

Rayhack® Ulnar Shortening Generation II

Low-Profile Locking System

Operative technique



Rayhack Ulnar Shortening

Generation II Low-Profile Locking System

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Operative technique as described by
John M. Rayhack, MD

This publication sets forth detailed recommended procedures for using Stryker devices and instruments. It offers guidance that you should heed, but, as with any such technical guide, each surgeon must consider the particular needs of each patient and make appropriate adjustments when and as required.

Important

- The patient should be advised that the device cannot and does not replicate a normal healthy bone, that the device can break or become damaged as a result of strenuous activity or trauma and that the device has a finite expected service life.
- Removal or revision of the device may be required sometime in the future.
- Cleaning and sterilization information is provided in the applicable instructions for use.
- Non-sterile devices, including implants and instruments, must be cleaned and sterilized prior to use, in accordance with validated methods.
- Devices that are able to be disassembled should be disassembled prior to point-of-use processing. Additionally, devices with movable components that do not facilitate disassembly should be manually articulated during the point-of-use processing step in order to evacuate additional soils.
- Please remember that the compatibility of different product systems has not been tested unless specified otherwise in the product labeling.
- Consult Instructions for Use (<https://ifu.wright.com>) for a complete list of potential adverse effects and adverse events, contraindications, warnings and precautions.
- The surgeon must advise patients of surgical risks, and make them aware of adverse effects and alternative treatments.
- An implant whose packaging is open or damaged or whose expiration date has passed must not be used. Every precaution must be taken to ensure sterility when opening the packaging of the implant and during implantation.

Indications and contraindications

Indications

The Rayhack Ulnar Shortening System is intended for long bone fixation utilized to assist healing but not intended to replace normal body structures. The plate and screws which attach to the bone are temporary internal fixation devices which align the bone surfaces in order to permit bone healing.

Contraindications

There are no device specific contraindications associated with this system.

Product information

Options available

In addition to this low-profile plate, the surgeon has the option of using the Generation I non-locking plate.

Plate placement

Ulnar subcutaneous surface (technically easier). Volar ulnar surface.

Saw guide

Generation I saw guide (ulnar subcutaneous approach).

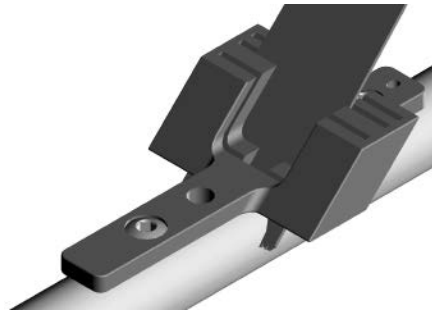
Universal surface-mount saw guide (both approaches).

Titanium plate

Only available in Rayhack Generation I non-locking design.



Low-profile locking plate
Stainless steel only



Universal surface-mount ulnar saw guide

Operative technique

Rayhack Ulnar Shortening

Generation II Low-Profile Locking System

Step 1 - Placement of the universal surface-mount ulnar saw guide

Options:

1. Volar ulnar surface

2. Subcutaneous ulnar surface

Volar ulnar surface

A 10cm incision is made along the ulnar subcutaneous border. The FCU tendon and surrounding soft tissues are retracted anteriorly.

The Generation I saw guide cannot be used for volar application. | **Figure 1**

Subcutaneous ulnar surface

Utilizing the same skin incision, the interval between the FCU and ECU is developed and the ulna is exposed. The Generation I saw guide or the Generation II **Figure 2** surface-mount saw guide may be used.

Step 2 - Positioning of the straight drill guide and fixation of the saw guide

In order to prevent excessive distal placement of the shorter Generation II saw guide, it is critical to first apply the plate on the ulnar surface so the distal plate end is approximately 3cm from the distal ulnar surface. Contouring the ulnar plate during the first stage is an option (see **STEP 5**). Mark hole #2 on the bone. Manually hold the saw guide centered on the ulna, line up screw hole #2 of the saw guide with the location of the mark on the ulna. Apply the straight drill guide and drill hole #2 with a 2.5mm drill bit. | **Figure 3** Measure, tap and insert a 3.5mm cortical screw. Keep the saw guide centered on the ulna, repeat the process for screw hole #4 and then #3.

Note:

Surgeons utilizing the Generation I saw guide who are placing a Generation II low-profile locking system on the ulnar subcutaneous border must remember to avoid drilling hole #1 as this will be the site of the future 2.7mm locking screw. | **Figure 4**

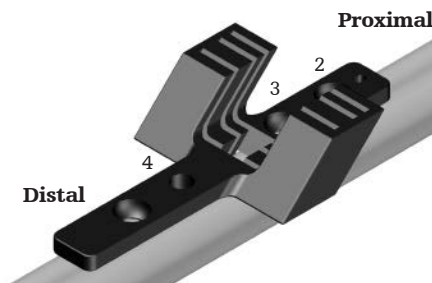


Figure 1

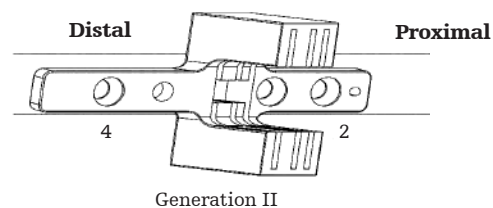
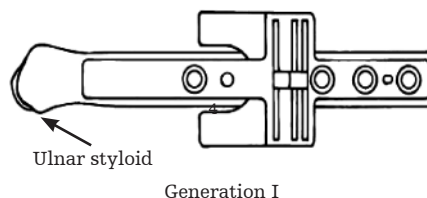


Figure 2

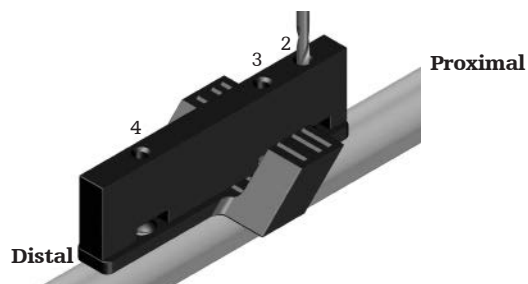


Figure 3

Note:

In Generation II, only holes #2, #3, and #4 will be drilled. Hole #1 will be drilled through the double-threaded drill bushing for placement of the 2.7mm locking screw.

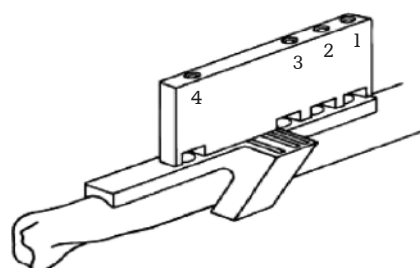


Figure 4

Operative technique

Step 3 - Width of the ulnar osteotomy and anticipated linear shortening of 3.5, 4.9, or 7.4mm

The stated distances between the slots are measured perpendicular to the osteotomy surfaces and represent the actual machined distances in the saw guide. The anticipated linear shortening of the bone: calculated as the hypotenuse of the right triangle is this perpendicular measurement multiplied by the square root of 2: (1.4142). Due to various clinical factors (amount of plate pre-bending, use of the specified saw blade, degree of linear compression, etc.) the actual amount of bone shortening will be very close to the hypotenuse in length.

| Figures 5 and 6

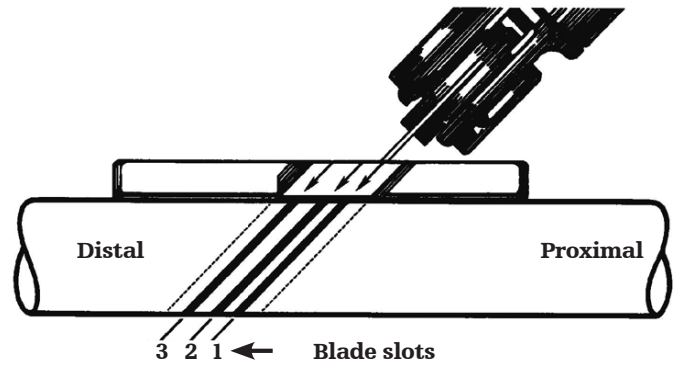


Figure 5

Osteotomy width (Perpendicular to osteotomy)		Anticipated shortening
Slots 1-2	2.5mm	3.5mm
Slots 2-3	3.5mm	4.9mm
Slots-3	5.25mm	7.4mm

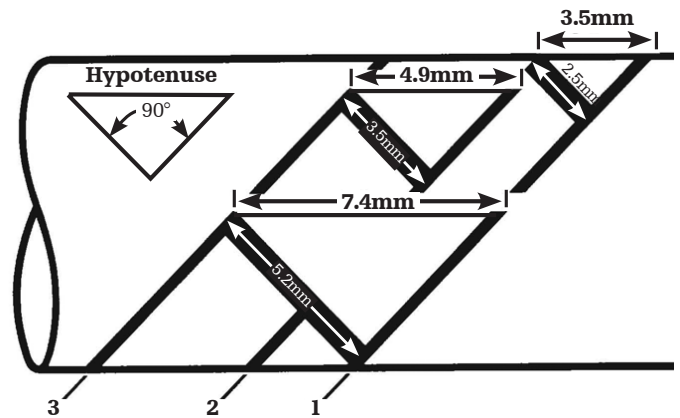


Figure 6

Operative technique

Step 4 - Performing the oblique ulnar shortening osteotomy

Use either of the dedicated saw blades designed for the ulnar osteotomy and make the distal cut first. Irrigate with sterile slush saline to minimize thermal necrosis. Use a gentle side-to-side motion with a pencil grip sagittal saw. | **Figure 7**

Complete the proximal osteotomy cut and remove the intervening bone fragment. | **Figure 8**

Carefully remove the three cortical screws and place them in the temporary holding slots.

Self-tapping screws are not advised as reinsertion of screws may cut a new thread in the bone and lead to screw loosening.



Cut distally first.

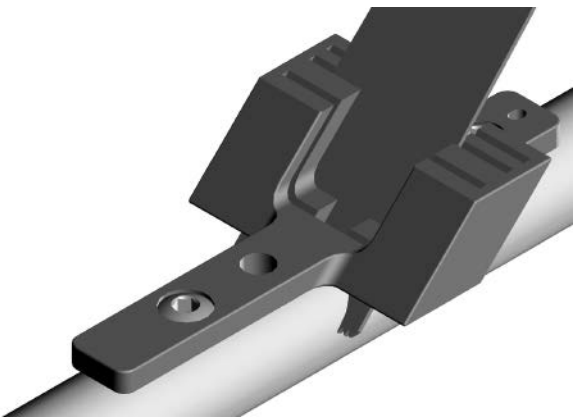


Figure 7

Next, cut proximally.

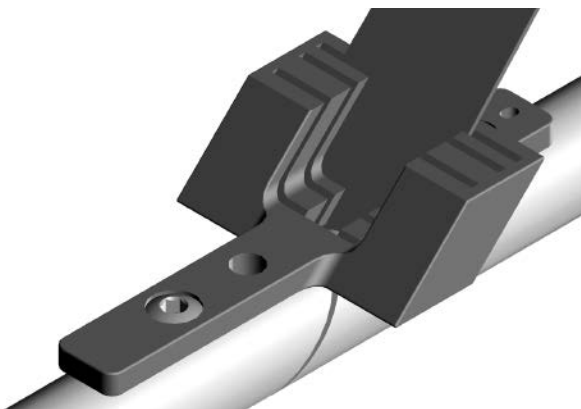


Figure 8

Operative technique

Step 5 - Low-profile locking ulnar bone plate fixation

Pre-bend the ulnar plate to the ulnar contour prior to applying to the bone. This is especially important when placing on the ulnar subcutaneous border. In this location, the plate will be bent convex toward the surgeon. In the volar approach, the distal plate end may need to be contoured. Pre-bending the plate during the first stage of plate placement is an option. | **Figure 9**

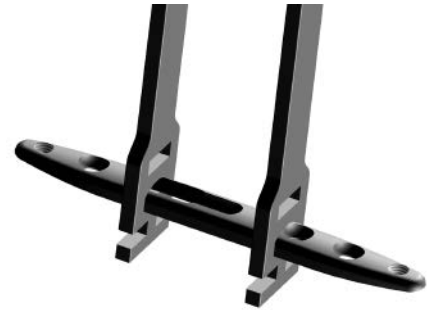


Figure 9

Insert the previously inserted screw #2 into hole #2 of the low-profile locking plate. (Or hole #2 of the Generation I non-locking ulnar plate.) | **Figure 10**



Figure 10

Step 6 - Application of the compression device

Apply the low-profile compression device over the plate and screw hole #3.

Insert a 3.5mm cortical screw through hole #3 that is 4mm longer than the original screw. This screw may be tightened to secure the plate and fixed block. | **Figure 11**

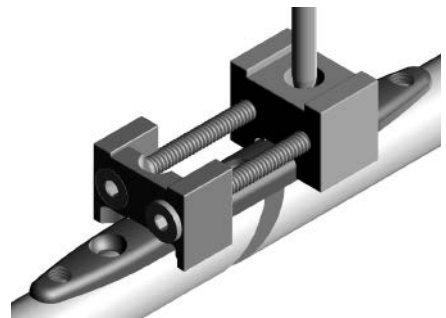


Figure 11

Apply a screw through the sliding block, the oblong slot in the plate and hole #4. It is important to keep this screw slightly loose during the osteotomy compression.

| **Figure 12**

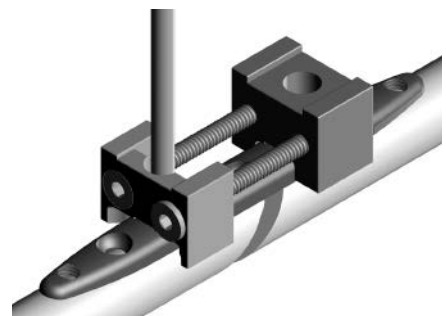


Figure 12

Operative technique

Step 7 - Compression of the osteotomy

Gently and evenly compress the osteotomy with a 2.5mm hex screwdriver alternating between both horizontal compression screws. | **Figure 13**

DO NOT utilize only one screw to compress the osteotomy as this may eccentrically load and damage the compression device and horizontal compression screws.

Do not excessively compress the osteotomy. Stop compression when both surfaces are visually compressed. | **Figure 14**

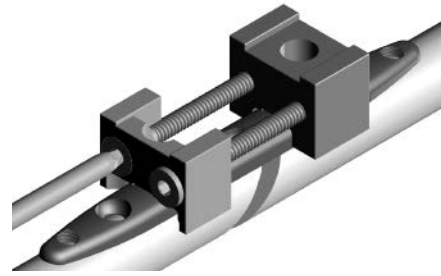


Figure 13

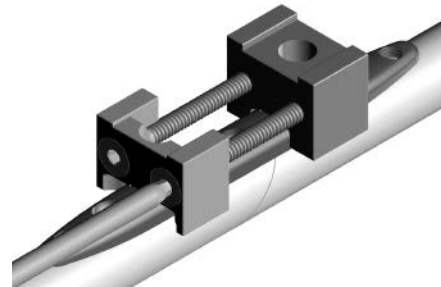


Figure 14

Step 8 - Drilling the 22 degree interfragmentary lag screw hole

Apply the 22 degree angled drill guide into the round hole of the fixed block.

| **Figure 15A**

Drill the first cortex with a 2.7mm drill bit. (Avoid drilling two cortices.) | **Figure 15B**

Apply the 2.7mm smooth drill bushing into the angled drill guide. | **Figure 15C**

Drill a 2.0mm hole in the far cortex through the smooth drill bushing. | **Figure 15D**

In some osteotomies employing slots 1 and 3 of the saw guide, the angled drill guide will not seat between the two blocks of the compression device. This occurs due to the morphology of the ulna or excessive compression of the osteotomy. In this instance, freehand the 2.7mm drill bit hole at the desired angle for the interfragmentary lag screw, then proceed with inserting the drill bushing and drilling the 2.0mm hole.

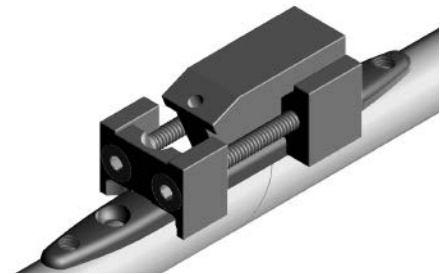


Figure 15A

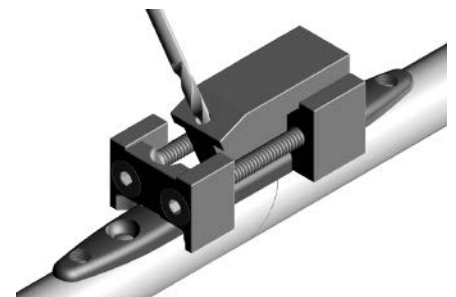


Figure 15B

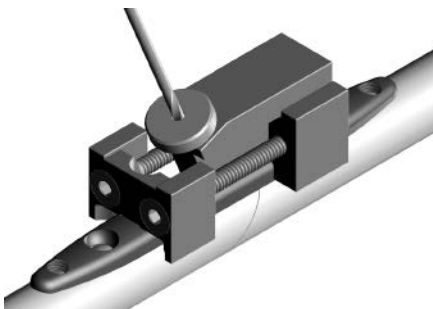


Figure 15D

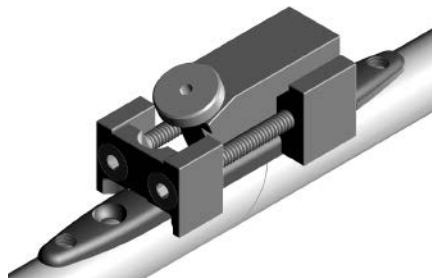


Figure 15C

Operative technique

Step 9 - Oblique 2.7mm interfragmentary lag screw application

Remove the 22 degree angled drill guide. | **Figure 16**

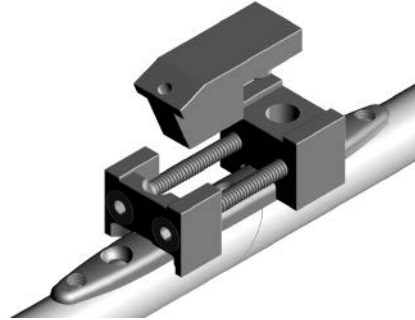


Figure 16

Measure the interfragmentary screw hole depth. | **Figure 17**

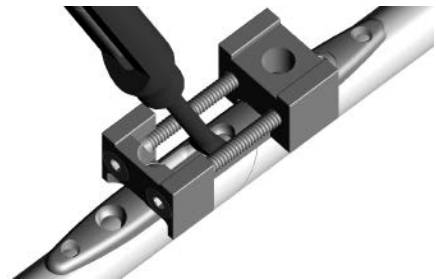


Figure 17

Reapply the angled drill guide and tap the far cortex with a 2.7mm tap. | **Figure 18**

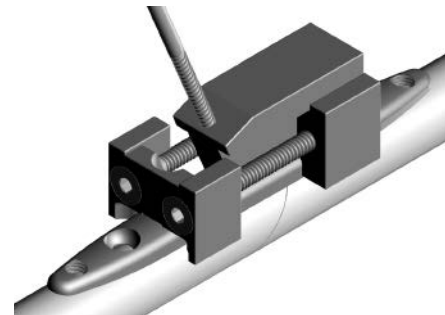


Figure 18

Carefully insert the 2.7mm cortical lag screw. | **Figure 19**

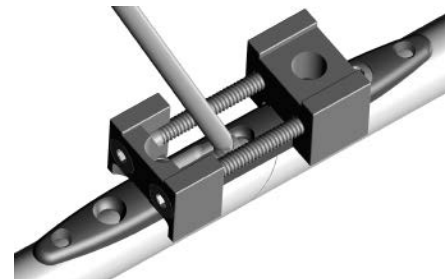


Figure 19

Operative technique

Step 10 - Final fixation of the plate – screw #5 and the locking screw application

Using the handheld drill guide, drill hole #5 with a 2.5mm drill bit. Measure, tap and then insert a 3.5mm cortical screw. | **Figure 20**

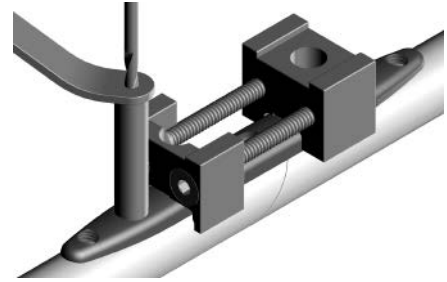


Figure 20

Gently screw in either end of the double-threaded drill bushing into hole #6. | **Figure 21**

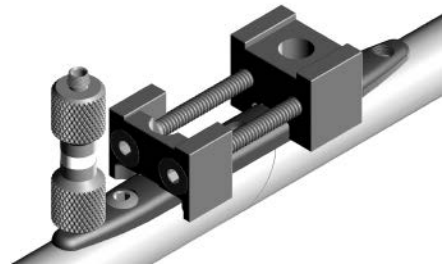


Figure 21

Drill a 2.3mm hole through both cortices. Unscrew the threaded drill bushing. | **Figure 22**

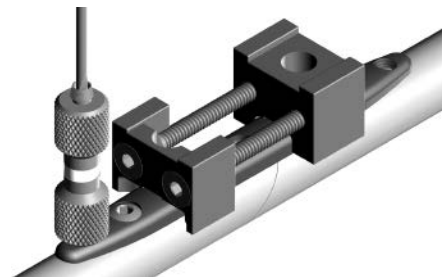


Figure 22

Measure and carefully insert a 2.7mm self-tapping locking screw with the star 8 driver. | **Figure 23**

Repeat the process for screw #1. | **Figure 24** Gently insert the 2.7mm locking screw into hole #1. Do not over-tighten. | **Figure 25**

Remove the compression device and insert the original 3.5mm screws #3 and #4.

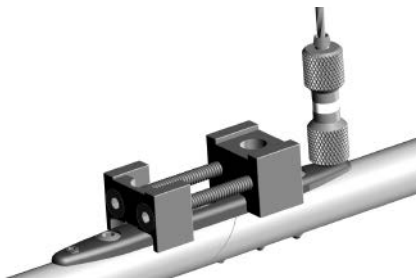


Figure 24



Figure 25

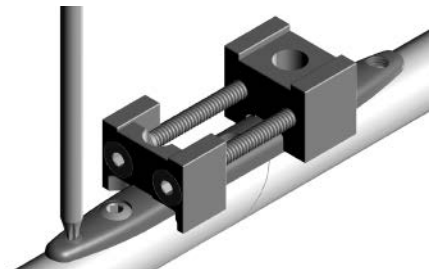


Figure 23

Operative technique

Step 11 - Ulnar shortening 9.1 - 18.1mm

Occasionally an ulna may be excessively long and require an osteotomy in excess of 7.4mm. It is possible to use the Rayhack Ulnar System to perform this osteotomy. This requires slightly more time and continued strict adherence to specific details. As the osteotomy width becomes larger, the technical demands of approximating the osteotomy may become even greater with the excessive tension exerted by the soft tissues attached to the distal fragment. Use of the compression device to approximate the osteotomy is particularly helpful in this regard.

The stated distances between the slots are measured perpendicular to the osteotomy surfaces and represent the actual machined distances in the saw guide. The anticipated linear shortening of the bone calculated as the hypotenuse of the right triangle is this perpendicular measurement times the square root of 2: (1.4142). Due to various clinical factors (the amount of plate pre-bending, use of the specified saw blade, degree of linear compression) the actual amount of ulnar shortening will vary slightly but will closely approach the calculated hypotenuse. | **Figure 26**

Osteotomy width (Perpendicular to osteotomy)	Anticipated shortening
F: 6.4mm	6: 9.1mm
G: 8.3mm	7: 11.7mm
H: 10.1mm	8: 14.2mm
I: 11.0mm	9: 15.5mm
J: 12.8mm	10: 18.1mm

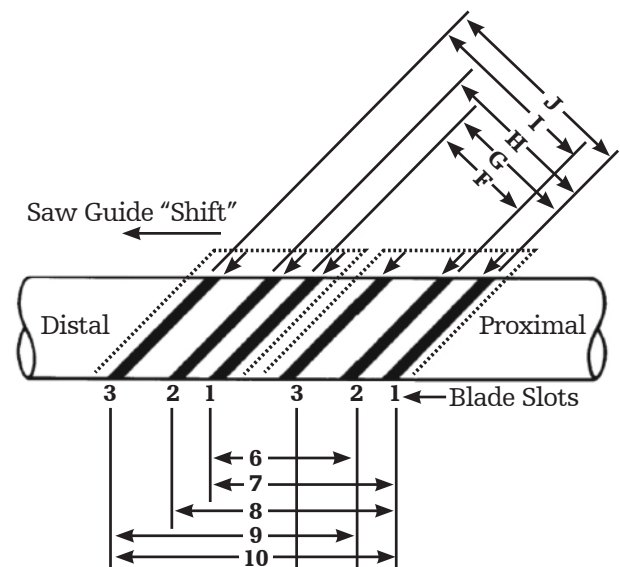


Figure 26

Operative technique

Step 12 - Ulnar shortening 9.1 - 18.1mm - shifting the saw guide distally

Volar option (not recommended)

Subcutaneous option (recommended)

Apply the Generation I (4-hole) ulnar saw guide.

| **Figure 27** Drill and insert the 3.5mm cortical screws into holes 2 and 3 of the saw guide. The screws are removed and placed in the tray's holding slots. The saw guide is shifted one hole distally and screws #2 and #3 are inserted through saw guide holes #1 and #2 respectively. | **Figure 28** Hole #4 is drilled, tapped, and a cortical screw is inserted. The distal osteotomy cut is made.

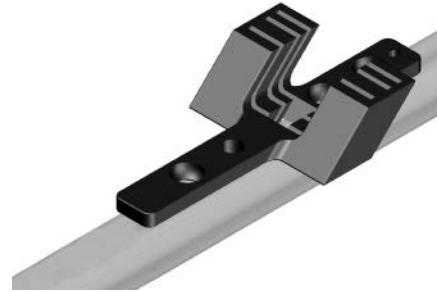


Figure 27

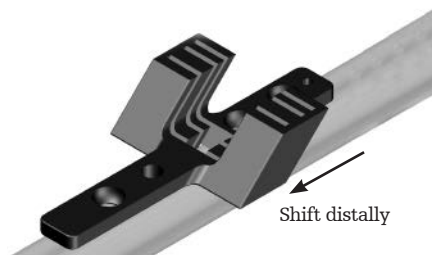


Figure 28

Step 13 - Ulnar shortening 9.1 - 18.1mm - shifting the saw guide proximally

D | Remove the saw guide and place the screws in the temporary tray holding slots.

E | Shift the saw guide back to its original position and reapply screws #2 and #3. | **Figure 29**

Cut in the proximal slot according to the desired amount of ulnar shortening.

F | Remove the saw guide and replace the screws in the corresponding tray slots.

G | Apply the plate and insert screw #2. Apply the compression device and apply the longer temporary 3.5mm cortical screws through holes #3 and #4.

| **Figure 30**

It may be necessary to grasp the distal ulna with a towel clip to pull it proximally in attempting to insert screw #4. If this is unsuccessful, drill an additional hole 3mm more proximally in line with the previous hole #4.

Compress the osteotomy as per the standard osteotomy routine depicted in **Step 7**.

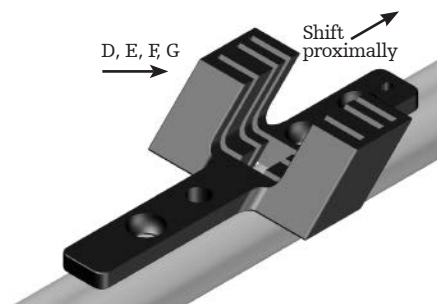


Figure 29

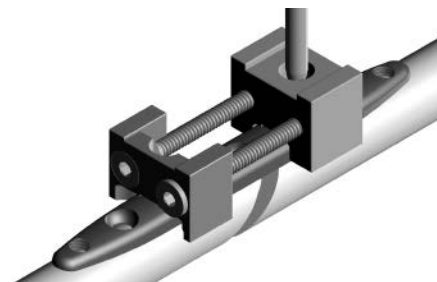


Figure 30

Operative technique

Step 14 - Intraoperative x-rays

To visualize the osteotomy surface, it is advisable to obtain two X-rays: one AP forearm in supination or 30 degrees short of full supination and one PA forearm in pronation. This will usually permit a true frontal and lateral view of the plate and osteotomy. Any screws deemed to be excessively long or too short may be replaced.

Step 15 - Post-operative care – plate breakage warning

In most cases a volar and dorsal plaster splint can be used to immobilize the forearm until the sutures are removed at two weeks post surgery. Most patients can be placed in a short arm removable plastic splint and protected until bone healing has occurred. In non-compliant patients, it is recommended that a sugar tong splint be applied at surgery and a short or long arm cast applied at the two week follow-up appointment. This can be converted to a thermoplastic splint when the surgeon is convinced that healing is satisfactory. No activity against resistance is permitted until bone healing has occurred.

Caution:

Plate breakage can occur if the patient remains unprotected prior to bone healing. In case of delayed union or non-union appropriate corrective measures must be taken to avoid plate breakage and loss of bone fixation.

Delayed union

A delayed union may occur on occasion. As long as no screw “toggle” or “backing out” occurs, the osteotomy will usually heal if adequately protected. If excessive callus appears or if any longitudinal plate bending occurs, or if screw loosening is noted, additional extended protection of the extremity or surgical intervention with replating and/or bone grafting may be necessary.

Implant removal

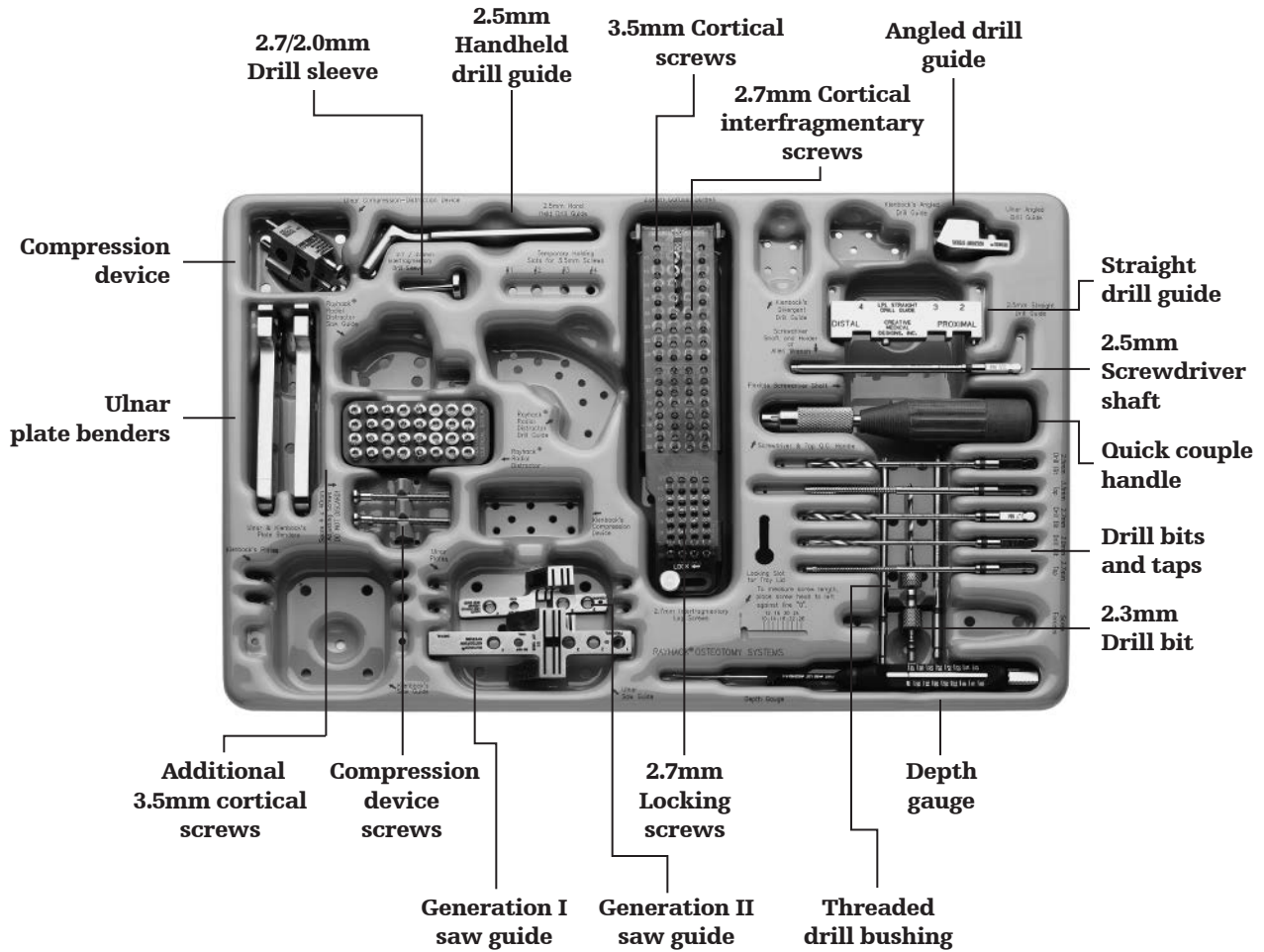
If the removal of the implant is required due to revision or failure of the device, the surgeon should contact the manufacturer using the contact information located on the back cover of this surgical technique to receive instructions for returning the explanted device to the manufacturer for investigation.

Appendix

Rayhack Ulnar Shortening Generation II

Low-Profile Locking System

Instrumentation



Appendix

Rayhack Ulnar Shortening Generation II

Low-Profile Locking System



Saw blade summary

Two individually packaged sterile saw blades are provided with each Rayhack Ulnar and Kienbock system. Both saw blades 40100110 and 110 are compatible with the Linvatec/Hall/MicroAire saws. Part numbers 40100410 and 410 saw blades are compatible with Stryker saws.

The provided saw blades are specifically designed for use with the Rayhack Ulnar and Kienbock systems. Using a generic blade is considered off-label and the responsibility of the user.

The below chart is for reference only. Due to manufacturer's specification changes, Stryker cannot guarantee the saw blades will fit all systems.



		Stryker part no.	Pneumatic	Electric	Battery
			1000-100/1950	1000ET/1950	6642B/6672
			1000-100/1955	000ET/1955	6642B/6670 (Battery SmartDriver)
				1641/6672 (Electric SmartDriver)	
Hall (Linvatec)  Microaire and Hall (Linvatec) compatible	ZS110*	40100110 110	5053-011 Micro 100	6020-022 Micropower (Pencil Style)	Pro6200/Pro2043 Mpower
			Pro6150/Pro2043 Pneumatic PowerPro	6021-022 Micropower (Pencil Style)	Pro6200/Pro2043 Mpower
				5020-022 Microchoice (Pencil Style)	Pro5100/Pro2043 Powerpro
				Pro6100/Pro2043 (Electric Powerpro)	Pro5100/Pro2043 Powerpro
Stryker  Stryker compatible	SP440 R*	40100410 410		Command II 2296-34	Cordless Driver 4200 with 4100-400 Saw
				TPS 5100-34	
				Core 5400-34	
				5400-99/4100-400 (Core Driver with Saw)	

Note:

Right angle grip of battery drivers is more difficult to use compared to pencil-type grips.

*Microaire part no.

Ordering information

Rayhack Ulnar Shortening Generation II

Low-Profile Locking System

Catalog No.	Catalog No.	Description
4010KITA	4009KITA*	
40100109	109	Rayhack ulnar plate
40100479	479	Rayhack LPL bone plate
40100110	110	Rayhack saw blade .020"
40100410	410	Rayhack saw blade .020"
40100910	910	Rayhack cort scr 3.5mm, 10mm
40100912	912	Rayhack cort scr 3.5mm, 12mm
40100914	914	Rayhack cort scr 3.5mm, 14mm
40100916	916	Rayhack cort scr 3.5mm, 16mm
40100918	918	Rayhack cort scr 3.5mm, 18mm
40100920	920	Rayhack cort scr 3.5mm, 20mm
40100922	922	Rayhack cort scr 3.5mm, 22mm
40100924	924	Rayhack cort scr 3.5mm, 24mm
40100950	950	Rayhack cort scr 2.7mm, 10mm
40100952	952	Rayhack cort scr 2.7mm, 12mm
40100954	954	Rayhack cort scr 2.7mm, 14mm
40100956	956	Rayhack cort scr 2.7mm, 16mm
40100058	958	Rayhack cort scr 2.7mm, 18mm
40100960	960	Rayhack cort scr 2.7mm, 20mm
40100962	962	Rayhack cort scr 2.7mm, 22mm
40100770	770	Rayhack lckg scr 2.7mm, 10mm
40100772	772	Rayhack lckg scr 2.7mm, 12mm
40100774	774	Rayhack lckg scr 2.7mm, 14mm
40100776	776	Rayhack lckg scr 2.7mm, 16mm
40100778	778	Rayhack lckg scr 2.7mm, 18mm
40100780	780	Rayhack lckg scr 2.7mm, 20mm
40100782	782	Rayhack lckg scr 2.7mm, 22mm
40100520	520	Rayhack drill bit 2.0mm
40100523	523	Rayhack drill bit 2.3mm
40100525	525	Rayhack drill bit 2.5mm
40100527	527	Rayhack drill bit 2.7mm

*4009 KITA/1 US distribution only.

Ordering information

Rayhack Ulnar Shortening Generation II

Low-Profile Locking System

Catalog No.	Catalog No.	Description
4010KIT1	4009KIT1*	
40100101	101	Rayhack ulnar saw guide
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40100401	401	Rayhack ulnar saw guide
40100402	402	Rayhack compression base
40100403	403	Rayhack compression block
40100404	404	Rayhack straight drill guide
40100406	406	Rayhack ulnar drill guide
40100449	449	Rayhack LPL comp screw
40100478	478	Threaded drill bushing
40100480	480	Rayhack depth gauge
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40100635	635	Rayhack bone tap 3.5mm
40100708	708	Rayhack star 8 driver shaft
40100725	725	Rayhack screwdriver shaft
40100750	750	Rayhack screwdriver handle

***4009 KITA/1 US distribution only.**

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