Trauma

Gamma3

Long Nail R2.0

Operative Technique

Hip Fracture Systems

Gamma3™ Long Nail R2.0

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This publication sets forth detailed recommended procedures for using Stryker Trauma devices and instruments.

It offers guidance that you should heed, but, as with any such technical guide, each surgeon must consider the particular needs of each patient and make appropriate adjustments when and as required. A workshop training is required prior to first surgery.

Note:
All bone screws referenced in this material here are not approved for screw attachment or fixation to the posterior elements (pedicles) of the cervical, thoracic or lumbar spine.

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Introduction

Gamma3™ Long Nail R2.0

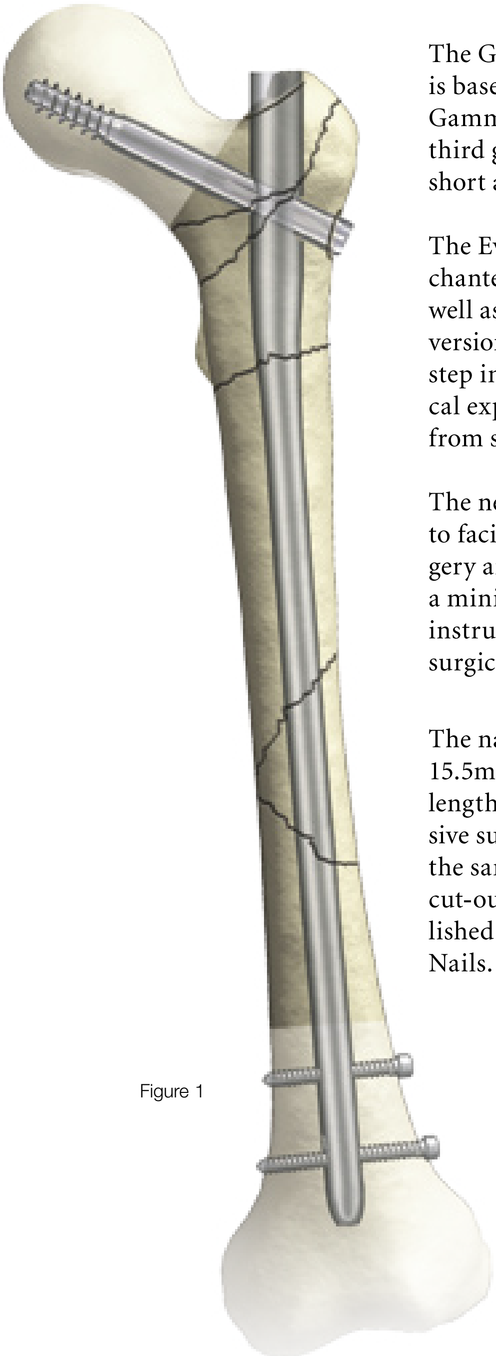


Figure 1

The Gamma3™ Locking Nail System is based on more than 15 years of Gamma Nail experience. This is the third generation of intramedullary short and long Gamma fixation nails.

The Evolution of the successful Trochanteric and Long Gamma Nails as well as the Asia Pacific and Japanese versions followed strictly a step by step improvement based on the clinical experience of the clinical outcome from surgeons all over the world.

The new Gamma3 System is designed to facilitate minimally invasive surgery and reduce the OR time down to a minimum by the aid of using new instrumentation and an optimized surgical technique.

The nails have a proximal diameter of 15.5mm to help minimize the incision length required for minimally invasive surgery. Nevertheless, they offer the same biomechanical strength and cut-out resistance as the well established Trochanteric and Long Gamma Nails.

The new Lag Screw shape has been improved, especially in the area of the thread and the cutting flutes at the tip of the screw. The new design offers superior cutting behavior during Lag Screw insertion, providing extremely low insertion torque. The new thread design also offers excellent grip in the cancellous bone of the femoral head and strong resistance against cut-out.

The 5mm distal locking screws are currently used in the Gamma-Ti and the T2 intramedullary nailing systems.

A major advantage of the system is the newly designed instrument platform. The instruments are designed for a minimally invasive surgical technique and reduce OR time to a minimum. The instruments are easy to use and easy to clean, and they share the same platform as the Stryker intramedullary T2 and S2 nails.

Acknowledgements:

Our thanks are due to the many surgeons who supported the development of the new Gamma3 System, with their feedback and ideas, during worldwide panel meetings and helped the Gamma3 System to be what it is today.

Special thanks to the Asian Pacific Technical Committee, who supported very early the idea of smaller implants for the treatment of proximal femur fractures.

Features

Design Features of the Gamma3™ System

Gamma3 Locking Nails come in 3 neck-shaft angles of 120, 125 and 130°.

- In the following, these Gamma3 Nails are called:
  Long Nail

All nails* use the same Lag Screws, Set Screw, distal Locking Screws and End Caps.

Gamma3 Nail Long

This nail incorporates several important mechanical design features. The nail is unslotted and cannulated for Guide-Wire-controlled insertion. To facilitate conformity with the human anatomy, the Long Nail is supplied in a left and right version.
The three neck-shaft angles accommodate variations in femoral neck anatomy. The Long Nail offers the opportunity to use two distal Locking Screws that are inserted through the distal nail end to control rotation and telescoping. As shown below, the nail offers the possibility for either static, dynamic or secondary dynamic distal locking, depending on the fracture pattern.

Technical Specifications:

- **Material:**
  Titanium alloy with anodized type II surface treatment or Orthinox® High Strength Stainless Steel
- **Nail length:**
  280mm to 460mm, in 20mm increments, shorter or longer nails are available on request
- **Nail diameter:**
  proximal 15.5mm, distal: 11.0mm
- **Proximal Nail angle range:**
  120°, 125°, 130°
- **M-L bend for valgus curvature:**
  4 degrees
- **Proximal anterversion of 10°**
- **End Caps**
  0mm, +5mm and +10mm
- **Antecurvature radius R2.0m of the shaft**
- **Distal locking holes (round and oblong)**
  for 5mm screws; up to 5mm dynamization is possible

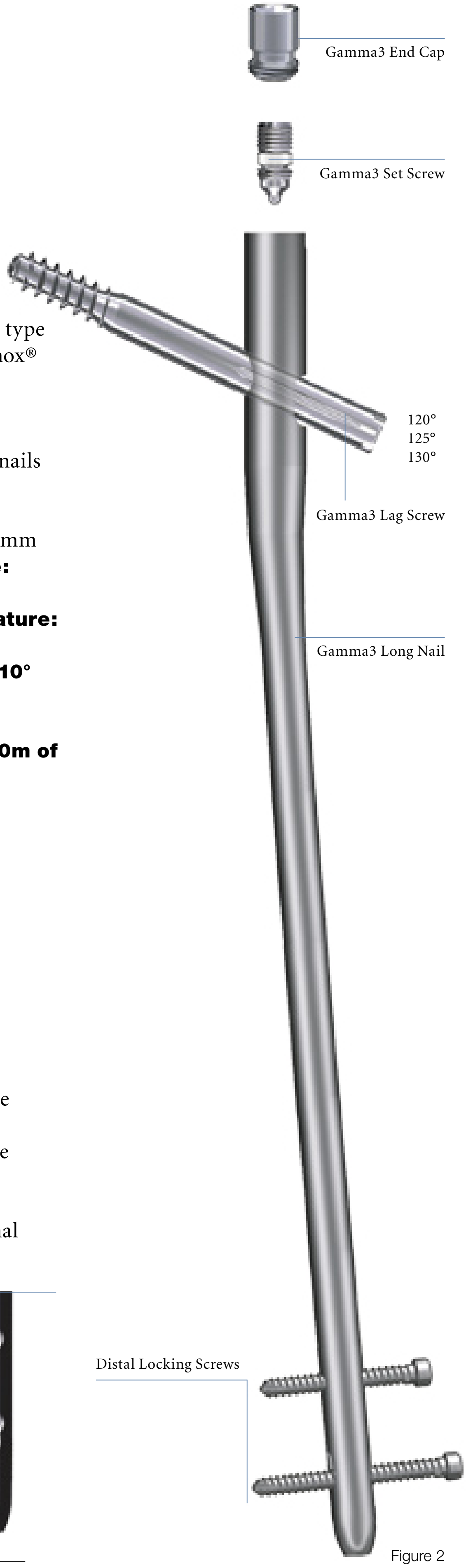
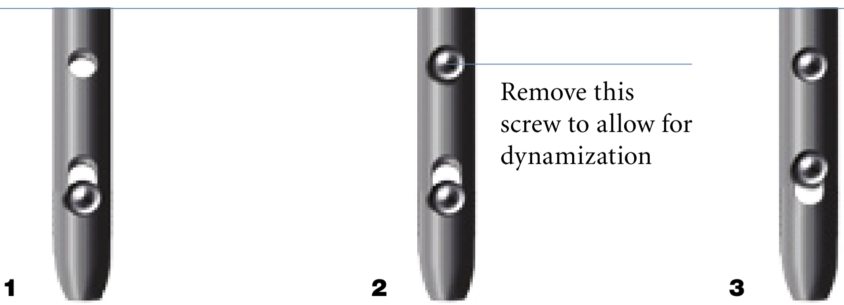


Figure 2

Long Nail Distal Locking Options

1. **Dynamic locking** (Only one screw is needed):
   Locking in the distal part of the oblong hole creates a dynamic locking mechanism.
2. **Secondary dynamization** (Two screws are needed):
   One screw placed in the distal part of the oblong hole and the other in the round hole.
   If dynamization is required after a period of time, the screw, placed in the round hole has to be removed.
3. **Static locking** (Two screws are needed):
   One screw placed in the round hole and the other is placed in the proximal part of the oblong hole.



* Each nail is supplied sterile packaged together with a Set Screw in one box.

Features

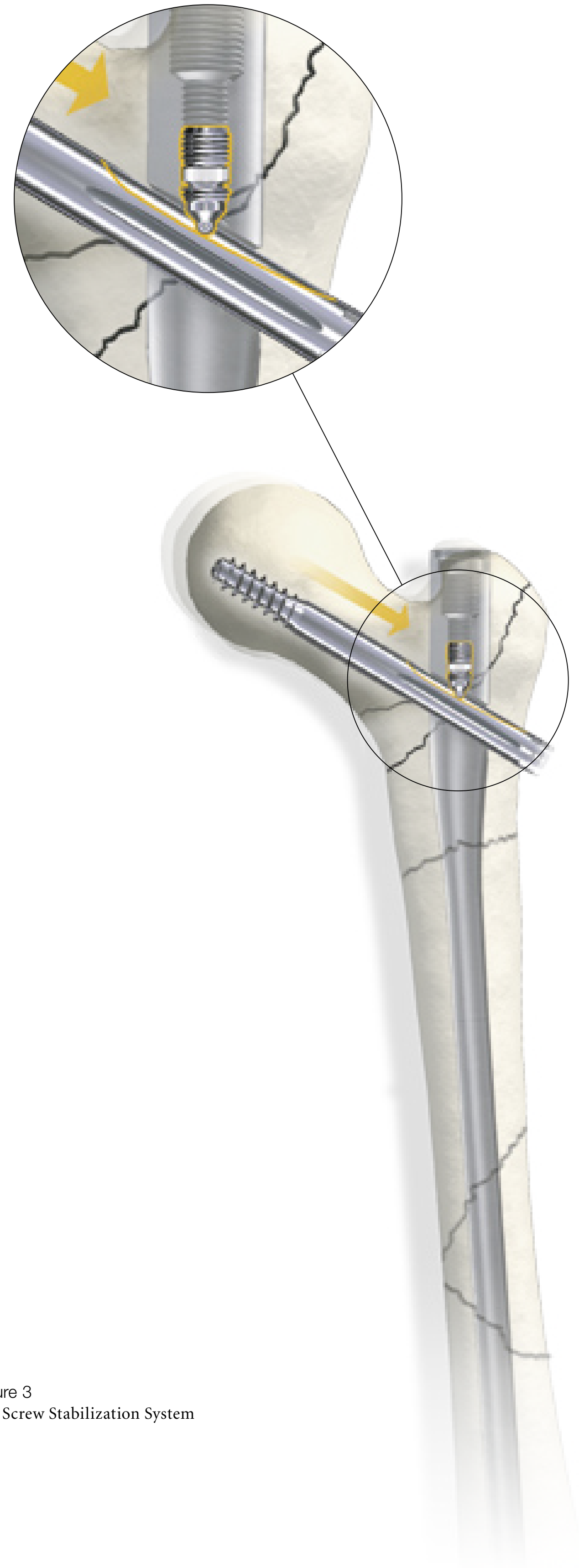


Figure 3
Lag Screw Stabilization System

Lag Screw and Set Screw Function

The Lag Screws are designed to transfer the load of the femoral head into the nail shaft by bridging the fracture line to allow fast and secure fracture healing. The load carrying thread design of the Gamma3 Lag Screw provides large surface contact to the cancellous bone. This provides high resistance against cut out. Gamma3 Lag Screws feature a special tip profile to allow use with bone substitutes and the self-tapping thread is designed for easy insertion.

The patented Set Screw is designed to fit into one of the four grooves of the shaft of the Lag Screw. This prevents both, rotation and medial migration of the Lag Screw.

The nail allows sliding of the Lag Screw to the lateral side for dynamic bone compression at the fracture sight to enhance fracture healing.

Technical Specifications

- Lag Screw diameter: 10.5mm
- Lag Screw lengths: 70-120mm in 5mm increments
- Patented Lag Screw design for high load absorption and easy insertion
- Asymmetrical depth profile to allow the Lag Screw to slide in the lateral direction only (see orange arrow on Figure 3).
- Patented self retaining Set Screw to protect the Lag Screw against rotation and simultaneously allowing sliding of the Lag Screw laterally.

Features

Distal Locking Screws

The distal Locking Screw has a short self-tapping tip which facilitates a faster and easier start as well as easy screw insertion. It promotes excellent surface to bone contact (Figure 4).

Figure 4

The screw has an external diameter of 5mm, and provides an even higher fatigue strength than the clinically successful 6.28mm Locking Screw of the regular Gamma™ and G/K Locking Nail System (data on file).

The screw diameter directly under the screw head has been reduced to prevent radial pressure that may cause micro fractures during screw insertion when the screw head reaches its final position. This reduction in diameter also improves the feel on the final tightening of the screw (Figure 5).

Length Definition of the Distal Locking Screw

The distal Locking Screw is measured from head to tip (Figure 5a).

Technical Specifications

- Distal Locking Screw Diameter: 5mm.
- Distal Locking Screw lengths ranging from 25-50mm, in 2.5 and 5mm increments. Longer screws up to 120mm are available on request.
- Fully threaded screw design. Partially threaded screws are available on request
- Self-tapping screw tip with optimized short cutting flutes.
- Optimized diameter under the head helps to prevent micro-fractures during insertion.
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- Optimized diameter under the head helps to prevent micro-fractures during insertion.

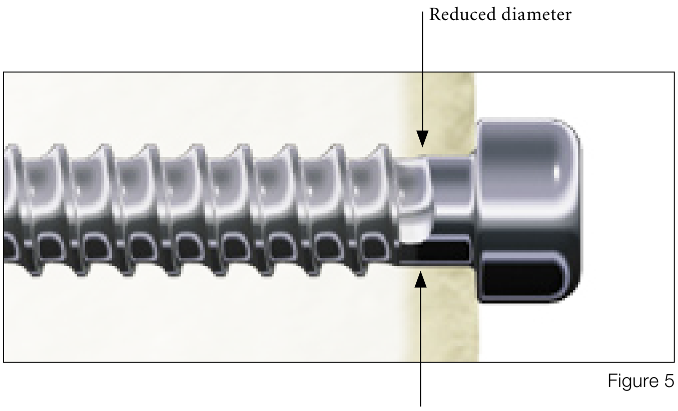


Figure 5

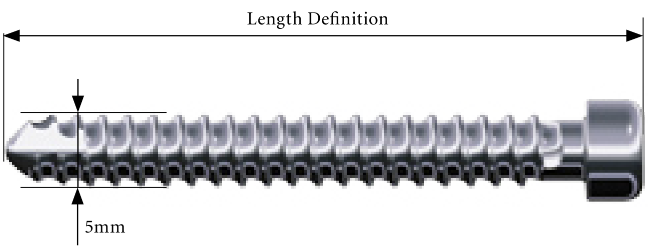


Figure 5a

Features

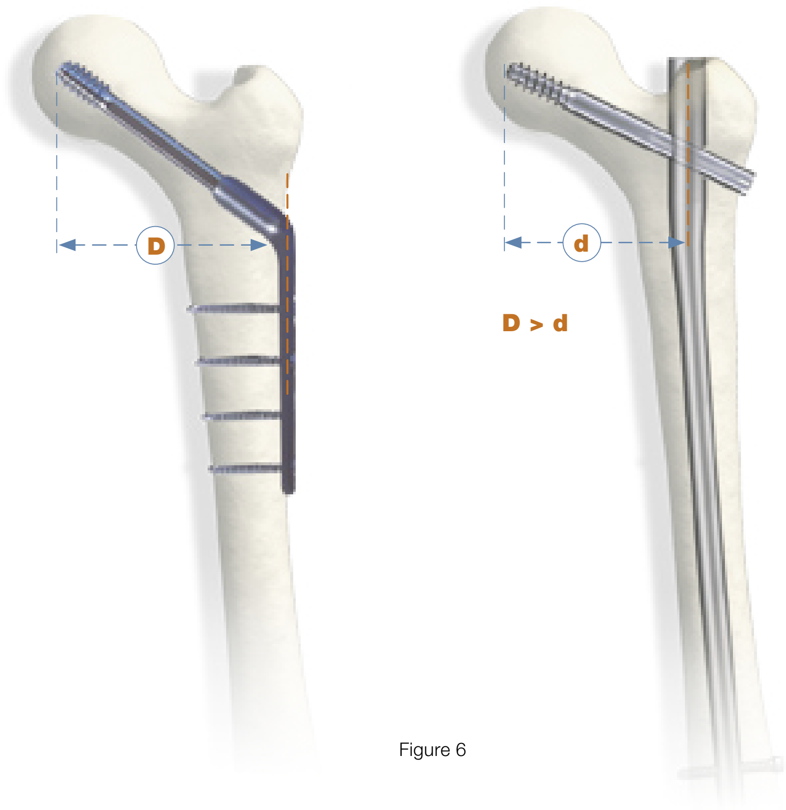


Figure 6

Gamma3™ System Benefits

Strength and Stability

The biomechanical superiority of the intramedullary system offers significantly greater strength and stability compared with the side plate, in clinical use [1]. The new Gamma3 system offers the same strength as the well established Gamma™ Locking Nail System.

The Biomechanical Advantage over Side-Plate Systems

Since the load-bearing axis of the Gamma3 Nail is closer to the hip joint fulcrum, the effective lever arm on the implant and femur is significantly shorter than with an extramedullary plate. The reduction factor is equivalent to d/D as shown in Figure 6 (approximately 25% [1]).
The resultant force is transmitted directly down the femur using a nail system. If a side-plate system is used, the femur shaft may be weakened through a high amount of locking screws. This increases both the strength and reliability of the biomechanical repair. The distal dynamic locking option additionally allows the use of dynamic compression.

Rehabilitation Benefits

The extra strength effectively gained through the biomechanics of the Gamma3 System combined with improved control of axial telescoping and rotational instability may allow earlier weight-bearing even in patients with complex or unstable proximal and combined ipsilateral shaft fractures. Early mobilization, dynamic compression, and a less traumatic operative technique increase the chance for rapid recovery and reliable bone union.

[1] K.S.Leung et al, Multicenter Trial of the Modified Gamma™ Nail in East Asia CORR323: 146-154,1996

Operative Technique

Figure 7

Indications/Contraindications

Indications

- Subtrochanteric fractures
- Pertrochanteric fractures associated with shaft fractures
- Pathological fractures (including prophylactic use) in both trochanteric and diaphysal areas
- Nonunion and malunion

Contraindications

Contraindications are medial neck fractures.

Note:
If no bone consolidation occurs the system may fail. The aim of post-operative care must be to ensure the promotion of bone consolidation.

The aim of this operative technique manual is to provide the surgeon with a simple step-by-step operating guide to aid in successful addition of the Gamma3 System into their standard trauma care. Once the technique has been learned, the surgeon should find the operative procedure simple to implement. In fact, many of the basic principles for the Gamma3 System are those employed for all closed intramedullary nailing procedures.

This operative technique has been devised in consultation with leading surgeons in many countries to be a basic guide, particularly for less experienced users of the Gamma3 System. It is acknowledged that several alternative approaches to certain elements of the procedure are available, and may have advantages for particular situations or surgeons.

Operative Technique

Implant Selection

The Gamma3™ Nail with a 125° nail angle may be used in the majority of patients. The 120° nail may be needed in patients with osteoarthritic coxa vara, and the 130° nail for coxa valga.

Where such variations in femoral anatomy require an alternative, the following chapter describes how to select the optimum implant size.

Preoperative Planning

X-ray templates are very helpful during preoperative planning. Use the X-ray Templates (Figure 9 and 9a) for short and long nails to select the correct implant and the optimal nail angle.

These templates show the true implant size at a magnification of 15% in anterior-posterior view. The X-rays should be taken at this magnification (15%) for an optimum surgical outcome (see Figure 9). If accurate anatomical reduction has been achieved, the X-ray can be taken from the fractured hip or from the contralateral side.

Alternatively the femoral neck angle, i.e. the angle between the femoral shaft mid-axis and the femoral neck mid-axis, could be measured using a goniometer. The nail length may also be determinated intraoperatively using the Guide Wire Ruler together with the Guide Wire.

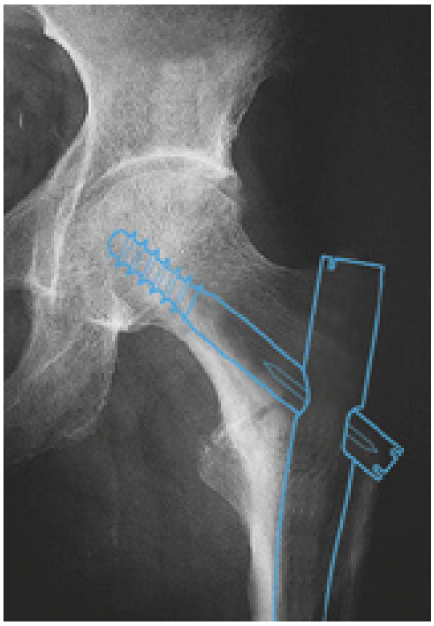
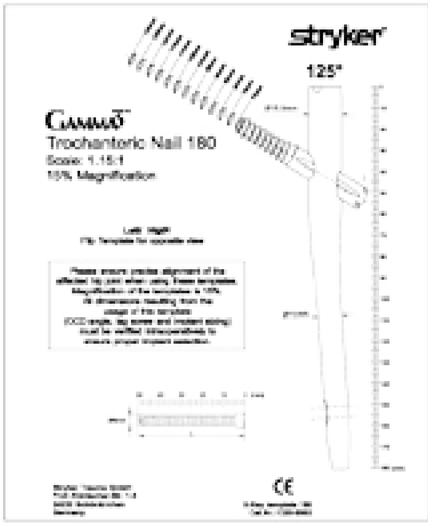
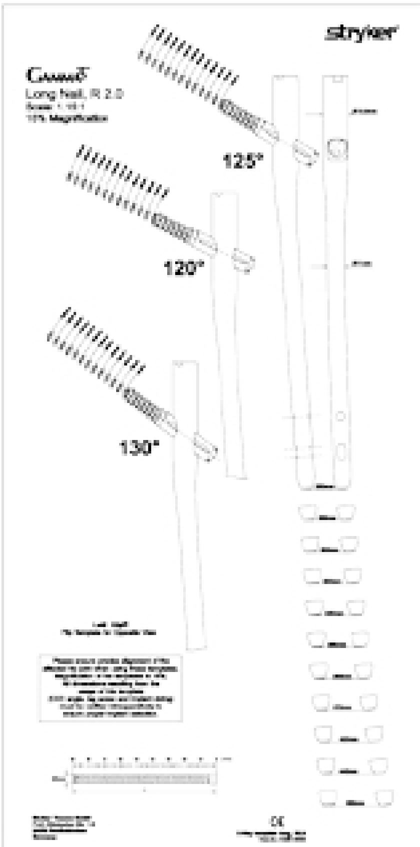


Figure 8
X-ray in a-p view, showing implant



Gamma3 Nail 180 X-ray Template (Ref. No 1320-0002) Figure 9



Gamma3 Long Nail X-ray Template (Ref. No 1320-0005) Figure 9a

Note:
Please ensure precise alignment of the affected hip joint when using these templates. Template magni-fication is 15%. All dimensions (nail angle and implant sizing) resulting from using these templates must be verified intra-operatively to ensure proper implant selection.

Operative Technique

Patient Positioning and Fracture Reduction

The procedure for patient positioning is normally similar to that of a subtrochanteric fracture, however, in fractures that are particularly difficult to reduce, a transcondylar sterile Steinmann pin may be used. The pin is fixed directly to the orthopaedic table by an adaptable stirrup, and traction is applied until anatomical reduction in the A-P view is obtained (Figure 10).

The patient is placed in a supine position on the fracture table and closed reduction of the fracture is recommended (Figure 11).

Traction is applied to the fracture, keeping the leg straight. The upper trunk should be flexed to the opposite side so that the fracture can be reduced by not too much adduction of the lower limb. It also gives easy access to the greater trochanter.

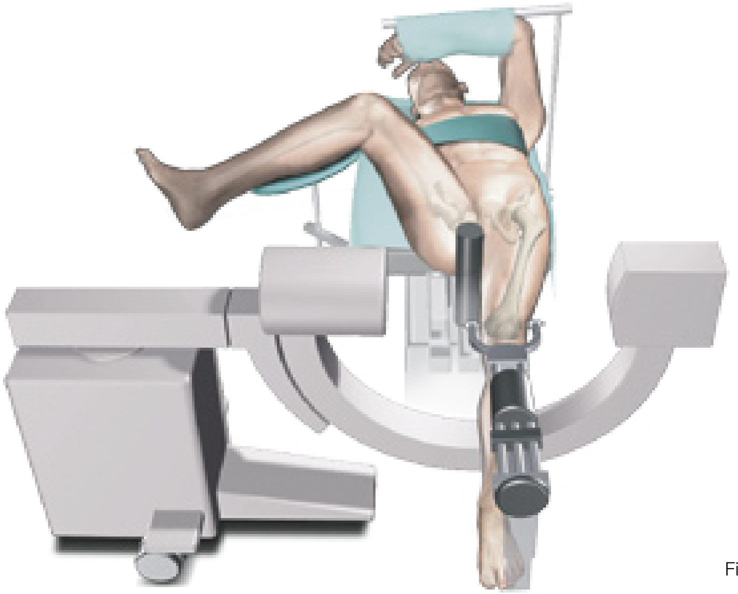


Figure 10

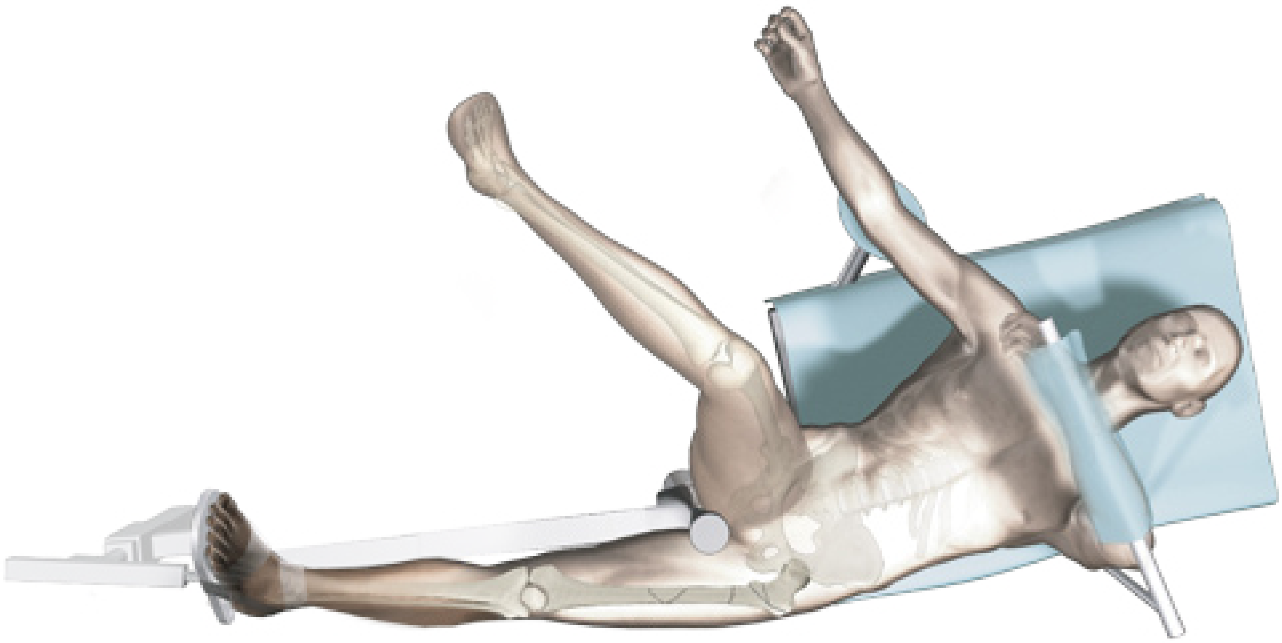


Figure 11

Operative Technique

Patient Positioning and Fracture Reduction

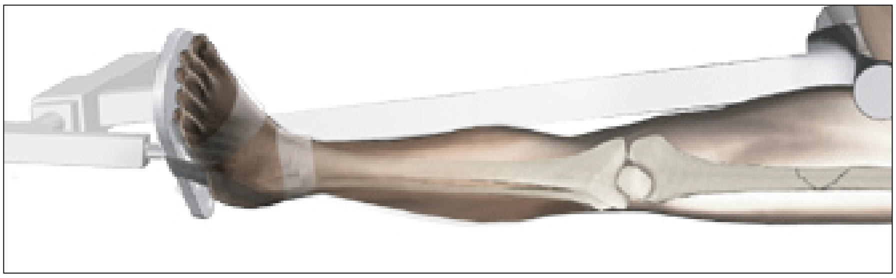


Figure 12

Maintaining traction, the leg is internally rotated 10-15 degrees to complete fracture reduction; the patella should have either a horizontally or slightly inward position (Figure 12).
Position the image intensifier so that anterior-posterior and mediolateral views of the trochanteric region of the affected femur can be easily obtained. This position is best achieved if the image intensifier is positioned so that the axis of rotation of the intensifier is centered on the femoral neck of the affected femur (Figure 13). The views of the distal femur should also be easily obtained for distal locking.

It is important to ensure that a view of both the distal and proximal tips of the nail can be obtained during the procedure without obstruction by the traction table.

The patient is then prepared and draped as for standard femoral nailing procedures. When positioning the drapes, bear in mind that the incision will be more proximal.

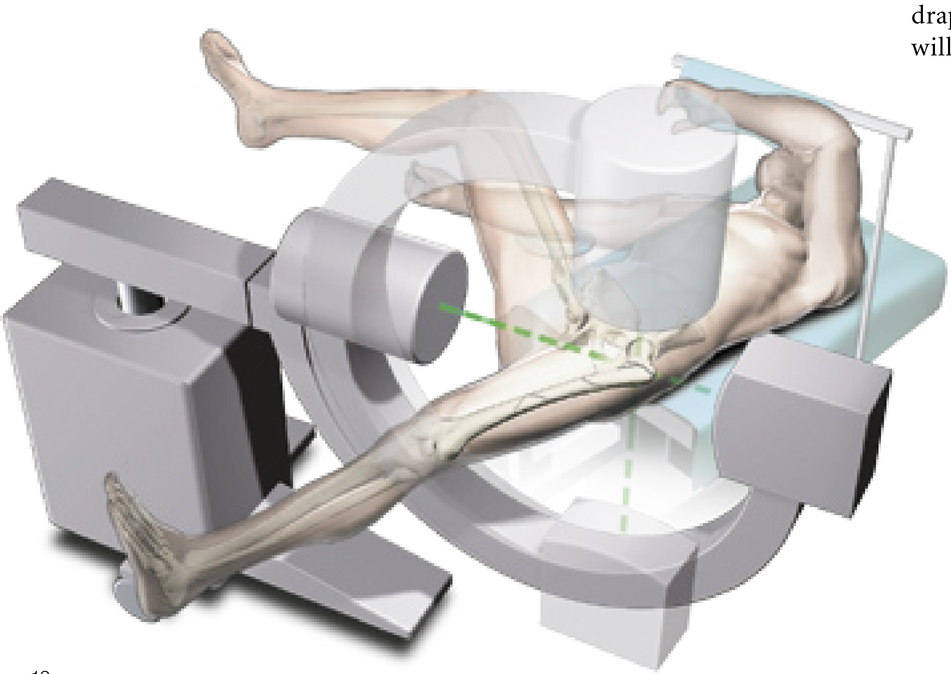


Figure 13

Note:
Reduction should be achieved as anatomically as possible. If this is not achievable, reduction should be achieved at least in one plane. Reduction in the other plane may be achieved with the Gamma3 Long Nail during insertion.

Operative Technique

Special Techniques for Fracture Reduction

For specific situations, special techniques have been developed for fracture reduction, and these are explained below.

To counter this misalignment, the trunk is turned to the opposite side and held in position by a thoracic rest or by a large drape. This tightens the gluteus medius muscles and relaxes the psoas, externally rotating the proximal fragment into alignment and exposing the trochanter for easier introduction of the nail. The fractured limb is kept straight, with the knee in flexion (Figure 14), using the stirrup to avoid adduction. This position helps to align the distal portion. Reduction is confirmed in the AP view.

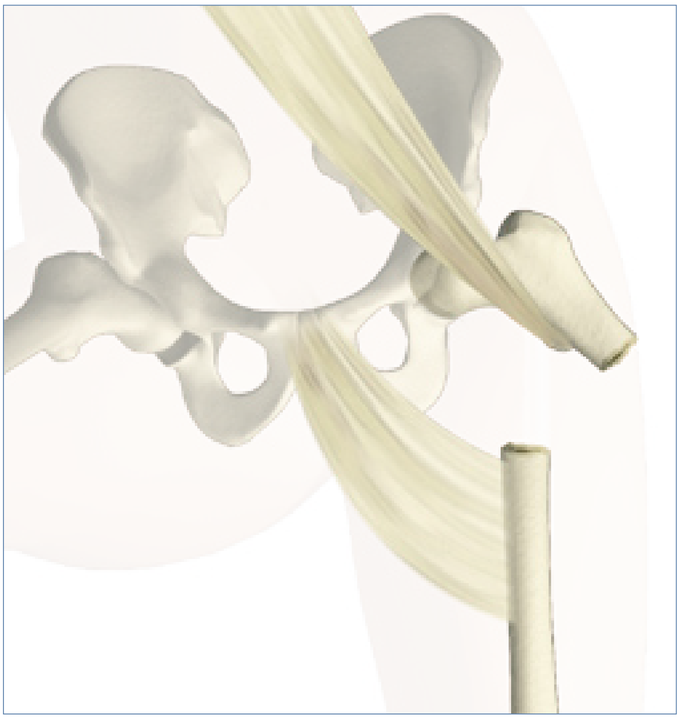


Figure 14

Subtrochanteric fractures cannot always be reduced during positioning in the lateral view, because the proximal fragment is drawn forward by tension from the psoas muscles. This may be reduced during surgery by using the Universal Rod (Fig. 15).

Care must be taken when introducing the implant as the proximal fragment may rotate during insertion.

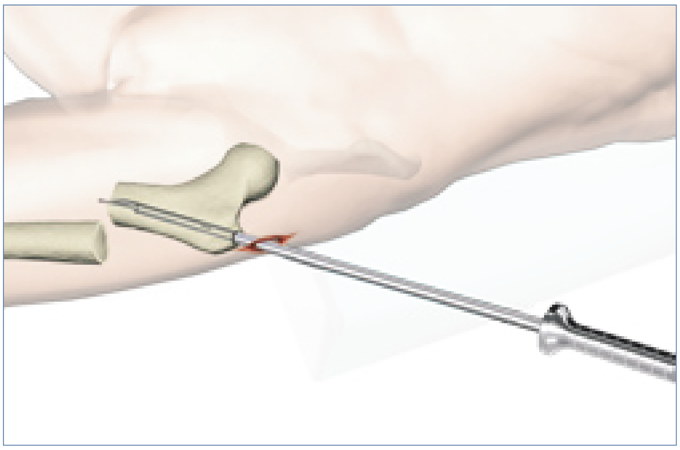


Figure 15

Incision

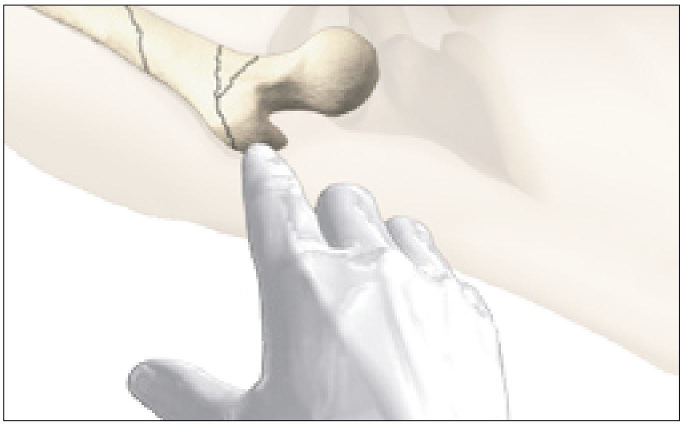


Figure 13

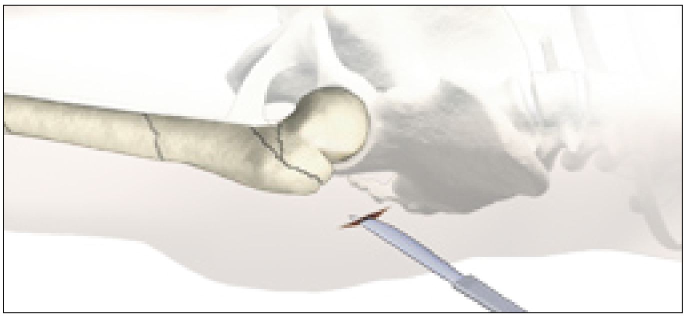


Figure 14

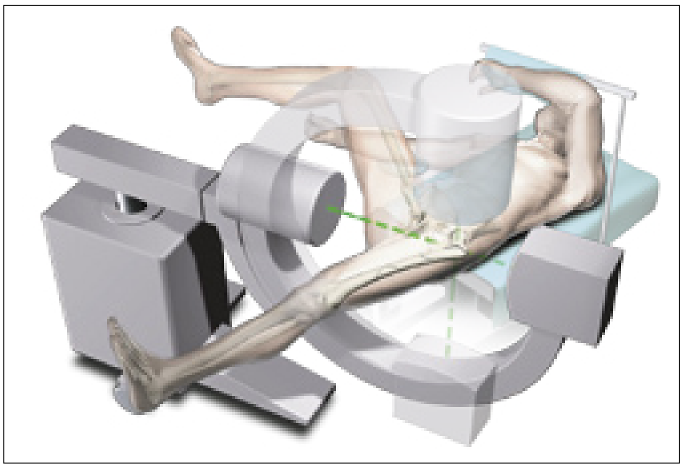


Figure 15


Figure 16

Incisions may be developed in different manners. Two alternatives will be described below.

Alternative 1:
The tip of the greater trochanter may be located by palpation (Figure 13) and a horizontal skin incision of approximately 2 - 3cm is made from the greater trochanter in the direction of the iliac crest (Figure 14). In obese patients the incision length may need to be longer, depending on obesity of the patient.
A small incision is deepened through the fascia lata, splitting the abductor muscle approximately 1 - 2cm immediately above the tip of the greater trochanter, thus exposing its tip. A self-retaining retractor, or tissue protection sleeve is put in place.

Alternative 2:
A long and thin metal rod (e.g. Screw Scale, Long) is placed on the lateral side of the leg. Check with image intensifier, using l-m view, that the metal rod is positioned parallel to the bone in the center of the proximal part of the femoral canal (Figure 16a). A line is drawn on the skin (Figure 16).

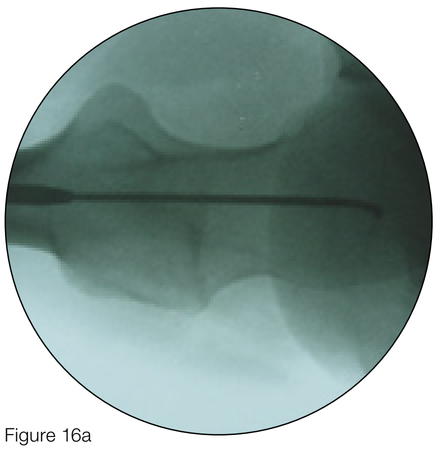


Figure 16a

Operative Technique

Incision

The C-arm is turned approx. 90° to provide an A-P image of the tip of the trochanter using the metal rod as shown in Figure 17 and 17a.

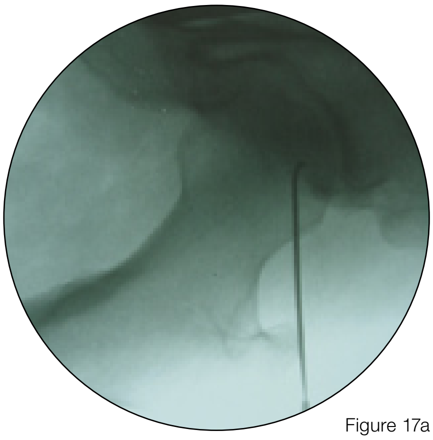


Figure 17a

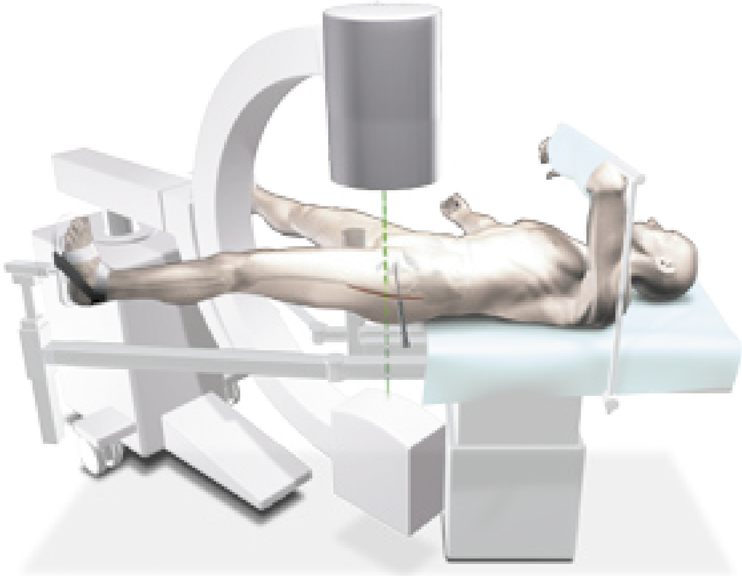


Figure 17

A vertical line is drawn onto the skin (Figure 18). The intersection of the lines indicates the position for the entry point of the nail. This is usually the anterior third of the tip of the greater trochanter as shown in Figure 22.

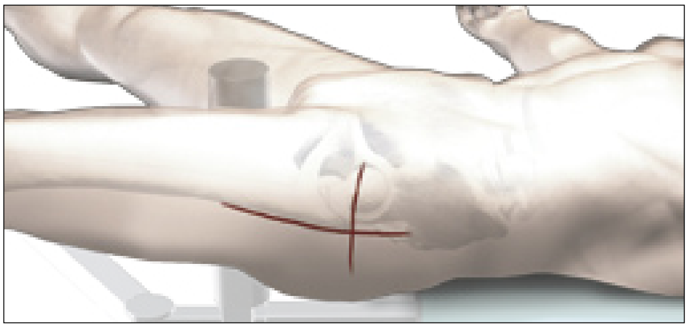


Figure 18

The skin incision is made cranially to the indicated intersection, following the sagital line in cranial direction. The distance between the intersection and the starting point for the incision differs, depending on the obesity of the patient. Under normal conditions it is a distance of approximately 2cm's.

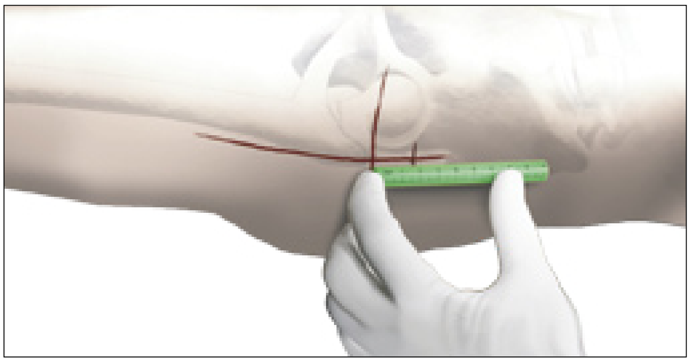


Figure 19

A small skin incision is made as described in Alternative 1 and shown in Figure 20.

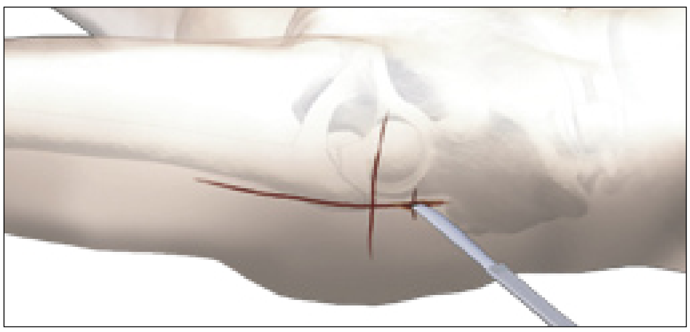


Figure 20

Operative Technique

Incision

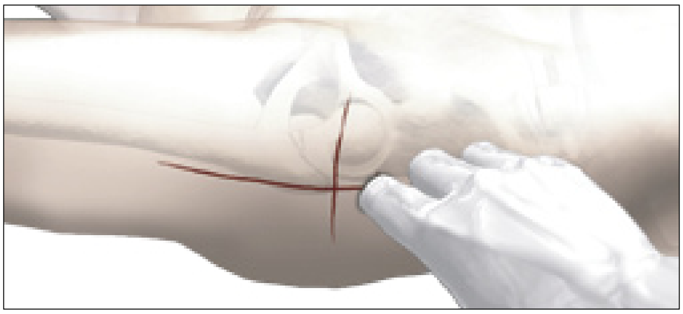


Figure 21

Using a finger, the tip of the trochanter should be felt easily (Figure 21).

Entry Point

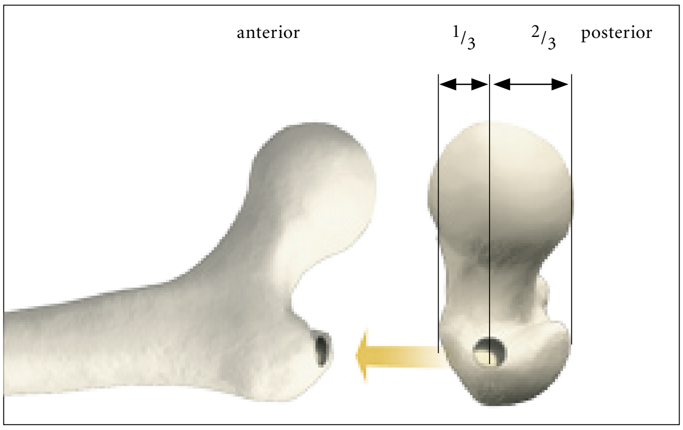


Figure 22

The correct entry point is located at the junction of the anterior third and posterior two-thirds of the tip of the greater trochanter and on the tip itself (Figure 22).

Preparation of the Medullary Canal

In order to prepare the medullary canal for the Gamma3 Long Nail, 3 possibilities are described in the next chapters.

Alternative 1: Opening the Cortex

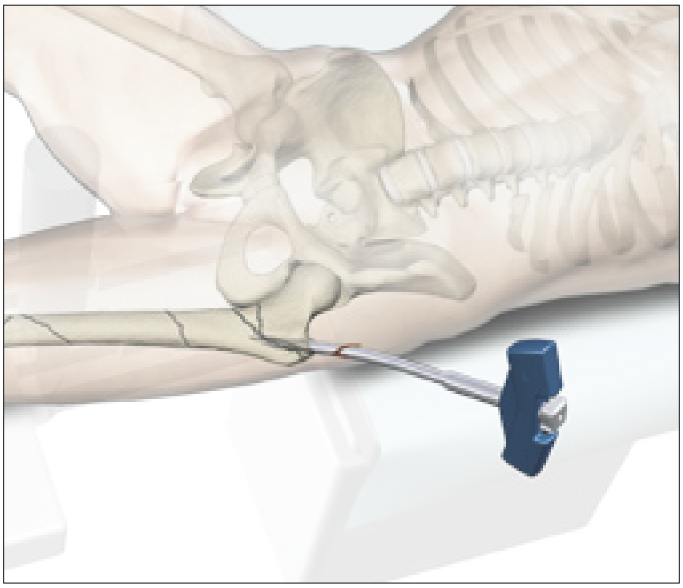


Figure 23

The medullary canal has to be opened under image intensification. The use of the cannulated Curved Awl (Figure 23) is recommended if conventional reaming or the One Step Conical Reamer will be used to prepare the canal for the nail.

Operative Technique

Reaming the Medullary Canal

A 3mm ball-tipped Guide-Wire is recommended as a reamer guide. Pass the reamer Guide Wire through the cannulated curved awl into the shaft of the femur as shown, using the Guide Wire Handle (Figure 24).

Rotating the Guide Wire during insertion makes it easier to achieve the desired position in the middle of the medullary canal.

Flexible reamers are used to ream the shaft of the femur in stages starting from 9mm diameter and increasing in 0.5mm increments (Figure 25). The canal should be reamed at least 2mm larger than the distal diameter of the nail, 13mm for the Gamma3 Long Nail (Figure 26).

In order to accommodate the proximal part of the Gamma3 Long Nail, the subtrochanteric region must be opened up to 15.5mm (Figure 27). This can be done either by reaming with the Stryker BIXCUT™ Reaming System (Figure 25) or, alternatively, with the One Step Conical Reamer. For soft tissue protection, the Conical Reamer Sleeve should be used during reaming.

Care must be taken with flexible reamers to ensure that the Guide-Wire is not displaced laterally during reaming. This could lead to resection of more bone on the lateral side, which in turn would lead to an offset position for the nail and a risk of shaft fracture.

Note:
Where the shaft is comminuted, reaming should be stopped at the fracture site and penetration continued with the power drill off.

Bixcut™ Reamer
The complete range of Bixcut™ reamers is available with either modular or fixed heads.

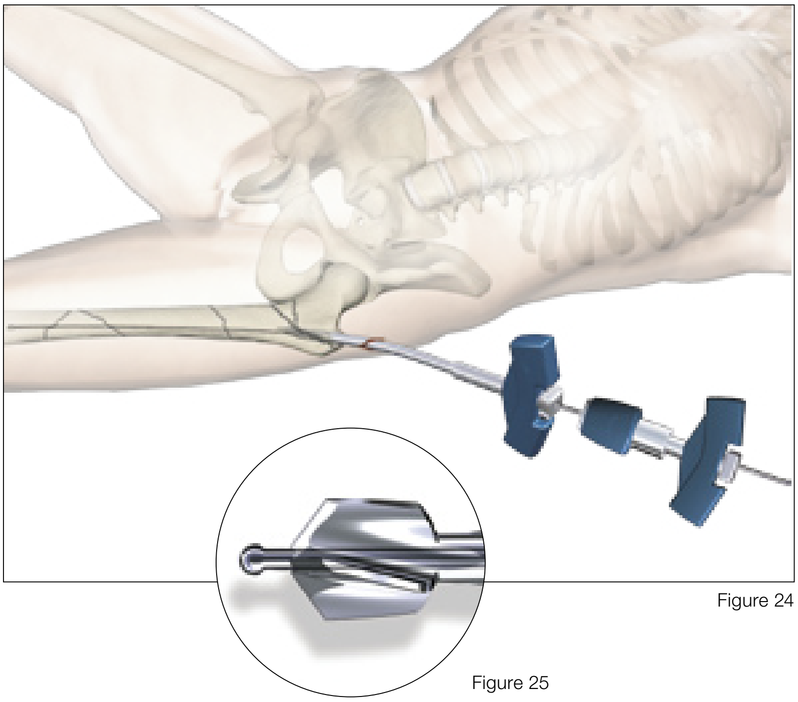


Figure 24

Figure 25

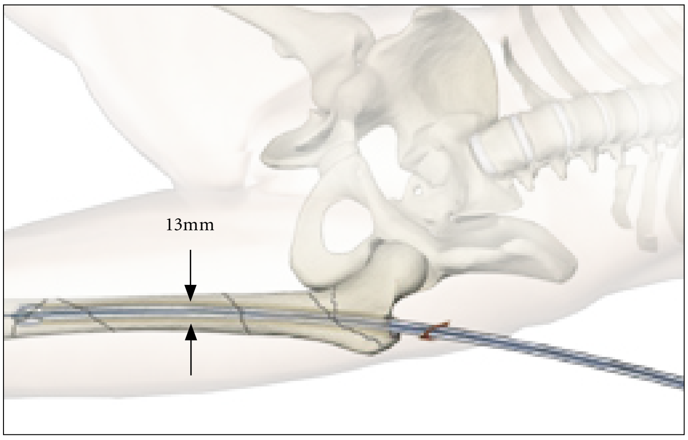


Figure 26

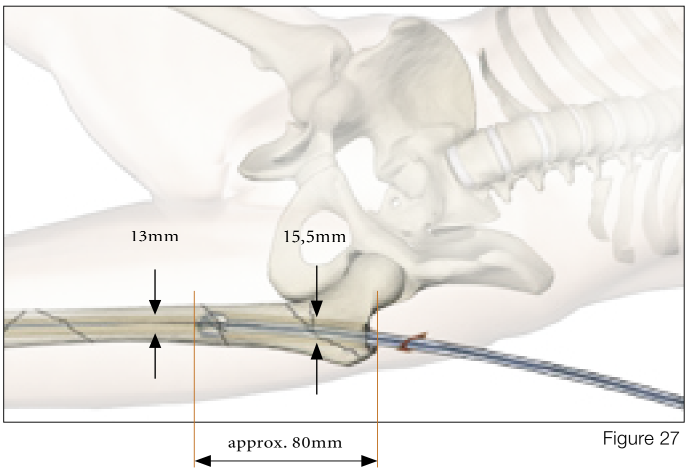


Figure 27

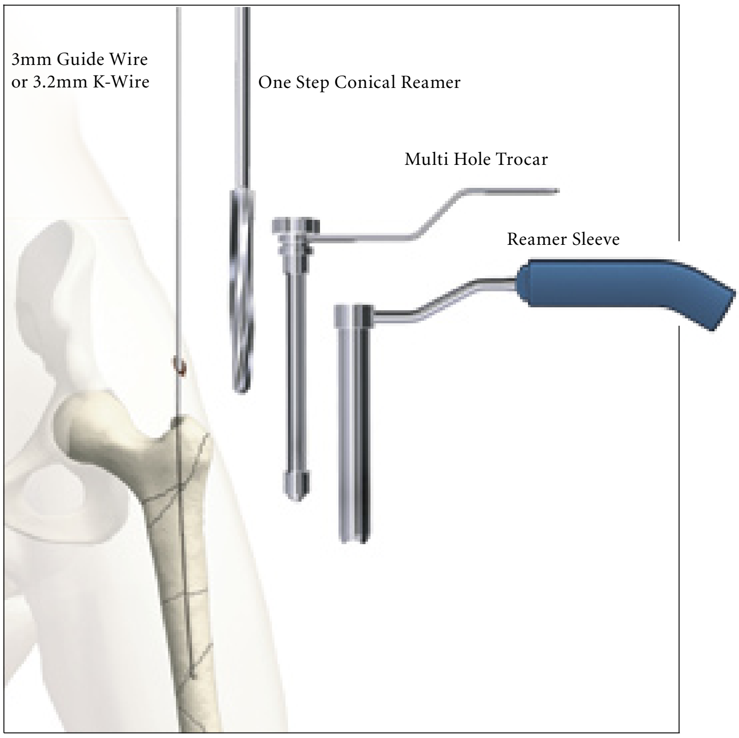


Figure 28

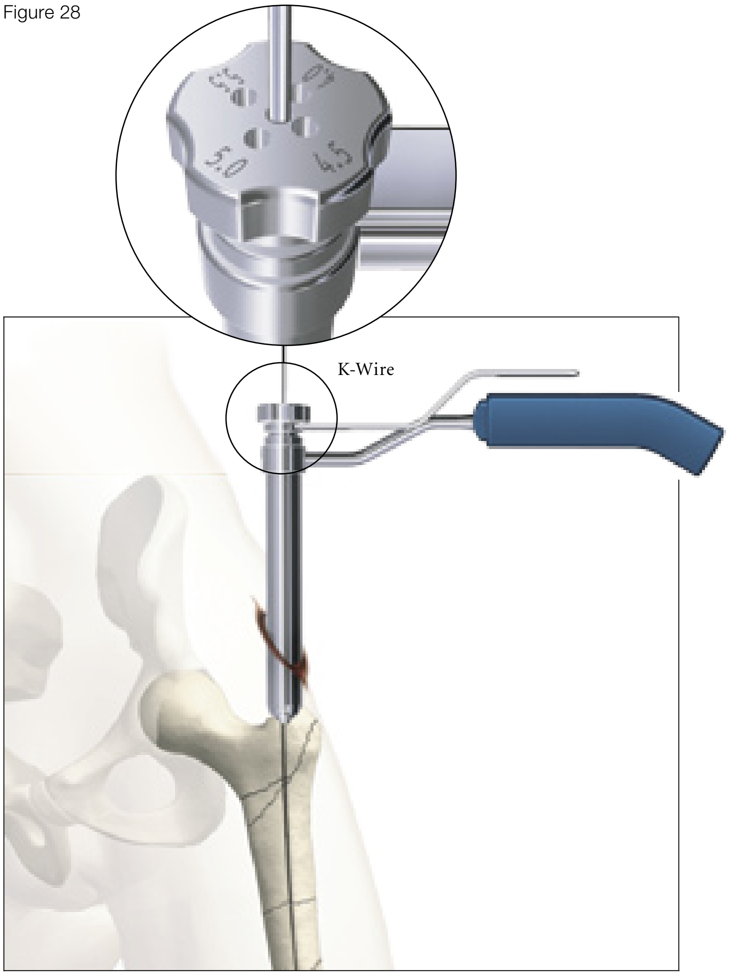


Figure 29

Alternative 2:
One Step Conical Reamer

The One Step Conical Reamer is an optional instrument and has been developed to provide surgeons with another option to prepare the proximal canal of the trochanter using only one drilling step.

When the Gamma3 Nail 180 is used, reaming of the subtrochanteric and diaphyseal region of the femoral cavity may not be required, particularly in elderly patients with wide medullary canals. For Long Nails it is recommended to ream the medullary canal all the way down to the condyle area, at least up to a diameter of 13mm.

After skin incision and positioning of the Guide Wire as described above, the Trocar or Multi Hole Trocar is inserted into the Reamer Sleeve to protect the soft tissue during insertion. Push the Trocar (use center hole, if Multi Hole Trocar is used) and Sleeve Assembly down over the 3mm Guide Wire to the tip of the trochanter (Figure 28 and 29).

Entry Point Optimization

The Entry Point can also be made without using the awl. A 3.2mm K-Wire is placed through the tip of the trochanter.

If you find that the K-Wire is not positioned in the optimal position, it may easily be corrected using a second K-Wire in combination with the Multi Hole Trocar.

The Multi Hole Trocar has a special design for more precise insertion. In addition to the central hole, 4 other holes are located eccentrically at different distances from the center (Figure 29) to easily revise insertion of the guiding K-Wire in the proper position (Entry Point).

The Trocar is then removed and the One Step Conical Reamer is connected to the T-handle and slid over the Guide or K-Wire to the tip of the trochanter. With gentle clockwise turning and pushing movements, the Conical Reamer will drill into the proximal part of the trochanter (Figure 30 and 31) and prepare the canal for the proximal part of the Gamma3 Nail. The One Step Conical Reamer stops when the correct depth is reached.

Note:
The One Step Conical Reamer is a front and side cutting instrument and should be used with great care to ensure that the sharp edges of the reamer do not damage intact bone inadvertently.

If a 3.2mm K-Wire was used it should be replaced by a Guide Wire now.

Figure 30

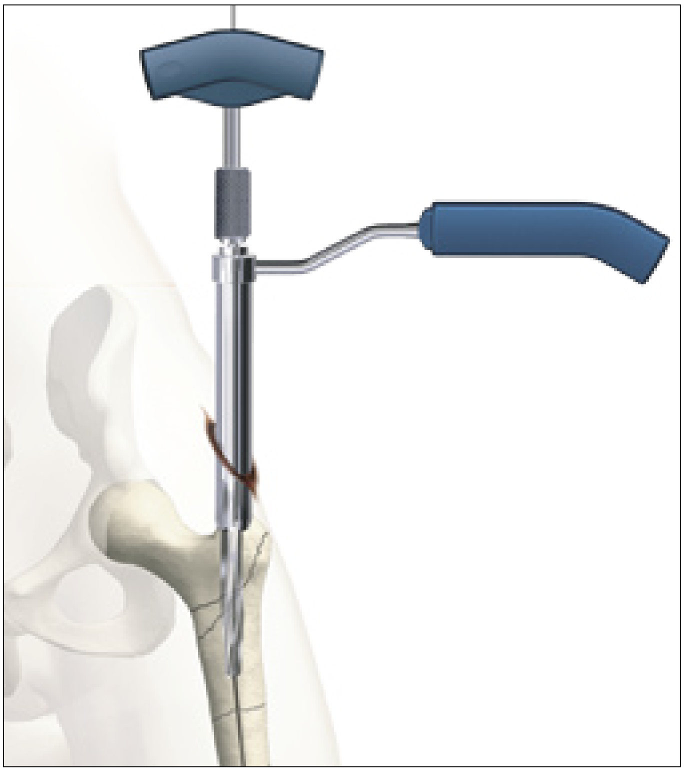


Figure 31

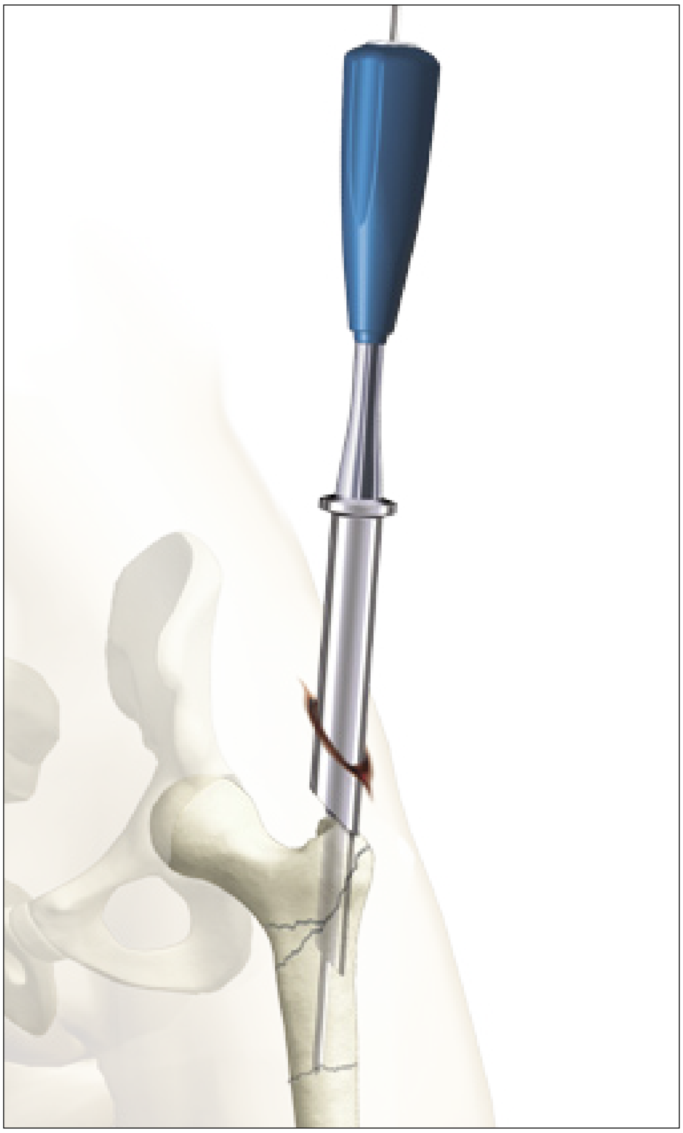


Figure 32

Alternative 3:
Cannulated Cutter

Opening the cortex
The Cannulated Cutter is a front cutting device used to prepare the proximal part of the femur for the Gamma3 Nail 180.

It provides surgeons with an advanced option to open the proximal femur cavity without reaming. Especially in older patients, it may reduce the re-quirement for reaming of the femoral cavity. For the Long Nail, it is recommended to ream the complete femur all the way down to the condyle area, up to a diameter of at least 13mm.

It is guided over a solid 4mm Guide Pin. The fixation of this Guide Pin in the bone allows for an optimal placement for the Cannulated Cutter. This device allows for easy collection of bone graft material which might be helpful in difficult healing conditions.

Its detailed operative technique is described separately (see Brochure “Cannulated Cutter” Ref No. B0300011).

Figure 33

Operative Technique

Assembly of Targeting Device

1. Targeting Sleeve and Knob Assembly

First assemble the Knob to the Targeting Sleeve (Figure 34) and adjust the point on the Knob to be in line with the arrow on the Targeting Sleeve. Push the knob hard against the sleeve (Figure 34a). The Knob moves approximately 5mm to the sleeve and has to be turned clockwise by approximately 30 degrees. Now release the Knob and it will slip back the same distance. Now the Knob is assembled to the Targeting Sleeve and has to be connected to the Targeting Arm (Figure 34b).

2. Targeting Arm and Targeting Sleeve Assembly

Push the Sleeve assembly over the Targeting Arm along the line until it stops (arrow line to arrow line).

Rotate the Targeting Sleeve around to the required nail angle position for the Lag Screw, e.g. 125° (point to point) or distal locking positions, either "Dynamic" or "Static". Now the Targeting Sleeve must be fixed in this position by pushing it strongly against the Targeting Arm. You will feel and hear, as the sleeve snaps into position.

The Knob has only one function, this is to lock either the Lag Screw Guide Sleeve or the Tissue Protection Sleeve.

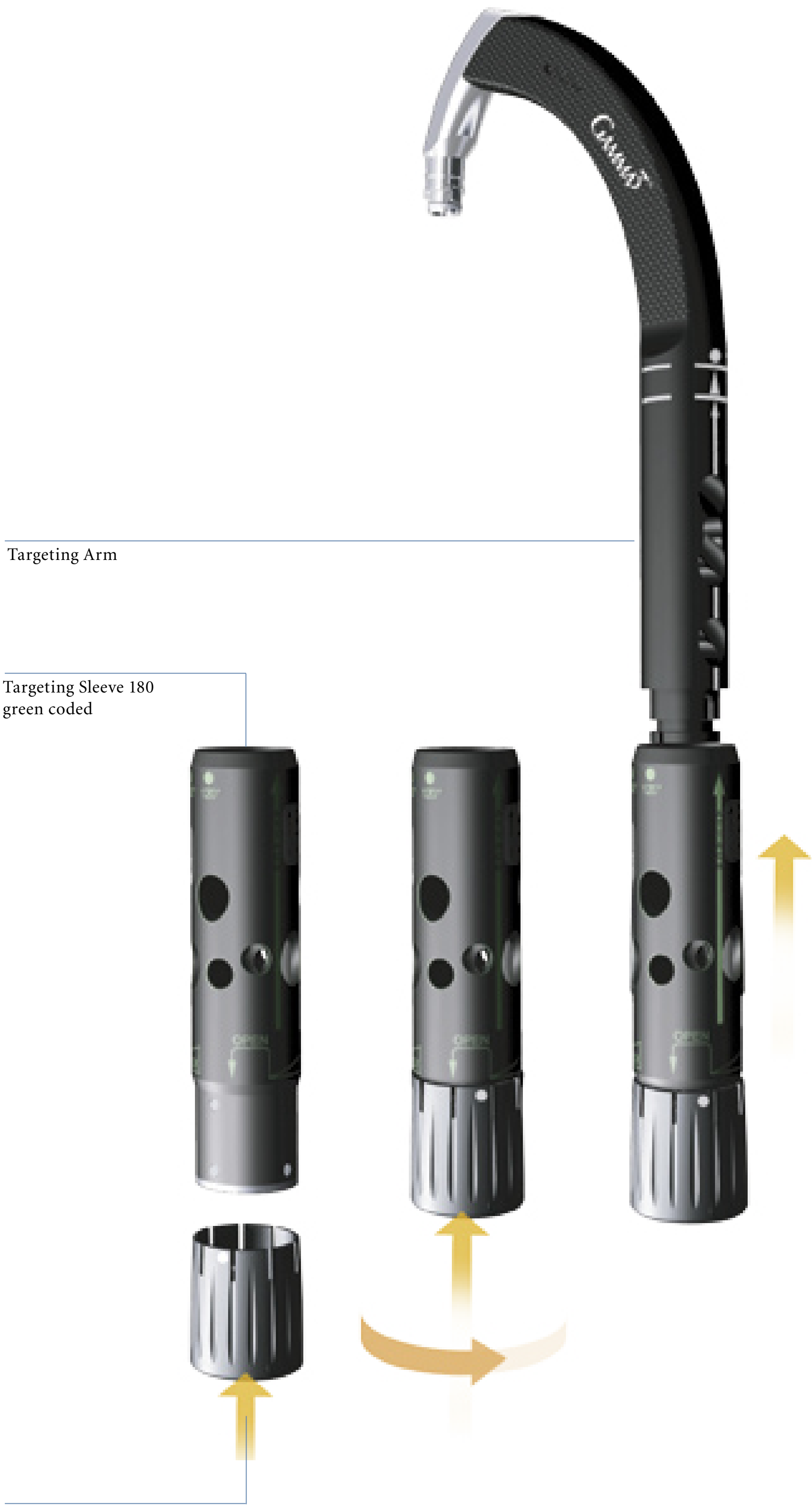


Figure 34 Figure 34a Figure 34b

Figure 35
Gamma3 Long Nail Assembly

3. Assembly of the Targeting Device and the Gamma3™ Long Nail

The selected Gamma3 Long Nail is now assembled to the Carbon Fibre Targeting Device as shown in Figure 35. The nail connecting part of the Targeting Device is designed with an easy assembly function for fast and secure nail fixation.
Ensure that the locating pegs fit into the corresponding notches of the proximal part of the nail. Securely tighten the Nail Holding Screw with the Ball Tip Screwdriver, so that it does not loosen during nail insertion.
Before starting surgery the following two functions of the Targeting Device have to be checked:

1. Secure fixation between Nail and Targeting Device

2. Lag Screw Guide Sleeve matches the selected nail angle.

Operative Technique

Before checking the function of the Lag Screw Guide Sleeve, the Knob must be positioned in the counter clockwise position. Pass the Lag Screw Guide Sleeve gently through the hole of the Targeting Sleeve and tighten it gently in its final position, by turning the Knob clockwise. Check correct nail angle using the, K-Wire, 4.2mm Drill or Lag Screw Step Drill (Fig. 36). Removal of the Lag Screw Guide Sleeve in the opposite order; turn the Knob counter clockwise and remove the Lag Screw Guide Sleeve by pulling it back.

Note:
Before starting surgery, the implant and instrument assembly must be checked. Ensure that the Targeting Sleeve angle matches the corresponding nail angle chosen, e. g. a 125° Targeting Sleeve for a 125° nail (Fig 36).

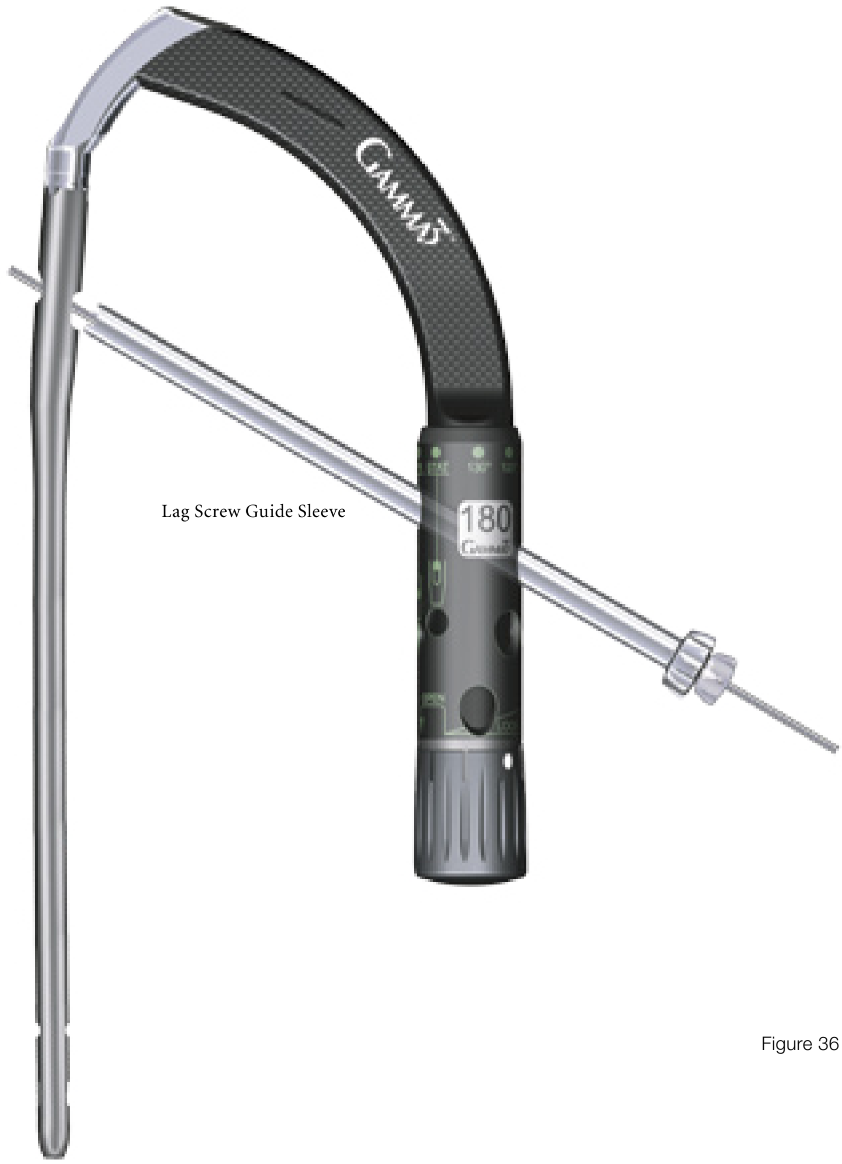


Figure 36

Operative Technique

Nail Insertion and Positioning

Figure 37

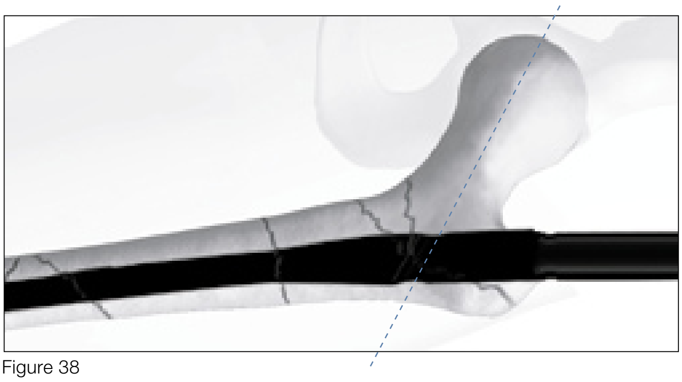


Figure 38

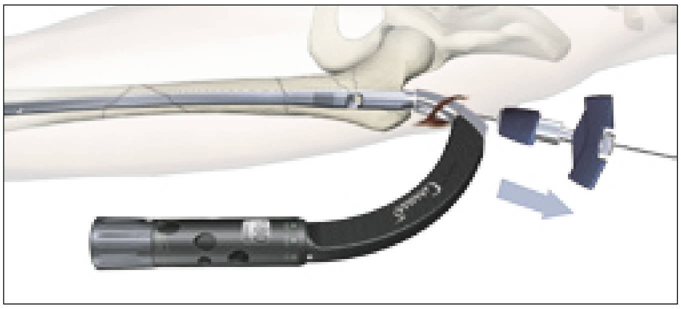


Figure 39

Figure 40

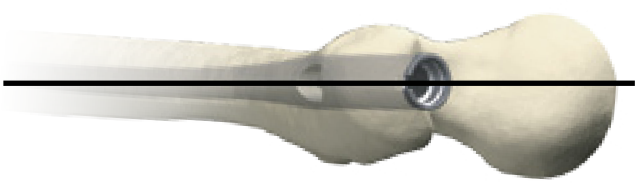


Figure 41

Insert the Gamma3 Nail by hand (Figure 37).

DO NOT use undue force – NEVER use a hammer for nail insertion.

The final Nail depth position is monitored with the image intensifier C-arm; the projected axis of the Lag Screw may be projected with a ruler on the monitor screen to ensure that the Lag Screw is placed in the optimal position.

Proceed until the axis of the Lag Screw hole (visible as a crescent shape on the screen) is aligned with the lower half of the femoral neck (Figure 38). The objective of this is to ultimately position the Lag Screw centrally or slightly inferior in femoral head in the frontal plane.

Note:
Remove Guide Wire for the flexible reamer and nail insertion using Guide Wire Handle. (Fig. 39).

When the Gamma3 Nail has been inserted to its final depth, check the anteversion of the nail. Use of the K-Wire Clip (Figure 40) or the "One Shot Device" is recommended (see next page).

The K-Wire Clip is mounted into the slots of the Target Arm by pressing the Clip flanges together.

The Lag Screw should be placed in the central position of the femoral head in the lateral view (Figure 41).

Before proceeding ensure that the Nail Holding Screw is still fully tightened.

Lag Screw Positioning using the One Shot Device

The One Shot™ Device is recommended for optimal Lag Screw placement:

The One Shot™ Device is recommended, for establishing whether the Lag Screw is in the optimum position. This device enables correct positioning of the K-Wire for Lag Screw placement before performing lateral skin incision and opening of the lateral cortex. Figures 42-43a give an overview of the working principle of the One Shot Device. Detailed steps are described in the separated Operative Technique of the “One Shot Device” (see Brochure “One Shot Device” REF NO. B0300010).

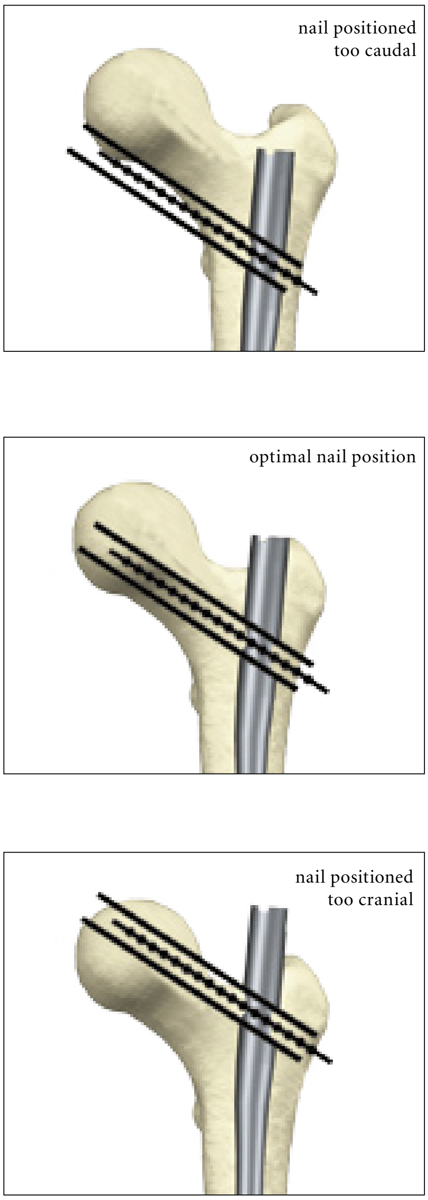
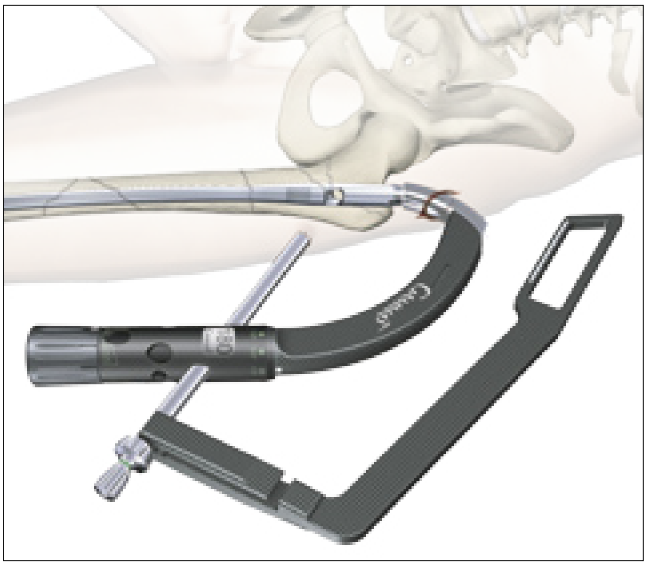


Figure 42a
A/P view

Positioning of nail depth

Figure 42



Positioning of anteversion

Figure 43

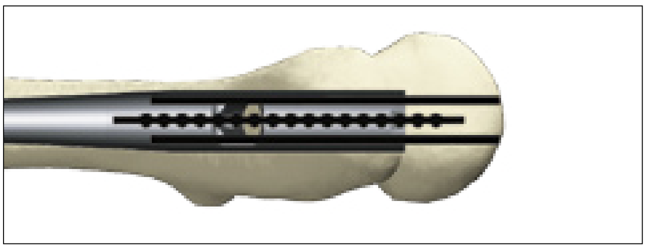


Figure 43a
Lateral view

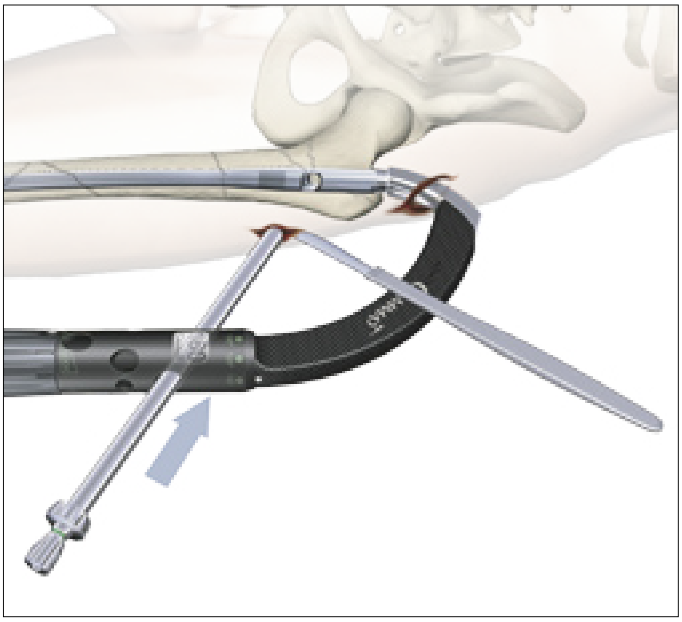


Figure 44

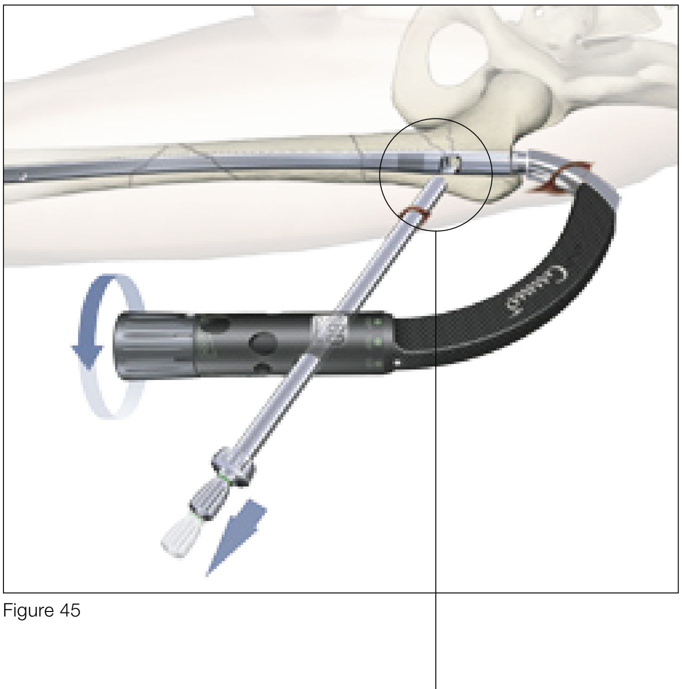
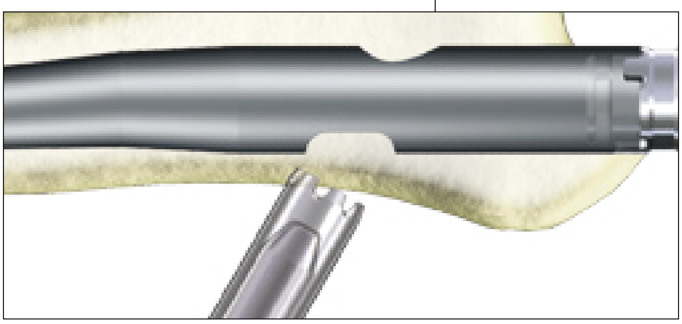


Figure 45


Lag Screw Guide Sleeve in good contact to the lateral cortex

Lag Screw Insertion

The Targeting Device may be held by an assistant to prevent its weight from externally rotating the nail until the next stage is completed.

Next, assemble the Lag Screw Guide Sleeve with the green coded 4.2mm Lag Screw Drill Guide Sleeve and pass them through the Targeting Sleeve to the level of the skin. This indicates the position for a small incision down to the bone (Figure 44). The Guide Sleeve assembly is now advanced through the incision. If the guide catches the fascia lata, twisting it will usually allow it to pass through to the bone.

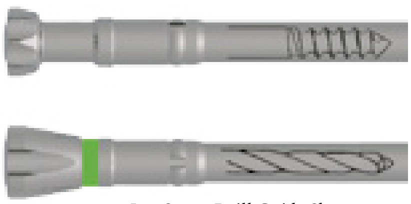
In order for an accurate Lag Screw length measurement, the outer Guide Sleeve must be in good contact to the lateral cortex of the femur (Figure 45). The Knob of the Target Sleeve must be turned gently clockwise to lock the Guide Sleeve in place and further stabilize the targeting assembly.

Operative Technique

With the Lag Screw Guide Sleeve firmly engaged in the cortex, the green coded 4.2mm Lag Screw Drill Guide Sleeve should be pushed gently against the cortex. Using the green coded 4.2mm × 300mm center tipped drill, the lateral cortex should be opened by power tool or by hand (Figure 46).

The green coded 4.2mm Lag Screw Drill Guide Sleeve is then replaced by the K-Wire Sleeve.

Both sleeves look similar, but have different inner hole diameters. The K-Wire Sleeve has no colored ring.



Note:
Before proceeding, check that the Guide Wire for the flexible reamer and nail insertion used earlier has been removed.

The single use K-Wire inserted through the K-Wire Sleeve should be advanced up to the subchondral bone (Figure 48), using the Guide Wire Handle. Check that the K-Wire is placed either central or in the lower half of the femoral head in the frontal plane and on the midline in the lateral plane (Figure 48).

Check the position with the image intensifier in both the anterior-posterior and mediolateral views as shown in Figure 38 to ensure optimal K-Wire positioning.

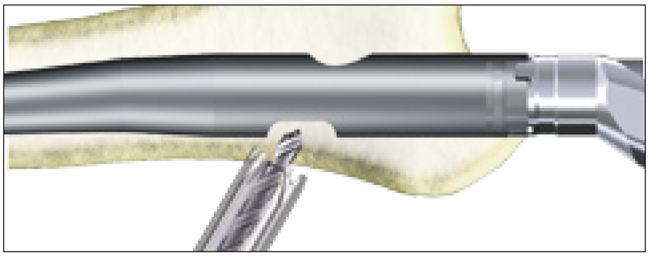


Figure 46
Opening of the lateral cortex

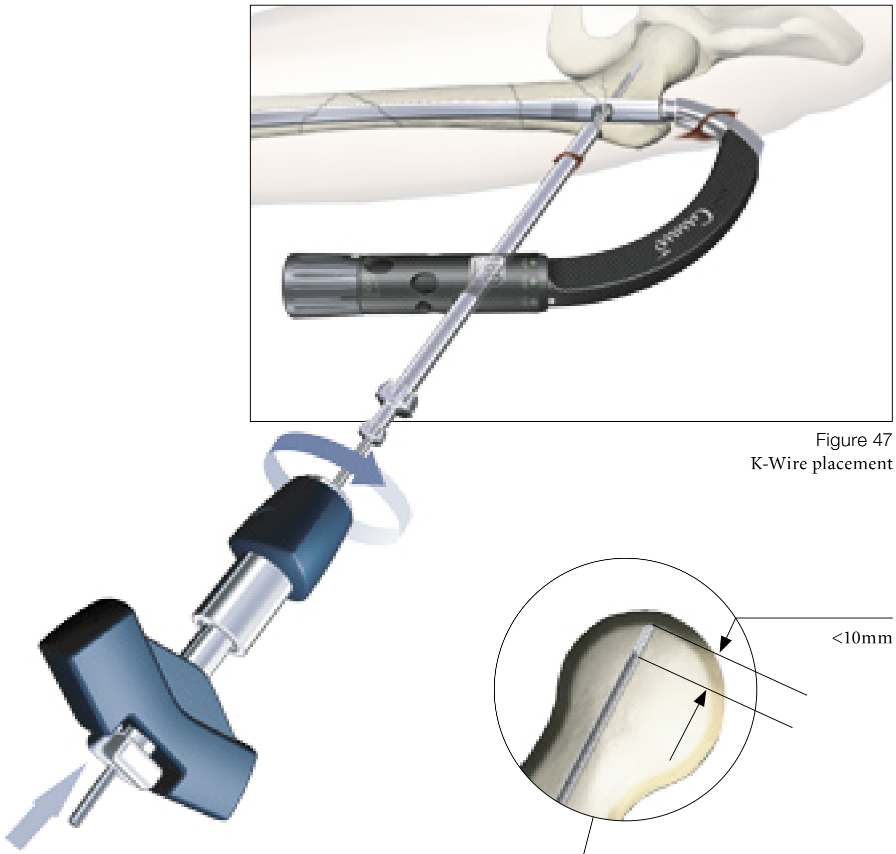


Figure 47
K-Wire placement

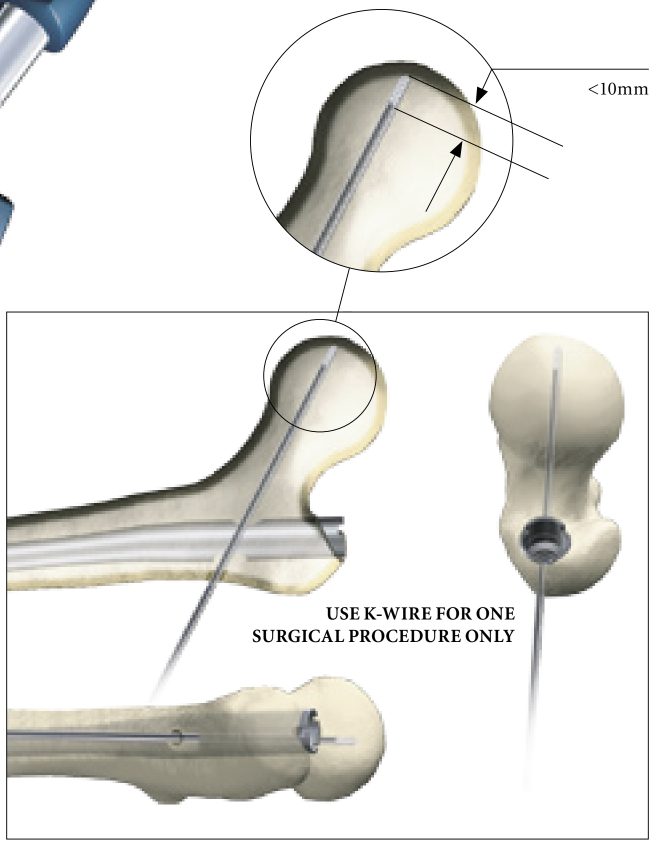


Figure 48
K-Wire placement

Lag Screw Insertion

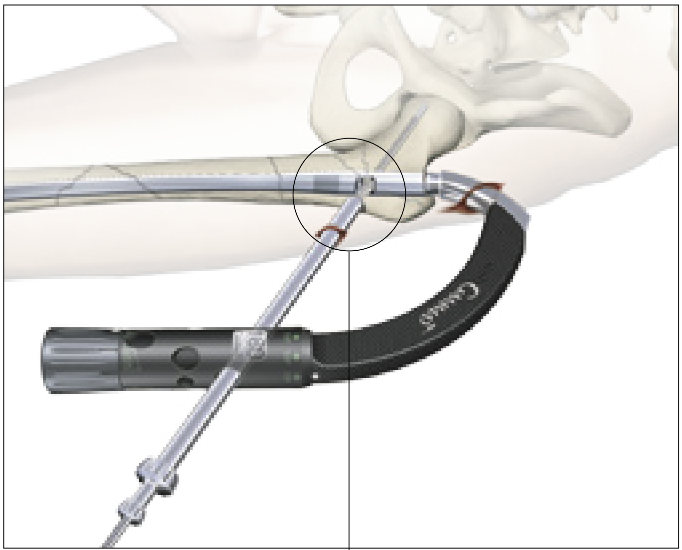


Figure 49
Lag Screw length measurement

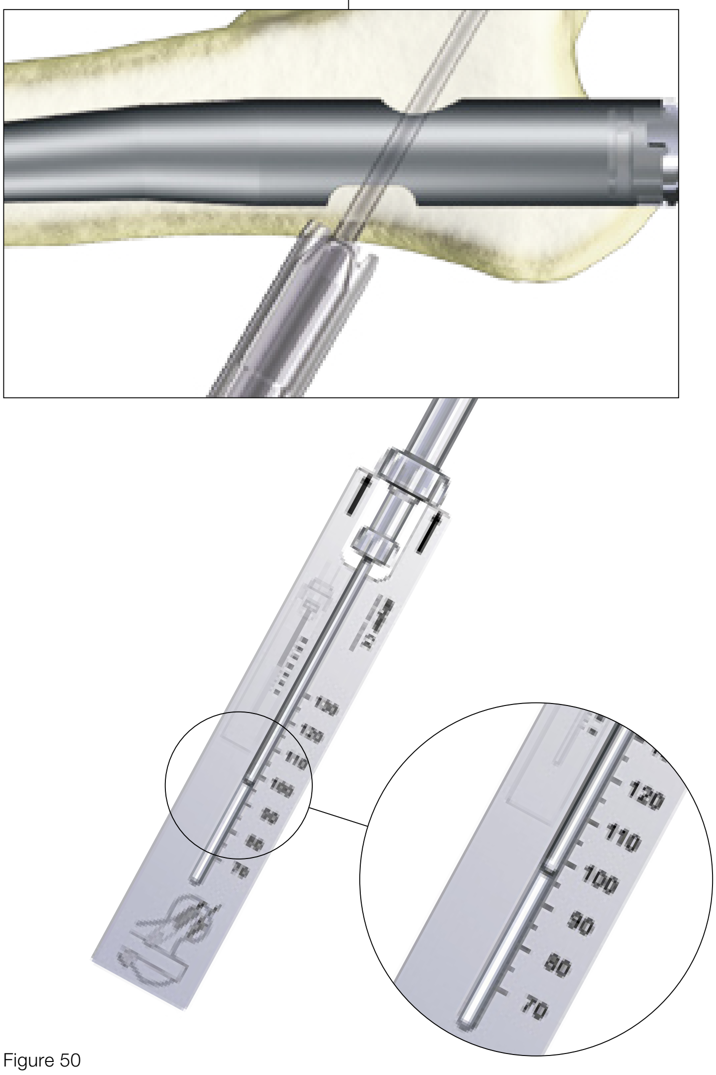


Figure 50
Lag Screw Length Measurement

The objective is to position the Lag Screw either in the center or below the center of the femoral head in the anterior-posterior view and centrally in the lateral view, to provide the best load transfer to the Lag Screw.

After satisfactorily positioning the K-Wire, the required Lag Screw length is measured using the Lag Screw Ruler.

Before starting to measure, ensure that the Lag Screw Guide Sleeve is still pressed firmly against the lateral cortex of the femur (Figure 49).

Place the Lag Screw Ruler directly under the K-Wire (Figure 50).

The recommended value for the Step Drill depth and the Lag Screw length can be read directly from the Lag Screw Ruler. If the value is between markings on the scale, e.g. 97mm, it should always be rounded up to the next higher value, e.g. 100mm.

Note:
K-Wires are not intended for re-use. They are single use only. K-Wires may be damaged or bent during surgical procedures. If a K-Wire is re-used, it may become lodged in the drill and could be advanced into the pelvis, and may damage large blood vessels or cause other serious injuries.

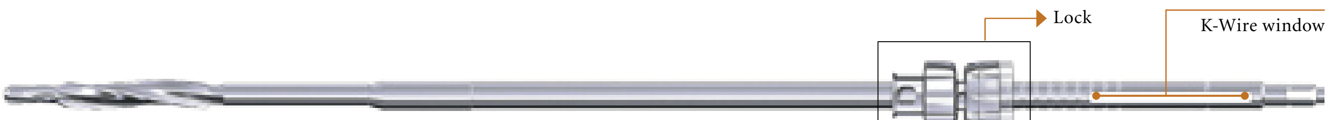
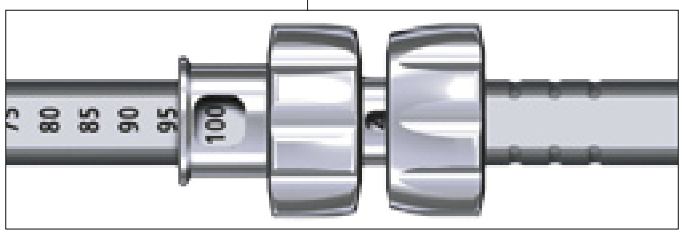


Figure 51



Window of the Step Drill Stop

The value of the measurement (Figure 50) is now transferred to the adjustable stop on the Lag Screw Step Drill.

The value e. g. 100 must be visible in the window of the Step Drill Stop (Figure 51)

The K-Wire Sleeve is now removed and the adjusted Lag Screw Step Drill is passed over the K-Wire (Figure 51a), through the Lag Screw Guide Sleeve.

The channel for the Lag Screw is prepared using the T-handle connected to the Lag Screw Step Drill. If exceptional resistance is encountered, a power drill may be used with great care.

Drilling should continue until the stop of the Step Drill comes into contact with the Lag Screw Guide Sleeve (Figure 51a). Ensure that the Targeting Device is well supported to prevent it from slipping back or rotating.

The drilling process, especially when the tip of the drill comes close to its final position in the femur head, should be controlled under an image intensifier to avoid hip joint penetration. The K-Wire also may be observed in the K-Wire window of the Step Drill.

Note:
It is important to observe the K-Wire tip during drilling on the intensifier. The K-Wire window provides an additional possibility to double check the K-Wire end position. Ensure that under no circumstances the K-Wire is advanced into the pelvis.

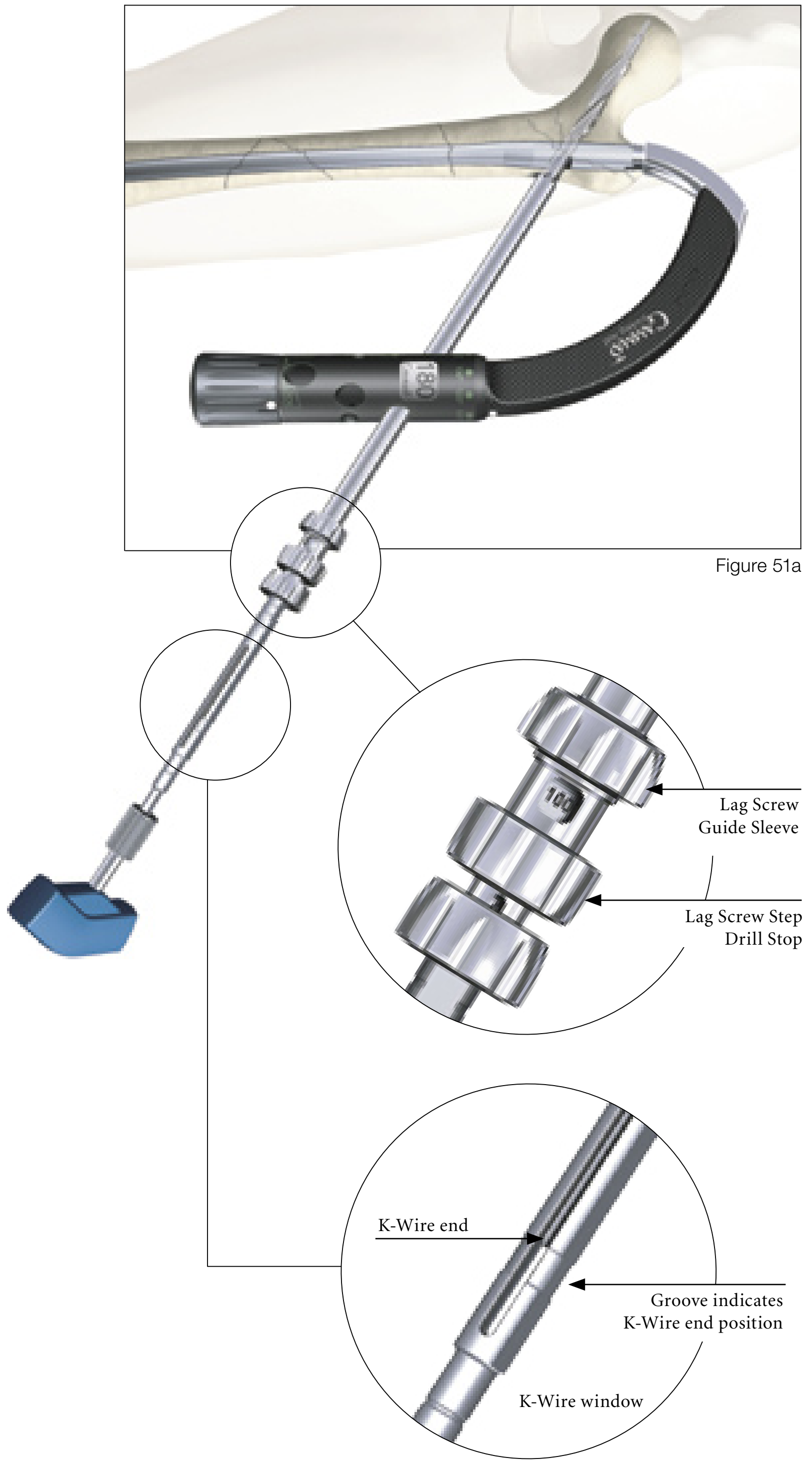


Figure 51a

Lag Screw Insertion

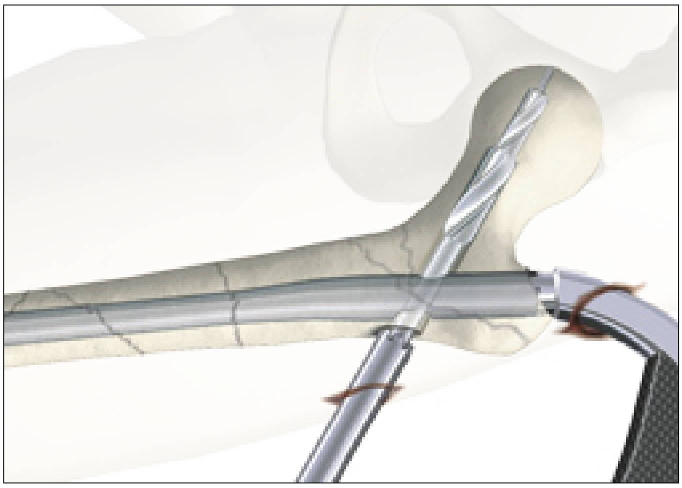


Figure 52

Check on the image intensifier during drilling to monitor the depth of the drill near the subchondral bone. At this stage, you should see the tip of the K-Wire protruding about 6 to 10mm out of the step drill (Figure 52). This is because the threaded portion of the K-Wire was intentionally not included in the drill measurement. This is to prevent the drill from penetrating the joint and to ensure that the K-Wire remains anchored in the subchondral bone after reaming. Remove the Step Drill by turning it clockwise and pulling it backwards.

The length of Lag Screw chosen should be the same as that of the Step Drill (in this example 100mm). The screw is then assembled to the Lag Screwdriver (Figure 53).

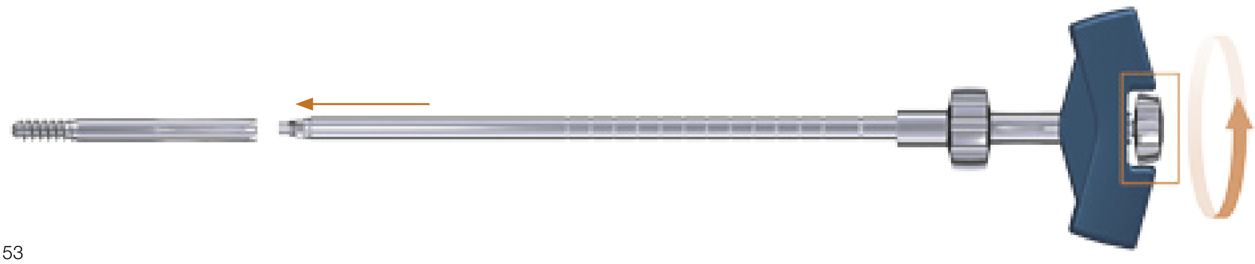


Figure 53
Lag Screw and Lag Screwdriver assembly

In a case where compression is to be applied, a shorter Lag Screw length should be chosen to avoid the end of it sticking out too far in to the lateral cortex (see chapter Compression / Apposition below). Ensure that the pins of the Lag Screwdriver are in the slots of the Lag Screw. The end thumbwheel must be turned clockwise and tightened using the Ball Tip Screwdriver.

The Lag Screw assembly is now passed over the K-Wire, through the Lag Screw Guide Sleeve, and threaded up to the end of the predrilled hole of the femur head. Check the end position of the Lag Screw on the image intensifier. A double check of the end position is also possible with the indicator ring on the Lag Screw Screwdriver when it reached the end of the Lag Screw Guide Sleeve.

Operative Technique

Lag Screw Fixation

The handle of the Lag Screwdriver must be either parallel or perpendicular (90°) to the Target Arm (Figure 55 on next page) to ensure that the Set Screw is able to fit into one of the 4 Grooves of the Lag Screw shaft.

If the T-handle is not perpendicular or parallel to the Target Arm, turn it clockwise until it reaches this position. NEVER TURN THE LAG SCREW COUNTER CLOCKWISE.
If the K-Wire is inadvertently removed, then the screw may still be inserted without it, provided that the Guide Sleeve is still in contact with the cortex.

Note:
It is strongly recommended to place the Lag Screw at the end of predrilled hole in order to provide maximal resistance against cut out. Never turn the Lag Screw counter clockwise after the final position is reached, because otherwise the Lag Screw may lose full bony surface contact to its tip.

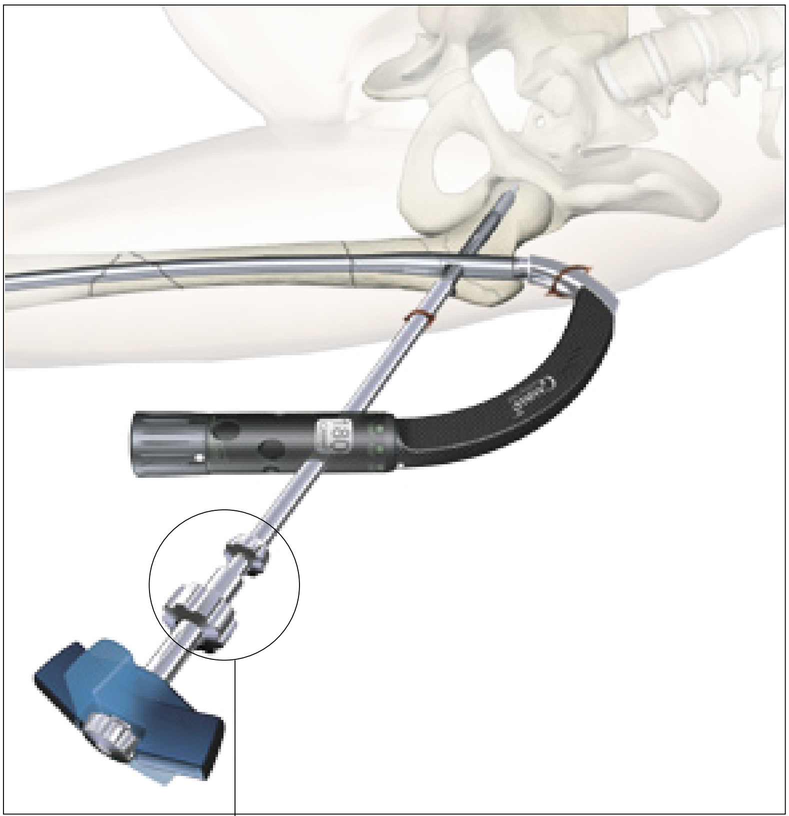
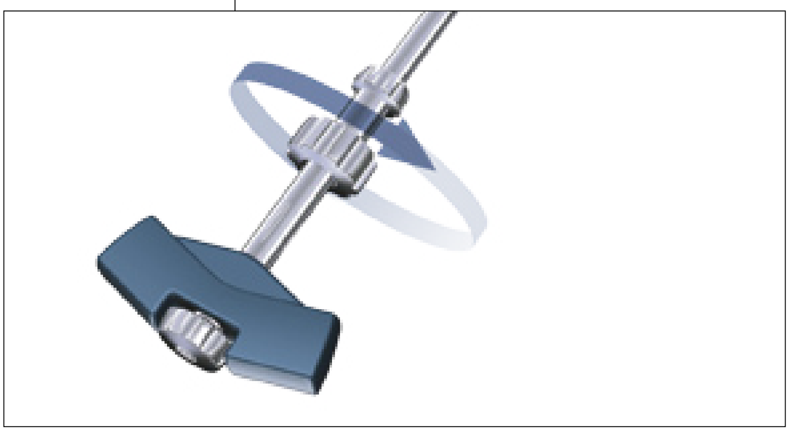


Figure 54

Compression / Apposition

If compression or apposition of the fracture gap is required, this can be achieved by gently turning the thumb-wheel of the Lag Screwdriver clockwise against the Guide Sleeve (Figure 54). Before starting compression, make sure that the Lag Screw Guide Sleeve is unlocked to allow its free sliding. To unlock the Lag Screw Guide Sleeve, the Knob has to be turned counter clock-wise. In osteoporotic bone care must be taken to prevent Lag Screw pullout in the femoral head. The Lag Screw should be chosen shorter depending on the expected amount of compression.



Compression / Apposition turning the thumbwheel clockwise.

Lag Screw Fixation

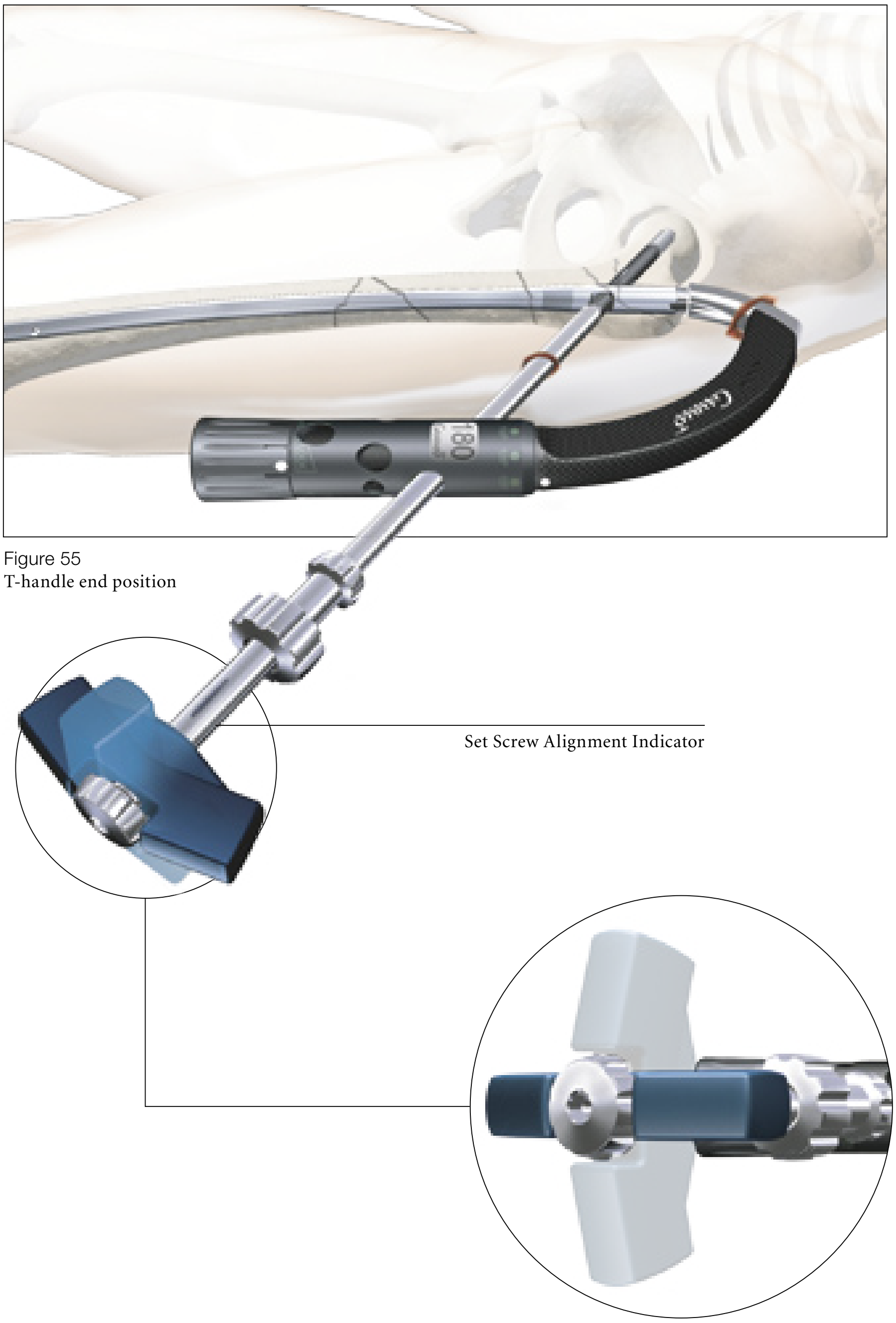


Figure 55
T-handle end position

Insert the Set Screw as shown in Figure 56 along the opening of the post of the Targeting Device and advance it through the Nail Holding Screw using the Set Screwdriver. While the Set Screw is passing the cannulated Nail Holding Screw, the Set Screw Driver has to be brought into proximal nail axis to allow a smooth push down of the Set Screw.

You may notice a slight resistance when turning the Set Screw. This is because the Set Screw thread is equipped with the "Nylstop" system to prevent spontaneous loosening. Turn the Set Screw until you feel contact in one of the grooves of the Lag Screw.

On slightly tightening the Set Screw, make sure that the T-handle of the Lag Screwdriver is either parallel or at right angles (90°) to the Targeting Arm (Figure 55). The Set Screw alignment indicator will help to find the right position of the T-handle.

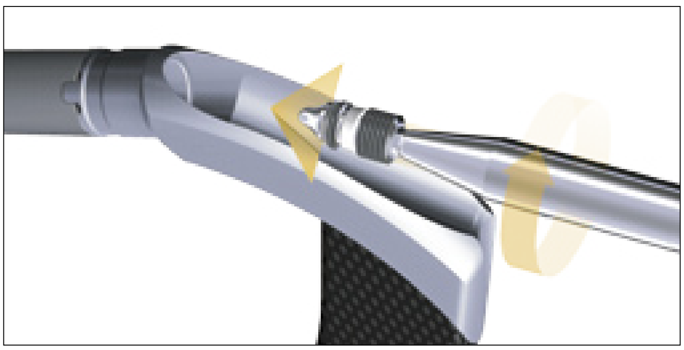


Figure 56
Set Screw insertion

Operative Technique

This ensures that the Set Screw will engage in one of the four Lag Screw grooves (Figure 57). To verify the engagement the Set Screw in groove of the Lag Screw, try to turn the Lag Screwdriver gently clockwise and counter-clockwise. If it is not possible to turn the Lag Screwdriver the Set Screw is engaged in one of the grooves. If the Lag Screw moves, recorrect the T-handle position and tighten the Set Screw again until it engages in one of the four Lag Screw grooves..

After slightly tightening the Set Screw it should then be unscrewed by one quarter (¼) of a turn, until a small play can be felt at the Lag Screwdriver. This ensures a free sliding of the Lag Screw.

Make sure that the Set Screw is still engaged in the groove by checking that it is still not possible to turn the Lag Screw with the Lag Screwdriver.

Note:
Do not unscrew the Set Screw more than ¼ to ½ of a turn.

If distal locking is not indicated, the End Cap should be assembled to the nail end to prevent bone ingrowth. Leaving the Lag Screwdriver in place, the Nail Holding Screw is now removed using the ball tip Screw Driver or Universal Socket Wrench and turning it counter clockwise. Remove the Nail Holding Screw. Insert the End Cap (size 0) using the Socket Wrench or the Ball Tip Screwdriver. The End Cap should be tightened slightly.

Please see „End Cap Insertion“ chapter.

Alternatively the End Cap could also be inserted free hand after removal of the Target Device.

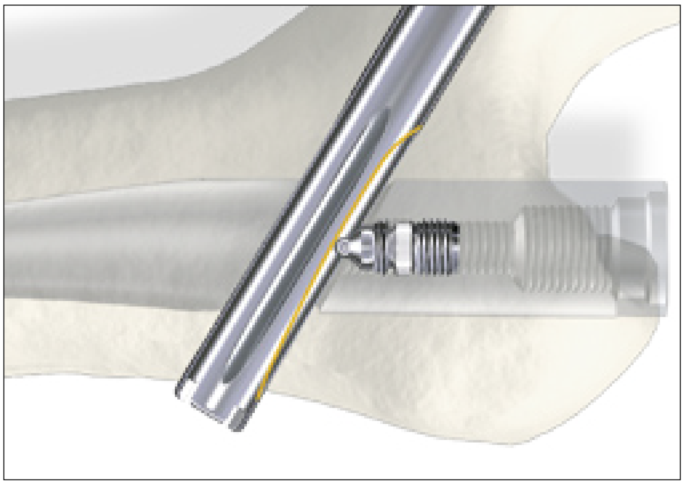


Figure 57

Operative Technique

Distal Screw Locking

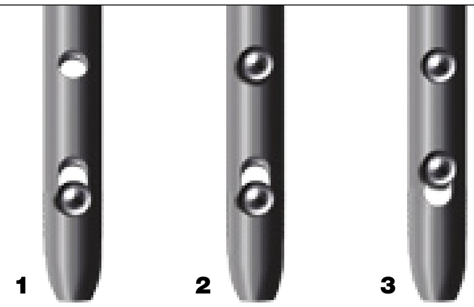


Figure 58

Gamma3™ Long Nails offer the possibility to be locked distally. For distal locking, the Long Nail offers the following three possibilities (Figure 58), depending on the fracture pattern.

Long Nail Distal Locking Options

1. Dynamic locking
   (Only one screw is needed):
   - Locking in the distal part of the oblong hole creates a dynamic locking mechanism.

2. Secondary dynamization locking
   (Two screws are needed):
   - One screw is placed in the distal part of the oblong hole and the other in the round hole.
     If dynamization is required after a period of time, the screw, placed in the round hole has to be removed.

3. Static locking
   (Two screws are needed):
   - One screw is placed in the round hole and the other is placed in the proximal part of the oblong hole.

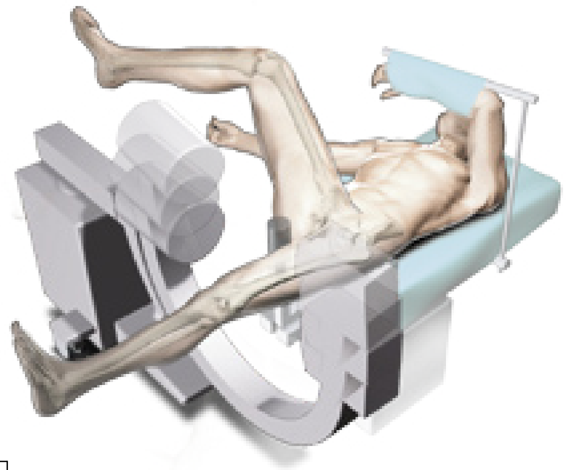
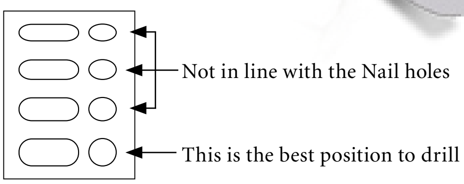


Figure 59



Distal locking is recommended:
- if the fracture is unstable
- if rotational stability is required
- if there is a wide disparity between the diameter of the nail and the femoral cavity.

Various techniques can be used to guide drilling and insertion of screws through the distal holes. The free-hand technique is described below.

Visualizing the distal holes.
The essential initial step in distal targeting is to position the image intensifier so that the distal hole in the nail appears perfectly round. The oblong hole does not appear round. If the hole appears to be elliptical in either the vertical or horizontal planes, the image intensifier position must be adjusted appropriately as shown in Figures 59 and 60.
It is advised to correct image in one plane at a time.

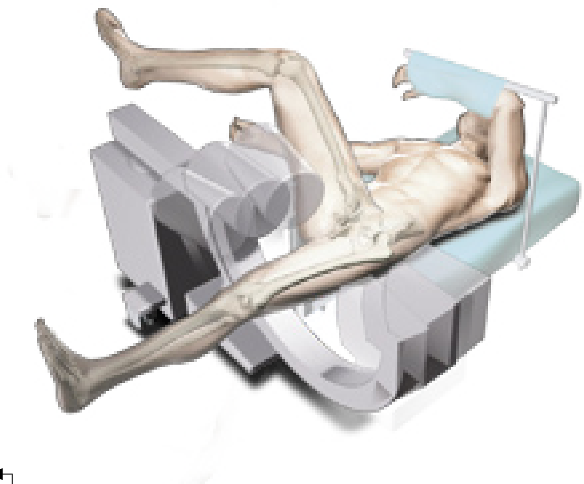
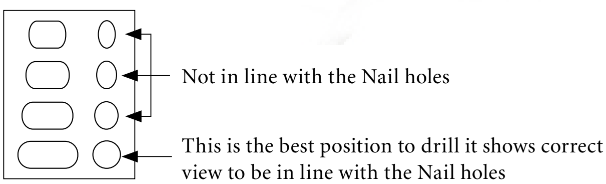


Figure 60



Operative Technique

Free-hand Technique

The free-hand drill technique is used to fix the distal bone fragment to the nail using Locking Screws. Length and rotational alignment of the leg must be checked before locking the nail. The distal nail locking is described as follows, using the Static Locking mode according to Figures 61-63. Skin incisions are made in line with the distal holes of the nail.
Once the image intensifier is correctly positioned as shown in Figures 59 and 60, use the centre tipped Ø4.2mm x 180mm, green coded drill and place the tip of the drill at an oblique angle to the centre of the hole (Figure 61). Verify the position by X-ray and move the drill into the same plane as the holes in the nail, then drill through the first cortex and the nail until resistance of the second cortex is felt as shown in Figure 62.

Alternatively, the drill can be drilled through the second cortex while viewing the image intensifier. The screw length can then be read directly from the Screw Scale on the drill (Figure 64).
If the Tissue Protection Sleeve is used with the drill, it has to be removed for the measurement.
It is also possible to measure the correct screw length using the Free Hand Screw Gauge. After drilling through the second cortex, remove the drill and advance the small hook of the Screw Gauge through the holes behind the medial cortex and read out the required locking screw length.

Insert the 5mm distal Locking Screw through the skin by using the 3.5mm Screwdriver; advance the screw head carefully until it is just in direct contact with the cortex (Figure 65).

Note:
Take care not to overtighten. The screw head should just come into contact with the cortex and resistance should be felt.

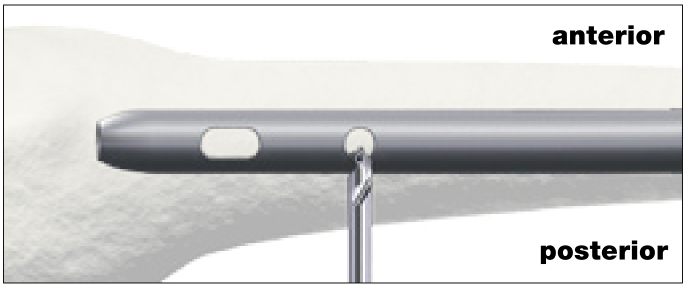


Figure 61

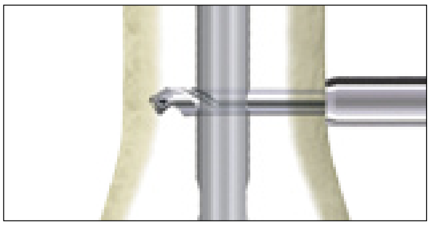


Figure 62

add thickness of the cortex (approx +5mm) to the read out value

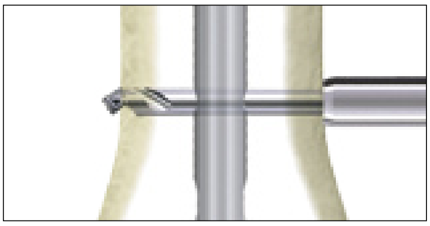


Figure 63

direct read out

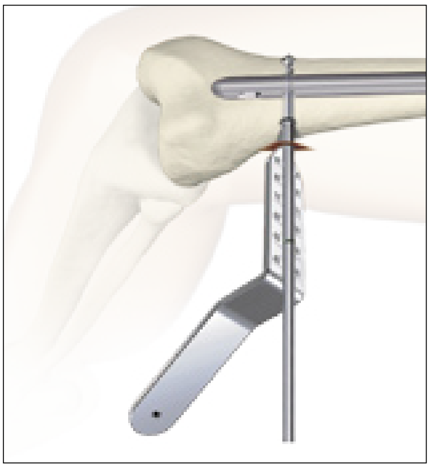


Figure 64

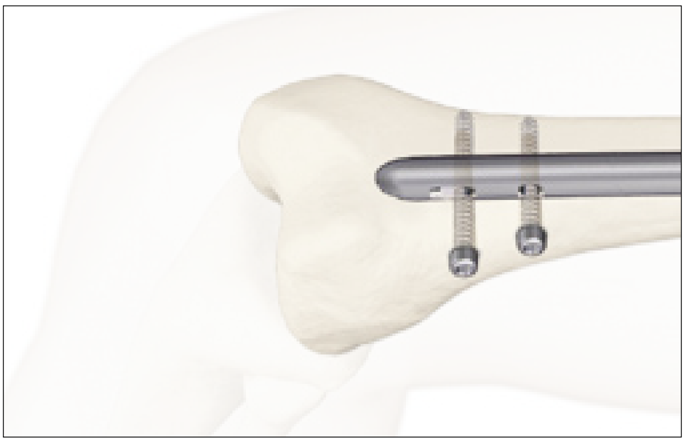


Figure 65

Alternative

Alternatively Condyle Screws could be used for distal locking. If a Condyle Screw will be inserted, both cortices are drilled to a diameter of 5mm using the Ø5×340mm Drill through the Tissue Protection Sleeve.
After drilling both cortices, the screw length may be read directly off of the calibrated Drill (Figure 66) or alternatively may be confirmed with the Screw Gauge, Long, after removing the drill and sleeve.

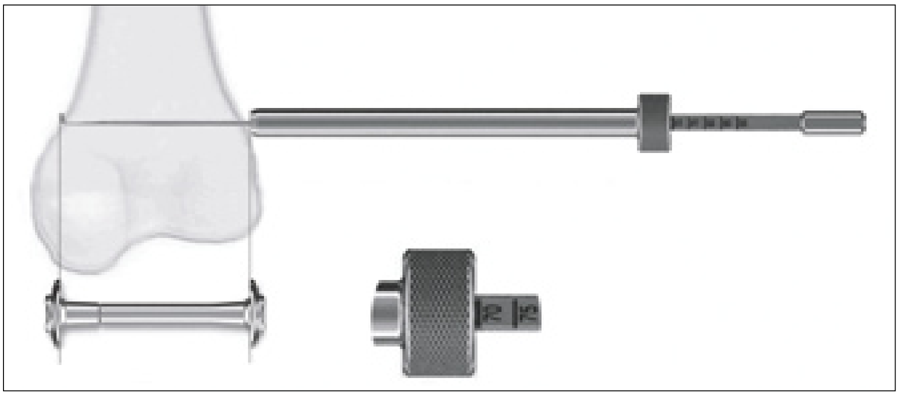


Figure 66

Note:
The measurement equals Condyle Screw fixation length (from top of the Condyle Screw head to the top of Condyle Nut head, as shown in Fig. 66). The Condyle Screw length is defined with the Condyle Screw tip flush to the Condyle Nut head.
The possible fixation length can be 2mm longer than the Condyle Screw length or 5mm shorter.
Please ensure that the Condyle Nut is tightened a minimum of 5 turns on the Condyle Screw!

The Condyle Screw K-Wire Ø1.8×310mm inserted from the lateral side to the medial side. At the medial point of the perforation, a skin incision is made for the Condyle Screw. From the medial side, the Condyle Screw is now brought forward over the Condyle Screw K-Wire and inserted using the Condyle Screw Screwdriver.
Insert the Condyle Nut over the K-Wire using the other Condyle Screw Screwdriver (Figure 67).
Alternatively, if patient anatomy allows, the Condyle Screw may be introduced from lateral to medial in a similar manner as described above.

Figure 67

Using both Condyle Screw Screwdrivers, the Condyle Nut and the Condyle Screw are tightened. Once tightened, the K-Wire is removed. The adjustable screw washers of the Condyle Screw and the Condyle Nut adapt to the surface of the bone.

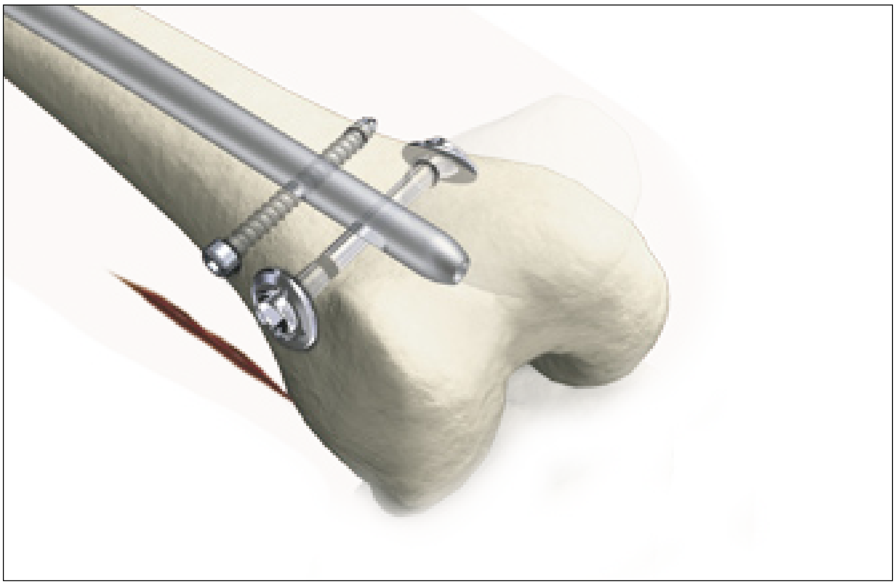


Figure 68

End Cap Insertion

It is recommended to use an End Cap to close the proximal part of the nail to prevent bone ingrowth.
Remove the Nail Holding Screw using the Ball Tip Screwdriver, Universal Socket Wrench or Strike Plate. Load the End Cap (size 0) to one of the Screwdrivers and pass the assembly through the top of the Targeting Device down into the nail.
Turn the handle clockwise until it stops mechanically. Remove the Screwdriver and remove the Targeting Device in cranial direction.
Alternatively the End Cap could also be inserted free hand after removal of the Targeting Device.

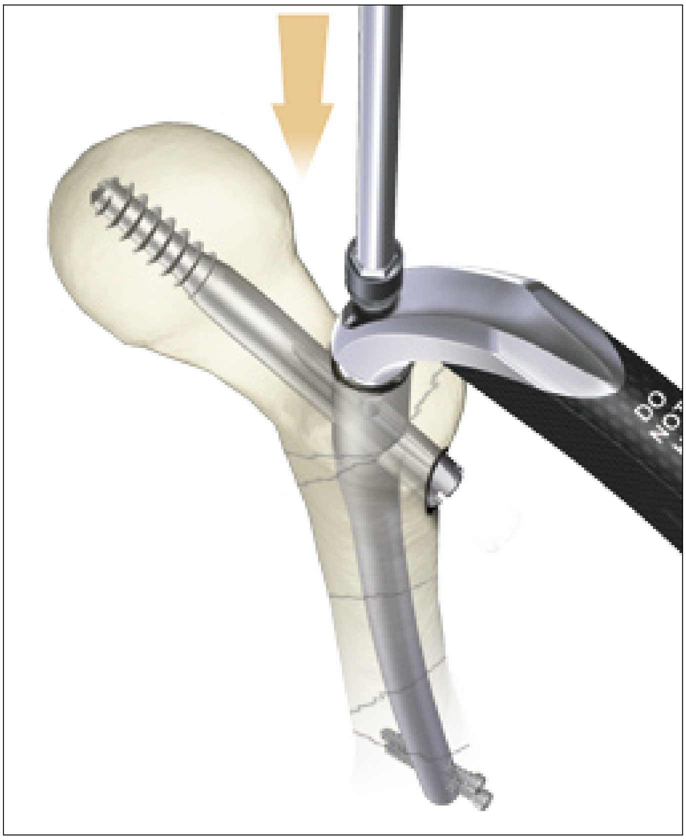


Figure 69
End Cap assembly


Figure 70
Final Nail assembly

Operative Technique

Nail Extension End Caps

If the proximal end of the nail is completely in the trochanter and cortical bone support is required at the end of the nail, End Caps in size +5mm and +10mm are available and can be assembled to the nail instead of the End Cap size 0. The proximal part of the nail will be elongated by 5mm or 10mm.
These nail elongation End Caps are assembled using the Strike Plate with the self-retaining ring or Ball Tip Screwdriver. This can only be done if the Targeting Device is already removed from the nail.

Postoperative Care and Rehabilitation

Active and passive mobilization of the lower limbs may be started immediately. The injured limb should be kept elevated.

For stable fractures, statically or dynamically locked, full weight bearing walking may be started immediately.

For unstable fractures with static locking, immediate full weight bearing walking is allowed in fractures with good bone contact.

For fractures with poor bone contact due to comminution, partial weight-bearing walking is allowed for the first 6 to 8 weeks. Full weight bearing walking can be commenced when there is a bridging callus formed as evident on the follow up X-ray.

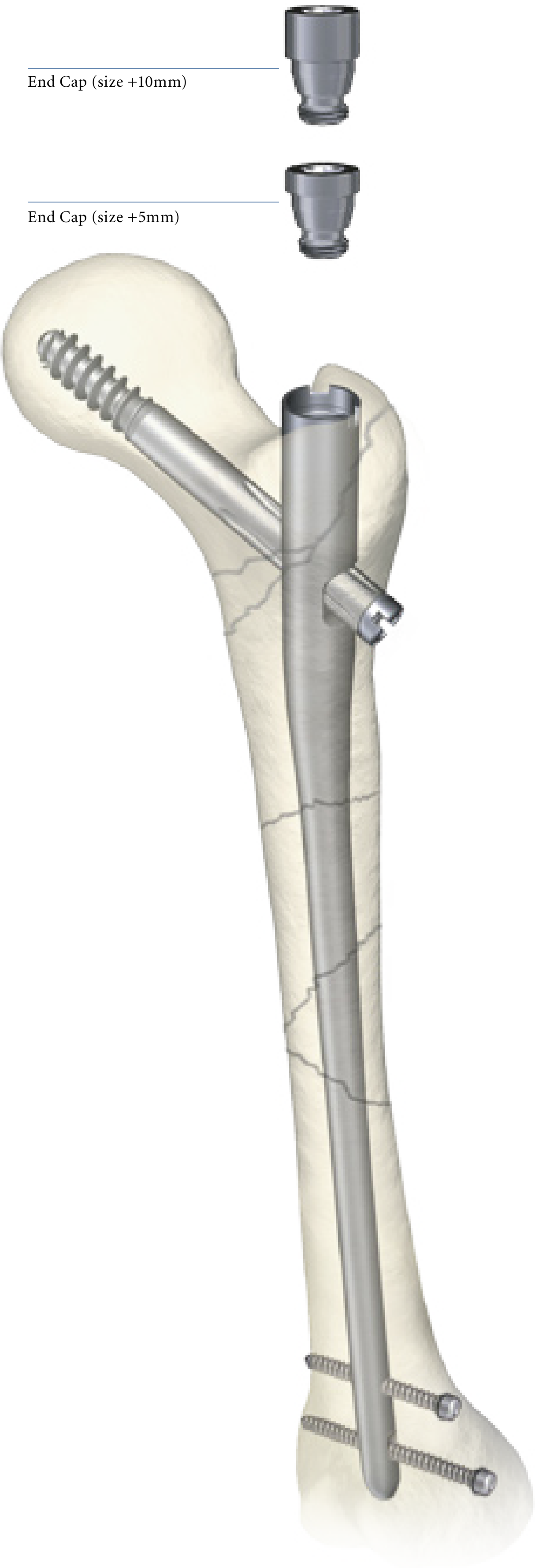


Figure 71

Operative Technique

Figure 72

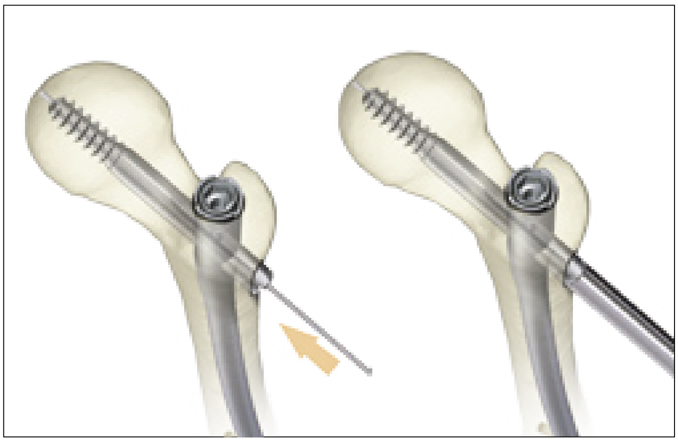


Figure 73

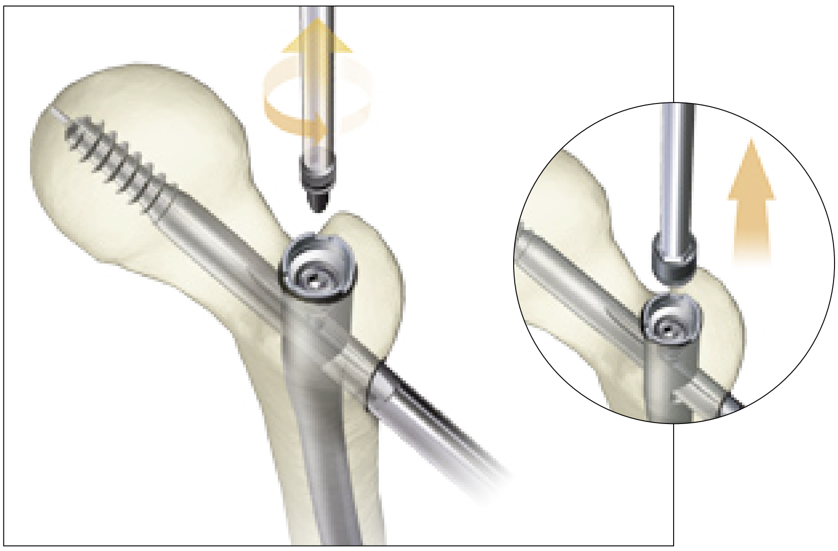


Figure 74

Extraction of the Gamma3™ Implant

Where implant extraction is indicated, please proceed as follows:

Step I (Figure 72)

Remove the distal screw using the 3.5mm Screwdriver after making an incision through the old scar.

Step II (Figure 73)

Make a small incision through the old scar below the greater trochanter to expose the outer end of the Lag Screw. Remove any bony ingrowth which may be obstructing the outer end or internal thread of the Lag Screw as necessary to enable the Lag Screwdriver to engage fully, if end cap was placed.

The K-Wire is then introduced via the Lag Screw into the head of the femur. The Lag Screwdriver is passed over the K-Wire, using the Lag Screw Guide Sleeve as a Tissue Protector, and engaged with the distal end of the Lag Screw.

Check that ingrowth does not obstruct secure engagement of the Lag Screwdriver, otherwise the Lag Screw or Screwdriver may be damaged and extraction will be much more difficult. Tighten the thumbwheel clockwise.

Step III (Figure 74)

An incision is made over the proxi-mal end of the nail, the proximal End Cap if used is removed using the Ball Tip Screwdriver or Strike Plate, and the Set Screwdriver is engaged with the Set Screw. The screw is rotated anti-clockwise until it is removed.

Step IV (Figure 75)

The Conical Extraction Rod is then threaded and tightened into the proximal end of the nail. The Lag Screw is extracted by anti clockwise rotation and pulling of the Lag Screw-driver. The K-Wire must then be removed.

Step V (Figure 76 & 77)

An appropriate sliding hammer assembly is attached to the Extraction Rod and the nail extracted.

Note:
It is a useful to turn the Lag Screw Screwdriver clockwise slightly first to loosen the possibly bony ingrowth into the screw threads before turning it counter clockwise.

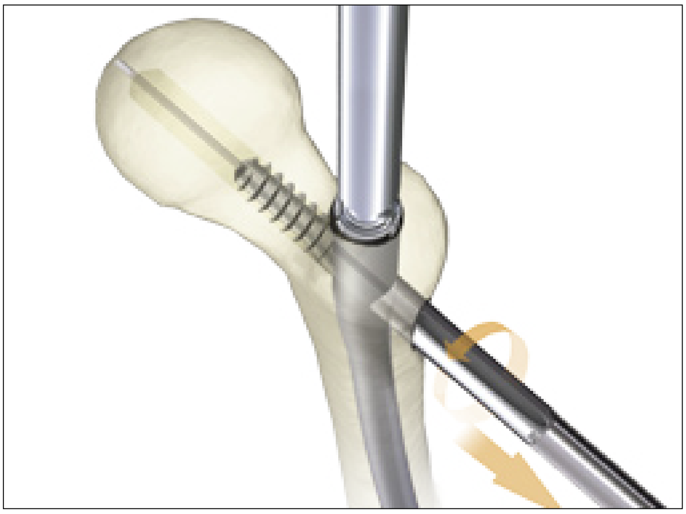


Figure 75

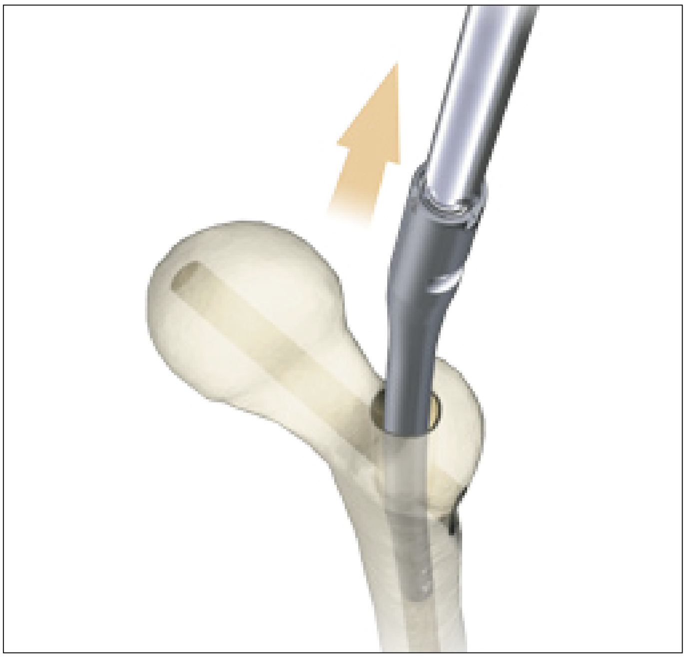


Figure 76

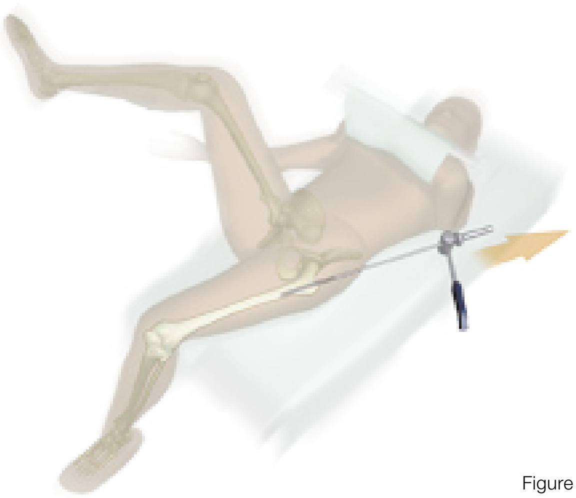


Figure 77

Operative Technique

Dealing with Special Cases

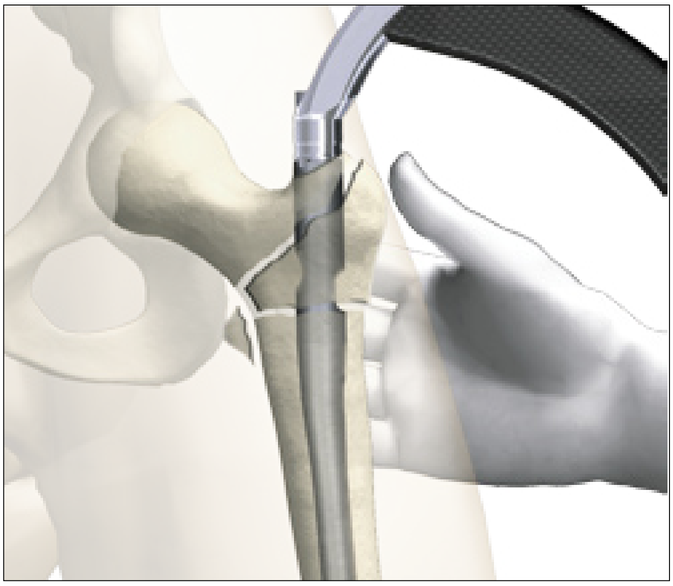


Figure 78

Posterior Displacement

In the case of a comminuted fracture, there is a tendency for the fracture to become displaced posteriorly, making it difficult to place the K-Wire into the center of the neck and head. This can be solved by lifting the nail insertion Targeting Device (Figure 78).

Alternatively, an assistant can lift up the greater trochanter manually or with a reduction spoon; or support it with a sandbag. This will maintain the neck and the femur in almost the same axis, facilitating passage of the K-Wire through the center of the neck and head.

The position should then be checked in both the anterior-posterior and lateral views using the image intensifier.

Ordering Information - Implants

Packaging

All implants are packed sterile only.

The Nail and Lag Screw Implant have to be secured using the Set Screw in every surgical operation, without exception (see also page 33).

The Nail and the Set Screw are therefore supplied together in the same blister pack (see Figure 79).

The blister is packed in a white carton and wrapped to protect the contents during transportation and storage.

Only two package sizes are used for all the nails (Figure 80).

The long nails are packed in a longer box and the short nails in a shorter box.

This facilitates identification in the storage area.

The package carries also the date of sealing and a sterility expiration date.

Long Nail, packaging example

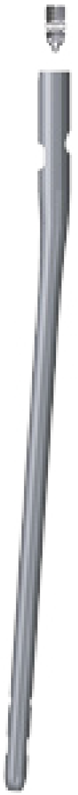
Trochanteric Nail, packaging example

Figure 80

Figure 79

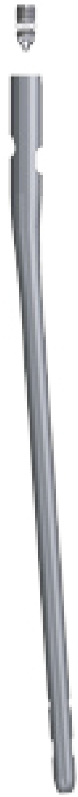
Ordering Information - Titanium Implants

Long Nail Kit R2.0, Ti, Left*, Ø15,5/11mm



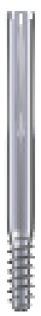
Length mm	Angle °	Titanium REF
280	120°	3320-0280S
300	120°	3320-0300S
320	120°	3320-0320S
340	120°	3320-0340S
360	120°	3320-0360S
380	120°	3320-0380S
400	120°	3320-0400S
420	120°	3320-0420S
440	120°	3320-0440S
460	120°	3320-0460S
280	125°	3325-0280S
300	125°	3325-0300S
320	125°	3325-0320S
340	125°	3325-0340S
360	125°	3325-0360S
380	125°	3325-0380S
400	125°	3325-0400S
420	125°	3325-0420S
440	125°	3325-0440S
460	125°	3325-0460S
280	130°	3330-0280S
300	130°	3330-0300S
320	130°	3330-0320S
340	130°	3330-0340S
360	130°	3330-0360S
380	130°	3330-0380S
400	130°	3330-0400S
420	130°	3330-0420S
440	130°	3330-0440S
460	130°	3330-0460S

Long Nail Kit R2.0, Ti, Right*, Ø15,5/11mm



Length mm	Angle °	Titanium REF
280	120°	3220-0280S
300	120°	3220-0300S
320	120°	3220-0320S
340	120°	3220-0340S
360	120°	3220-0360S
380	120°	3220-0380S
400	120°	3220-0400S
420	120°	3220-0420S
440	120°	3220-0440S
460	120°	3220-0460S
280	125°	3225-0280S
300	125°	3225-0300S
320	125°	3225-0320S
340	125°	3225-0340S
360	125°	3225-0360S
380	125°	3225-0380S
400	125°	3225-0400S
420	125°	3225-0420S
440	125°	3225-0440S
460	125°	3225-0460S
280	130°	3230-0280S
300	130°	3230-0300S
320	130°	3230-0320S
340	130°	3230-0340S
360	130°	3230-0360S
380	130°	3230-0380S
400	130°	3230-0400S
420	130°	3230-0420S
440	130°	3230-0440S
460	130°	3230-0460S

Lag Screw**



Length mm	Diameter mm	Titanium REF
70	10.5	3060-0070S
75	10.5	3060-0075S
80	10.5	3060-0080S
85	10.5	3060-0085S
90	10.5	3060-0090S
95	10.5	3060-0095S
100	10.5	3060-0100S
105	10.5	3060-0105S
110	10.5	3060-0110S
115	10.5	3060-0115S
120	10. 5	3060-0120S

5mm fully threaded Locking Screw***

Length mm	Diameter mm	Titanium REF
25.0	5.0	1896-5025S
27.5	5.0	1896-5027S
30.0	5.0	1896-5030S
32.5	5.0	1896-5032S
35.0	5.0	1896-5035S
37.5	5.0	1896-5037S
40.0	5.0	1896-5040S
42.5	5.0	1896-5042S
45.0	5.0	1896-5045S
50.0	5.0	1896-5050S
55.0	5.0	1896-5055S
60.0	5.0	1896-5060S
65.0	5.0	1896-5065S
70.0	5.0	1896-5070S
75.0	5.0	1896-5075S
80.0	5.0	1896-5080S
85.0	5.0	1896-5085S
90.0	5.0	1896-5090S

*Nails are packed together with the Set Screw, sterile

**Longer Lag Screws are available on request.

***Longer Locking Screws as well as partly threaded screws are available on request.

Ordering Information - Titanium Implants

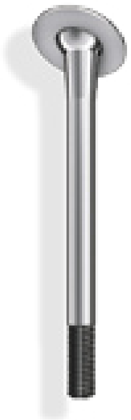
Set Screw (available separately)

Length mm	Diameter mm	Titanium REF
17.0	8.0	3003-0822S

End Caps

Length mm	Diameter mm	Titanium REF
0	11.0	3005-1100S
+5	15.5	3005-1105S
10	15.5	3005-1110S

Condyle Screws



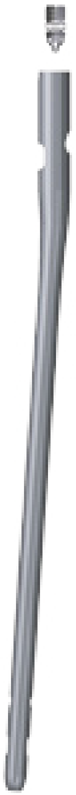
Length mm	Diameter mm	Titanium REF
40	5.0	1895-5040S
45	5.0	1895-5045S
50	5.0	1895-5050S
55	5.0	1895-5055S
60	5.0	1895-5060S
65	5.0	1895-5065S
70	5.0	1895-5070S
75	5.0	1895-5075S
80	5.0	1895-5080S
85	5.0	1895-5085S
90	5.0	1895-5090S

Nut for Condyle Screw

Length mm	Diameter mm	Titanium REF
17.0	-	1895-5001S

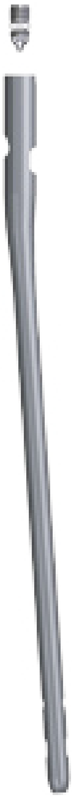
Ordering Information - Stainless Steel Implants

Long Nail Kit R2.0, StSt, Left*, Ø15,5/11mm



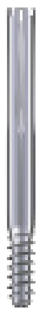
Stainless Steel REF	Length mm	Angle °
4320-0280S	280	120°
4320-0300S	300	120°
4320-0320S	320	120°
4320-0340S	340	120°
4320-0360S	360	120°
4320-0380S	380	120°
4320-0400S	400	120°
4320-0420S	420	120°
4320-0440S	440	120°
4320-0460S	460	120°
4325-0280S	280	125°
4325-0300S	300	125°
4325-0320S	320	125°
4325-0340S	340	125°
4325-0360S	360	125°
4325-0380S	380	125°
4325-0400S	400	125°
4325-0420S	420	125°
4325-0440S	440	125°
4325-0460S	460	125°
4330-0280S	280	130°
4330-0300S	300	130°
4330-0320S	320	130°
4330-0340S	340	130°
4330-0360S	360	130°
4330-0380S	380	130°
4330-0400S	400	130°
4330-0420S	420	130°
4330-0440S	440	130°
4330-0460S	460	130°

Long Nail Kit R2.0, StSt, Right*, Ø15,5/11mm



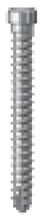
Stainless Steel REF	Length mm	Angle °
4220-0280S	280	120°
4220-0300S	300	120°
4220-0320S	320	120°
4220-0340S	340	120°
4220-0360S	360	120°
4220-0380S	380	120°
4220-0400S	400	120°
4220-0420S	420	120°
4220-0440S	440	120°
4220-0460S	460	120°
4225-0280S	280	125°
4225-0300S	300	125°
4225-0320S	320	125°
4225-0340S	340	125°
4225-0360S	360	125°
4225-0380S	380	125°
4225-0400S	400	125°
4225-0420S	420	125°
4225-0440S	440	125°
4225-0460S	460	125°
4230-0280S	280	130°
4230-0300S	300	130°
4230-0320S	320	130°
4230-0340S	340	130°
4230-0360S	360	130°
4230-0380S	380	130°
4230-0400S	400	130°
4230-0420S	420	130°
4230-0440S	440	130°
4230-0460S	460	130°

Lag Screw**



Stainless Steel REF	Length mm	Diameter mm
4060-0070S	70	10.5
4060-0075S	75	10.5
4060-0080S	80	10.5
4060-0085S	85	10.5
4060-0090S	90	10.5
4060-0095S	95	10.5
4060-0100S	100	10.5
4060-0105S	105	10.5
4060-0110S	110	10.5
4060-0115S	115	10.5
4060-0120S	120	10. 5

5mm fully threaded Locking Screw***



Stainless Steel REF	Length mm	Diameter mm
1796-5025S	25.0	5.0
1796-5027S	27.5	5.0
1796-5030S	30.0	5.0
1796-5032S	32.5	5.0
1796-5035S	35.0	5.0
1796-5037S	37.5	5.0
1796-5040S	40.0	5.0
1796-5042S	42.5	5.0
1796-5045S	45.0	5.0
1796-5050S	50.0	5.0
1796-5055S	55.0	5.0
1796-5060S	60.0	5.0
1796-5065S	65.0	5.0
1796-5070S	70.0	5.0
1796-5075S	75.0	5.0
1796-5080S	80.0	5.0
1796-5085S	85.0	5.0
1796-5090S	90.0	5.0

*Nails are packed together with the Set Screw, sterile

**Longer Lag Screws are available on request.

***Longer Locking Screws as well as partly threaded screws are available on request.

Ordering Information - Stainless Steel Implants

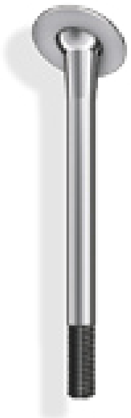
Set Screw (available separately)

Stainless Steel REF	Length mm	Diameter mm
4003-0822S	17.0	8.0

End Caps

Stainless Steel REF	Length mm	Diameter mm
4005-1100S	0	11.0
4005-1105S	+5	15.5
4005-1110S	10	15.5

Condyle Screws

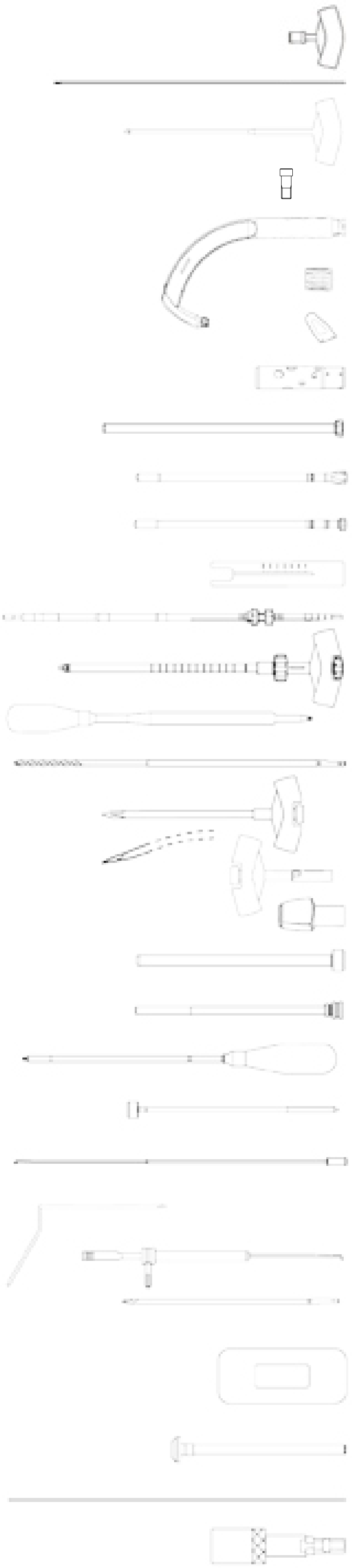


Stainless Steel REF	Length mm	Diameter mm
1795-5040S	40	5.0
1795-5045S	45	5.0
1795-5050S	50	5.0
1795-5055S	55	5.0
1795-5060S	60	5.0
1795-5065S	65	5.0
1795-5070S	70	5.0
1795-5075S	75	5.0
1795-5080S	80	5.0
1795-5085S	85	5.0
1795-5090S	90	5.0

Nut for Condyle Screw

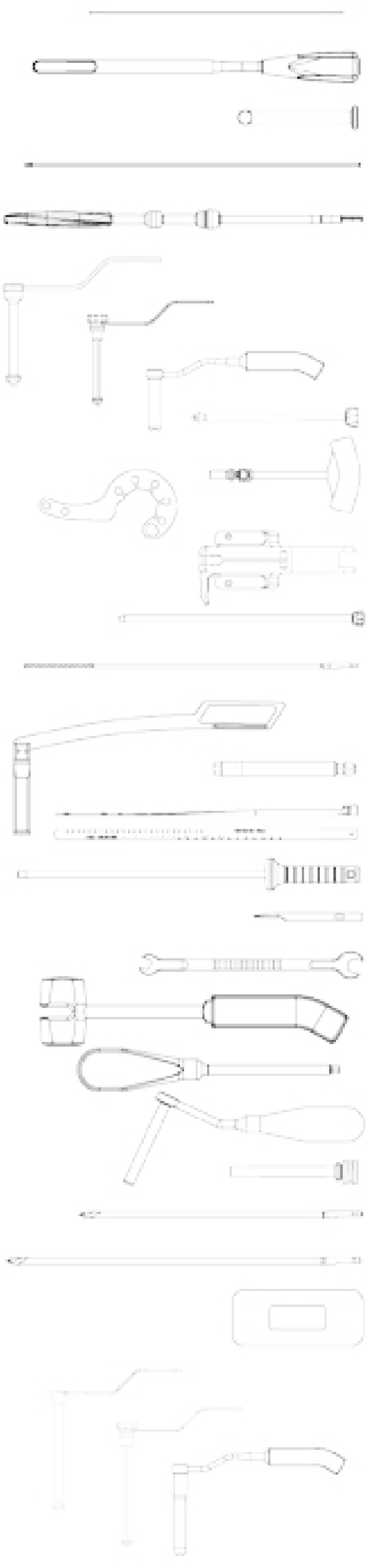
Stainless Steel REF	Length mm	Diameter mm
1795-5001S	17.0	-

Ordering Information - Instruments



REF	Description	
Basic Instruments		
702628	T-handle, Quicklock	
1210-6450S	Kirschner wire, sterile	
1320-0065	Screwdriver 8mm, Ball-Tip, T-handle	
1320-0090	Nail Holding Screw	
1320-0100	Gamma3™ Targeting Arm	
1320-0105	Knob for Targeting Sleeve	
1320-0110	Clip for K-Wire	
1320-0118	Targeting Sleeve 180, green coded	
1320-0130	Lag Screw Guide Sleeve	
1320-0140	Drill Guide Sleeve 4.2mm for Lag Screw, green	
1320-0150	K-Wire Sleeve	
1320-0180	Lag Screw Rule	
1320-0190	Lag Screw Step Drill	
1320-0200	Lag Screw Driver	
1320-0230	Set Screwdriver 4mm, flexible shaft	
1320-3042S	Drill 4,2 × 300mm, AO small, green, sterile	
1806-0041	Awl, Curved	
1806-0095	Guide Wire Handle	
1806-0096	Guide Wire Handle Chuck	
1806-0185	Tissue Protection Sleeve, Long	
1806-0215	Drill Sleeve, Long	
1806-0232	Screwdriver, Long	
1806-0315	Trocar, Long	
1806-0325	Screw Gauge, Long	
1806-0365	Screw Scale, Long (for Long Nail	
1806-0480	Screw Gauge (for Long Nail	
1806-4270S	Drill Ø4.2 × 180mm, AO small, green, sterile (for Long Nail	
1320-9000	Instrument Tray, Basic, empty	
1320-6000	Instrument Set, Basic, completely filled	
1320-0131	Lag Screw Guide Sleeve, navigated	(not stored on tray)
1806-0085S	Guide Wire, Ball Tip, Ø3 × 1000, Sterile	(not stored on tray)
702634	Large AO Coupling Hall Fitting	(not stored on tray)

Ordering Information - Instruments



REF	Description
Optional Instruments	
0152-0218S	K-Wire 1,8×310mm, for Condyle Screws
1320-0041	Cannulated Cutter, use with 4mm Pin only
1320-0042	Sleeve for Cannulated Cutter
1213-9091S	Guide Pin 4×400mm, sterile
1320-0011	One Step Conical Reamer, working with Conical Reamer Sleeve short and long
1320-0021	Conical Reamer Trocar, short
1320-0026	Multihole Trocar, short
1320-0031	Conical Reamer Sleeve, short
1320-0070	Screwdriver Strike Plate
1320-0080	Universal Joint Socket Wrench
1320-0135	Adaptor for One Shot Device, Gamma
1320-0160	Fragment Control Clip
1320-0170	Fragment Control Sleeve
1320-3030S	Drill 3,0×300mm, AO small, sterile, white (for Fragment Control Clip)
1320-3010	One Shot Device, Gamma3™
1407-4006	Nail Extraction Adapter
1806-0020	Guide Wire Ruler (for Long Nail)
1806-0110	Universal Rod
1806-0125	Reduction Spoon
1806-0130	Wrench, 8mm / 10mm
1806-0170	Slotted Hammer
1806-0255	Condyle Screwdriver (for Condyle Screws)
1806-0450	Tissue Protection Sleeve
1806-0460	Drill Sleeve Ø4.2mm
1806-4290S	Drill 4,2×230mm, AO small, sterile, green (Long Nail)
1806-5020S	Drill, 5×340mm, AO small, sterile, black (for Condyle or Shaft Screws)
1320-9005	Instrument Tray, Optional
1320-0022	Conical Reamer Trocar, long
1320-0027	Multihole Trocar, long
1320-0032	Conical Reamer Sleeve, long
1320-0002	X-Ray Template, Gamma3 Nail 180
1320-0005	X-Ray Template, Gamma3 Long Nail R 2.0

Gamma3 Long Nail Publications

Publications

More than 750,000 Gamma Nail implantations have been performed world wide over the last 15 years. Extensive clinical experience has been published with the Gamma™ Locking Nail.

We recommend the following publications:

- The Gamma Locking Nail, Ten Years Surgical Experience
  Gahr, R. H.; Leung, K.-S.; Rosenwasser, M.P.; Roth, W. (eds.),
  Einhorn-Presse Verlag, ISBN 3-88756-808-7
- Patients treated with the Long Gamma Nail
  R. van Doorn,
  Bedrijfsnaam: Castellum Drukwerk Vof.

These books contain almost 300 clinical reports available on request.

Notes

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