hofer
MEDICAL SOLUTIONS

Surgical Technique

HSN-esin - Hofer Sliding Nail

Elastic Stable Intramedullary Nailing

Warning
This description is not sufficient for immediate use of implants and instruments.
An instruction into handling these instruments by a surgeon experienced with them is strongly recommended.

This document provides information about the handling of HOFER implants and instruments.

This operation manual shall be considered as an addition and under no circumstances as a substitute to existing literature about surgical methods within orthopaedics and traumatolgy.

The content shall be regarded as a recommendation for a standardized procedure of how to apply the products without addressing the issues of any further necessary tasks, additional operative actions and possible extensions of the surgical technique.
The actual selection of the most suitable implant and its implantation method has to happen exclusively by the surgeon based on his education and the individual diagnostic findings.

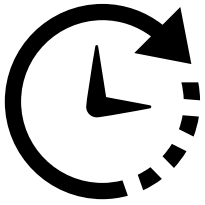
All illustrations printed here have a purely symbolic character to support the description of the surgical technique and can vary.

These operation instructions don't contain any details on the use of the instruments. Corresponding documents are available in the form of

- Usage instructions for instruments: intra- and postoperative handling
- Usage instructions for implants (each implant is enclosed)

Please ensure that the diagnosis and determination of the treatment plan are left up to the surgeon.

Hofer-medical gladly offers detailed training in safe handling and various surgical techniques.



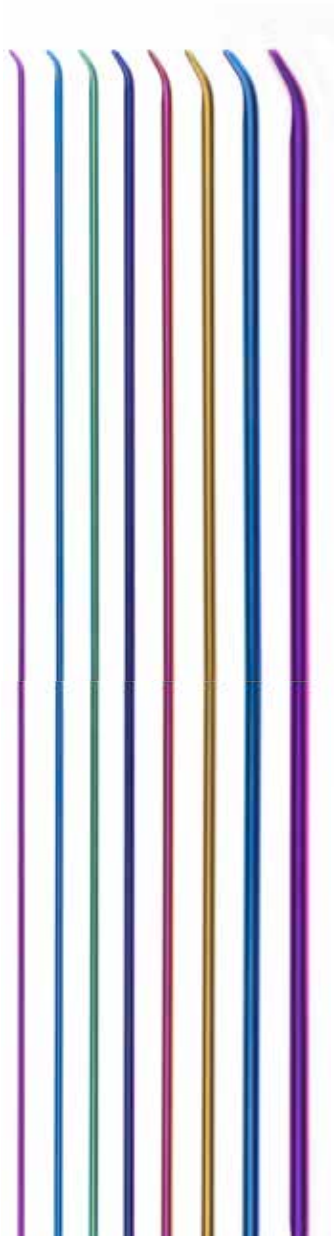
Please contact our 24/7 service hotline:
Tel.: +43 (0)3382 53388
Mail: office@hofer-medical.com

The HSN System of the company Hofer GmbH & Co KG (HOFER) is an intramedullary implant system.

It is designed to treat fractures of long bones for children and adolescents.

All HOFER products result out of a joint development of experienced clinicians and our engineers. This successful cooperation results in providing products to meet the anatomical and functional requirements of the respective sites due to their anatomically adjusted design and to provide an almost unrestricted operative treatment of various fractures.

HSNesin - Hofer Sliding Nail



Indications

Proper Use
- Intramedullary fixing of diaphyseal fractures of long, hollow bones to maintain the repositioning.

For children and patients who are still growing:
- diaphyseal fractures of long, hollow bones

For adults:
- diaphyseal fractures of long, hollow bones found in the upper extremities

Contra Indications

Complete contraindications:
- Mögliche oder gegebene Sensibilität gegenüber dem Material

Relative contraindications:
- Infections or inflammations (accute, chronic, local)
- Reduced circulation in the area concernced
- Patients with little or no compliance in relation to postoperative rehabilitation recommendations
- In case of a leg fracture: patients weighing over 50kg

Warnings:
- Smoking,
- Alcohol, disabilities (reduced patient compliance)

Position of Patient and Approaches

Patient Positioning:
- Standard

Approach:
- Standard approaches for the respective site

Implant Specific Details

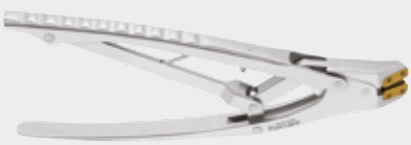
- The skid has a broadened, round tip
- Minimised danger of perforation, as a result of low surface pressure
- Improved sliding action as a result of the skid design
- Laser labelling to determine correct skid alignment
- Co-ordinated plugs on the nail diameter
- Minimally invasive implantation of plugs with special driver and drill instruments
- Fixing of plugs independent from nail inlet opening diameter
- Plugs enable different overhangs and inclination of nails to be balanced

HSN Plug

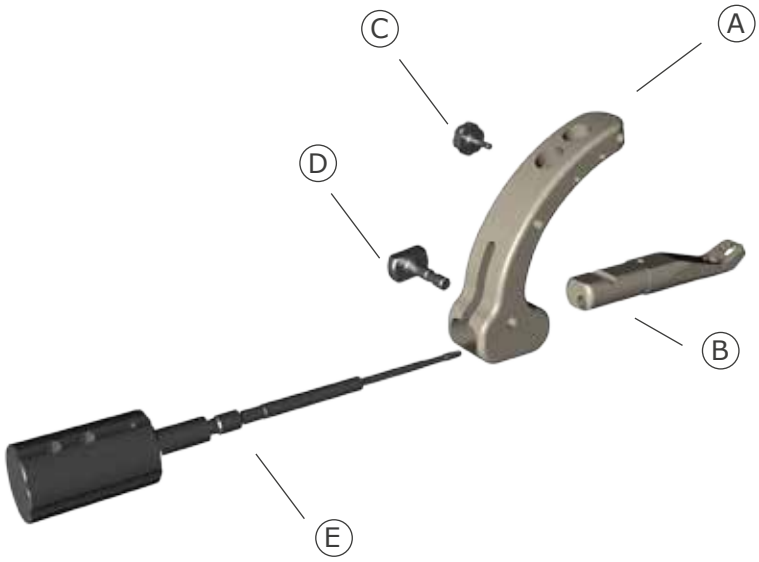
Indications (additional)

- More complex oblique / instable fractures (relative)
- Larger nail projection and sharp end (relative)

Instruments (Selection)

	Awl with T-handle
	Awl straight Handle
	Drill Bit
	T-Handle with Quick-chuck
	ESIN Impactor DeLuxe
	ESIN Impactor Bolt
	ForceDRIVE Shaft
	Holding Sleeve ForceDRIVE T8 Save Lock Pull & Push
	Screwdriver Handle
	ESIN Measurement Gauge
	Mega Hercules

ESIN Plug Insert and Aiming Device with Sleeve System



A - Aiming Device
B - Inserter: 35° (standard) or 25° (optional)
C - Fixation Screw (F)
D - Clamping Screw (CS)
E - Fixation Bolt

	ESIN Trocar
	ESIN Drill Sleeve
	ESIN Tissue Protector Sleeve

Implants and Instruments

- Always pay attention to the correct orientation of the implants!
- For a further insertion than possible with handle or impactor **only** use the impactor bolt!
- The ESIN plug insert and aiming device is **only to be used for insertion of the plugs.**
- For better insertion of the nail the tip can be pre-bent!
- For stronger fixation pre-bend the nail along its total length! The maximal deflection should be at the zone of instability / fracture zone -> 3-Point-Contact!
- For general information on the ESIN philosophy see *Dietz / Schmittenbecher / Slongo / Wilkins (2006) AO Manual of Fracture Management: Elastic Stable Intramedullary Nailing (ESIN) in Children, Thieme*

4 - Using the HSN System - Example bilateral Implantation

IMPORTANT:
Preparatory measures for the use of HOFER implants require a preparation as thorough as possible of the operation field. Nearby nerve fibers and blood vessels require special caution.
An adequate reduction of the anatomical structure has to be carried out when HOFER implants are used.

NOTE: All common techniques of the ESIN (elastic stable intramedullary nailing) philosophy are also valid for the HSN system.

4.1 - Insertion of first Nail

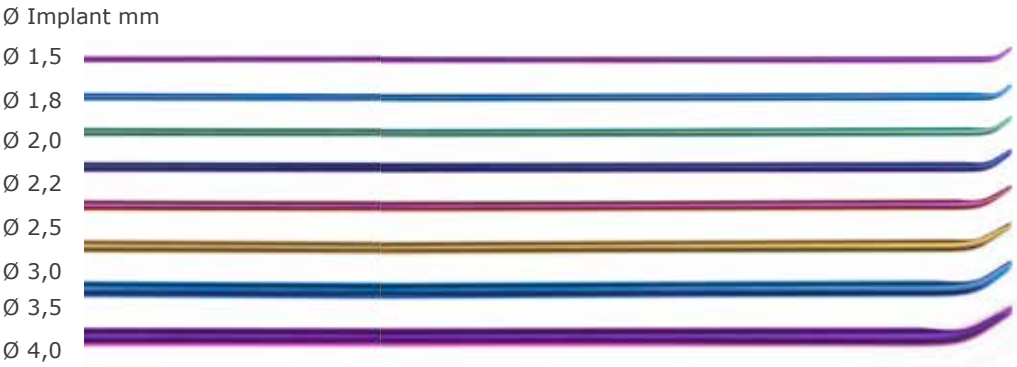
4.1.1 - Preparation of Insertion Site of first Nail
The insertion site depends on the anatomical region, in which the implant is used. It should still lie outside the articular capsule to protect epiphysis and epiphyseal plate. In certain meta- and epiphyseal fractures the approach is performed from the opposite side - indirect method.

The figures used in the following parts serve to symbolically illustrate the surgical steps with the example of an implantation to the femur.

The implant, promising the higher reduction effect, is inserted first. The diameter of the nail should be 1/3 of the smallest diameter of the medullary cavity.

Ø Narrowest point of medullary cavity (approx.)

x 1/3



After the skin incision the insertion site of the nail is opened with an awl. Alternatively drill bits Ø 2.5 (predrilling) and with the final diameter (overdrilling) may be used.

Fig. 1: Option 1 - Opening with awl

The aperture should be a little bit larger than the diameter of the used HSN implant. For predrilling the awl or drill bit is inserted vertically first. Then it immediately has to be turned in axial direction to proceed **in a maximum angle of 45° -** approximately in the planned direction of entry of the nail.

For more information on the handling of the drill bits please refer to:

- Instruction manual for handling the drill bit
- Instruction manual for handling the double drill guide / drill sleeve

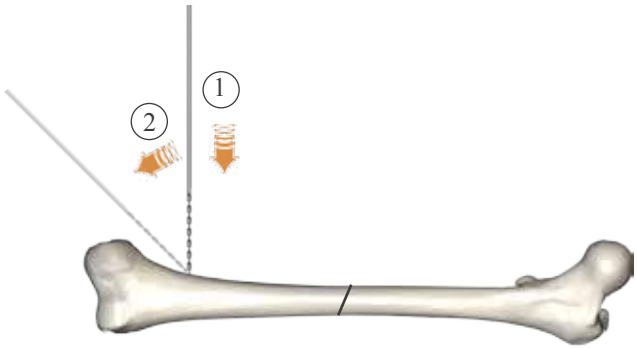


Fig. 2: Option 2 - Vertical „predrilling" with drill bit (1), then turn in axial direction (2)

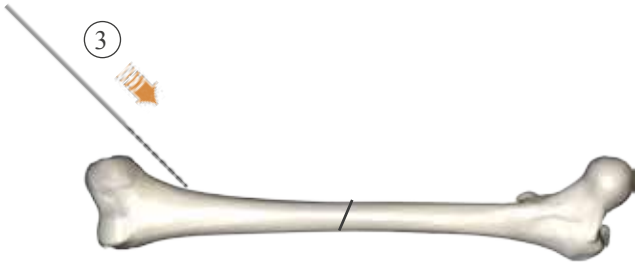


Fig. 3: Option 2 - Drilling in an angle of max. 45° (3)

4.1.2 - Insertion of first Nail

If necessary the nail may be pre-bent. For insertion the impactor or the handle with quick-chuck is connected to the implant. Both instruments can be adjusted if necessary.

The orientation of the implant tip is determined by the **flattened end** of the sliding nail. The implant is oriented so that the tip points in direction of the medullary cavity. Insertion should by performed under **image intensifier control**! If it is necessary to insert the implant further than it is possible with impactor or handle an impactor bolt, which can be put on the nail, is available. For this further insertion until reaching the final position only the impactor bolt can be used!

Note: In order to have 2 points of application for reduction, it may often be advantageous not to exceed the fracture gap with the first nail before the second implant (4.2.2) has reached the fracture line.

The nail can also be shortened before reaching its final position (e.g. using cutting device, too massive soft tissue). As hereby the flattened end might be completely cut off, the orientation of the tip should be checked by means of the image intensifier.

By means of strokes, performed by a hammer onto the impactor bolt, the implant tip is finally anchored in the cancellous bone.

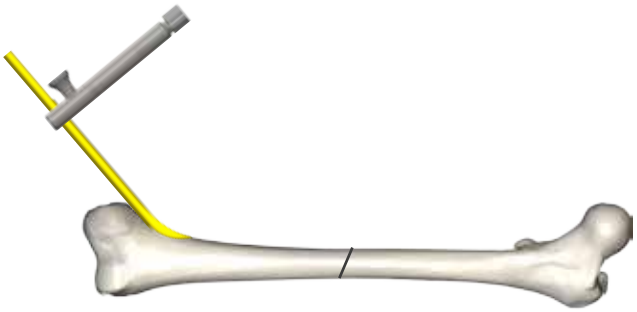


Fig. 4: Insertion of first nail with impactor

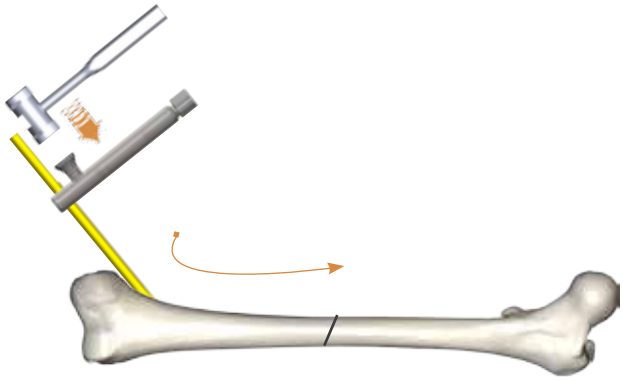


Fig. 5: Strokes with hammer

4.2 - Preparation and Insertion of second Nail

4.2.1 - Preparation of Insertion Site of second Nail

Use implant with the **same diameter** as the first nail and insert it at the **same level**. The procedure is the same as for the preparation of the insertion site for the first nail (4.1.1).

Fig. 6: Drilling for second nail (same level as for first)

4.2.2 - Insertion of second Nail

The procedure is the same as for the insertion of the first nail (4.1.2).

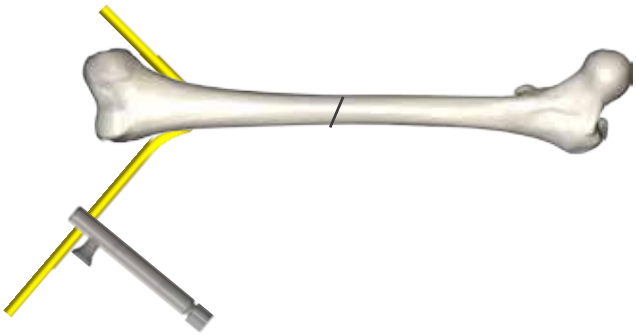


Fig. 7: Insertion of second nail with impactor

4.3 - Shortening the Nails

Have the nails not already being shortened (4.1.2), they are now - in final position - cut approximately 1 cm above the cortical bone by an adequate pliers (e.g. Hercules for nails up to 3.5 mm diameter or rod cutter).

For more information on cutting with the Herclues pliers please refer to:

- Instruction manual for handling the Hercules

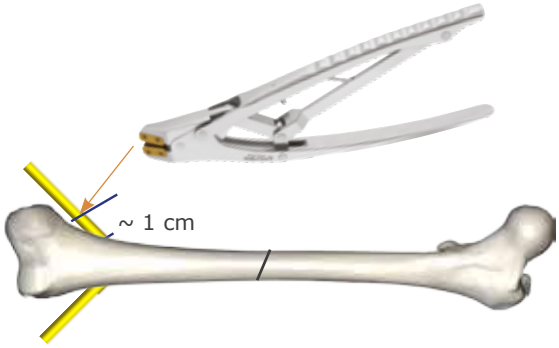


Fig. 8: Shortening first nail with Hercules

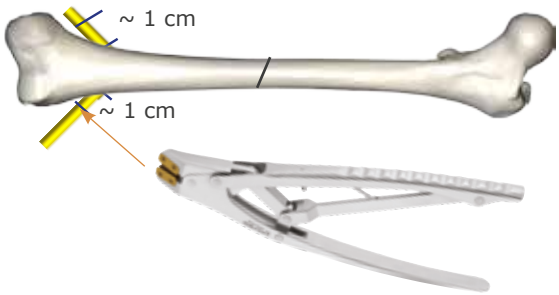


Fig. 9: Shortening second nail with Hercules

Fig. 10: Shortened nails

After shortening sharp edges of the nails should be rounded.

4.4 - Insertion and Fixation of first Plug

4.4.1 - Insertion of first Plug

To avoid slipping back and soft tissue irritations a closure cap (plug) is applied to the end of the nail protruding from the bone. Please pay attention to the size of the plugs, which are adjusted to the respective nail diameters.

Nail Ø 1,5 / Ø 1,8 and Ø 2.0	Plug small
Nail Ø 2,2 / Ø 2,5 and Ø 3.0	Plug medium
Nail Ø 3.5 and Ø 4.0	Plug large

For insertion of the plugs a special insert and aiming device is available. The plug, which is connected to the inserter, is put on the end of the nail. For insertion of the plug the insert and aiming device is used **without** the sleeve system. **The plug must not be used together with a hammer.**

For more information on handling the insert and aiming device please refer to:

- Instruction manual for handling the ESIN plug insert and aiming device

4.4.2 - Fixation of first Plug

The sleeve system with all 3 components (tissue protector sleeve, drill sleeve, trocar) is led - depending on the used inserter (25° or 35°) through the correspondingly marked hole of the aiming device.

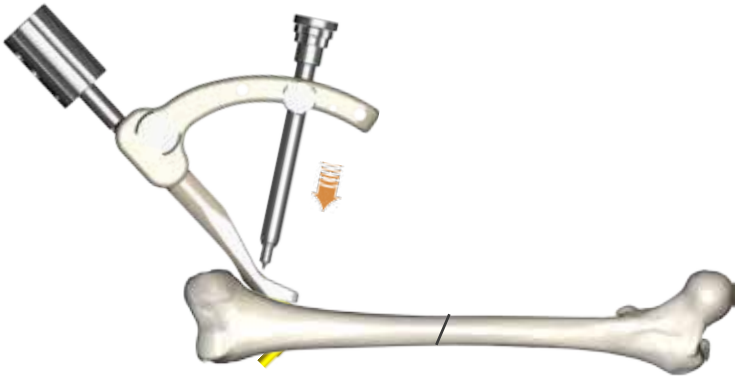
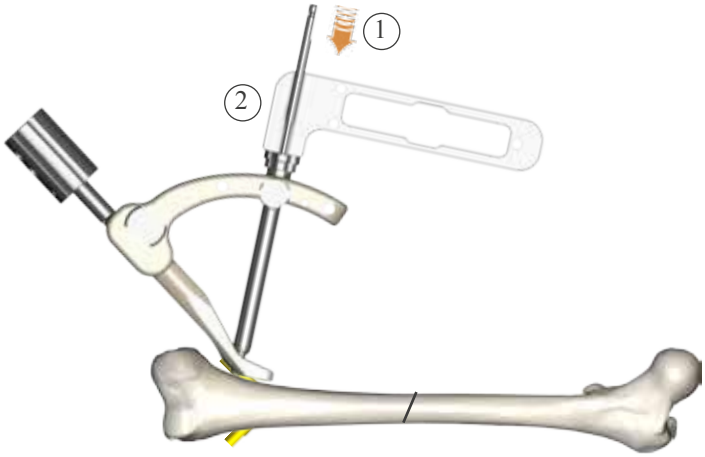


Fig. 11: Insertion of sleeve system (Example inserter 35°)

After removing the trocar the drill bit is guided through the drill sleeve for drilling (1). For screw length determination a measurement gauge, which can be put on the **drill sleeve**, is available (2).



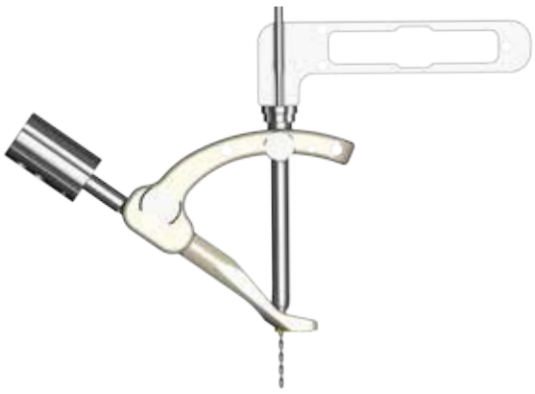


Fig. 12: Drilling and determination of length for first screw

For more information on sleeve system, drill bit and screw length determination please refer to:

- Instruction manual for handling the ESIN plug insert and aiming device
- Instruction manual for handling the drill bit
- Instruction manual for handling the double drill guide / drill sleeve
- Instruction manual for handling the ESIN measurement gauge

After removing the drill sleeve the screwdriver with put on screw is finally led through the tissue protector sleeve (1) and the screw is screwed in (2).

Important: Only the screwdriver Save Lock Pull & Push can be used!

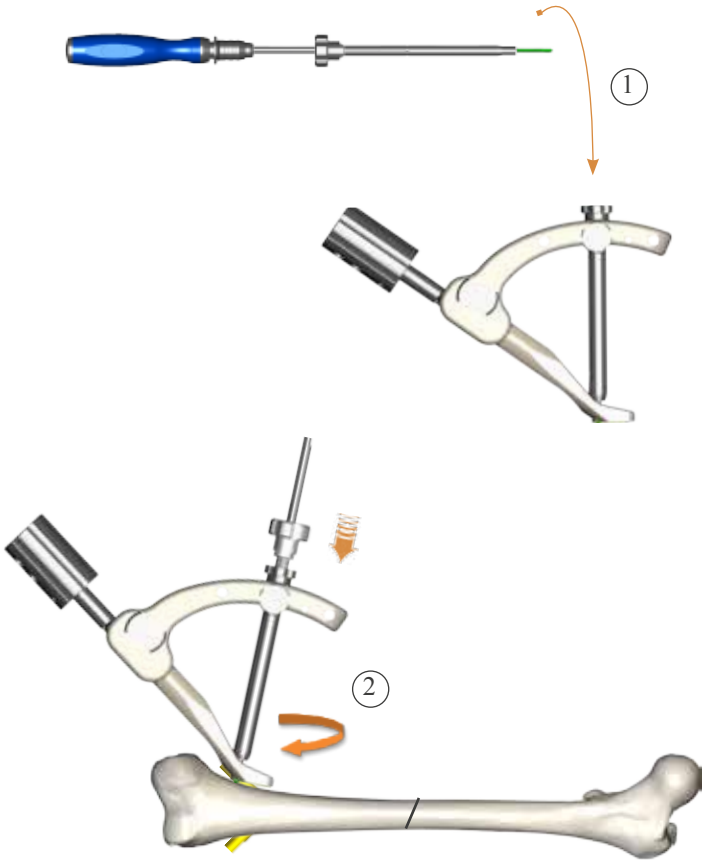


Fig. 13: Fixation of first plug by means of screw

For more information on the screwdriver please refer to:

- Instruction manual for handling the screwdriver save lock pull & push

4.5 - Insertion and Fixation of second Plug

4.5.1 - Insertion of second Plug

The procedure is the same as for the insertion of the first plug (4.4.1).

4.5.2 - Fixation of second Plug

The procedure is the same as for the fixation of the first plug (4.4.2).

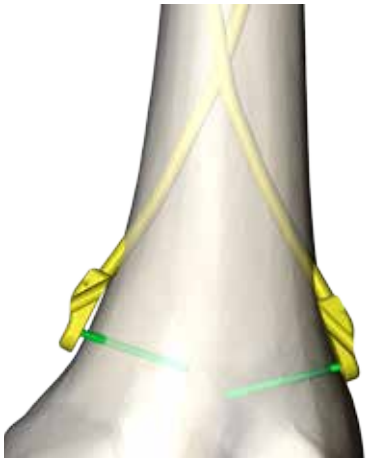


Fig. 14: 2 inserted plugs

4.6 - Post-operative Treatment

The starting point for a post-operative functional treatment has to depend on the fracture type and the intra-operatively achieved stability.

4.8 - Material Removal

As soon as there is enough bone support and the implant has lost its function it should be removed. First the plug is removed. Then the nail can be pulled out by means of an extraction pliers.

The methods and practices, etc. quoted in this scripture have been carefully tested and verified. However, should errors or suggestions of improvement be apparent, despite said verification, we politely ask you to disclose them to us. The surgical method portrayed here merely presents one possible method for the indication that is to be treated. It remains the responsibility of the relevant surgeon to either keep to the aforementioned osteosynthetic method or to vary the method according to individual needs. Direct and indirect complications as well as sequential complications are thus, in every case, excluded.

Should you have any further questions, please do not hesitate to contact us at any time.

CE 0483

hofer
MEDICAL SOLUTIONS

AUSTRIA
HOFER GMBH & CO KG
Jahnstrasse 10-12
A 8280 Fürstenfeld
TEL: +43 3382 53388
FAX: +43 3382 53093
office@hofer-medical.com
www.hofer-medical.com
FN21826y
UID ATU30764704

GERMANY
HOFER-MEDICAL GMBH
Ruhrtalstraße 52-60
D 45239 Essen
TEL: 0800-700 80 22 (innerhalb BRD)
FAX: +49 201 56599 1069
office@hofer-medical.de
www.hofer-medical.com
HRB24645
UID DE290596924

ITALY
HOFER MEDICAL ITALIA S.R.L.
Via della Giuliana, 66
I 00195 Rome
Tel: +39 393 8950481
FAX: +39 06 81151148
office@hofer-medical.it
www.hofer-medical.it
RM-1454597
UID IT13534721009

POLAND
HOFER GMBH & CO KG SPÓŁKA
KOMANDYTOWA ODDZIAŁ W POLSCE
Radkowska 9
PL 57-402 Nowa Ruda
Tel.Kom.:+48 603 224112
Fax: +48 748 712273
office@hofer-medical.pl
www.hofer-medical.com
REGON 141527293
UID PL1070011771

creating partnership

For us, a partnership is the result of a long and happy relationship in all areas of our work . Reliable bone healing for patients, optimal handling of the systems for surgeons and surgical personnel, as well as the simple preparation of the instruments, constantly strengthen this partnership.

For us, "creating" means more than just finding solutions in the form of innovative products.

It is the result of high standards, constant development, innovative products and excellent service for patients, surgeons and surgical personnel around the clock.

Please do not hesitate to contact us if you have questions about our company, our employees or our production methods.

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