-wire (115 116ND) is placed in the center of the prepared base of the proximal phalanx and driven in a distal direction along the axis of the hallux.

4-2 Care is taken not to penetrate the interphalangeal joint. Reaming must begin by using the smallest size of phalangeal reamer (size 14mm) in order to avoid any excessive reaming. The metatarsal head should be protected when reaming.

Using the Quick Coupling device (129 710ND) the HALLU-REAMER is then engaged over the 1.6mm K-Wire (115 116ND). The phalanx is reamed, creating a concave cup-shaped surface.

If necessary, due to the diameter of the articular surface of the phalanx, superior sizes of the phalangeal reamers can be used until the dimensions match the size used for the metatarsal reamer. When an additional bone graft is required, bone debris in the reamer can be used after the reaming process is complete.

Warning: The same size metatarsal and phalangeal reamers must be used to obtain congruent surfaces.
(Example: If metatarsal reaming has been achieved with a 18mm reamer, the largest and last reamer to be used for the phalanx should also be an 18mm.)

4-3 The reamer and K-wire are then removed. The cup and cone shaped surfaces can be aligned in any desired position. It is then possible to rotate the surfaces, change the dorsi-flexion, plantar flexion and valgus angles.

4-4 A temporary K-wire is introduced from the phalanx to the metatarsal to stabilize the joint in the adequate position for final arthrodesis.

Bone graft can then be placed into the joint.

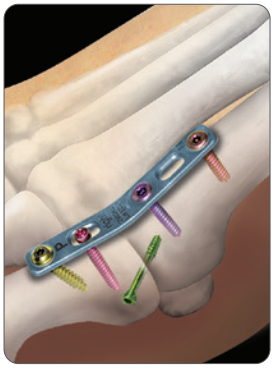


Figure 5-1

Figure 5-2

Figure 6-1

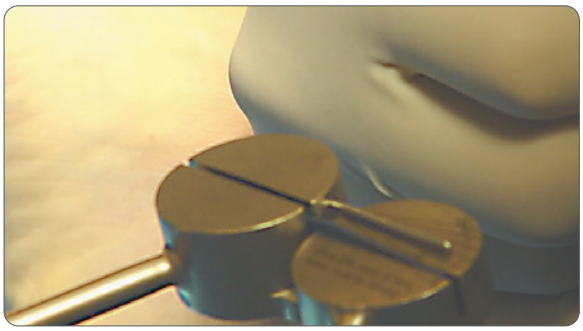


Figure 6-2

Step 5 ▪ Sizing

5-1 The choice of the appropriate size of the HALLU°-LOCK C or HALLU-LOCK S plate is made by the surgeon based on the dorsal aspect of the bone surfaces and assessing the dimensions. For the HALLU-LOCK C plate, the small central hole should be positioned over the center of the metatarsal head.

5-2 In the case of a revision (HALLU-LOCK S plate), the positioning hole is used as a “landmark” to create the center of the joint.

Step 6 ▪ Plate Positioning

6-1 The plate has 2 marks on its dorsal aspect:

- P stands for Phalanx and M for Metatarsal.
- This orientation is mandatory.

6-2 HALLU-LOCK C Plate Bending

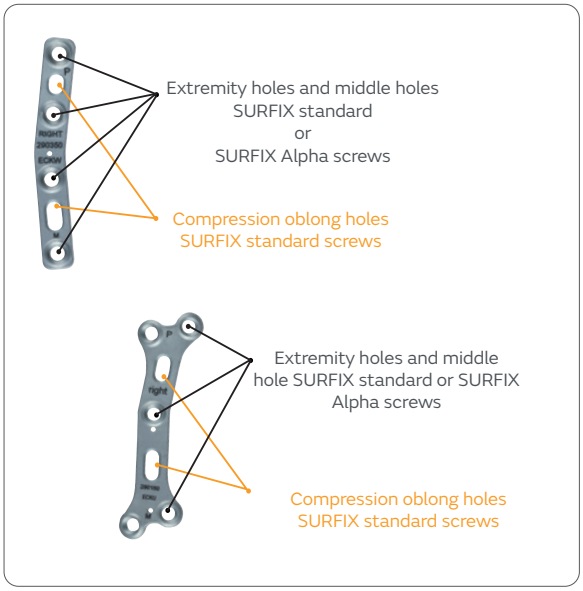
The HALLU-LOCK 10° S plates have both a 10° lateral angulation (10° valgus) as well as 10° dorsal flexion. The HALLU-LOCK 5° S plates have a have a 10° lateral angulation (10° valgus) and 5° dorsal flexion. The HALLU-LOCK C plates have both a 10° lateral angulation (10° valgus) as well as 10° dorsal flexion and can be bent by using 2 benders (299 070ND/ 299 080ND), left & right, to match the degree of dorsal flexion required by the case or activity of the patient.

Warning:

- **Do not bend the HALLU-LOCK S Plate**
- **The HALLU-LOCK C plate may be bent only once and should not be bent excessively**

Figure 7-1

Figure 7-2



Step 7 ▪ Plate Fixation

7-1 Once the correct size and type of plate have been chosen, and adequate alignment has been achieved, a 1.0mm diameter K-wire is inserted through the central hole of the corresponding final plate in the metatarsal head for temporary stabilization. The K-wire allows for rotation of the plate in order to reach the ideal position.

Available Locking Screws:

- SURFIX◊ screws 2.7mm/3.0mm, length 10 to 24mm and SURFIX Alpha screws 2.7mm/3.0mm (variable angle screws), length 10 to 24mm.
- Screws are color-coded for easy identification.
- Torx screwdriver (219 127ND) can be used for both locking and non-locking screws.

Warning: The HALLU-LOCK plates must be fixed with the SURFIX fixed angle locking system and with the SURFIX Alpha variable angle locking system of 2.7mm or 3.0mm diameter (screws and lock washers)

7-2 The choice of using SURFIX Standard or SURFIX Alpha locking screws (2.7mm or 3.0mm) depends on the need for angulation and orientation of the screw.

The larger diameter screw (3.0mm) should be chosen to achieve optimal stability when bone quality is poor.

The oblong holes allow compressive screw fixation. SURFIX screws should be placed in the oblong holes without the lock screw cap.

Warning: Do not use the SURFIX Alpha screw in the oblong holes of the plate.

The central K-wire should be removed when solid fixation of the plate is achieved.

Screws should be inserted into the extremity holes first and then the middle.

Warning: Screw and lock-screw insertion in each threaded hole of the HALLU-LOCK plates are mandatory to have good stability, specifically in the four extremity holes of the HALLU-LOCK S plate.

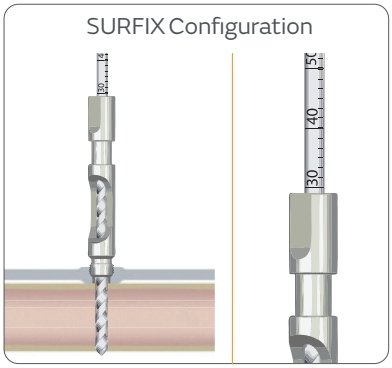
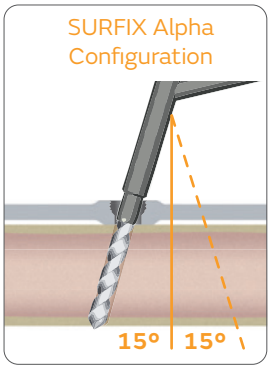


Figure 8-1a



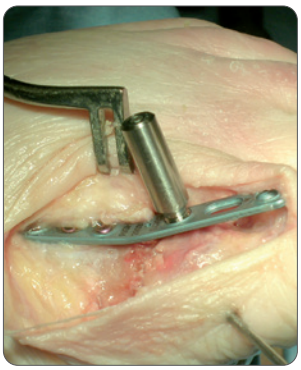


Figure 8-1b

Step 8 ▪ Preparation of the Screw Holes

8-1a Prepare the holes with the 2.0mm drill (299 005ND or 299 050ND) through the SURFIX◊ drilling guide (219 627ND) screwed in the plate (See Figure 8-1a)

8-1b Use the SURFIX Alpha drilling guide (219 027ND) orientated the correct way and inserted into the hole of the plate (See Figure 8-1b).

Figure 9-1

Step 9 ▪ Measuring of the Depth

9-1 Alternatively measure for the necessary screw length using the depth gauge (600 706) and angle for SURFIX Alpha configuration.

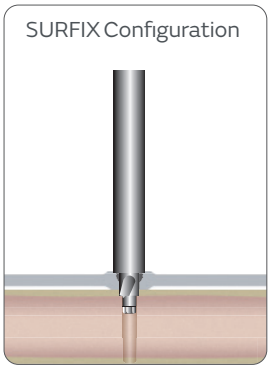


Figure 10-1a

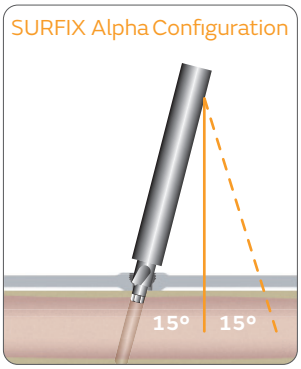


Figure 10-1b

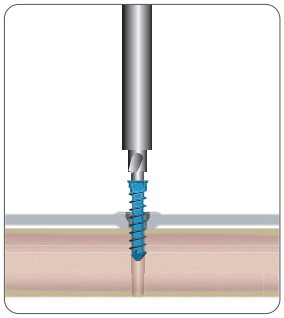
Step 10 ▪ Chamfering of the Hole

10-1a/10-1b To create proper seating of screw and SURFIX Locking Washer Cup, chamfer each screw hole prior to screw hole insertion with screwdriver (219 127ND, 219 227ND).

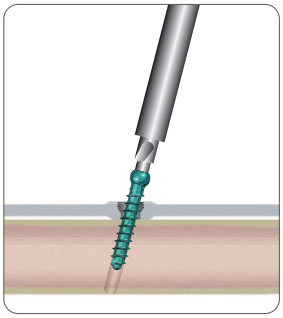
Figure 10-1a shows standard SURFIX screw and Figure 10-1b shows alpha SURFIX screw.

SURFIX Configuration

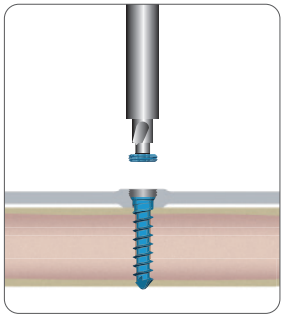
SURFIX Alpha Configuration



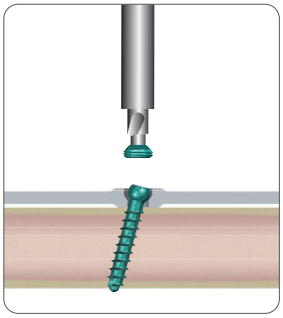
SURFIX Configuration



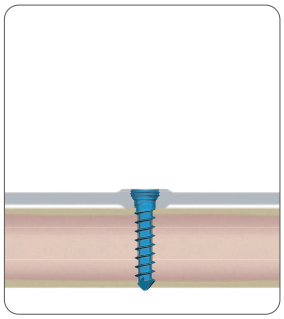
SURFIX Alpha Configuration

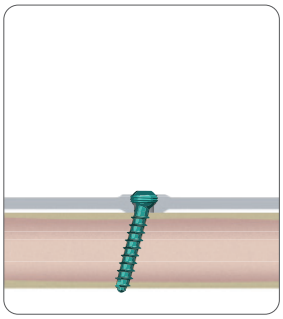


SURFIX Configuration



SURFIX Alpha Configuration





Step 11 ▪ Insertion of the Screw

11-1 Insert the screw with the screwdriver (219 127ND, 219 227ND) into the prepared hole until screw head comes in contact with the plate. The screw should be fully seated in the plate. Clean the threaded hole before and after introducing the screw. Maintain co-axiality between the screw and the threaded hole.

Step 12 ▪ Positioning of the Locking Screw

12-1 Assemble the locking screw to the screwdriver (219 127ND). Lock screws should be inserted after each screw, and before preparation and insertion of the subsequent screw. This prevents potential damage to threaded holes.

Note: The spherical shaped locking screw of the SURFIX◊ Alpha screw has to be inserted perpendicularly to the plate in order to be screwed properly.

Step 13 ▪ Locking of the System

13-1 Fully seat the locking screw in the plate hole.

The SURFIX locking screw should be flush with the top of the plate when it is fully inserted.

The locking screw on the head of the screw should block the hole of the plate remaining parallel to the plate (the screw is maintained in an oblique position).

Step 14 ▪ Compression Device (oblong holes)

14-1 Once all the circular holes are fixed, the oblong one can be fixed. SURFIX standard screws are inserted as described in the previous steps, without any locking with the locking screws.

Warning: Do not use the SURFIX Alpha screw in the oblong holes of the plate.

The central K-wire should be removed when solid fixation of the plate is achieved.

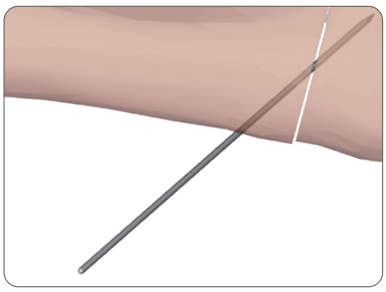


Figure 15-1

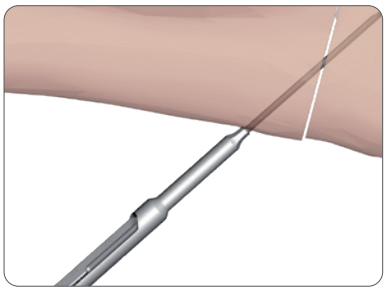


Figure 15-2

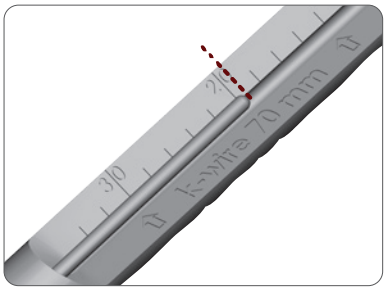


Figure 15-3

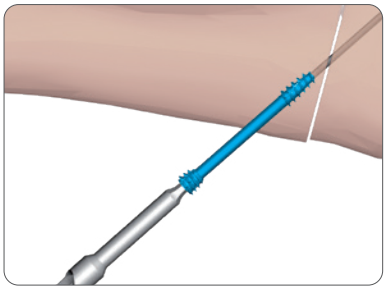


Figure 15-4

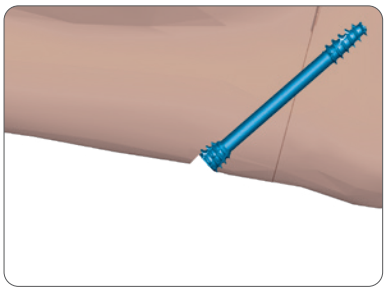


Figure 15-5

Step 15 ▪ QWIX◊ Screw Insertion

Note: Can be preformed prior to screw placement into plate.

Note: Addition of a fixation screw (e.g. QWIX Screw Insertion) crossing the joint is designed to facilitate arthrodesis.

15-1 A K-wire (115 070ND, 115 101ND, 115 116ND) is inserted in the correct place for the QWIX screw. The position should be checked under fluoroscopy. This K-wire will guide the screw.

15-2 Measure the screw length.
The length read on the cannulated screwdriver is equal to the length of K-wire inserted in the bone plus 1.5mm offset for compressing Bi-Cortical fixation.

15-3 For Bi-Cortical fixation: Insert the appropriate cannulated screwdriver (119 135ND / 119 114ND) on the K-wire. Read the indicated screw length directly from the scale (Figure 15-3). For Mono-Cortical fixation subtract 1.5mm to determine appropriate screw length.
Although the QWIX 3.0mm and 4.3mm screws are self-drilling and self-tapping in most bone, the surgeon is responsible for assessing this hardness before use and closure is performed following standard technique.
Prepare the cortex by power or manually with the drill (159 027SND), 2.2mm diameter drill.

15-4 The QWIX screw can be inserted under power then completed by hand (assembling the Dia 3.0mm screwdriver tip (119 135ND) or the Dia 4.3mm screwdriver tip (119 114ND) to the AO handle (119 133ND)).

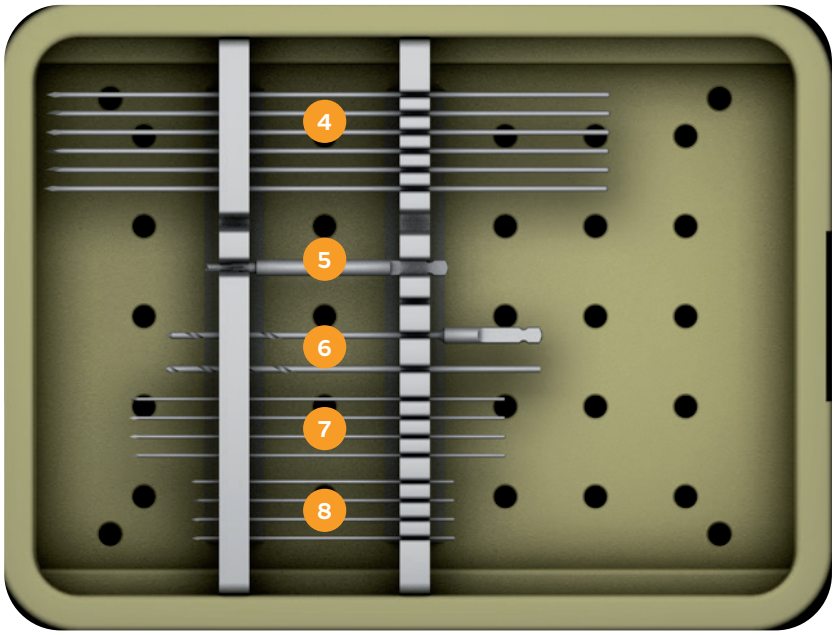
15-5 The head of the screw must be completely embedded in the cortex to obtain optimal compression.
Complete insertion is also recommended to help prevent soft tissue irritation.

Step 16 ▪ Post-Operative Treatment

16-1 It is important that post-operative immobilization with a slipper shoe (solid rigid sole) be worn by the patient during the initial 6 weeks or longer, if required by the surgeon for some specific patients, pathologies, or associated surgical procedures. The slipper shoe should be worn until fusion is confirmed by X-ray. Failure to comply with postoperative recommendations could result in failure of the fusion and/or plate breakage.

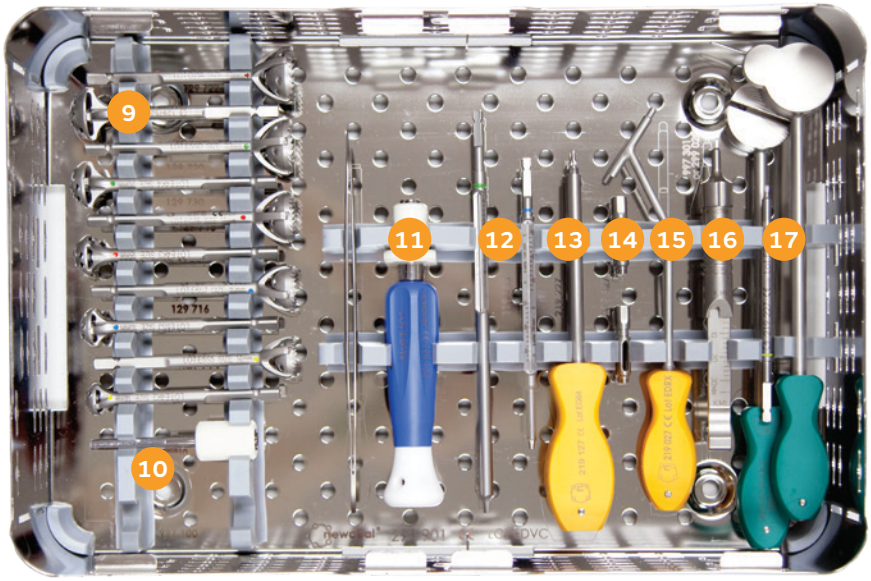
HALLU◊-LOCK Instrumentation Set

1. HALLU-LOCK C-Plate
2. HALLU-LOCK S-Plate
3. SURFIX◊ standard and Alpha Locking Screws (2.7mm & 3mm)



4. K-wire Dia 1.6 x L.150mm
5. Drill AO 2 in 1 (2.2mm x L 65mm)
6. Drills 2.0 x L.100mm (with/without AO)
7. K-wire Dia 1.0 x L.100mm
8. K-wire Dia 1.0 x L.70mm

HALLU◊-LOCK Instrumentation Set



9. HALLU-REAM attachments
10. Quick- Coupling device
11. AO QWIX◊ screw handle
12. AO QWIX screwdriver tip
13. Torx screwdriver and AO torx screwdriver tip
14. SURFIX◊ drilling guides
15. SURFIX Alpha drilling guide handle
16. Screw Depth gauge
17. Left and Right Plate benders

18. 3.0mm QWIX Compression Screws (24-34mm)
19. 4.3mm QWIX Compression Screws (24-40mm)

HALLU-LOCK S Plate 10˚

Catalog Number	Description
290 145SND	Right-Size 0: L40mm
290 150SND	Right-Size 1: L45mm
290 155SND	Right-Size 2: L50mm
290 160SND	Right-Size 3: L55mm
290 245SND	Left-Size 0: L40mm
290 250SND	Left-Size 1: L45mm
290 255SND	Left-Size 2: L50mm
290 260SND	Left-Size 3: L55mm

HALLU-LOCK S Plate 5˚

Catalog Number	Description
290 545SND	Right-Size 0: L40mm
290 550SND	Right-Size 1: L45mm
290 555SND	Right-Size 2: L50mm
290 560SND	Right-Size 3: L55mm
290 645SND	Left-Size 0: L40mm
290 650SND	Left-Size 1: L45mm
290 655SND	Left-Size 2: L50mm
290 660SND	Left-Size 3: L55mm

SURFIX Standard 2.7mm+Locking Screw

Catalog Number	Description
285 210SND	10mm
285 212SND	12mm
285 214SND	14mm
285 216SND	16mm
285 218SND	18mm
285 220SND	20mm
285 222SND	22mm
285 224SND	24mm
185 200SND	Lock-screw washer cap

SURFIX Alpha 2.7mm+Locking Screw (Variable Angle)

Catalog Number	Description
295 210SND	10mm
295 212SND	12mm
295 214SND	14mm
295 216SND	16mm
295 218SND	18mm
295 220SND	20mm
295 222SND	22mm
295 224SND	24mm
195 200SND	Lock-screw washer cap

HALLU-LOCK C Plate 10˚

Catalog Number	Description
290 335SND	Right-Size 0: L35mm – 4 holes
290 340SND	Right-Size 1: L40mm – 4 holes
290 345SND	Right-Size 2: L45mm – 5 holes
290 350SND	Right-Size 3: L50mm – 6 holes
290 435SND	Left-Size 0: L35mm – 4 holes
290 440SND	Left-Size 1: L40mm – 4 holes
290 445SND	Left-Size 2: L45mm – 5 holes
290 450SND	Left-Size 3: L50mm – 6 holes

SURFIX◊ Standard 3.0mm+Locking Screw

Catalog Number	Description
285 110SND	10mm
285 112SND	12mm
285 114SND	14mm
285 116SND	16mm
285 118SND	18mm
285 120SND	20mm
285 122SND	22mm
285 124SND	24mm
185 100SND	Lock-screw washer cap

SURFIX Alpha 3.0mm+Locking Screw (Variable Angle)

Catalog Number	Description
295 110SND	10mm
295 112SND	12mm
295 114SND	14mm
295 116SND	16mm
295 118SND	18mm
295 120SND	20mm
295 122SND	22mm
295 124SND	24mm
195 100SND	Lock-screw washer cap

QWIX◊ 3.0mm Screw

Catalog Number	Length
111 324SND	24mm
111 326SND	26mm
111 328SND	28mm
111 330SND	30mm
111 332SND	32mm
111 334SND	34mm

HALLU◊-REAM Metatarsal Reamer

Catalog Number	Description
129 714ND	14mm diameter
129 716ND	16mm diameter
129 718ND	18mm diameter
129 720ND	20mm diameter
129 722ND	22mm diameter

Instrumentation

Catalog Number	Description
299 070ND	HALLU◊-LOCK C plate bender left (proximal)
299 080ND	HALLU-LOCK C plate bender right (distal)
219 027ND	SURFIX◊ Alpha drilling guide Dia 2.0mm
219 127ND	Torx screwdriver T7
219 227ND	Torx AO screwdriver tip T7
219 627ND	SURFIX drilling guide Dia 2.0mm
600 706	Depth gauge
299 005ND	Drill Dia 2.0 x L100mm
299 050ND	Drill AO Dia 2.0 x L100mm
119 133ND	AO screwdriver tip 3.0mm QWIX
119 135ND	AO screwdriver tip QWIX
159 027SND	Drill AO 2 in 1 Dia 2.2 x L65mm QWIX
119 139ND	Short Drill AO 2 in 1 4.3mm QWIX
119 516ND	Long Drill AO 2 in 1 4.3mm QWIX
119 114ND	AO screwdriver tip 4.3mm QWIX

QWIX 4.3mm Screw

Catalog Number	Length
111 424SND	24mm
111 426SND	26mm
111 428SND	28mm
111 430SND	30mm
111 432SND	32mm
111 434SND	34mm
111 436SND	36mm
111 438SND	38mm
111 440SND	40mm

HALLU-REAM Phalangeal Reamer

Catalog Number	Description
129 724ND	14mm diameter
129 726ND	16mm diameter
129 728ND	18mm diameter
129 730ND	20mm diameter
129 752ND	22mm diameter

K-wires

Catalog Number	Description
115 070ND	K-wire Dia 1.0 x L70mm
115 101ND	K-wire Dia 1.0 x L100mm
115 116ND	K-wire Dia 1.6 x L150mm

Container

Catalog Number	Description
299 901ND	Lower Basis
299 911ND	Upper Basis
299 904ND	K-wire Tray
299 915ND	Supporting Rack
996 200ND	Lid

Availability of these products might vary from a given country or region to another, as a result of specific local regulatory approval or clearance requirements for sale in such country or region.

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