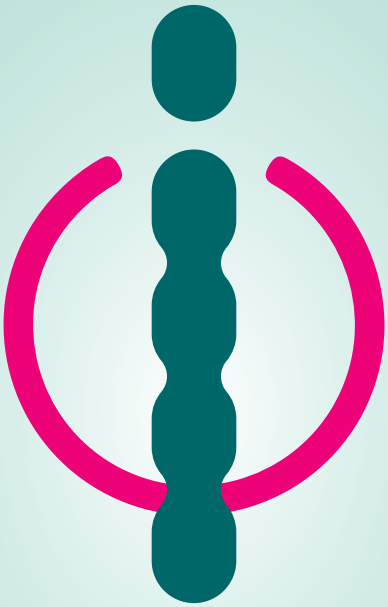

intercus

Surgical technique

Proximal femur fractures with the GN Gliding Nail

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GLIDING NAIL

GN Gliding Nail
Proximal femoral nail

Introduction

For the treatment of proximal femoral fractures, a distinction between two main implant groups must be made:

» Extramedullary implants

» Intramedullary implants

1.1 EXTRAMEDULLARY IMPLANTS

Due to the large lever arm length D (fig. 1), these are subject to a high bending moment load. The lever arm length depends on the angle between the implant and the application of the force and is therefore highest for angle plate implants with a flat blade. The load-bearing capacity of the implant also depends to a large extent on the shape of the femoral neck component profile.

1.2 INTRAMEDULLARY IMPLANTS

These have the biomechanical advantage of a low bending moment due to the intramedullary position. Further advantages of intramedullary implants are the low fracture exposure and the soft tissue protection.

The first fixed-angle intramedullary implant for the treatment of proximal femoral injuries was the Y-Küntscher nail. However, it showed the disadvantages of a rigid nail-blade connection with the risk of perforation into the hip joint and a rotational instability of the shaft. This problem was already solved by Küntscher in principle with his Detensor nail and is the basis of all today's locking nail systems which mostly work with different types of screws as femoral neck component profiles.

GN GLIDING NAIL

Since proximal femur fractures are typical injuries in old age that present with many different biomechanical properties, the GN Gliding Nail was developed in 1992 as a universal implant for indications from the medial femoral neck fracture through to the shaft fracture.

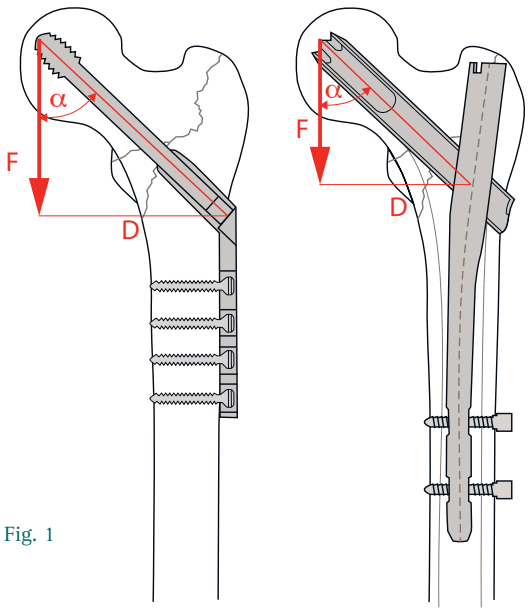


Fig. 1

Extensive experimental and clinical studies have led to the design of the GN Gliding Nail with the possibility of impaction of the double T-blade in the femoral neck direction and the distal elongated holes in the femoral shaft direction.

Special importance was attached to the implantation technical features in order to make the application as simple as possible and thus low in complications.

The selected and patented double T-profile has the same cross-sectional area and can withstand much higher loads than a U-profile or a circular profile.

Concept / description

» Since 1992 a clinically proven intramedullary locking nail system with length safety and rotational stability.

» Extensive range with diameters of 17/11 mm and 19/12 mm in total lengths from 180 mm to 440 mm and «CCD angle» of 125° (standard) and 135°. The long Gliding Nails have an antecurvation according to the femoral shaft curvature and are therefore designed as right and left variant.

» Depending on the width of the medullary cavity, the nail can also be inserted without drilling.

» The nail curvature of 6° in the frontal plane corresponds to the anatomical axis ratios between the trochanter axis and the extension of the femoral shaft axis (fig. 2). Thus, the nail entry point is exactly on the tip of the trochanter which is much easier than opening the piriformis fossa with regard to the surgical technique. It also has a lower risk of circulatory disorders to the femoral head.

Fig. 2

» The patented femoral neck blade as a double T-profile offers the following advantages:

› intra- as well as postoperative rotational stability of the blade against the nail as well as the blade against the head-neck fragment.

› Avoidance of impaction, as the head-neck fragment cannot impact on the dorsomedial defect zone during extension / flexion of the hip. This also means that the femoral neck length is largely preserved which is of decisive importance for the strength of the abductor muscles (joint balance).

› The flap sliding mechanism with a high moment of resistance of the blade allows for an impaction of a normal pertrochanteric fracture (A1, A2 fracture according to the AO classification – compare fig. 6). For example, in the case of purely subtrochanteric fractures, the blade can also be blocked with the GN fixation screw.

› Large surface with small cross-sectional area for optimum osseous anchoring. This greatly reduces the risk of passage and eruption even with osteoporotic bones, as there is no drilling for the insertion of the blade and the blade liner thus experiences a compaction of the cancellous bone.

› Determination of the blade seat via a guide wire system. The blade is inserted via a guide wire, eliminating the difficulty of finding the correct three-dimensional blade position.

› Short bone defect distance for rapid healing after removal.

» The distal locking can be axial, static or dynamic:

› when the locking pins are inserted dynamically, axial compression in the direction of the femur shaft is possible.

» Simple and safe surgical technique with few instruments, simple target procedures and correspondingly short fluoroscopy times. Up to the standard Gliding Nail with a length of 220 mm, a distal locking with the radiotranslucent targeting device is possible.

Indications

» Lateral and medial femoral neck fractures
» Trochanteric and subtrochanteric fractures
» Femoral shaft fractures down to the middle third
» Combined injuries of the femoral neck and trochanter area and subtrochanteric and shaft injuries
» Pathological fractures – in the case of single or multiple metastases, the GN osteosynthesis is not indicated in primary malignant bone tumours
» Revision osteosynthesis

SPECIAL INDICATIONS

» Corrective osteotomies

Contraindications

GENERAL CONTRAINDICATIONS FOR OPEN FRACTURE TREATMENT IN THE CASE OF

» Infected soft tissues
» Poor local blood circulation situation
» Fractures that are outside the area of indication for which the implant can be used in a stable manner

RELATIVE CONTRAINDICATION

» Shaft fractures which exceed the isthmus of the femoral medullary cavity and in which varus/valgus instability can only be avoided by special techniques (cerclages of the fracture zone, 2 bolts in an oblong hole)

Preoperative planning

FRACTURE CLASSIFICATION AND GLIDING NAIL APPLICATION

Fracture classification:
The fracture centre is always decisive for the assignment of the fracture to the respective classification (fig. 3).

1 = femoral head
2 = femoral neck medial
3 = femoral neck lateral
4 = pertrochanteric region
5 = subtrochanteric region

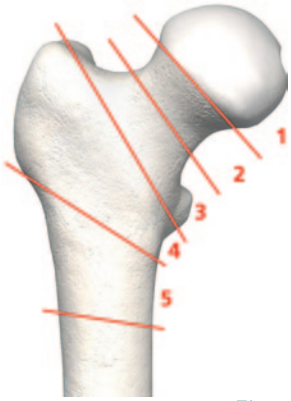


Fig. 3

Medical femoral neck fractures: Classification according to Pauwels or Garden.

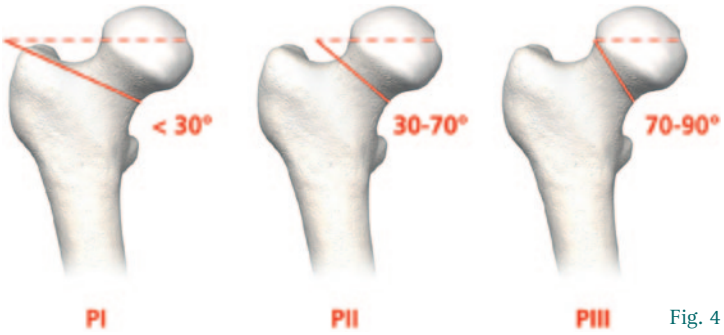


Fig. 4

The Pauwels classification considers the angle of the fracture line (fig. 4).

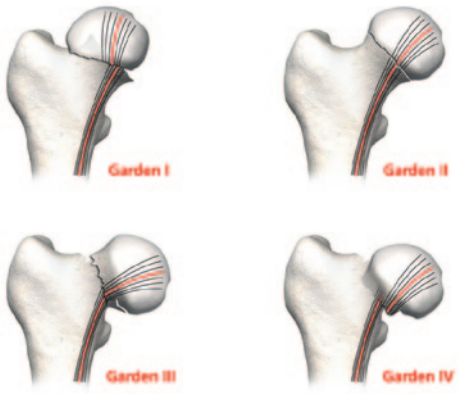


Fig. 5

Classification according to Garden.

Pauwels 2, 3 are mostly dislocated with vascular resection. The higher the fracture steepness and dislocation, the higher the instability and blood circulatory disorder. In higher grade fractures, an additional dorsal comminuted zone is usually present (fig. 5).

Lateral femoral neck fractures are classified as pertrochanteric femoral fractures because they correspond to the same blood circulation situation and clinical procedure as pertrochanteric fractures.

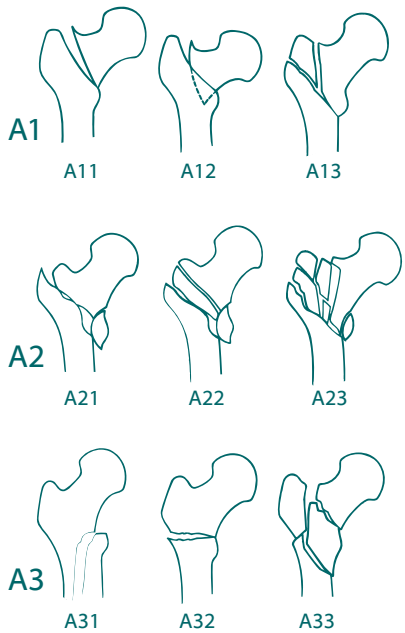


Fig. 6

AO CLASSIFICATION

Subtrochanteric fractures are classified e.g. according to Müller and shaft fractures according to AO (fig. 6).

Indications and use of Gliding Nails and components for femoral fractures

Femoral fracture type	Nail type [1] SGNS = Short GN Small 17/11, 180 mm GNS = 17/11, 220 mm GN = 19/12, 220 mm GNL = 19/12, 280–440 mm	Blade [2] (static with fixation screw)	Distal locking [3]
Medial femoral neck impacted (Pauwels 1; Garden I, II)	SGNS	Stat./ dynamic possible with firm bone	Dyn.
Dislocated (young patients) (Pauwels 2, 3, Garden III, IV)	SGNS	Dyn.	Dyn.
Lateral femoral neck pertrochanteric A1	GN / GNS [1] / SGNS [1]	Dyn./stat. with pronounced osteoporosis	Dyn.
A2	GN / GNS [1] / SGNS [1]	Dyn.	Dyn.
A3	GN / GNS [1] / SGNS [1]	Dyn.	A31 + A33 Stat.; A32 Dyn.
Subtrochanteric	GNL / GN	Dyn./stat.	Dyn. in transverse fracture stat. in oblique comminuted or pathological fracture
Femoral shaft	GNL	Stat.	Dyn. in transverse fracture stat. in oblique comminuted or pathological fracture
Pathological shaft fracture	GN / GNL	Stat.	Stat.
Reosteosynthesis	GN / GNL	Stat.	Dyn./stat. (depending on fracture as described)
Corrective osteotomies	GN / GNL	Dyn.	Dyn.

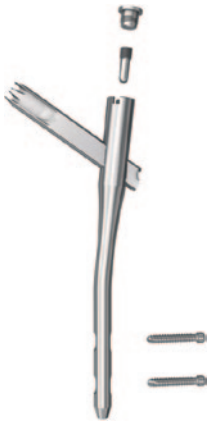


Fig. 7

1 Due to the higher load reserve, the largest possible nail diameter should always be selected according to the anatomical conditions. The recommended standard is GN Gliding Nail 19/12, 220 mm with 125°. The slim GN Gliding Nail 17/11 is used for narrow medullary cavity diameters. If the femora is very strongly curved, a short GN Gliding Nail small with a length of 180 mm should be selected.

The Gliding Nail length is determined as a function of the distal fracture extent. For normal pertrochanteric fractures (A1, A2) a standard nail is used, for a reverse fracture, a subtrochanteric fracture or an additional shaft fracture a long GN Gliding Nail (> 220 mm) may be indicated. When using long nails, the longest possible GN Gliding Nail should be selected for distal locking in the distal cancellous bone according to the given femur in order to exclude the risk of a later distal femoral fracture.

CCD angle: Under normal conditions (CCD angle up to approx. 135°), the GN Gliding Nails 125° provide the most favourable placement option for the femoral neck blade in the lower third. A 125° nail requires a less deep insertion of the nail, as the blade window is located more proximal, and allows the blade to be positioned favourably in the caudal head / neck area (fig. 8). Only at an even steeper CCD angle than 135° a GN Gliding Nail 135° should be used.

Fig. 8

2 If the blade liner seat is pre-damaged (reosteosynthesis, blade position change), the blade should always be fixed statically with the fixation screw. The severity of osteoporosis determines the extent of a necessary bearing drilling and a dynamic or static blade fixation.

3 For GN Gliding Nails up to 220 mm there should be a distance of at least 3 cm between the distal fracture end and the proximal locking pin.

If metal removal is planned, the protective cap should be used.

Recommendations for storage, reduction and image converter adjustment

The procedure is performed on the extension table in **back position**. Both legs are **extended and tightened** via the shoe clamping device. The arm on the side to be operated is placed on a splint or suspended from the headband in a 90° anteflexion of the shoulder and a 90° flexion of the elbow (fig. 10).

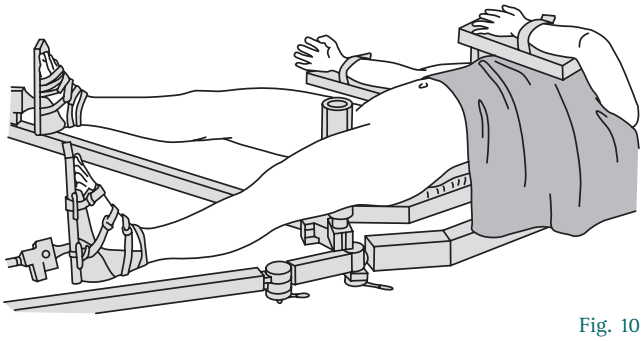


Fig. 10

In order to achieve a fast and stable reduction as well as a good image converter representation of the fracture, a few essential points of storage must be observed:

- The injured leg is always extended in the axis of the patient and slightly adducted.
- The support bolt for the crotch region must basically be inserted on the side to be operated in order to prevent the pelvis from tilting.
- The healthy leg is abducted by about 30° to 40° without force to facilitate axial X-ray fluoroscopy.
- The pelvis must be regarded like a scale. A stable position needs a 3-point fixation. Therefore, the tension on the uninjured leg must be as strong as on the injured leg to avoid tilting of the pelvis and slipping of the upper body to the injured side. However, the tension on the healthy leg must not be too big, as otherwise the angulation of the fracture area around the support bolt of the extension table could be at risk. Therefore, the tension must also be made first on the injured leg.
- The positioning of the injured leg with an internal rotation of 10° allows horizontal alignment of the targeting device in the case of closed repositionable fractures. This allows the antetorsion of the femur to be adjusted and the guide wire to be correctly inserted centrally into the femoral neck.
- When inserting a **long GN Gliding Nail**, the uninjured leg must be positioned on a gynaecological positioning tray in 90° flexion of the hip joint (fig. 11) due to the necessary image converter adjustment to control the distal locking.

  In order to achieve a stable positioning, a 3-point support is also required here, which means that the tension of the injured leg must be compensated via the support bolt in the area of the patient's shoulder. This requires the attachment of a side support in the shoulder area. This must be applied from far cranial, preferably with an operating table splint extension so that access to the trochanteric region can be kept free.

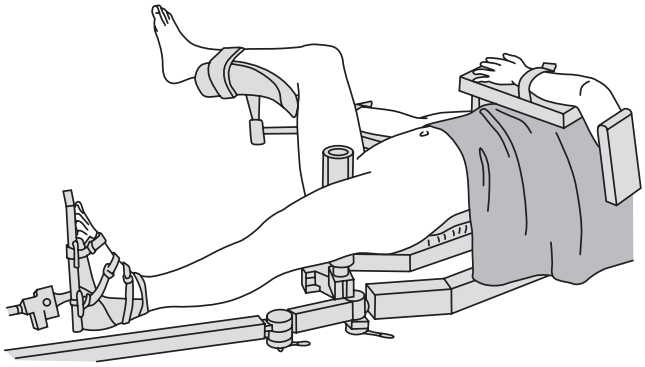


Fig. 11

Special positioning features

» Positioning of the patient with **limited mobility of the hip joint**. If there is no abduction, but full extension capability of the uninjured leg, the treatment should be carried out in supine position on a head table. The actual fracture reduction is performed by longitudinal traction and, if necessary, an incision widening to distal and reduction with a bone hook or reduction forceps. Axial fluoroscopy control can be carried out if the beam path is not completely horizontal. If there is sufficient flexion capability in the hip joint, the axial X-ray control can also be performed by flexion of the hip and knee joint by 90° (according to the Lauenstein imaging technique).

» Alternatively, in the case of **very poor hip mobility**, a parallel positioning of the legs on the extension table can be carried out, whereby the uninjured leg stands slightly lower so as not to significantly disturb the axial beam path. This storage is possible as an alternative for long GN Gliding Nails even with normal mobility.

» If the patient has both a **hip and a knee joint contracture**, as is occasionally the case with bedridden patients, it is best to perform the nailing in lateral position (on the healthy side of the patient). Fracture reduction takes place openly. The AP X-ray control is carried out with the transverse beam path of the image converter, the axial control with the C-arm adjusted largely vertically.

The reduction is now performed under image converter control.

For precise, especially axial fluoroscopy control, the image converter must be inserted at an angle of approx. 30° to the axis of the injured leg. This allows a perpendicular course to the femoral neck and thus a wide-ranging presentation even without superimposition of the targeting device. The spatial orientation of the image converter image should correspond to the position of the patient in the room.

Cave: If the primary traction on the healthy leg is too strong, the fracture will bend and anatomical reduction will be largely prevented. Therefore, the traction should first be applied to the injured leg, then a slight counter extension is applied to the healthy leg and locked. Now the final length extension and thus the reduction of the injured side are carried out.

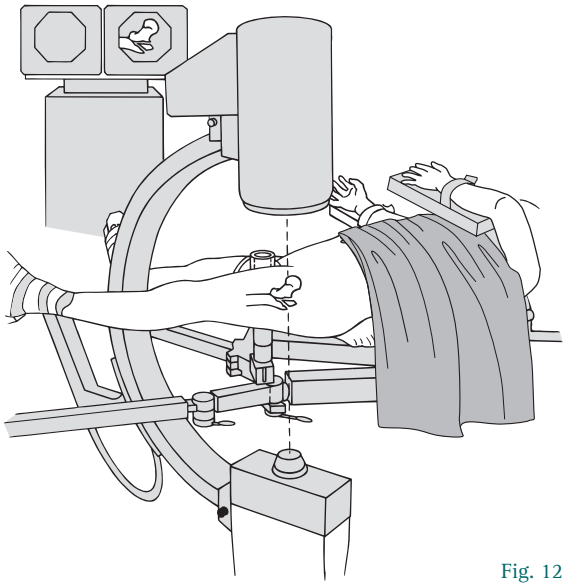


Fig. 12

With gradual increase of the extension, an exact adjustment of the fracture in AP projection is performed. In addition to the corresponding cortical course of the medial femoral neck restriction and in the area of the minor trochanter, care must be taken to restore a femoral neck-shaft angle

(CCD angle) corresponding to that of the uninjured side. In the case of muscle attachment and not completely torn periosteal connections, a precise anatomical adjustment of the fracture is quickly achieved (fig. 12).

Now the axial image converter projection is adjusted for a horizontal beam path. It is now possible to evaluate and correct the exact rotation setting of the shaft relative to the femoral neck (fig. 13).

Please note
When the image converter is swivelled through, a side reversal and a 90° rotation of the image counterclockwise are always necessary in order to have the same room setting as for the AP projection.

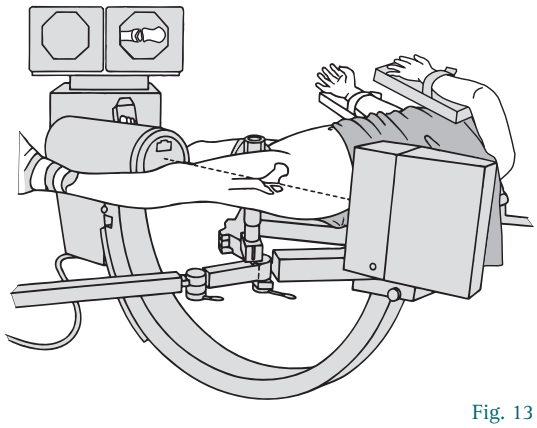


Fig. 13

Special features of insertion and reduction

- In the case of subtotal and complete periosteal rupture, dorsal dislocation of the shaft and the metaphyseal fragment is usually also present. This can be corrected by increasing the extension only in the case of incomplete periosteal and muscle attachment injuries and usually only partially.
- Complete rupture of the muscle attachment and periosteal connections causes the femur to sag due to gravity. In these cases, post-reduction can be achieved by supporting the proximal shaft area with a wooden hammer attached from dorsal (fig. 14). If this is not successful, it makes more sense to extend the incision from the trochanter tip 3 to 4 cm to caudal, to digitally blank the fracture and to reduce it with a bone hook (fig. 15 and 16).
- If the femoral neck fragment is caught in front of the shaft, the extension pull must be relaxed and then the reduction must be carried out. A reduction is not possible with further tension increase.

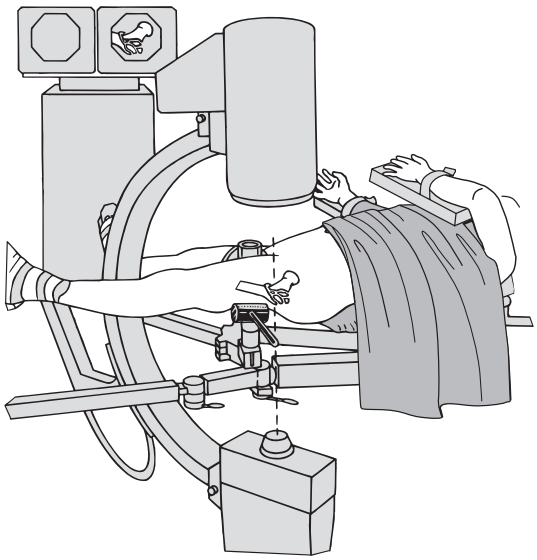


Fig. 14

Fig. 15

Fig. 16

» In case of **intraoperative length loss or increase of the femoral neck varus position**, the following points should be checked:

› Check the locking of the longitudinal tension of the leg extension! The pull of the opposite side must also be checked, since tilting the pelvis to the injured side also results in a loss of reduction.

› Support rod position in crotch on the correct (injured) side?

› Check the central axis locking of the extension splint and the leg direction in extension of the body!

› Foot fixation not fixed to the shoe?

› Upper body not fixed and shifted to the injured side? (in the case of positioning for the long GN Gliding Nail)

» In the case of **reverse fracture course and subtrochanteric fractures**, in contrast to normal fractures, the traction of the psoas iliac muscle results in adduction, flexion and also external rotation malposition of the proximal fragment. In order to achieve a fast and correct reduction, it is advantageous to extend the incision from the insertion site to the centre of the fracture and to perform an open reduction and fixation with reduction forceps or one to two temporary cerclage wires here. After insertion of the nail, these can usually be removed again so that as little circulatory disorder as possible is achieved. A further fracture gap does not primarily impair the postoperative load-bearing capacity, but it leads to a significant delay in the fracture consolidation and to an impairment of the anatomical restoration (fig. 17).

Fig. 17

Problem description using the example of osteosynthesis in the case of subtrochanteric fractures. Result after closed nailing (fig. 17). Result after open reduction and reosteosynthesis (fig. 18).

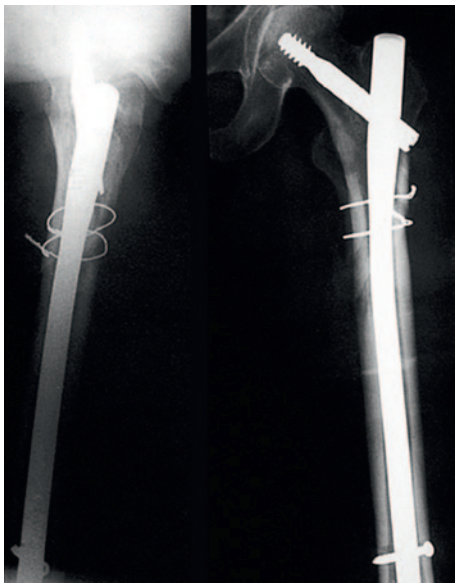


Fig. 18

Covering the surgical area

The covering of the surgical area should enable a safe, displacement-free covering of the surgical area even when the image converter is swivelled through. Cloth fixations with clamps should not be performed in the area of the surgical site as these would impair intraoperative fluoroscopy (fig. 19).

Please note
In order to avoid an impairment of the sterility while swivelling the image converter, the last applied image converter cloth must be lifted from the base so that deep parts of the cloth are not lifted to the height of the surgical area.

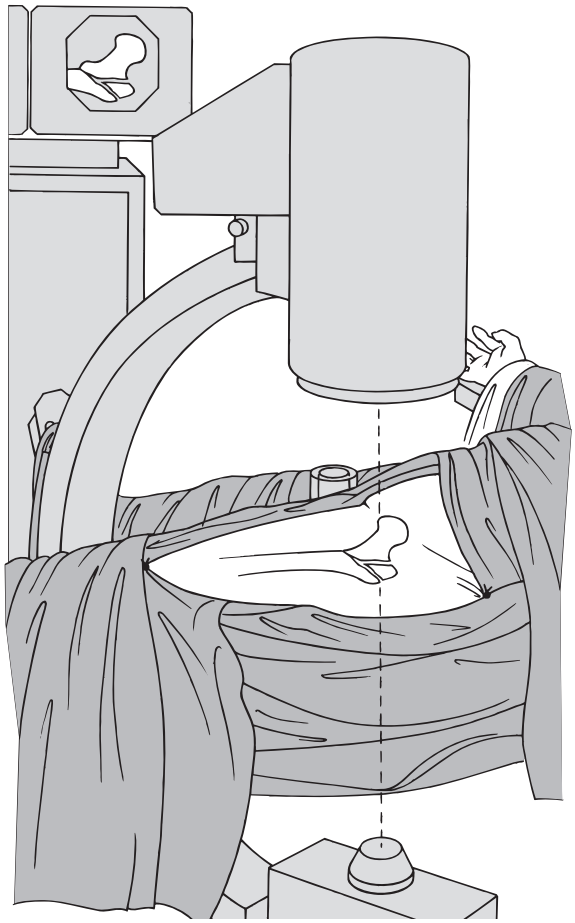


Fig. 19

SURGICAL TECHNIQUE WITH THE EXAMPLE OF TROCHANTERIC FRACTURES

Access

The skin incision begins proximal to the trochanter tip and is extended approx. 3 cm to proximal (fig. 20).

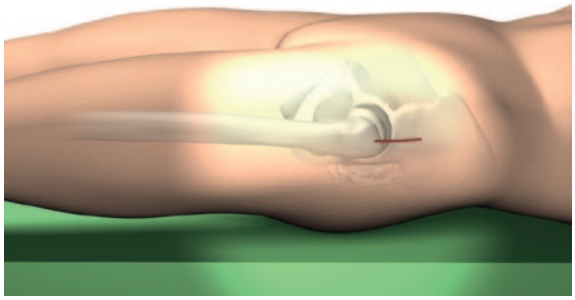


Fig. 20

Since the nail is inserted directly in the middle of the trochanter tip and the direction of the femoral shaft curvature is ventral, the incision must be made in the posterior third of the palpated trochanter width.

Please note
If the incision is placed too far to ventral, correct insertion of the medullary cavity drilling instruments and the nail is largely impossible! In this case, only a considerable extension of the incision can ensure correct insertion. An extension of the incision distal to the trochanter tip is not advisable with good, closed reduction.

After sectioning of the skin and subcutis, a precise hemostasis follows. In the same direction incision of the fascia lata. If the incision is placed correctly, one is now at the posterior edge of the gluteus medius muscle (fig. 21).

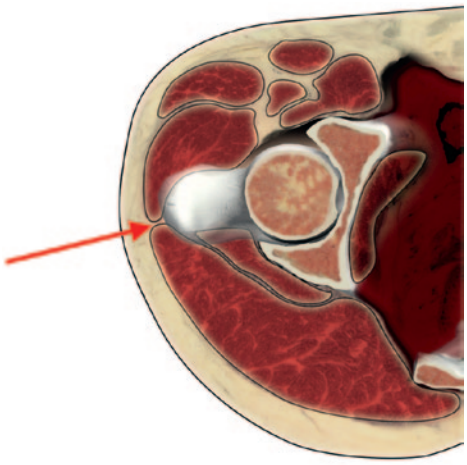


Fig. 21

If muscle fibres are visible after fascial incision, one is clearly too far ventral.

Opening of the medullary cavity

The width of the greater trochanter must now be palpated with the finger and the drilling must be prepared in the middle with a pointed awl. For the long Gliding Nails, the entry point in the dorsal half of the trochanter tip should be selected (fig. 22).

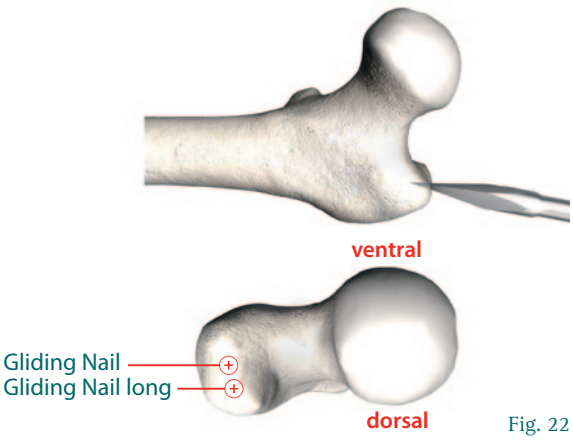


Fig. 22

Accurate adherence to the correct entry site position is one of the two critical steps for the easy performance of the surgery.

If the trochanteric region is fragmented, an angle of 6° to the femoral shaft axis must be entered regardless of the position of the fragments. If possible, a larger trochanter fragment should be threaded with it. However, it is not relevant for further surgery and postoperative loading whether the nail has a proximal bony hold in the trochanter-major fragment.

Please note
In the case of additional fractures in the trochanter major region, the changed anatomical situation must also be taken into account. To select the entry point, the nail clamped in the targeting device can also be held over the femoral shaft under X-ray control. The proximal end of the nail shows the exact entry point in the trochanter area.

If the nail entry point was selected incorrectly, the nail entry point must be reworked according to the correct position.

Please note
In the case of simple fracture shapes, incorrect placement of the entry site and forced insertion can lead to additional fractures, as the GN Gliding Nail is a rigid implant. If the dorsal entry point is too far, the nail tip can be hit against the ventral cortical bone. In the case of a missing trochanter major injury, the insertion may be more difficult if the entry site is too far ventral or lateral and if the entry site is too far medial, a fracture may occur in the trochanter major region. When advancing an awl into the medullary cavity, the ascending direction of the medullary canal ventrally and the 6° angle to the femoral shaft axis must be taken into account.

The position of the awl on the trochanter tip must basically be checked under image converter control.

With the GN cannulated awl (1130070) the proximal cancellous bone is opened up to the medullary cavity and the drill bit is advanced through the cannulation in the awl (Fig. 23).

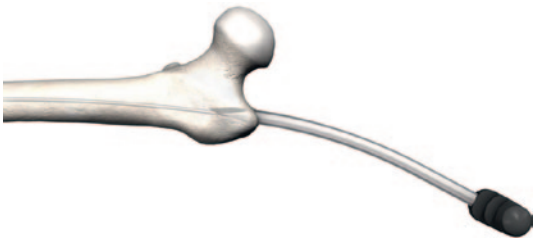


Fig. 23

Please note
The correct placement of the drill bit in the medullary cavity can be determined by the typical feeling of distal cancellous bone and fixed stop so that normally no second-plane fluoroscopy is required. Otherwise, the manoeuvre must be repeated using the techniques described in «Special features of insertion and reduction» (fig. 14).

If necessary, it makes sense to adjust the image converter horizontally for axial control.

Afterwards, the awl is pulled out over the drill bit.

A DRILLING THE MEDULLARY CAVITY USING A DRILL BIT

The extent of medullary drilling depends on the bone strength, the extent of additional trochanter major fracture and endosteal bone atrophy in old age.

Fig. 24

In standard drilling with medium strength bone structure without trochanter injury and medium wide medullary cavity, drilling is first performed with a 9 mm drill with flexible drill shaft (fig. 24).

For soft tissue protection, a protective plate or a correspondingly large drill sleeve should be used.

The depth of the medullary cavity drilling must in principle be performed by the so-called isthmus of the medullary cavity. This is noticeable when the bore can be drilled again without any greater resistance.

Please note
When retracting the drill, the assistant must prevent the drill bit from slipping out. With an appropriate holding forceps, a retraction of the drill shaft is prevented by holding it at the flattening of the drill bit respectively after retraction of the drill shaft directly at the entry point of the drill bit into the bone.

In the case of very firm juvenile bones with low osteoporosis and narrow medullary cavity, especially in subtrochanteric fractures, further drilling in 1 mm or even 0.5 mm increments is required. If bone atrophy is pronounced, the drilling steps can be selected at 2 mm intervals.

It is better to drill at least around 2 mm, better around 3 mm, over the distal nail diameter of 12 mm. For 17/11 nails, 13 mm shaft boring is usually sufficient. With relatively strong curvature of the femoral shaft, short femoral length and aggravated nail insertion, drill up to 14 mm.

In the case of soft tissue tensions, counterpressure must be used to prevent too wide a lateral drilling, which would make nail insertion more difficult. The distal end of the GN drill guide neck blade No. 2 (1130054) for the femoral neck blade should be used to press the drill shaft to medial.

Please note
If the medullary cavity is large and osteoporosis is pronounced, or if an additional trochanteric fracture occurs, the GN Gliding Nail can be inserted without drilling the medullary canal after the cancellous region has been widened accordingly with a larger awl.

The bore for the **proximal diameter of the nail** (Ø 17.5 mm resp. Ø 19.0 mm) should not be drilled below the small trochanter, but only in the proximal cancellous bone area (fig. 25).

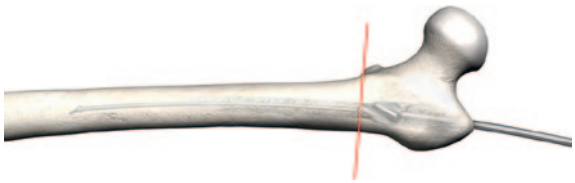


Fig. 25

After drilling the medullary canal, drilling should continue at 2 mm intervals, corresponding to the proximal nail diameter of 19.0 mm or 17.5 mm.

With the **long nail**, the trochanteric entry point is somewhat more dorsal and must be widened oval to medial so that the long straight nail part can also be inserted in a straight direction. This is achieved by medialising the drill head by pressing the GN drill guide (1130054) against the drill shaft (see chapter «Supplementing the surgical technique for subtrochanteric and shaft fractures, page 45»). This technique may also be indicated in normal fractures in which the entrance point is accidentally drilled too far laterally and too little medially

B UNDRILLED GLIDING NAIL INSERTION

For an undrilled medullary cavity insertion with a correspondingly wide medullary cavity, a drill sleeve can be inserted over the drill bit after insertion of the drill bit. A hollow mill with an outer diameter of 19.0 mm respectively 17.5 mm can be inserted via these and the cancellous bone up to the height of the small trochanter can be milled out as a single block (fig. 26).

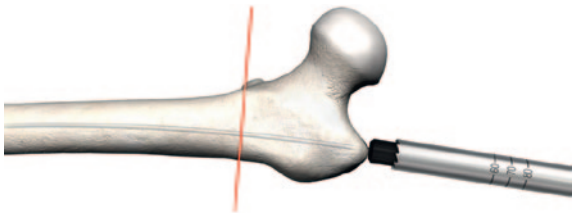


Fig. 26

The cancellous bone can usually be removed with a hollow mill and, if necessary, be used for local cancellous bone attachment. Make sure that the drill sleeve for the hollow mill is always removed before hammering in the nail.

Please note
If the plastic centering has been inserted too deeply and cannot be easily extracted, a simple removal can always be carried out by pulling back the drill bit. Afterwards the drill bit can be inserted into the wide trochanter opening again.

Preparation of the following instruments

Depending on the nail used, place the GN targeting guide carbon 125° (1130022) or 135° (1130023) onto the GN carbon targeting device handle (1130020) and tighten with the integrated screws (fig. 27). Check that there is no gap between the handle and the bar. The screws are slightly tightened with the screwdriver attachment GNp adapter allen SW 4 (GNp adapter allen 1133153).

Fig. 27

The targeting device is a precision instrument and must not be used to move or position the patient or be subjected to hammer blows. This can affect the accuracy or destroy the instrument.

Attach the screwdriver attachment to the GNp T-handle modular (1133151) or to the GNp modular handle (1133155) by simultaneously pressing the locking button and inserting the attachment (fig. 28).

The attachments can be released by pressing the locking button.

Fig. 28

Insertion of the nail

The desired GN Gliding Nail is now connected to the targeting device. Due to the asymmetrical location on the targeting device, twisted clamping of the nail is impossible.

The GN adapter screw for handle (1130021) is tightened firmly with the screwdriver attachment SW 10 (GNp adapter allen 1133152) (fig. 29).

Fig. 29

The nail is advanced via the drill bit and the insertion depth is checked.

Please note
If a definitive reduction was not achieved preoperatively or during drilling, it must now be performed. The reduction can be facilitated by means of tension to lateral and by raising the targeting device handle. For this purpose, the leg extension must be temporarily reduced.

The nail should be pushed forward with slight right-left turns with a deflection of a few degrees. When driving in the nail no high resistance may occur. Larger rotational movements, especially with the long nails, may be associated with a risk of trochanteric fracture due to the curvature of these implants.

Fig. 30

If the end position of the nail has not yet been reached, the last few centimetres can be reached after removing the drill bit and at high resistance also by light strikes on GNp impactor for targeting device (1133156), which is inserted into the locking screw of the targeting device (Fig. 30). No strikes may be made on the targeting device. The device is always guided by the transverse handle and not by the longitudinal leg.

To estimate the insertion depth of the nail, the screwdriver is held under X-ray control parallel to the body surface of the patient at the centre of the nail blade penetration point and according to the drawn angles of 125° respectively 135° on the targeting guide (image converter adjustment exactly perpendicular to the fracture plane required due to the projection error) (fig. 31).

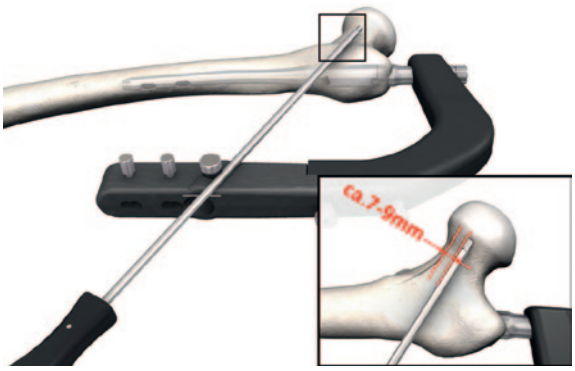


Fig. 31

A distance of about 7–9 mm to the calcar limit should be maintained. This means that the femoral neck guide wire to be inserted will run slightly below the centre of the femoral neck in AP projection.

Please note
If the insertion of the nail encounters strong resistance, the tip of the nail end should be displayed under image converter control (e. g. to dorsal or lateral trochanter entry point). Manipulation of the proximal part of the insertion handle in the opposite direction should prevent rubbing of the nail tip against the medial or ventral cortical bone, otherwise reworking of the entry site is necessary

REMOVAL OF THE DRILL BIT.

The assistant holds the targeting device in position so that the rotation and the penetration depth are not lost (and/or changed).

Insertion of the femoral neck blade

The GNp centering sleeve No. 2 (1130050) is inserted into the insertion guide at marking 2 (fig. 32).

After pushing the centring sleeve forward onto the skin and marking of the entry point, a skin incision of approximately 2.5 cm length is made. After the skin has been cut, the fascia should also be split directly with a scalpel or, in the case of thick soft tissue, with scissors. The centering sleeve can now be advanced above the fascia level.

Fig. 32

The centering sleeve can also be inserted together with the GN drill guide neck blade No. 2 (1130054), as this acts like a trocar in combination.

The centering sleeve should not be pushed forward to the bone surface itself but should only keep the fascia open. In this position, the centering sleeve is clamped to the targeting device with the fixation screw (fig. 33).

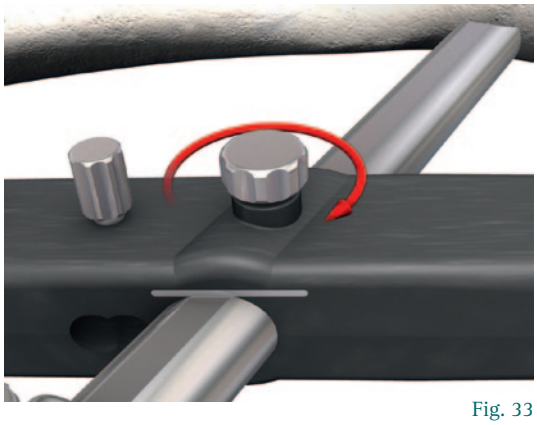


Fig. 33

The GN drill guide neck blade No. 2 (1130054) is now inserted in the centering sleeve for the GN centering wire Ø 3.0 mm (1133105) (fig. 34).

Fig. 34

This drill guide is to be advanced as closely as possible to the bone surface so that winding of soft tissues during the drilling process is prevented and thus the risk of bleeding can be reduced. This can be supported by light hammer blows on the drill guide in axial direction (fig. 35).

Fig. 35

Once the drill guide has been inserted, it is fixed opposite the centering sleeve with another locking screw (fig. 36).

Fig. 36

The exact placement of the GN centering wire Ø 3.0 mm (1133105) **is the second decisive step in the surgical technique (fig. 37).**

The targeting device should be aligned parallel to the floor with the leg rotated about 10° inwards, as this takes into account the anteversion of the femoral neck. Before actually drilling the femoral neck centering wire, the drill bit of the nail must be removed!

If the blade length of the last 2 sizes is expected to be long, the wire must be clamped shortly in the drill chuck.

Fig. 37

The femoral neck centering wire is first drilled into the femoral head contour under AP image converter control up to the desired central blade position of approx. 5 mm (fig. 38).

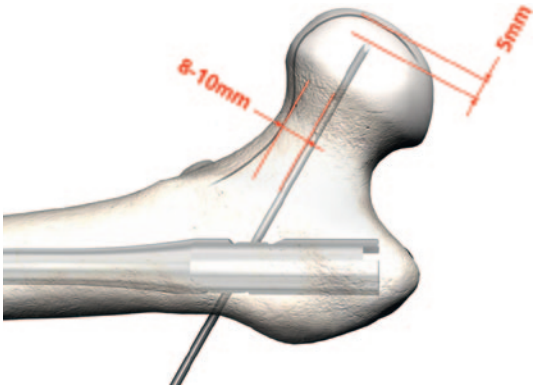


Fig. 38

The distance between the wire and the caudal femoral neck limitation should be about 8–10 mm, as the inserted blade will need about 6.5 mm to reach the femoral neck limitation (fig. 39).

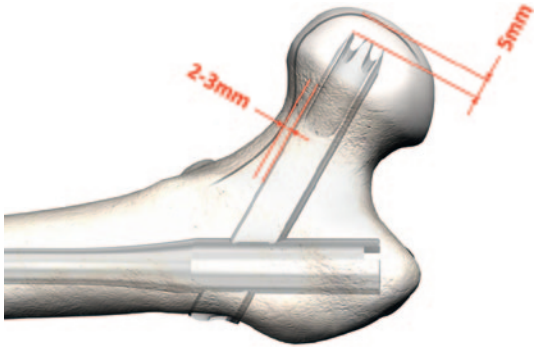


Fig. 39

The centering wire is therefore located in the AP projection slightly below or in the middle of the femoral neck in the AP beam path (fig. 40).

When drilling the wire, the bone quality can be assessed and a decision can be made about further drilling of the blade liner.

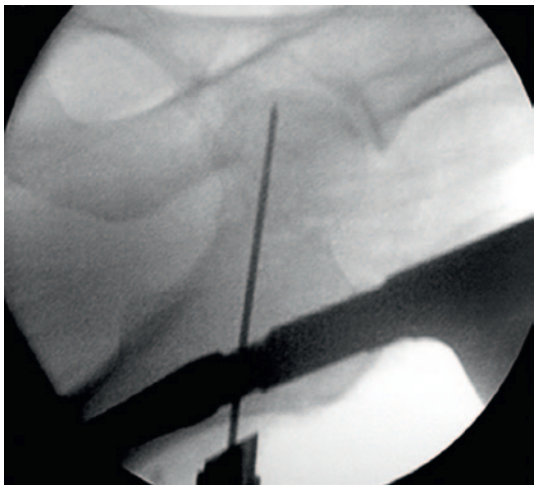


Fig. 40

At this point, the second fluoroscopy level must also be checked mandatorily for the first time.

In lateral projection, the centering wire must always run in the middle third of the femoral neck and head. (In lateral projection, the central, possibly slightly dorsal position is aimed at; the blade should never be placed ventrally or cranially.) (fig. 41, 42, 44)

Fig. 41

Please note
In order for the femoral head contour to be reliably assessed in the axial beam path, the image converter must be moved as steeply as possible and in this position be guided towards the body centre. Thus, a femoral head and femoral neck projection can also be achieved without superimposing a metal targeting device.

If this setting should cause difficulties, it is helpful to slightly raise or lower the targeting device or to increase or decrease the C-arm swivelling by 5° accordingly.

Fig. 42

Please note
If the cortical and cancellous bone structure of the proximal femoral end is strong or the femoral neck cortical bone is touched, a deviation of the drilling direction may be observed when drilling to cranial. Advancing the drill guide close to the bone improves the drill guidance and thus prevents a drilling direction deviation (fig. 43).

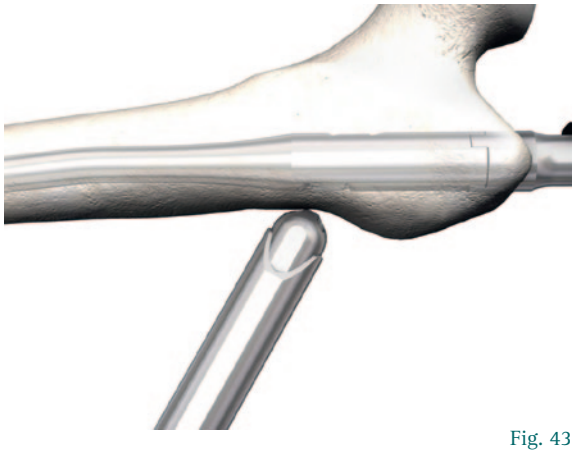


Fig. 43

Please note
If the position of the centering wire is not optimal, the wire should be drilled back and forth through the cortical bone several times after a slight correction, after a corresponding change in height, anteversion or retroversion of the targeting device so that the new drilling direction can be specified and bending of the wire into the old drilling channel can be avoided. If this is not successful, the nail should be driven somewhat deeper or even retracted slightly so that a new passage through the cortical bone and thus a straight drilling direction can be guaranteed.

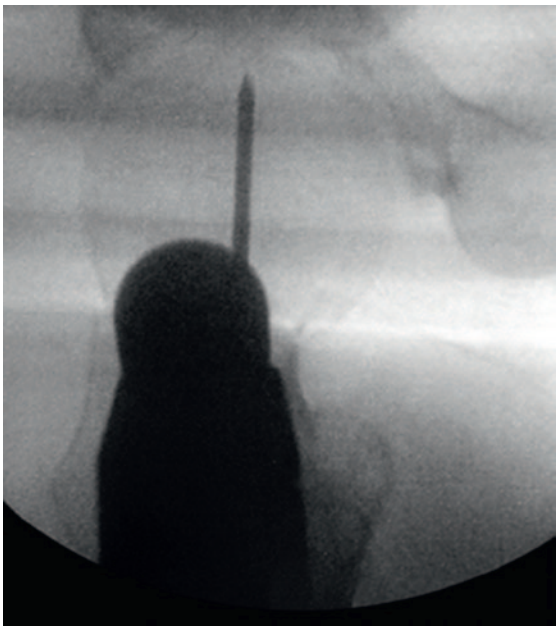


Fig. 44

In order to avoid a later need to correct the direction of the centering wire, a Kirschner wire can first be inserted into the soft tissues ventrally of the femoral neck and parallel in front of the femoral neck under image converter control in the horizontal beam path **before the centering wire is inserted into the femoral neck** (fig. 45). The femoral neck centering wire must then be inserted under AP image converter control of the cranio-caudal position parallel to this Kirschner wire.

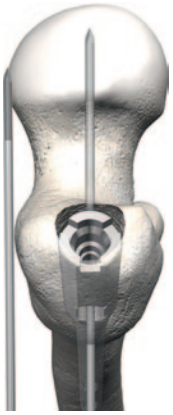


Fig. 45

With the remaining centering wire, the lateral cortical bone is now drilled via the four outer drill channels using the GN drill bit Ø 4.5 mm (1133106) so that a fissure of the bone can be prevented when the blade chisel is impacted (fig. 46).

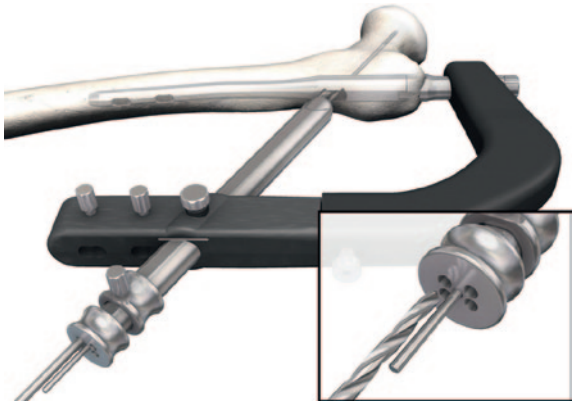


Fig. 46

The additional drilling of the blade seat liner depends on the bone strength.

In general, excessive drilling of the blade seat liner must be avoided, as excessive removal of bone substance leads to a weakening of the blade seat. This can result in insufficient anchorage strength of the blade and thus a risk of the blade slipping out. This should be avoided at all costs. Especially with severely osteoporotic bones, the impaction of the blade also causes a cancellous bone compaction and thus promotes stability.

Further drilling must be decided depending on the bone resistance when drilling the centering wire.

THE FURTHER SURGICAL STEPS DEPEND ON THE EXISTING OSTEOPOROSIS.

In cases of severe osteoporosis, it may be sufficient to open the cortical bone with the chisel alone (fig. 53). Drilling is performed with the 4.5 mm drill in the two cranial and caudal bores of the drill guide (fig. 47). The drill should not be advanced further than the lateral femoral neck area.

Fig. 47

Please note
In practice, this means that immediately after overcoming the drilling resistance of the lateral cortical bone, the pressure must be removed from the drill to avoid drilling too deeply into the soft cancellous bone.

In the case of juvenile, **firm bone**, drilling with the 4.5 mm drill may be necessary in all four positions of the drill sleeve up to the medial femoral neck region respectively the head base (fig. 47).

After loosening the fixation screw, the drill guide is removed leaving the centering wire as it is.

The GN neck blade length gauge (1133108) for the femoral neck blade length is inserted via the centering wire up to the lateral femoral cortical bone. Read the required blade length on the scale at the height of the wire end (fig. 48).

The measurement is independent of the sleeve position and always requires the corresponding centering wire. If the wire is e. g. inserted too far, the corresponding length would have to be subtracted.

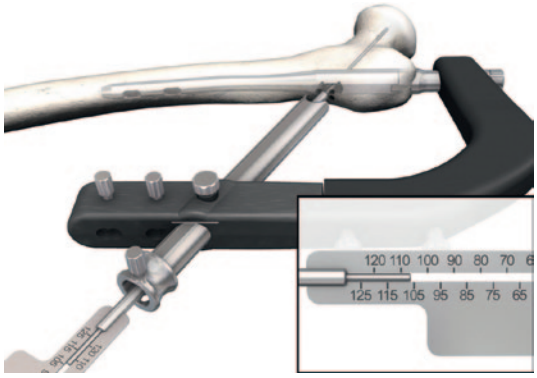


Fig. 48

In the case of **very solid bone substance**, after measuring the required blade length, an additional drilling can be carried out using the GN cannulated drill bit Ø 6.0 mm (1133107) via the wire to the medial femoral neck or maximum to the head base (fig. 49).

Otherwise there is a risk of the centering wire being completely drilled out so that the aiming process must be repeated and the blade bearing damaged.

Fig. 49

Please note
If the centering wire has been accidentally removed, the drill guide is re-inserted and the wire is manually advanced through the corresponding bore (image converter control in both planes).

However, if the drilling procedure is too strong compared to the bone strength, the following possible solutions should be considered:

» If there is still a sufficient distance between the drilling respectively the blade length used and the femoral head contour, a longer blade would be inserted into the undrilled section of the femoral head via the centering wire.

» Selection of a new blade position, e. g. further caudal or other CCD angle (125° or 135°), since a suboptimal position is better than a poor bone bearing.

» If the length of the femoral neck blade has already been exhausted and the blade cannot be repositioned, it would be advisable to use the blade fixation screw. Since the impaction of the blade rarely exceeds 3 mm, a **minimum distance** of 5 mm to the femoral head contour should be maintained ventrally and dorsally when using GN fixation screw. In the central direction, the distance should be as close as possible to 5 mm (fig. 50).

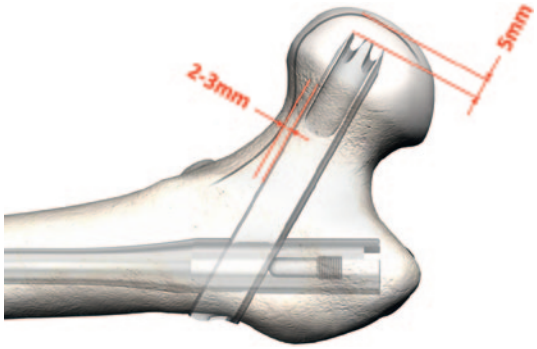


Fig. 50

Mounting the chisel or the blade

The GN blade impactor handle (1133149) is pushed through the GNp tube for neck blade angular (1130052). The GN profile chisel (1133138) or the blade is carefully placed in the correct position on the tube for neck blade and tightened only slightly with the impaction handle (fig. 51).

Please note
If there is a sluggishness when inserting into the centering sleeve, the impaction handle should be tightened less tightly.

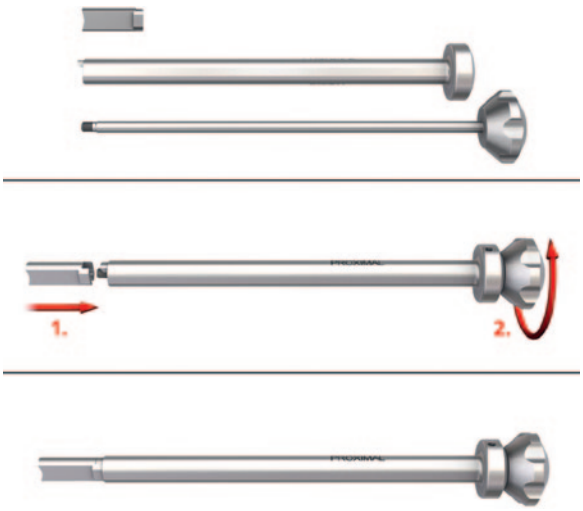


Fig. 51

The GNp tube for neck blade angular (1130052) can only be inserted into the centering sleeve in one position (fig. 52).

Fig. 52

In the area of the blade entry point, the cortical bone is now punched out with the GN profile chisel (1133138).
For this purpose, the impaction instrument with the mounted profile chisel is driven in only so far that the lateral cortical bone is just exceeded by the cranial part of the chisel (fig. 53).

Then retract the impaction instrument and reassemble it to the desired blade.

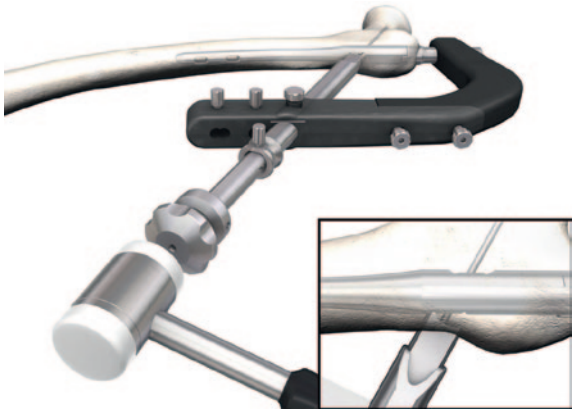


Fig. 53

The assembled femoral neck blade is now inserted with hammer blows on the impaction instrument via the centering wire under image converter control until to the cranial blade length of approx. 5 mm to the femoral head contour (fig. 54).

With a thin outer lateral cortical bone at the blade entry point, the blade collar can easily perforate the cortical bone up to the blade window, so the distance of 5 mm should be observed.

Fig. 54

The centering wire should never be removed before reaching a firm blade seat in the head base, otherwise the blade may deviate to ventral or dorsal.

It is possible, especially when correcting the position of the centering wire, that there is a certain bending of the wire and that this may cause jamming when inserting the blade. This bend can also easily be overlooked and would cause the wire to bend when the blade is inserted if it is impacted until the end (fig. 55).

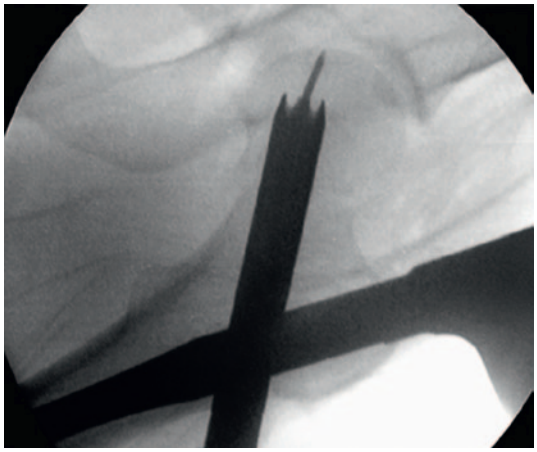


Fig. 55

In these cases, after the blade has been advanced until the head base, the impaction instrument is unscrewed, the guide wire is removed and the impaction instrument is screwed on again. The impaction process of the blade can then be terminated safely.

Please note
During all working steps for blade insertion, the assistant should push the targeting device horizontally towards the foot to compensate for the proximal displacement caused by force and rotation caused by gravity. If the wire bends to cranial convex during these operations, the counter-support on the device is insufficient and/or the extension of the leg has given way.

If a blade that is too short or too long is used, it can be removed by striking the impaction instrument in the opposite direction and be replaced by a blade that is correspondingly long.

Please note
If necessary, secure the centering wire by pressing a second wire through the cannulated bore of the impaction instrument during deflection.

During impaction of the blade and if the bone structure is firm or the drilling of the blade seat is slightly too small in relation to the bone strength, there may be gaping in the fracture in the direction of the centering wire.

In this case, the extension of the leg should first be reduced and the blade further impacted. The blade collar further impacts the femoral shaft with the nail through the blade and eliminates the gaping of the fracture.

Fig. 56

If there is still a gaping of the fracture with maximum use of the blade liner length (blade tip must not touch the head contour), an impaction through the incision of the blade entry point with impacts on the lateral cortical bone below the blade entry point must be carried out with as wide a plunger as possible (fig. 56). If the blade base is more than 5 mm above the lateral cortical bone and there is

no space for further impaction of the blade, the blade must be replaced with a shorter one. This is important to avoid irritation of the iliotibial tract. Pulling out the centering wire with the reverse drill is performed as described below after removing the impaction instrument.

Loosening of the blade impactor handle (1) and pulling out of the handle (1) and tube for neck blade (2) from the centring sleeve (3) (fig. 57).

After loosening the fixing screw on the targeting device, the centering sleeve (3) is also removed.

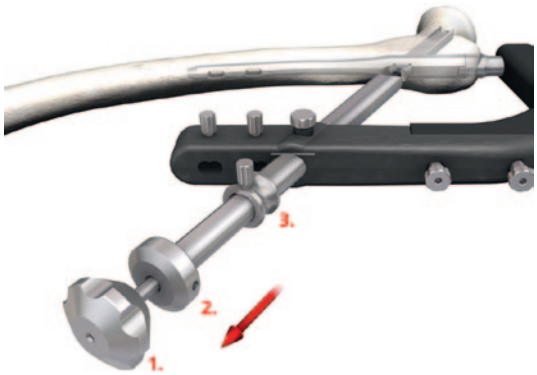


Fig. 57

GN fixation screw blocking

The double T-profile of the femoral neck blade offers a simultaneous rotation protection against the nail as well as against the head-neck fragment without the additional use of a GN fixation screw.

If a static blade-nail connection is desired, as in purely subtrochanteric fractures or blade changes, the fixation screw can be inserted through the **adapter screw of the targeting device** using the hexagon screwdriver SW 4 (GNp adapter allen 1133153) and tightened firmly (fig. 58, 59).

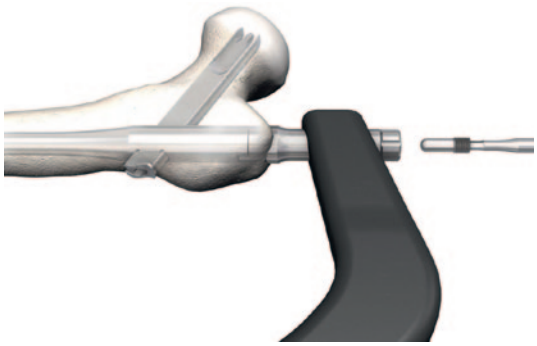


Fig. 58

Please note
First dip the screw into the water so that it holds better on the screwdriver during insertion due to the capillary effect.

When screwing in threaded screws, first half a turn to the left is carried out before the actual insertion procedure so that a possible tilting can be prevented.

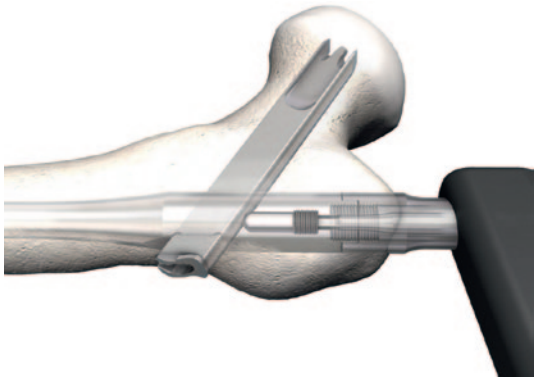


Fig. 59

GN protective cap

For a metal removal or if a secondary GN fixation screw fixation (0132242) is suitable in the case of a stronger sintering and a blade change, a GN protective cap (0132251) should always be used. This is inserted with the screwdriver SW 4 into the proximal opening of the nail after dismantling the targeting device and prevents the ingrowth of connective tissue and callus masses (fig. 60).

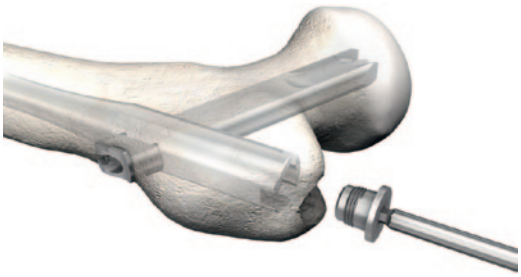


Fig. 60

Insertion of the GN protective cap with the screwdriver SW 4 under image converter control of the axial guidance. Positioning of the cap with half a turn to the left, screwing in and tightening the cap.

Placement of the distal locking pins

For per- and subtrochanteric fractures, it is recommended to use two locking pins, as the stress concentration at the nail tip is lower and tilting in sagittal plane is possible with only one bolt and wide medullary cavity. This can lead to selective overloading of the nail tip.

The distance between the end of the fracture and the proximal end of the two locking pins should not be less than 3 cm . (Otherwise change to the next longer nail.)

A static locking should be applied whenever immediate impaction with corresponding loss of length is to be expected in the case of an extensive debris zone or a pathological fracture with osteolysis (fig. 61).

A dynamic locking is recommended for medial defect zones, fracture distractions and subtrochanteric transverse or short oblique fractures as it allows impaction in the shaft direction (fig. 65).

Basically, the dynamic distal locking should be preferred with the exception of the abovementioned indications. If the fracture does not heal in an individual case, the distal locking bolts must be removed after a period of three to four months for further dynamisation.

If a GN Gliding Nail 135° (up to a length of 220 mm) was used, the GN targeting guide carbon 125° (1130022) must be reattached to the targeting device handle for distal locking.

In general, only sharp, undamaged drills may be used. Because of the curved surface of the femur, it is advisable to initially work with relatively light pressure during the drilling process in order to avoid deformation of the device and thus to prevent deviation of the drill.

For dynamic or static locking, the corresponding bores on the GN targeting guide carbon 125° (1130022) are marked with «3» and «dyn» and/or «stat». The GNp drill guide distal locking No. 3 (1130060) is inserted according to the desired locking (fig. 61).

Fig. 61

The GNp drill guide distal locking No. 3 (1130060) with GNp trocar drill guide distal locking No. 3 (1130061) (fig. 62) is advanced through the corresponding bore onto the skin and an incision with a length of approximately 1 cm of the skin and fascia is made at these locations.

With pressure or a light blow on the trocar, the drilling point should be slightly «centre-punched» to prevent possible deviation of the drill.

Fig. 62

After the trocar has been removed, the drill guide should be in contact with the bone to prevent the winding of tissue and thus a haematoma formation during drilling. This can be supported by light hammer blows. The drill guide should be clamped in this position with the fixation screw.

With the scaled GNp drill bit for locking with stop D 5.0 mm (1130062), the bore for both locking pins can now be drilled one after the other under image converter control (fig. 63).

Fig. 63

The required bolt length can be read directly in controlled end position of the drill (approx. 2 mm protrusion at the medial cortical bone) at the scaled end and at the edge of the drill sleeve (fig. 64).
For this purpose, the drill gauge must be in contact with the bone.

The medial projection of the bolt prevents the bone from growing into the self-cutting notches of the bolts in the case of a very strong bone and from blocking them during metal removal.

Optionally, the measurement can also be performed with the GNp locking pin length gauge (1133183).

Fig. 64

With dynamic locking, the bore is positioned at a greater distance to the proximal edge of the oval bore (fig. 65).

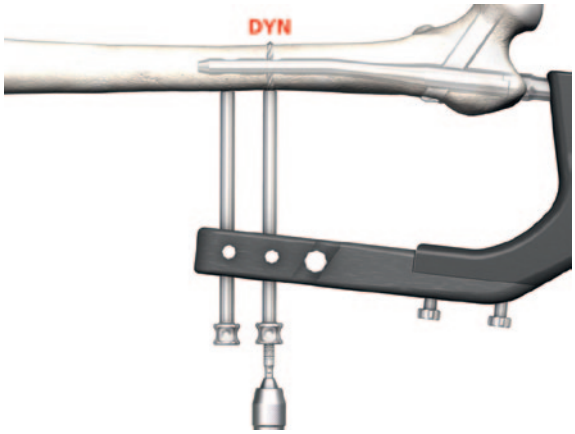


Fig. 65

The locking pins are inserted through the sleeve using the screwdriver SW 4 (T-handle 1133151 in the case of very firm cortical bone). Firm tightening of the bolts does not make sense, since no screw compression effect is desired here, but only a support function of the bolt against the nail (fig. 66).

Fig. 66

Please note
If the bolt is slightly too long, the protrusion can easily be distributed between the medial and lateral cortical bone side. A complete penetration with greater protrusion of the bolt tip over the medial cortical bone should be avoided due to the possibility of soft tissue irritation in this area.

After inserting the bolts, a second mandatory image converter check in axial direction must be performed in order to document the safe placement of the bolts through the nail perforation (fig. 67, 68).

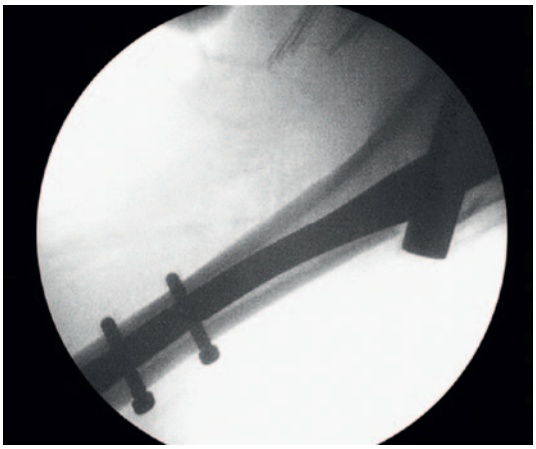


Fig. 67

Please note
If the use of a blunt step drill or the application of a high force at the beginning of the drilling process has resulted in a non-ideal bore with nail contact, the second drilling of the same locking bore should be carried out in the opposite drilling position (static or dynamic).

Fig. 68

Blade change and explantation

Due to the rotation-stable fixation of the head-neck fragment, it is not possible to twist the head fragment into the usually dorsomedial instability zone. Therefore, the impaction process is generally very limited.

Replacement of the blade: If the fracture zone is sintered more strongly, the femoral neck blade may slip out more strongly. If very rare irritation should occur in the area of the iliotibial tract, a blade change is indicated.

The removal of the blade may weaken the bearing.

If a fixation screw was inserted primarily, it must be loosened before the blade deflection.

Incision of approximately 2.5 cm length at the height of the blade impaction point.

After exposing the blade base, the centering wire is advanced into the central perforation of the femoral neck blade via the blade tip (fig. 69).

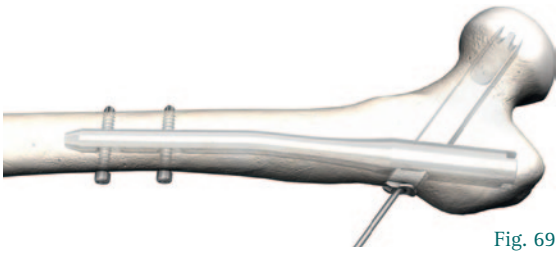


Fig. 69

The blade impaction instrument with the centering sleeve pushed over it is advanced over the wire and screwed on (fig. 70).

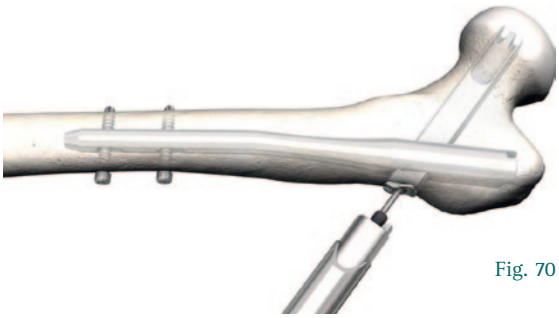


Fig. 70

The blade is knocked out with hammer blows onto the plate of the tube for neck blade.

In order to avoid deformation of the instrument, it is advisable to strike alternately cranially and caudally (fig. 71).

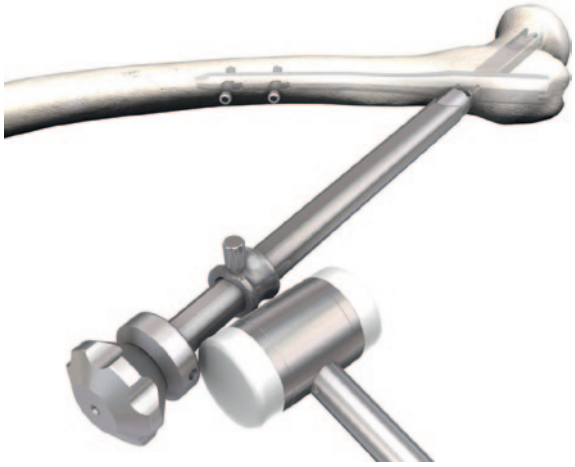


Fig. 71

Please note
If the centering wire also slides out (fluoroscopy control), the process must be stopped and a second wire must be inserted through the central bore of the impaction instrument to prevent the wire from being pulled out (fig. 72).

Subsequently, a correspondingly shorter blade is inserted deeper with the impaction instrument via the lying centering wire much more in the direction of the femoral head contour (5 to 10 mm).

If this is not possible, a fixation screw fixation must be performed after changing the blade.

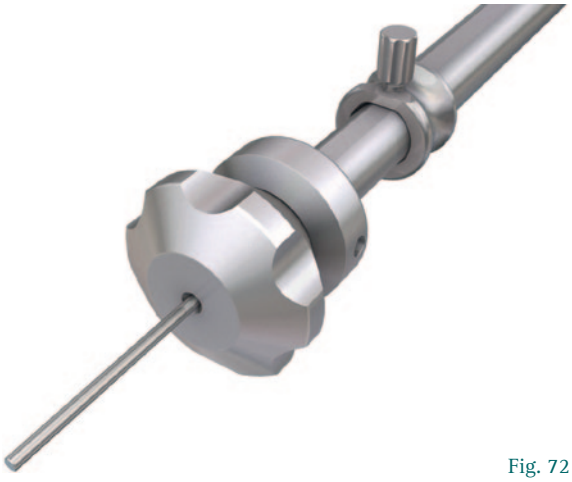


Fig. 72

Complete material removal: is mostly indicated for younger patients. First, the two distal locking pins are displayed via stab incisions. During the removal of the blade with the pull-out instruments, at least one bolt should be left so as not to advance the nail.

If a GN fixation screw has been used, it and, if necessary, the GN protective cap must be removed before the blade is removed.

Fig. 73

The femoral neck blade is removed by opening the corresponding stab incision using a special deflection instrument. After unscrewing the GN protective sleeve pull out screw (1133127) the tip is inserted into the blade connection up to the thread like a guide wire. Apply with half a turn to the left, screw in and tighten the GN pull out screw with ball (1130036).

The GNp ball adapter slap hammer small (1130035) is screwed onto the pull out screw and the GNp slap hammer small (600181) is screwed into the ball adapter of the pull out screw. Due to the axial impact alignment, the blade can be easily removed even with very firm blade impaction (fig. 73).

Now the incision is made over the nail insertion site. (If the GN protective cap and GN fixation screw have not already been removed.)

The last distal bolt must be removed prior to nail removal.

The pull out screw is then screwed into the nail. Since the nail does not have any firm jamming in the medullary cavity, it can usually be removed by hand without using the slap hammer (fig. 74).

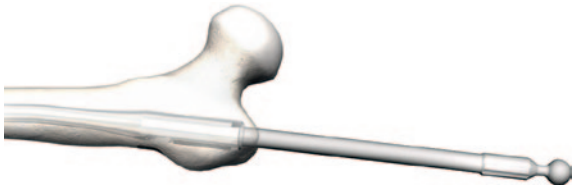


Fig. 74

Case studies on pertrochanteric fractures

Fig. 75 and 76:
Pertrochanteric fracture type A1 in a 72-year-old female patient with intraoperatively patent fracture gap. Full impaction upon start of load.

In the case of insufficient drilling and sclerotic bone, a fracture dehiscence can be seen, which is closed after load. Due to the risk of tract irritation through the blade base, the fracture should be impacted intraoperatively. For this purpose, the blade should be looked up after relaxation of the extension. The shaft is pushed medially with the nail through the collar of the blade.

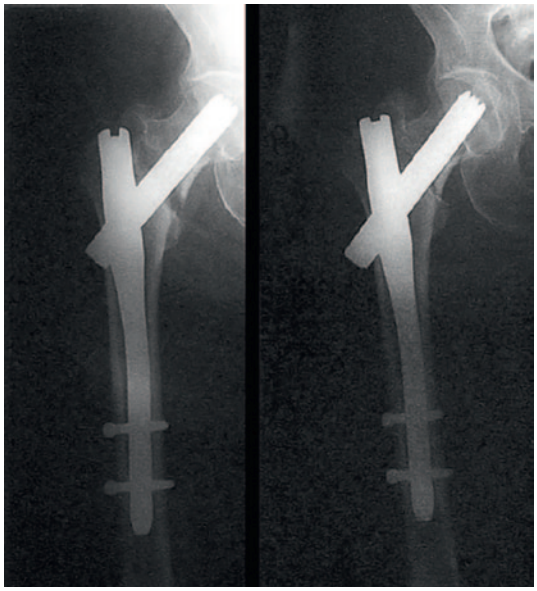


Fig. 75 Fig. 76

Fig. 77: Pertrochanteric A23 fracture
Fig. 78: After Gliding Nail osteosynthesis

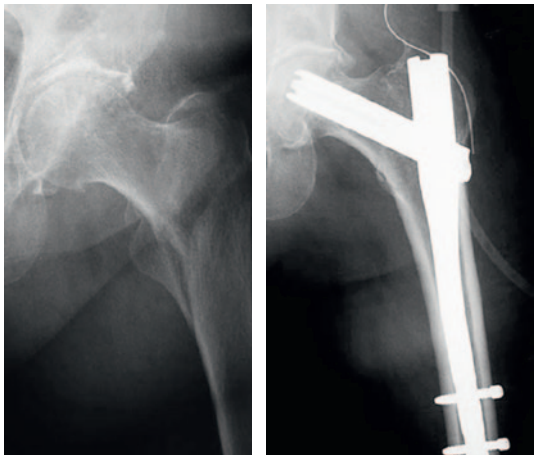


Fig. 77 Fig. 78

Even with intertrochanteric fragment ejections, the rotational stability of the femoral neck blade results in only slight impaction.

Fig. 79: Pertrochanteric multiple fragment fracture A33 postoperatively

Fig. 80: Pertrochanteric multiple fragment fracture after healing

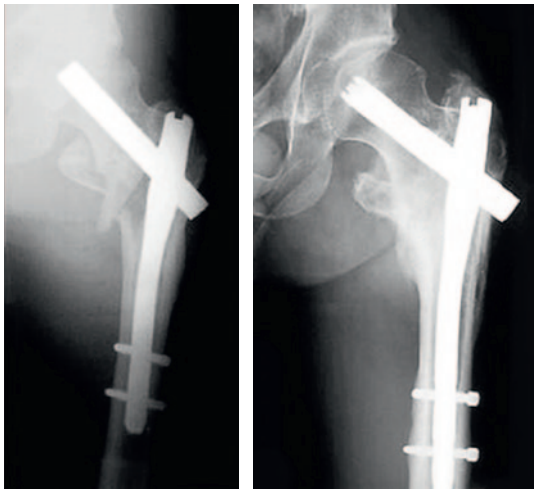


Fig. 79 Fig. 80

SUPPLEMENT TO THE SURGICAL TECHNIQUE FOR MEDIAL FEMORAL NECK FRACTURES

Introduction: Femoral neck fractures are typical injuries in old age. They occur when falling over the adducted or abducted leg.

Due to its very good clinical results, the GN Gliding Nail is also particularly suitable for head-retaining therapy in the case of medial femoral neck fractures due to the advantages of the Gliding Nail blade. The rotational stability prevents micro-movements with bone resorption and impactions. This avoids the well-known strong impaction of this type of fracture and the risk of break as after screw osteosynthesis. All medial femoral neck fractures in young patients as well as all impacted femoral neck fractures in young and old patients are treated with the small GN Gliding Nail (Ø 11/17 mm, 180 mm length).

Reduction

» Always adjust the anatomical reduction.

» Due to the high stability of the GN osteosynthesis no valgisation is necessary. Since there is no muscle traction, the reduction of dislocated fractures cannot be performed

» indirectly, but must be performed «mini open» with the joystick technique.
(Fig. 81, 82)

Fig. 81

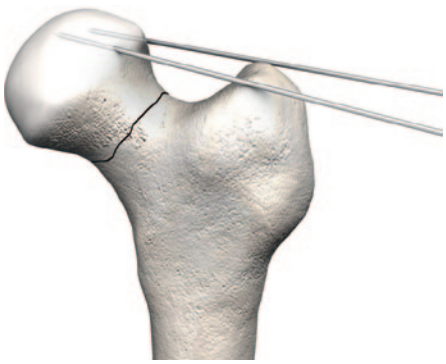


Fig. 82

Special information on the surgical technique

Dislocated medial femoral neck fractures should be treated as quickly as possible (preferably within the first 6 hours) in order to restore blood flow to the femoral head.

» In the case of medial fractures of the femoral neck, the trochanteric incision is used to open the joint capsule over a short distance in order to check and / or carry out the fracture reduction (fig. 83).

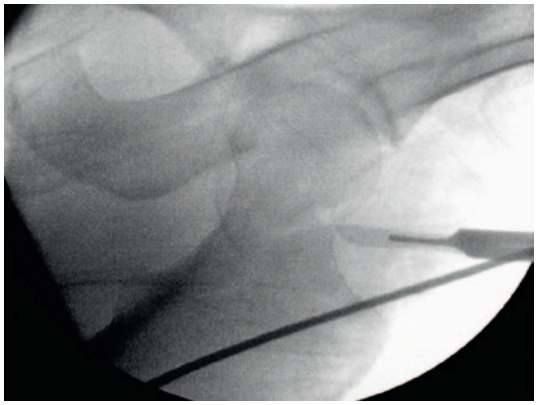


Fig. 83

» Using a strong K-wire as joystick, stabilise the head and bring it into the exact reduction position under X-ray control until the blade guide wire is placed in the femoral head and thus fixed (fig. 84, 85).

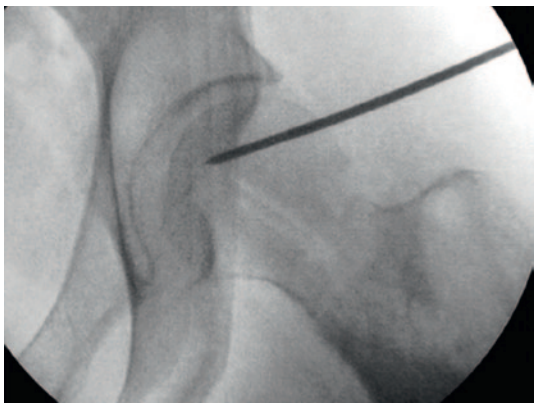


Fig. 84

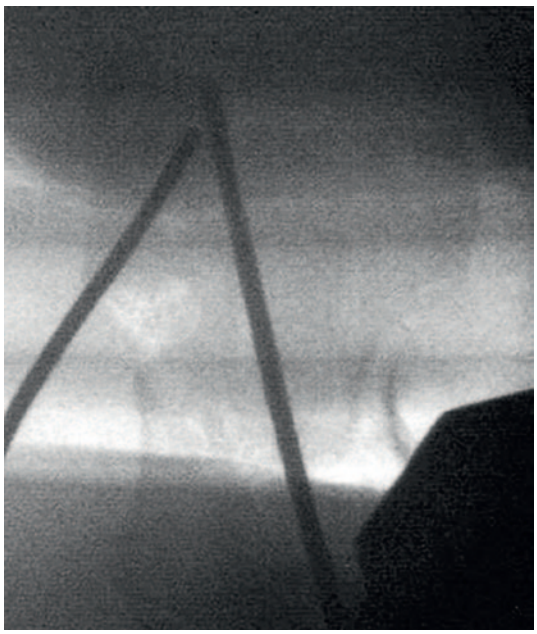


Fig. 85

Case studies

Fig. 86:
Dislocated medial femoral neck fracture (Pauwels III) preoperatively

Fig. 86

Fig. 87:
After Gliding Nail osteosynthesis
Due to safe axial and rotational stability of the head-neck fragment, only slight fracture impaction.

Fig. 87

Fig. 88:
After healing

Fig. 88

Fig. 89:
After metal removal

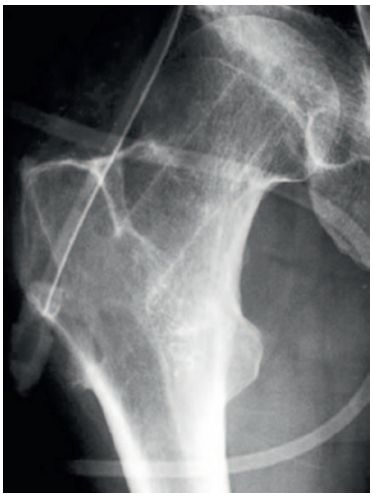


Fig. 89

Fig. 90 and 91:
Impacted medial femoral neck fracture (Pauwels I) before and after Gliding Nail osteosynthesis.

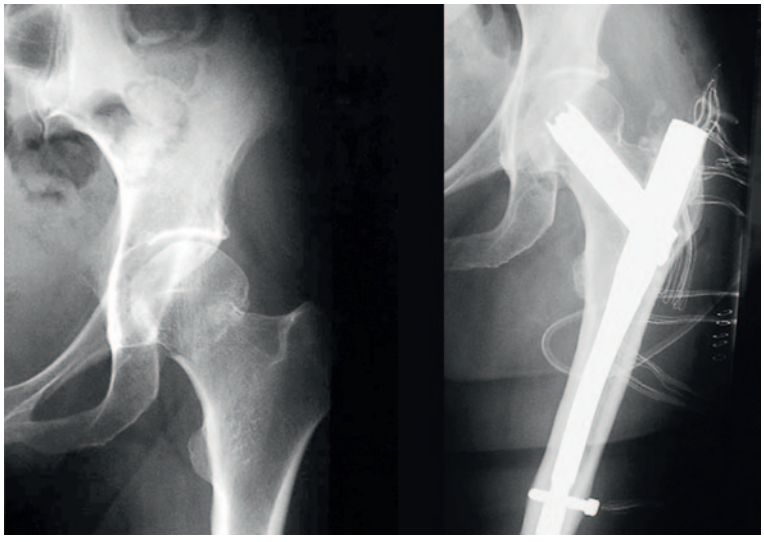


Fig. 90 Fig. 91

SUPPLEMENT TO THE SURGICAL TECHNIQUE FOR SUBTROCHANTERIC AND SHAFT FRACTURES

Introduction: Pertrochanteric femoral fractures usually occur in a fall with a violent adduction of the hip joint, in an impact trauma in the area of the trochanter and only rarely with axial force. Subtrochanteric femoral fractures also occur in younger patients with a high level of axial force.

Special information on the surgical technique

With the long nail (bent, right different to left) the trochanteric entry point is somewhat more dorsal and must be widened oval approx. 8 mm to medial so that the long straight nail part can also be inserted in a straight direction. Otherwise, subtrochanteric fractures may occur due to the nail reaching the medial cortical bone during difficult insertion (fig. 92, 93).

Fig. 92

Fig. 93

Please note
To expand the entry point, the GNp centering sleeve No. 2 (1130050) – tip in fishmouth form – can be placed behind the medullary cavity drill head and pressed in the desired direction.

Placement of distal locking pins for long Gliding Nails

The freehand technology with the GNp guide wire Ø 1.8 mm for locking long nails (1133115) is now shown here. In order to avoid exposure of the hands to radiation, it is gripped with a long clamp.

The wire tip is projected onto the desired proximal (static) or distal (dynamic) portion of the locking hole by axially adjusting the image converter in the direction of the distal locking holes.

Stitched skin incision.

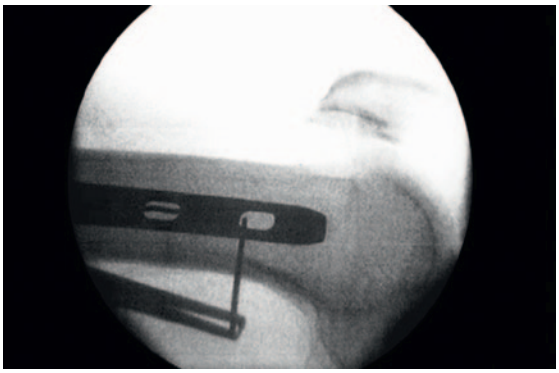


Fig. 94

Insertion of the target wire through the soft tissues onto the cortical bone and check of the tip projection for the corresponding limit of the locking hole (fig. 94).

The target wire is now successively raised or lowered respectively tilted to cranial and caudal until it can only be seen as a point. The wire is now drilled vertically through the bone using a drill (fig. 95).

Please note
For this purpose, the wire should be held with the second hand and a compress, as otherwise the rubber glove can be rolled up.

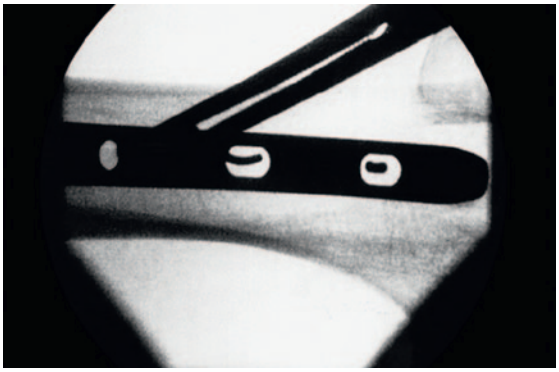


Fig. 95

The position of the target wire in the distal locking perforation is controlled (bending of the wire end with a clamp to obtain a reliable image converter distinction between wire tip and wire end).

Then the actual drilling is done via the guide wire with the conical GNp cannulated drill D 5.0 mm for locking long nails (1133116). This makes drilling easier even if the target wire is not completely centralised.

Length measurement, bolt insertion and X-ray control are carried out as described for the standard nail (fig. 96, 97).

If the drill comes into contact with the nail during the drilling procedure, it is essential to stop the drilling procedure and to remove the cannulated drill and Kirschner wire. Through the laterally drilled cortical bone, a full drill can now be inserted through the nail and the opposite cortical bone can be drilled specifically (step drill or in the case of a far distal position in the cancellous bone GN drill bit to seat the blade Ø 4.5 mm 1133106).

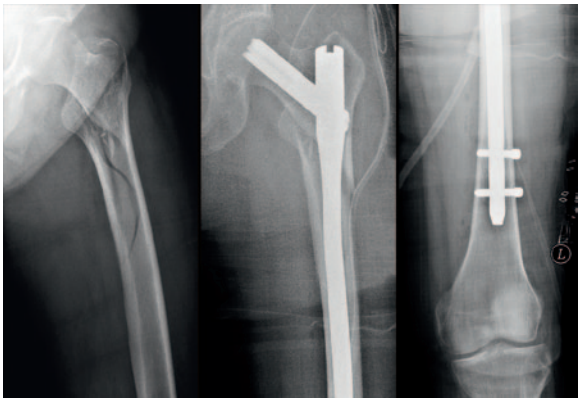
Please note
For users of a radiolucent angular gear, the guide direction setting is similar to the one given above for the guide wire setting. However, a primarily precise central adjustment of the drill is required to avoid nail contact.

Fig. 96

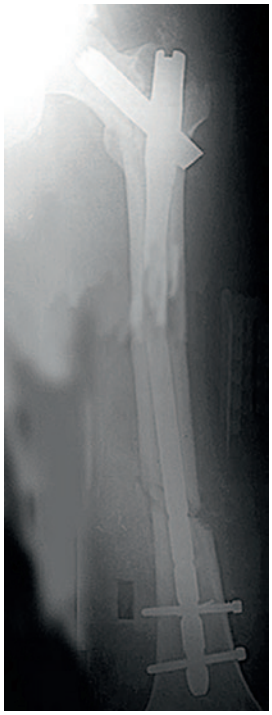
Fig. 97

Case studies

Stage fracture pertrochanteric and subtrochanteric multiple fragment, preoperatively and after Gliding Nail osteosynthesis with a long GN Gliding Nail.



Load-stable restoration of an equilateral pertrochanteric and a femoral shaft fracture with a long GN Gliding Nail.



SUPPLEMENT TO THE SURGICAL TECHNIQUE FOR PATHOLOGICAL FRACTURES

Introduction: The femur is by far the most common localisation of pathological fractures. This results from the high biomechanical load as well as the relatively high blood flow and bone mass of this section of the skeleton.

Special information on the surgical technique

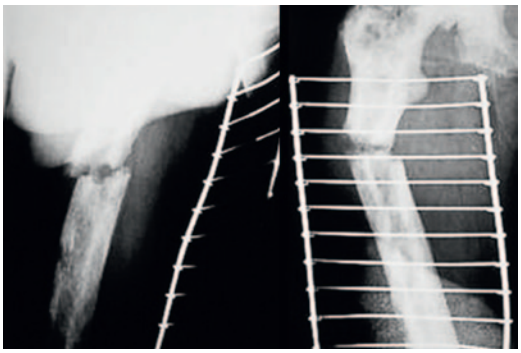
Always choose the longest possible GN Gliding Nail with a fixed Gliding Nail blade and distal static locking to achieve maximum stability even in the event of possible further progression of the metastases or the occurrence of further metastases.

» Single metastases can be resected with a good prognosis. The defect area of the bone is to be built up with bone cement. In benign tumours such as aneurysmatic bone cysts, the bone defect can be replaced by a bone transplant.

» In the case of multiple metastases and poor prognosis, no resection is performed.

Case studies

Pathological fracture in multiple metastases.



Supply with a long GN Gliding Nail.

SUPPLEMENT TO THE SURGICAL TECHNIQUE FOR REOSTEOSYNTHESES

Introduction: Corrective interventions after implant failure, e. g. with round profile component profiles, are useful with the GN Gliding Nail as long as there is no acetabular damage.

Due to the completely different profile configuration of the blade, a head-retaining restoration is usually possible even after a round component profile has passed through.

For the biomechanical investigation of the risk of migration of the femoral neck blade in comparison to round profile component profiles, paired corpse tests were carried out. A reduction of the penetration of more than 50 % in the physiological load range in comparison to the stronger single screw of the locking nail and of more than 75 % in comparison to the double screw system with thinner cranial screw of the proximal femoral nail was observed (Friedl / Chirurg 2001).

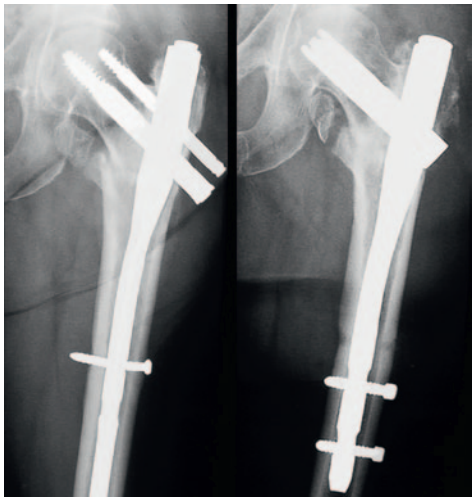
Special information on the surgical technique

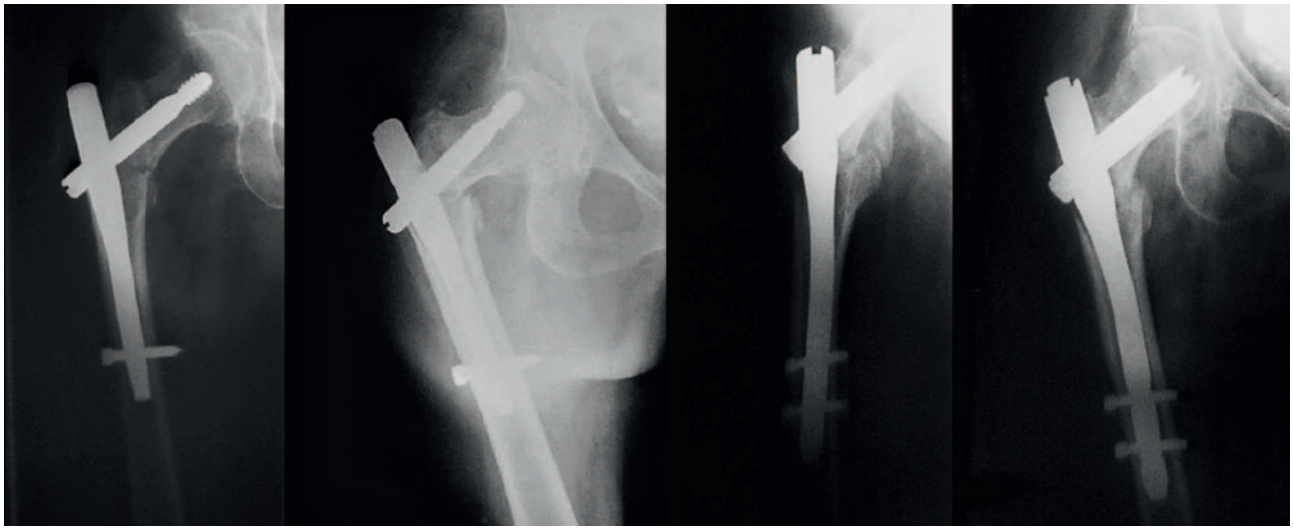
During reosteosynthesis, the blade should be placed as far away as possible from the bearing of the first femoral neck component profile.

Case studies

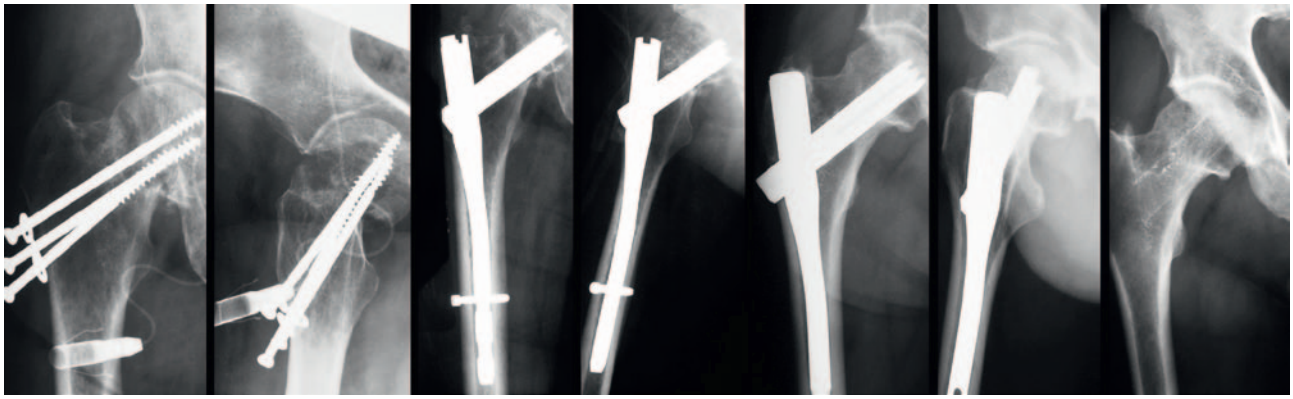
Change of procedure in case of missing fracture healing and strong impaction on a GN Gliding Nail.

The blade should be inserted as caudally and centrally as possible in the axial direction of the femoral neck and as far as possible along the calotte contour.





Revision operation after passing through a round profile component profile and supply with a standard Gliding Nail.



Femoral neck pseudoarthrosis with massive bone resorption and impaction after Pauwels III fracture

Gliding Nail reosteosynthesis

Gliding Nail reosteosynthesis after healing

Metal removal after healing

SUPPLEMENT TO THE SURGICAL TECHNIQUE FOR CORRECTIVE OSTEOTOMIES

Introduction: Orthopaedic indications present valgisation osteotomies, but especially varus osteotomies. The Gliding Nail osteosynthesis enables immediate load-bearing capacity as well as direct compression of the osteotomy plane during dynamic implantation.

Reduction

After the osteotomy, the bone surfaces should be reduced in a plane-parallel manner.

Special information on the surgical technique preoperative planning

Plan the corrective osteotomies (OT) from the desired angle, select the entry point of the nail according to the corrective OT angle to lateral (in the case of varus osteotomy) or medial (valgisation OT). The valgus osteotomy can only be performed to a limited extent with the implant, since the entry point of the nail is shifted far to medial and thus into the cranial femoral neck limitation.

Case studies

Pseudoarthrosis after varus osteotomy of the femur with angle plate. Reosteosynthesis with the GN Gliding Nail.

POSTOPERATIVE TREATMENT

As a rule, all femoral fractures treated with a GN Gliding Nail have primary load stability. A limited postoperative load should only be applied in the case of poor circulation situation of the femoral head (e.g. when using a GN Gliding Nail in the case of a primarily dislocated medial femoral neck fracture). The effect of this partial loading or unloading phase is not guaranteed.

A standard radiographic check should be performed three months postoperatively or in patients with clinical symptoms.

If the fracture does not heal in an individual case, the distal locking bolts must be removed after a period of three to four months for dynamisation in order to prevent a possible fatigue fracture of the nail. If necessary, a decortication or spongiosaplasty must also be performed.

Postoperative aftercare

Every patient requires consistent postoperative care by the surgeon or a sufficiently qualified specialist. Post-operative care and treatment must be carried out using recognised procedures and taking into account the information contained in the description of the surgical technique. Postoperative treatment must be documented in accordance with the hospital's own guidelines. The patient must be informed about the limitations of the implant and advised that caution is required with regard to loading and permitted activity level in the **absence of bone healing**.

The patient should be asked to inform his doctor immediately of any unusual changes in the operation area.

Follow-up treatment

» Physiotherapy with full load up to the complete restoration of the normal gait pattern

» Clinical and X-ray control up to safe fracture healing in **symptomatic patients**

» If there is a risk of necrosis of the femoral head, as in the case of femoral neck fractures, further checks (X-rays, scintigraphy) should be carried out and, if necessary, further measures should be taken.

» Metal removal is usually determined individually, mostly depending on age and state of health. It may be indicated for local complaints. In older patients or patients with osteoporosis, metal removal without replacement should never be performed, as the implant is the best hip protector.

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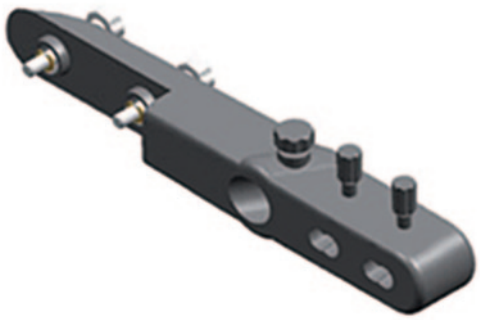
European Journal of Trauma (2006), Vol. 32, Heft 6, S. 562

General information

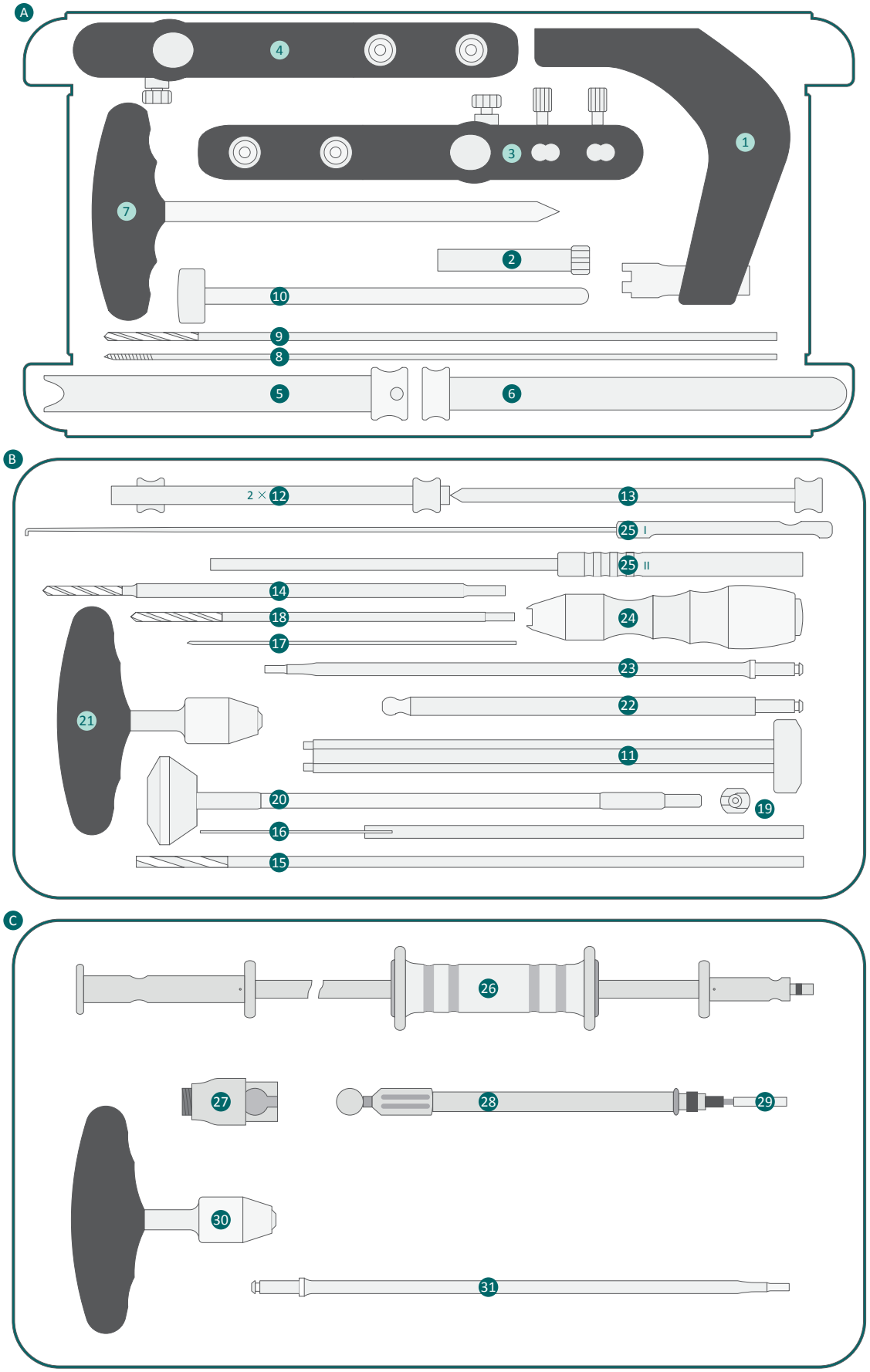
When using all our products, please follow the Instructions for the use of medical devices made by INTERCUS GmbH. This is available on our website www.intercus.de or can be requested from us in paper form.

Special information on cleaning

For cleaning, the targeting guide is removed from the targeting device handle.



Attention
All fixing screws are secured, so do not attempt to remove them for cleaning.


A
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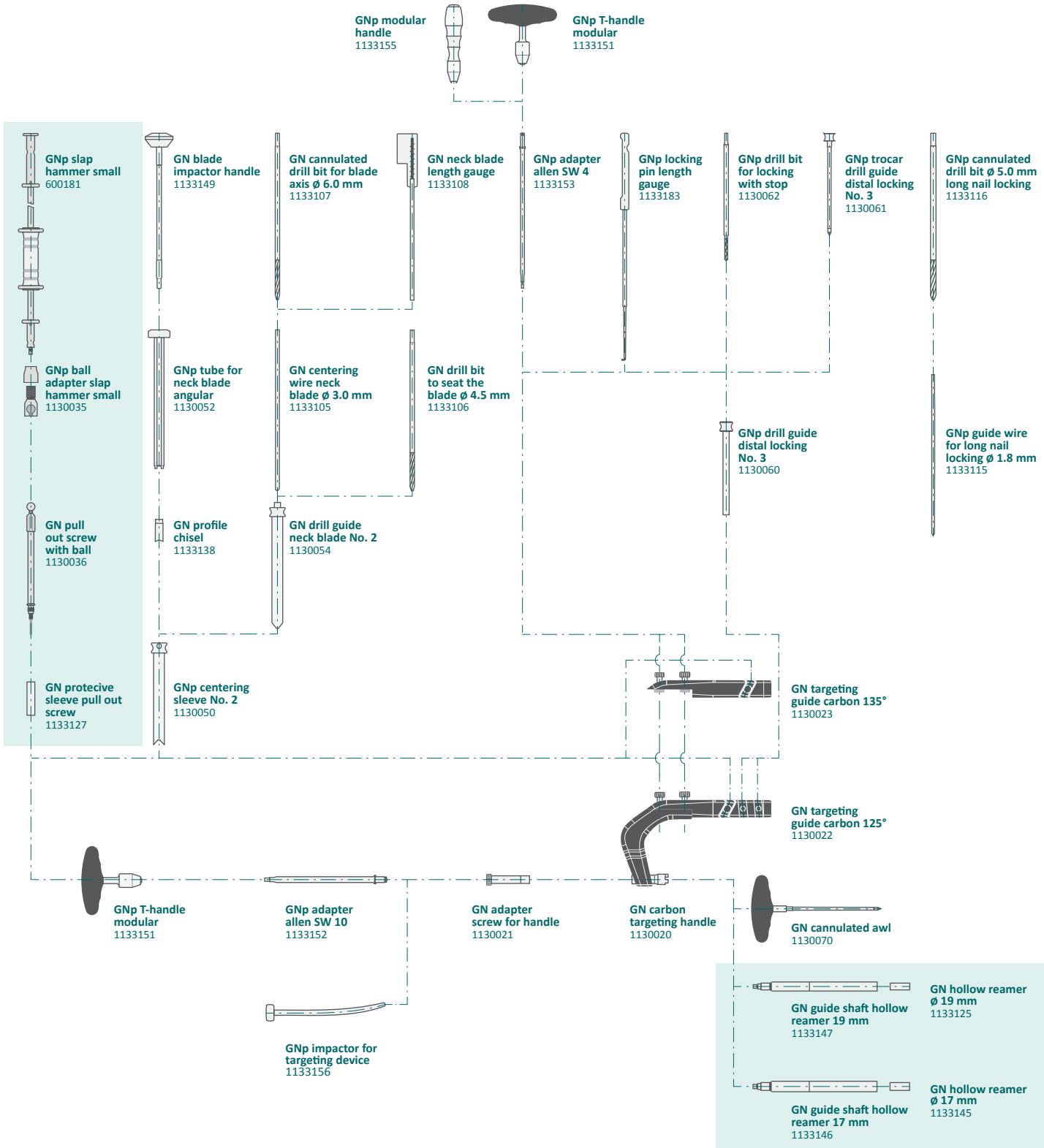
Product overview

GN Gliding Nail (optional) instruments



Personal remarks

ICPOP05en 02 2021-11

CE 0197

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