stryker®

Trauma

Gamma3 Plus
Targeting System

Operative Technique

Hip Fracture System
Trochanteric and Long Nails

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Contributing Surgeons

Christopher T. Born, M.D.
Professor of Orthopaedic Surgery
Brown University
Providence, RI
USA

James Maxey, M.D.
University of Illinois College of Medicine
Peoria, IL
USA

Robert Probe, M.D.
Department of Orthopaedic Surgery
Texas A&M University Health
Science Center
Temple, TX
USA

Gilbert Taglang, M.D.
Association Internationale pour
L'Osteosyntheses Dynamique (AIOD)
Strasbourg
France

We gratefully acknowledge and appreciate the contributions to this technique made by:

Kevin Luke, M.D.
Parkview Musculoskeletal Institute.
Chicago, IL
USA

Daniel Horwitz, M.D.
University of Utah
Salt Lake City, UT
USA

Anthony Sorkin, M.D.
Rockford Orthopaedics Associates
Rockford, IL
USA

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

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

Note

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

Gamma3 Nail
Introduction

Introduction

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

This evolution is based on the experience and clinical outcomes from surgeons all over the world.

The Gamma3 Plus Targeting System is designed to facilitate Gamma Nail surgery in patients with excess soft tissue.

Improvements in design and function allow for:

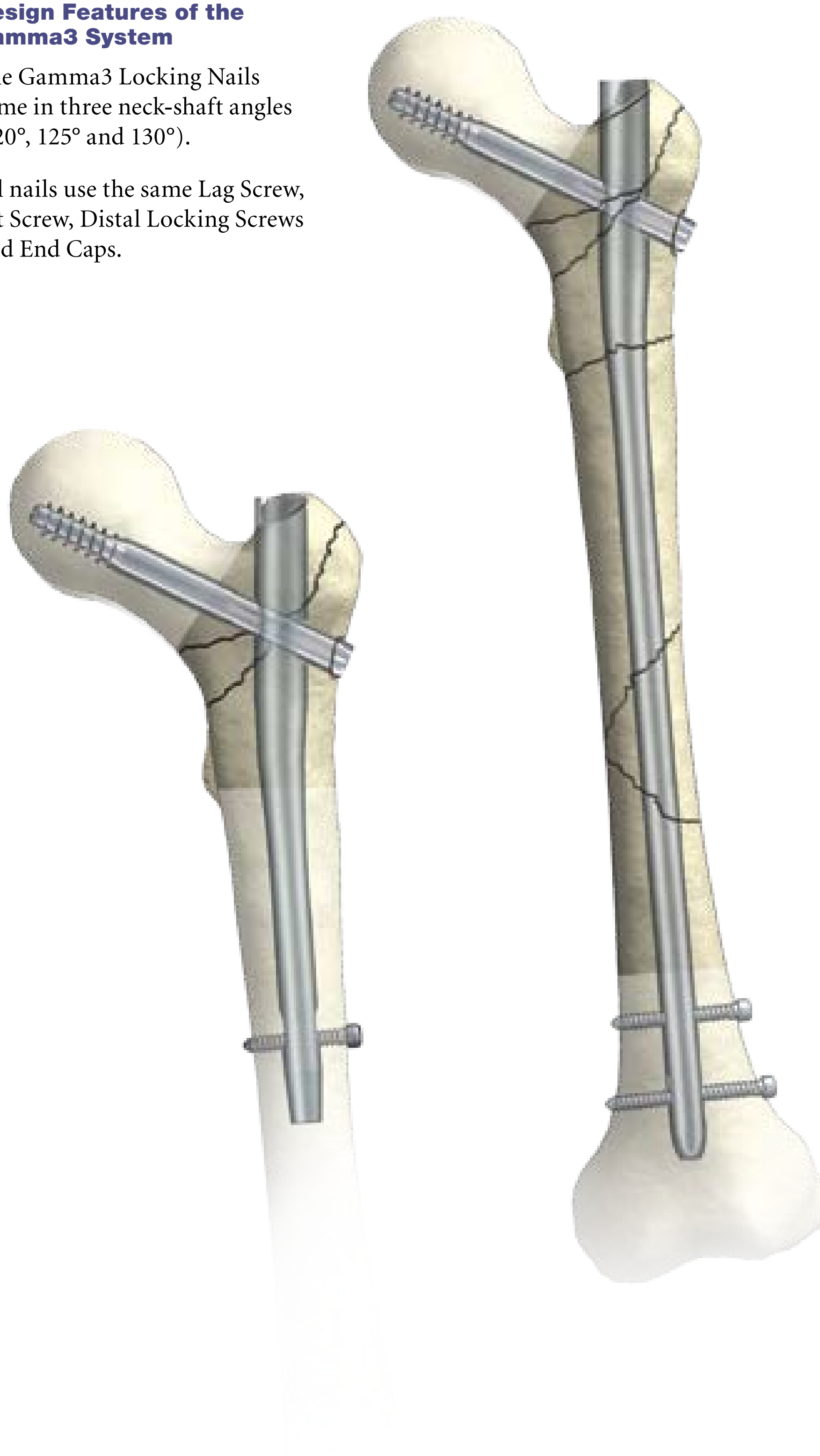
- An implant with a 15.5mm proximal diameter, reducing the amount of bone taken prior to nail insertion.
- A Lag Screw with a 10.5mm diameter and improved cutting flutes while maintaining the superior resistance to cut-out of earlier Lag Screw designs.
- 5mm Distal Locking Screws that are compatible with the T2 IM Nail System.
- Titanium Alloy (Ti-6Al-4V).

Another major advantage of this system is the newly designed instrument platform. The intuitive and ergonomic instrument designs are intended to reduce the learning curve of the OR staff, as well as providing for a less invasive technique, where applicable. Additionally, the Gamma3 instruments share the same design platform as the critically acclaimed T2 and S2 IM Nail Systems.

Design Features of the Gamma3 System

The Gamma3 Locking Nails come in three neck-shaft angles (120°, 125° and 130°).

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



Gamma3 Nail
Implant Features

Trochanteric Gamma3 Nail

The anatomical shape of the nail is universal for all indications involving the treatment of intertrochanteric fractures. The nail is cannulated for controlled insertion and features a conical tip for positioning within the medullary canal.

A range of three different neck-shaft angles is available for Lag Screw entry to accommodate variations in femoral neck anatomy.

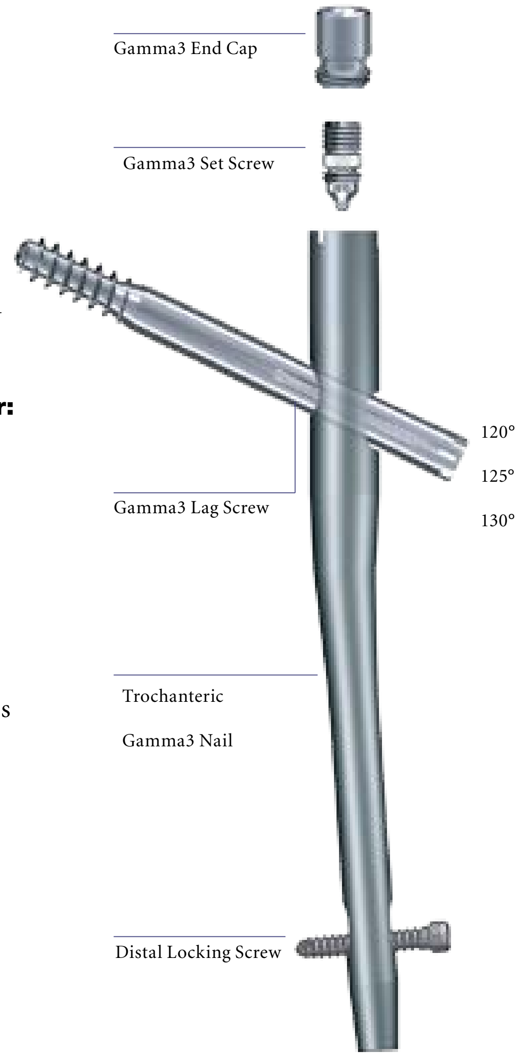
A single Distal Locking Screw is provided to stabilize the nail in the medullary canal and to help prevent rotation in complex fractures. The oblong hole allows for static or dynamic locking.

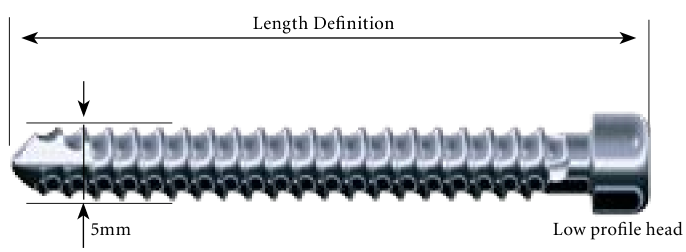
Technical Specifications

- **Material:** Type II anodized Titanium alloy (Ti-6Al-4V)
- **Nail length:** 180mm
- **Nail diameter:** Proximal 15.5mm, Distal: 11.0mm
- **Proximal Nail neck-shaft angles:** 120°, 125°, 130°
- **M-L bend for valgus curvature:** 4 degrees
- **End Caps in lengths of:** Standard, +5mm and +10mm
- **Distal oblong hole:** 5mm screws allow up to 5mm of dynamic compression
- **Lag Screw diameter:** 10.5mm
- **Lag Screw lengths:** 75–120mm in 5mm increments
- **Patented Self-Tapping 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 for dynamic bone compression at the fracture site to enhance fracture healing
- **A patented self retaining Set Screw** to help prevent rotation and to simultaneously allow sliding of the Lag Screw laterally
- **Distal Locking Screw diameter:** 5mm
- **Fully threaded Distal Locking Screw lengths:** ranging from 25-120mm in 2.5mm or 5mm increments
- **Self-tapping screw tip** with optimized short cutting flutes
- **Optimized diameter** under the head helps to prevent microfractures during insertion
- **Low profile head**

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





Distal Locking Options

- Locking in the distal portion of the oblong hole creates a dynamic locking mechanism (Figure 1).
- Locking in the proximal part of the oblong hole allows static locking of the nail (Figure 2).

Figure 1
Dynamic Locking

Figure 2
Static Locking

Gamma3 Nail
Implant Features

Long Gamma3 Nail

This nail incorporates several important mechanical design features, including an unslotted and cannulated design for Guide-Wire controlled insertion.

The three neck-shaft angles: 120°, 125° and 130° accommodate variations in femoral neck anatomy. The Long Nail offers the opportunity to use two distal Locking Screws that are inserted through the distal end of the nail 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:** Type II anodized Titanium alloy (Ti-6Al-4V)
- **Nail length:** 280mm to 480mm, in 20mm increments, in left and right (shorter or longer nails are available on request)
- **Nail diameter:** Proximal 15.5mm, distal: 11.0mm
- **Proximal Nail neck-shaft angles:** 120°, 125°, 130°
- **M-L bend for valgus curvature:** 4 degrees
- **Proximal anterversion:** 10 degrees
- **End Caps:** Standard, +5mm and +10mm
- **Radius of Curvature :** R2.0m of the shaft
- **Distal locking holes:** (round and oblong) for 5mm screws; up to 5mm of dynamization is possible
- **Lag Screw diameter:** 10.5mm
- **Lag Screw lengths:** 75-120mm in 5mm increments
- **Patented Self-Tapping 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 for dynamic bone compression at the fracture site to enhance fracture healing
- **A patented self retaining Set Screw** to prevent rotation and simultaneously allowing sliding of the Lag Screw laterally
- **Distal Locking Screw diameter:** 5mm
- **Fully threaded Distal Locking Screw lengths:** ranging from 25-120mm in 2.5mm or 5mm increments
- **Self-tapping screw tip** with optimized short cutting flutes
- **Optimized diameter** under the head helps to prevent microfractures during insertion
- **Low profile head**

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

Long Nail Distal Locking Options

Dynamic locking (Only one screw is needed):

- Locking in the distal part of the oblong hole creates a dynamic lokking mechanism (Figure 3).

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 (Figure 4).

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 (Figure 5).

Figure 3
Dynamic Locking

Figure 4
Secondary Dynamization

Figure 5
Static Locking

Gamma3 Nail
Indications

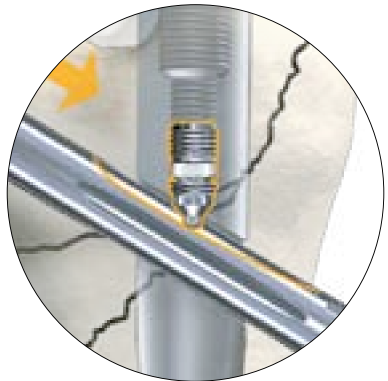
Trochanteric Gamma3 Nail

The Gamma3 Trochanteric Nail is indicated for:

- Intertrochanteric fractures
- Pertrochanteric fractures
- Nonunions and malunions

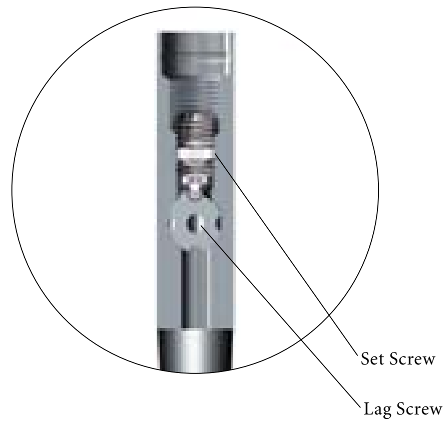
Contraindications for the Trochanteric Gamma3 Nail

- Medial neck fracture
- Subtrochanteric fracture



Lag Screw and Set Screw function

Cut-Away View



Lateral view of Lag Screw

Lag Screw Stabilization System

Gamma3 Nail
Indications

Long Gamma3 Nail

The Long Gamma3 Nail is indicated for:

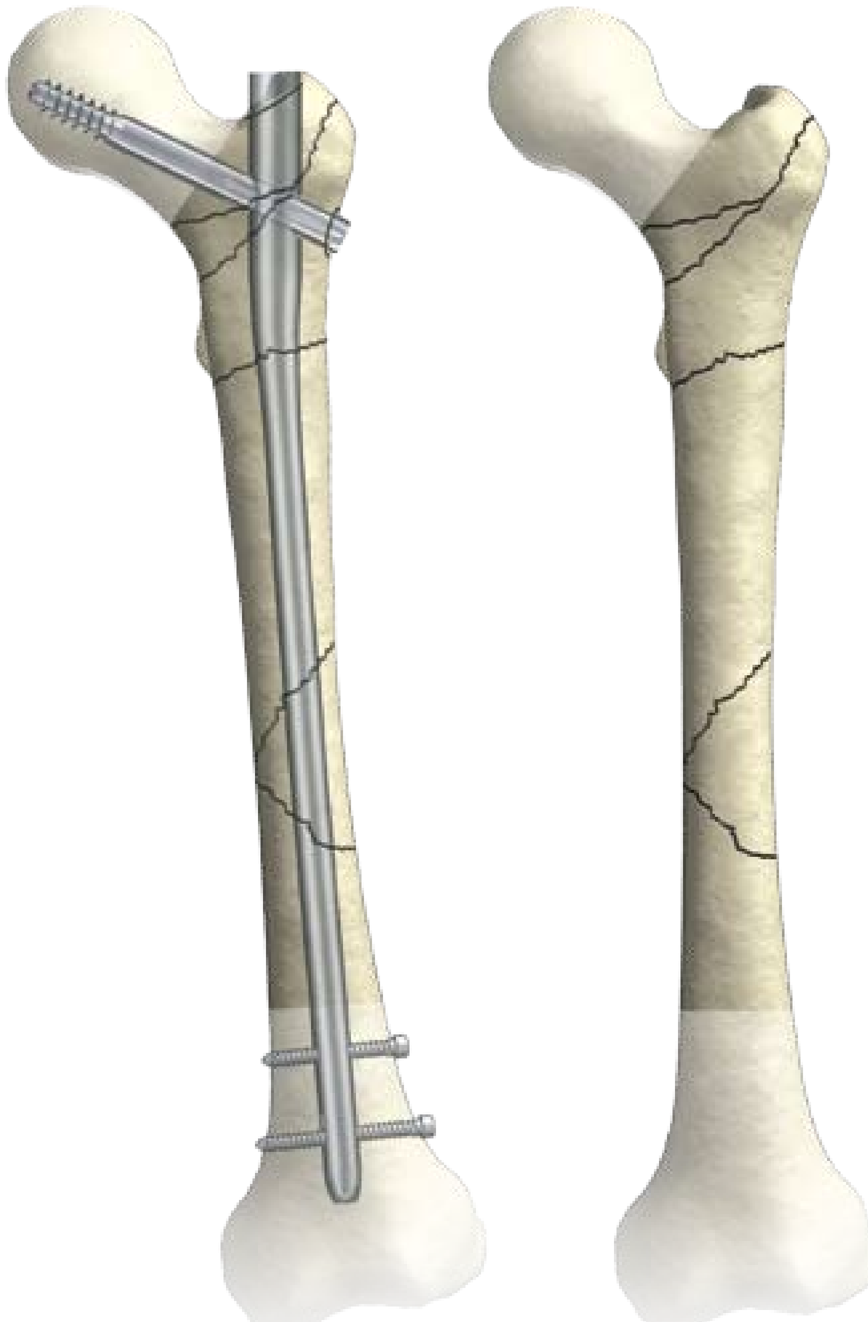
- Subtrochanteric fractures
- Pertrochanteric fractures associated with shaft fractures
- Pathological fractures (including prophylactic use) in both trochanteric and disphysal areas
- Nonunions and malunions

Contraindications for the Long Gamma3 Nail

- Medial neck fracture

Long Gamma3 Nail Length Selection

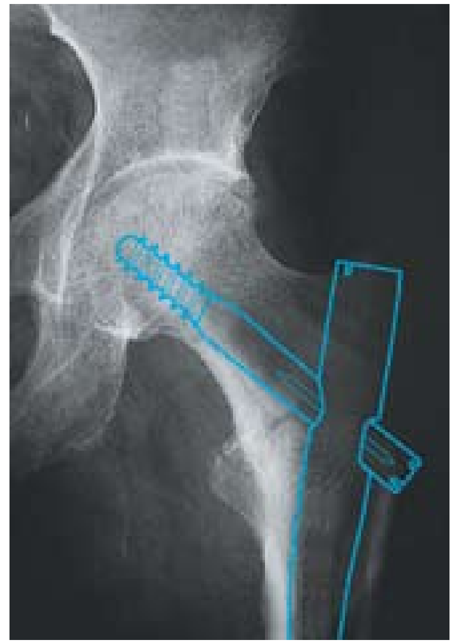
The appropriate length of the Long Nail may be chosen either by pre-operative planning using an X-ray of the injured femur and a template, or intra-operatively as is the usual practice in intramedullary nailing.



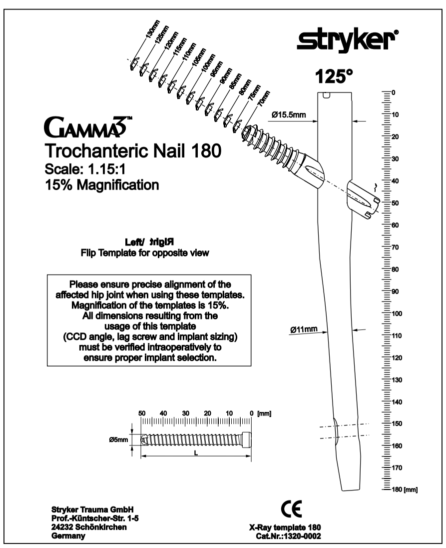
Gamma3 Nail
Operative Technique

Implant Selection

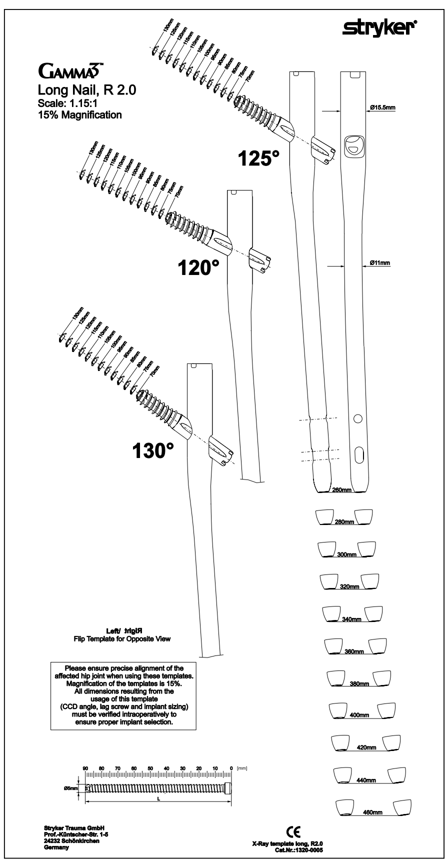
X-ray templates may be used for pre-operative planning. Alternatively the femoral neck angle may be determined through the use of a goniometer.



X-ray in A/P view, showing implant



Gamma3 Trochanteric Nail X-ray Template (Cat. No 1320-0002)



Gamma3 Long Nail X-ray Template (Cat. No 1320-0005)

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

Suggested Patient Positioning

The patient is placed in a supine position on the fracture table and closed reduction of the fracture is recommended. Reduction should be achieved as anatomically as possible. If this is not achievable in a closed procedure, open reduction may be necessary.

Traction is applied to the fracture, keeping the leg straight. The unaffected leg is abducted to allow for use of the image intensifier (Figure 6).

While maintaining traction, the leg is internally rotated 10-15 degrees to complete fracture reduction; the patella should be horizontal or slightly inward.

Position the image intensifier so that A/P and M/L views of the trochanteric region of the affected femur may 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 7).

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

The patient is then prepared and draped accordingly.

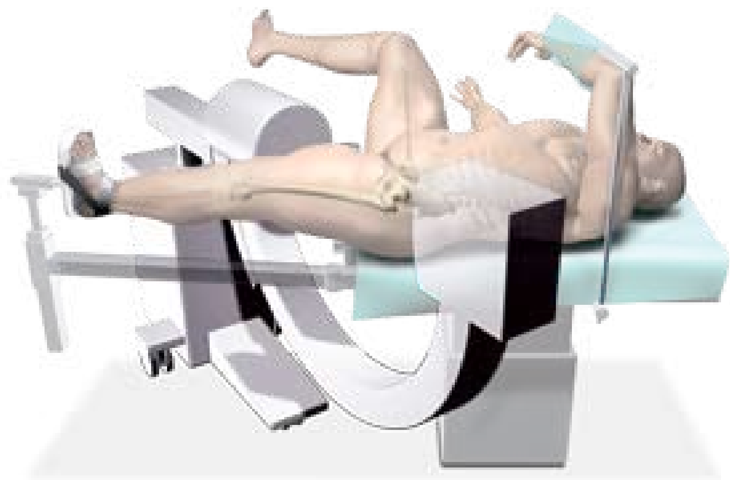


Figure 6

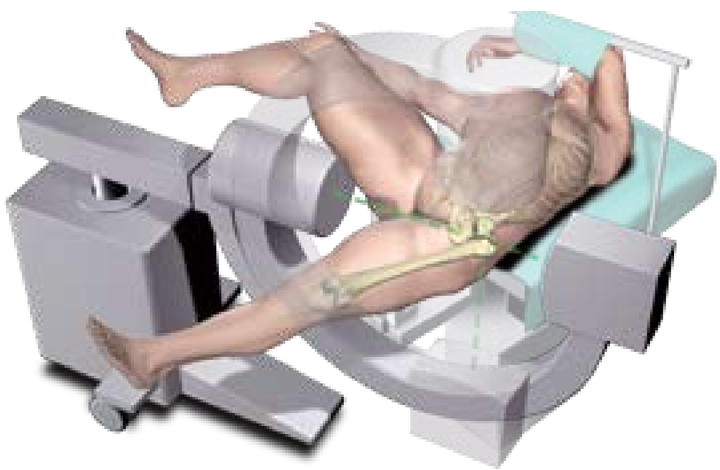


Figure 7

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 8), using the stirrup to avoid adduction. This position helps to align the distal portion. Reduction is confirmed in the A/P view.

Subtrochanteric fractures cannot always be reduced during positioning in the lateral view, because of the stresses applied to the proximal fragment by the psoas muscles. The fragment may be reduced during surgery by using the Universal Rod and the Reduction Spoon. (Figure 9).

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

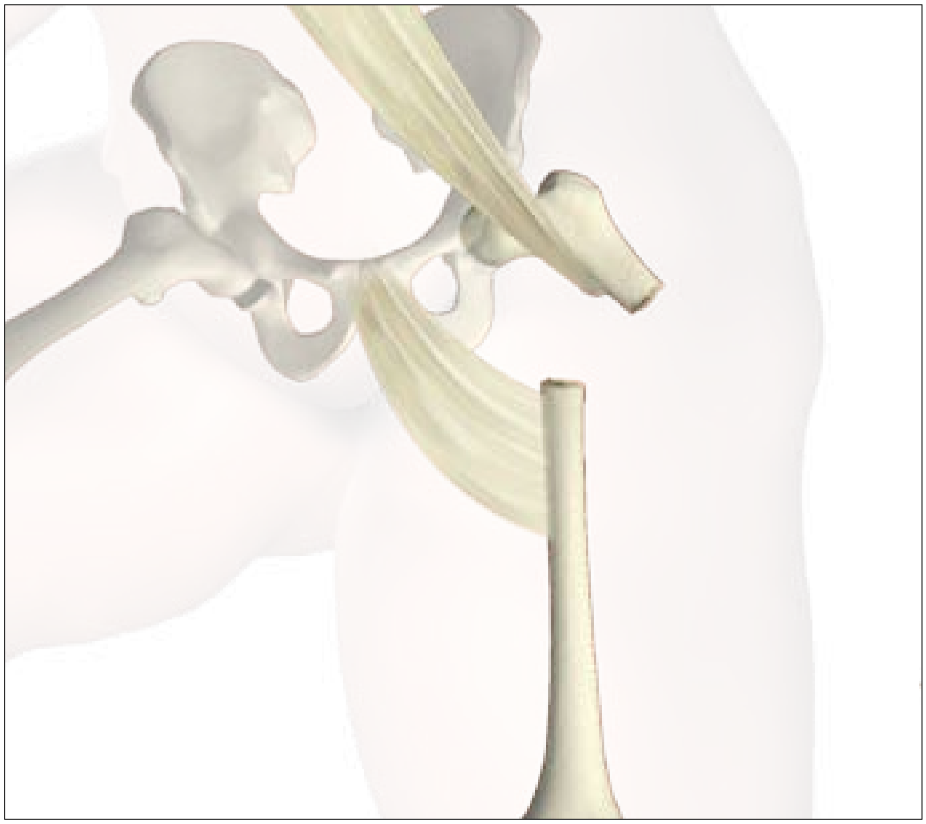


Figure 8

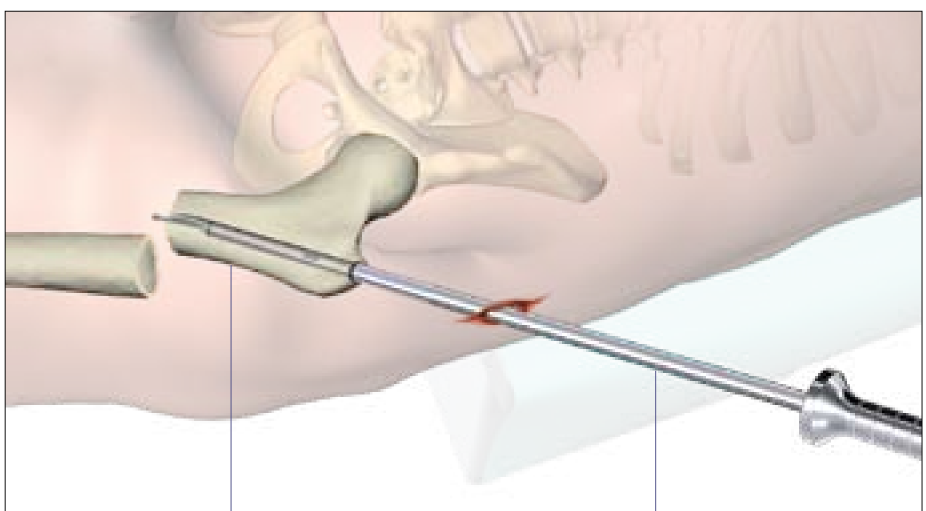


Figure 9

Reduction Spoon

Cat No. 1806-0125

Universal Rod

Cat No. 1806-0110

Entry Point

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 10). A skin incision of appropriate length centered between the tip of the greater trochanter and the anterior superior iliac spine. Incision site is also determined by the amount of soft tissue around immediate area.

Preparation of the Medullary Canal

The Cannulated Curved Awl (Cat. No. 1806-0041, Figure 11) is used to open the medullary canal under image intensification. The optional Cannulated Cutter (Cat. No. 1320-0041) may be used in place of the Cannulated Curved Awl (Figure 12).

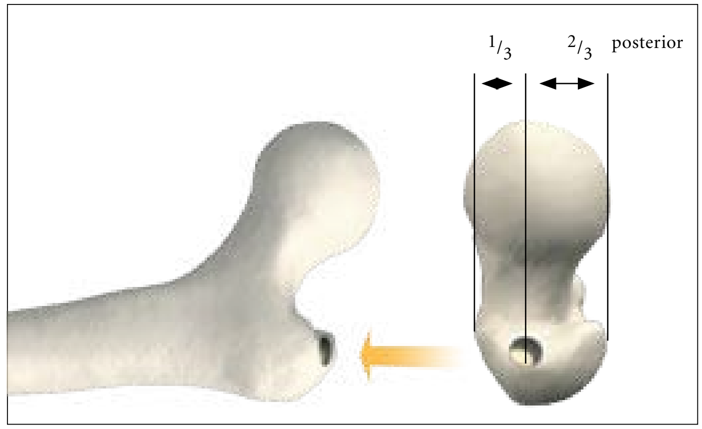


Figure 10

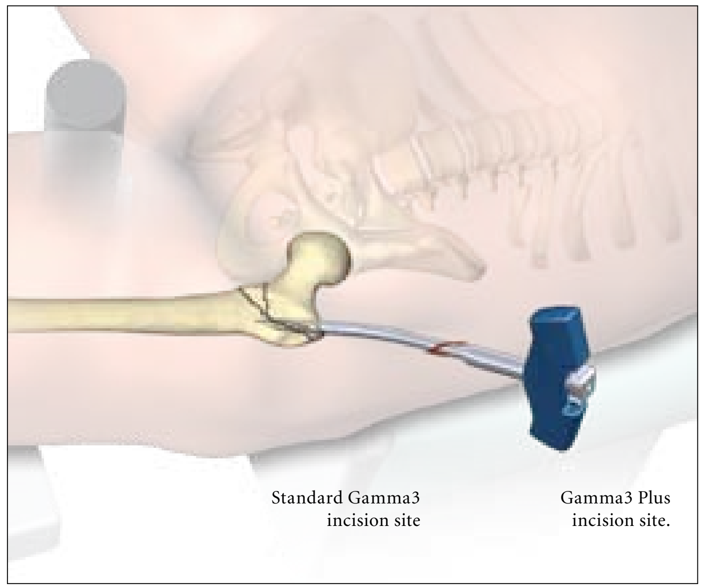


Figure 11

Figure 12

Trochanteric Gamma3 Nail
Reaming the Medullary Canal

A 3mm Ball-Tipped Guide Wire (Cat. No. 1806-0085S) is passed through the Cannulated Curved Awl into the shaft of the femur as shown, using the Guide Wire Handle (Cat. No. 1806-0095 and 1806-0096, Figure 13).

Flexible reamers are used to ream the shaft of the femur in stages starting from 9mm diameter and increasing in 0.5mm increments (Figure 13a). The canal should be reamed at least 13mm (Figure 14).

In order to accommodate the proximal portion of the nail, the subtrochanteric region must be opened to 15.5mm (Figure 15). This can be done either by reaming with the Stryker Bixcut Reaming System (Figure 13a) or, alternatively, with the One Step Conical Reamer (Cat. No. 1320-0011). For soft tissue protection, the Conical Reamer Sleeve (Cat. No. 1320-0031) should be used during reaming.

Care must be taken with flexible reamers to ensure that the Guide Wire is not displaced laterally during reaming.

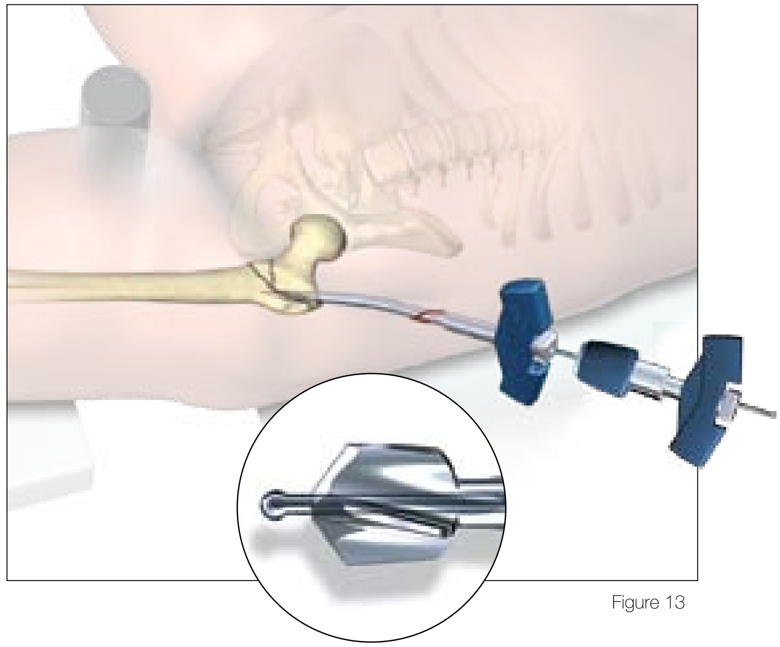


Figure 13

Figure 13a

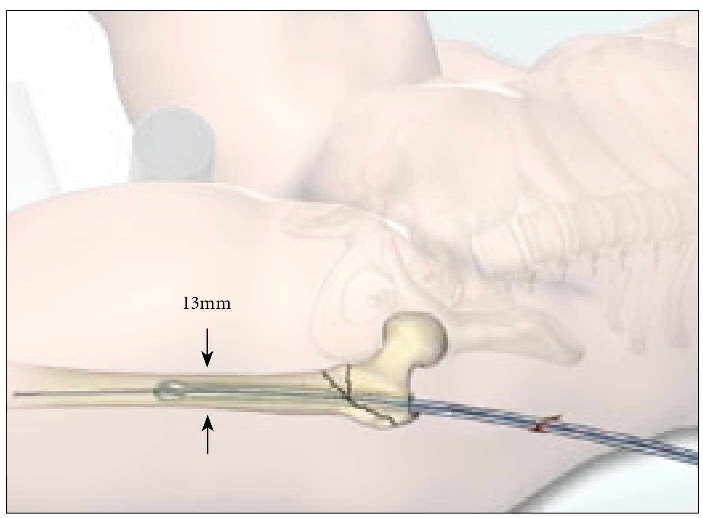


Figure 14

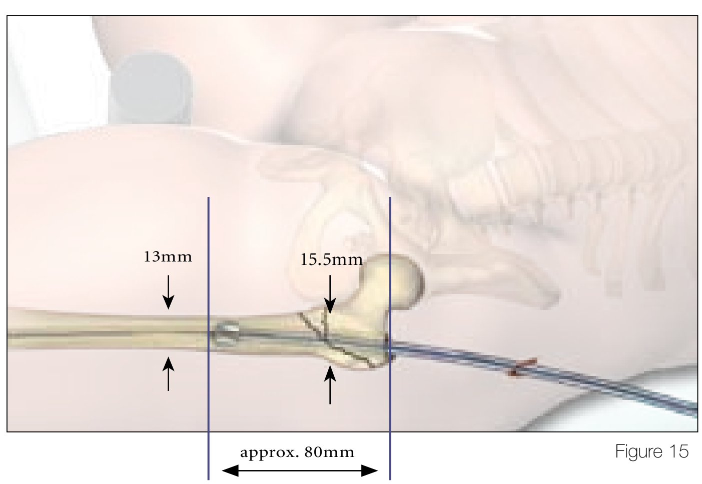


Figure 15

Long Gamma3 Nail
Reaming the Medullary Canal

A 3mm Ball-Tipped Guide Wire (Cat. No. 1806-0085S) is passed through the Cannulated Curved Awl into the shaft of the femur as shown, using the Guide Wire Handle (Cat. No. 1806-0095 and 1806-0096, Figure 16).

Flexible reamers are used to ream the shaft of the femur in stages starting from 9mm diameter and increasing in 0.5mm increments (Figure 16a). The canal should be reamed at least 2mm larger than the distal diameter of the nail (Figure 17).

When reaming is performed, the entire femoral canal should be over-reamed down through the isthmus, in order to reduce stress risers in the bone.

In order to accommodate the proximal portion of the nail, the subtrochanteric region must be opened to 15.5mm (Figure 18). This can be done either by reaming with the Stryker Bixcut Reaming System (Figure 16a) or, alternatively, with the One Step Conical Reamer (Cat. No. 1320-0011). For soft tissue protection, the Conical Reamer Sleeve (Cat. No. 1320-0031) should be used during reaming.

Care must be taken with flexible reamers to ensure that the Guide Wire is not displaced laterally during reaming.

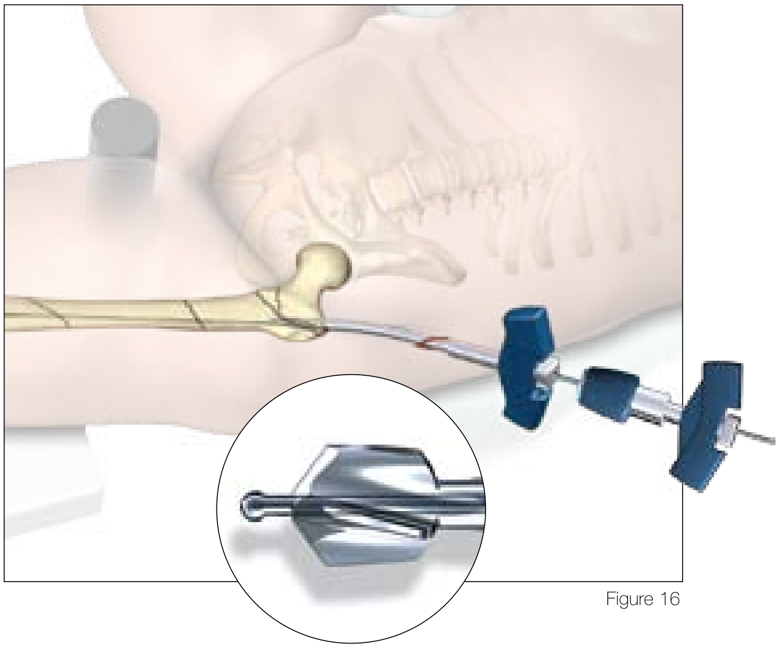


Figure 16

Figure 16a

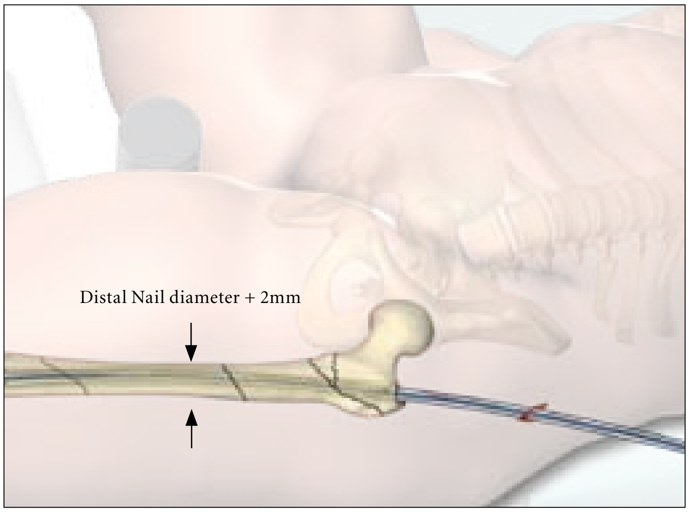


Figure 17

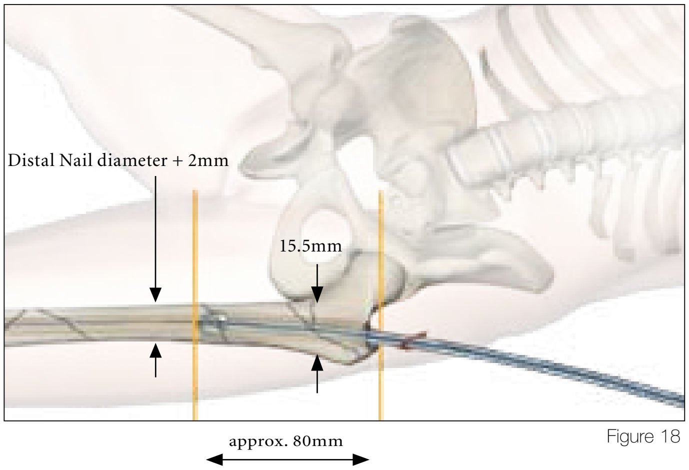


Figure 18

Using the Optional "One Step Conical Reamer"

The One Step Conical Reamer (Cat. No. 1320-0011) is an optional instrument that has been developed to provide surgeons with another option to prepare the proximal canal of the femur using only one drilling step.

When the Gamma3 Nail 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.

After skin incision and positioning of the Guide Wire as described above, the Trocar (Cat. No. 1320-0021) or Multi Hole Trocar (Cat. No. 1320-0026) is inserted into the Conical Reamer Sleeve (Cat. No. 1320-0031) 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 19 and 20).

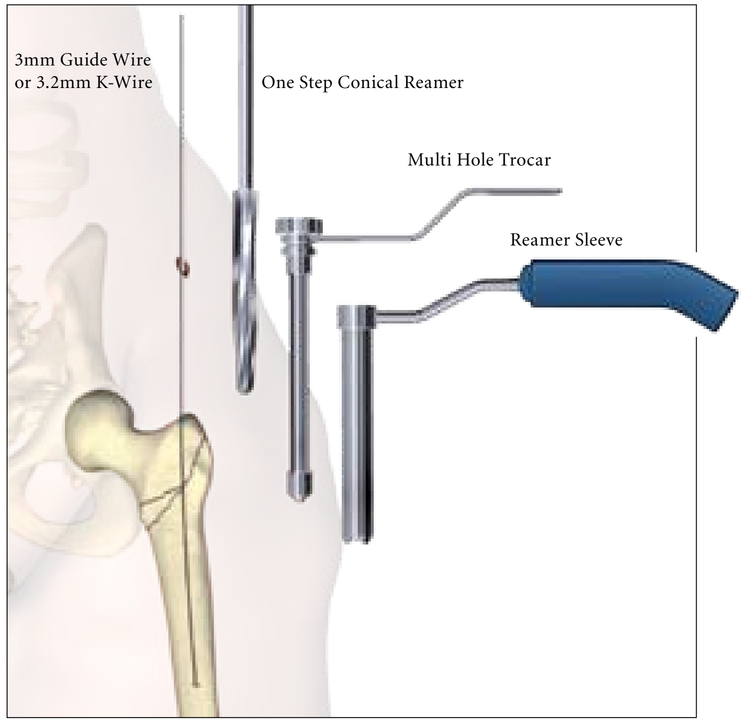


Figure 19

Entry Point Optimization

The Entry Point can also be made without using the Awl or the Cannulated Cutter. 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 be easily corrected using a second K-Wire in combination with the Multi Hole Trocar.

The Multi Hole Trocar (Figure 20a) has a special design for more precise insertion. In addition to the central hole, four other holes are located eccentrically at different distances from the center (Figure 20) to easily revise insertion of the guiding K-Wire into the proper position (Entry Point).

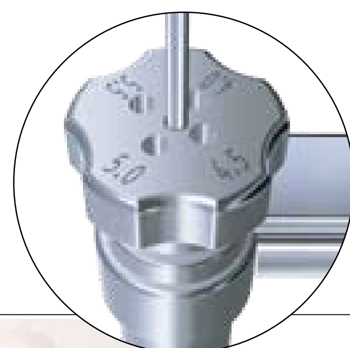


Figure 20a

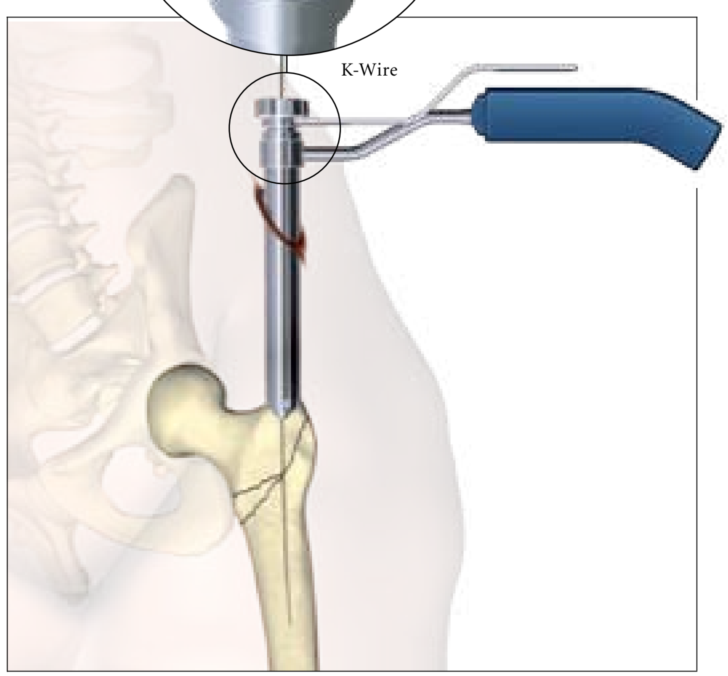


Figure 20

Assembly of the Targeting Device

1. Targeting Sleeve and Knob Assembly

Align the arrow on the Targeting Sleeve (Cat. No. 1320-0118) with the "spot" on the Knob (Cat. No. 1320-0105) for assembly (Figure 21a). Slide and push the knob approximately 5mm onto the Targeting Sleeve and turn clockwise one-third of a turn to secure in place (Figure 21b).

2. Targeting Arm and Targeting Sleeve Assembly

With the Knob in place on the Targeting Sleeve (Figure 21b) align the long arrow on the Targeting Sleeve with the long arrow on the Targeting Arm (Cat. No. 1320-1000) and assemble (Figure 21c). Rotate the Targeting Sleeve around the barrel of the Plus Targeting Arm until the appropriate nail angle (eg 125°, point-to-point) or distal locking position (static or dynamic) is reached. Once adjusted, the Targeting Sleeve is snapped into place by pushing towards the proximal part of the Targeting Device.

Figure 21a Figure 21b Figure 21c

3. Assembly of the Targeting Device and the Gamma3 Nail

The appropriate size Gamma3 Nail is now assembled to the Targeting Device (Figure 22a). The Targeting Device is keyed and the nail should be aligned with the appropriate pegs for proper assembly.

Securely tighten the Nail Holding Bolt (Cat. No. 1320-0990) with the Ball Tip Screwdriver (Cat. No. 1320-0065), so that it does not loosen during nail insertion.

Before starting surgery the following functions of the Target Device should be confirmed:

1. There is a secure connection between the Nail and the Target Device.
2. The Lag Screw Guide Sleeve (Cat. No. 1320-0130) is correctly aligned with the selected nail angle (Figure 22b).
3. The Distal locking position of the Tissue Protection Sleeve (Cat. No. 1320-0215), is aligned for either static or dynamic locking (Figure 22c).

Figure 22a
Gamma3 Nail Assembly

Figure 22b

Figure 22c
Checking of Lag Screw Sleeve and Distal Locking Sleeve positioning and function.

Nail Insertion

Insert the Gamma3 Nail by hand (Figure 23).

Optional Gamma3 Plus Final Seating Impactor

The carbon fiber guide should never be struck as it may break or become deformed. The impactor that is provided can be utilized to assist with final seating of the long nail (Figure 23a). Gentle tapping will produce small adjustments (in the nail position) that can help to optimize the ultimate position of the lag screw in the femoral head. Following any use of the impactor, the connecting bolt should be re-tightened.

The impactor should not be utilized to force the nail down the canal. If the nail cannot be seated manually or if there is no advancement each time the impactor is tapped, A/P and Lateral fluoroscopic X-rays should be reviewed to determine the cause of the impingement - there may be a mis-match between the nail geometry and the medullary canal. The starting position, the femoral bow and the canal diameter should all be examined to insure that the leading end of the nail is not impinging on the medial or anterior cortex and that the canal itself has been sufficiently reamed. Periodically, nail removal and further reaming of the diaphysis may be required.

In some cases (particularly young patients or those of short stature), the proximal metaphyseal flair may be undersized and serve to prevent nail advancement. If this situation is encountered, a 15.5 or 16mm flexible reamer may be used to further widen this area to (at least) the level of the lesser trochanter.

Beginning long nail insertion with the nail internally rotated 90° until the fracture has been passed may help to facilitate manual passage.

The final nail depth position is monitored with the image intensifier. The Lag Screw position may be estimated with a ruler on the C-arm monitor to confirm proper Lag Screw position. The Lag Screw should be placed centrally or slightly inferior in the femoral head and frontal plane (Figure 24).

Note:

Remove the Guide Wire (Cat. No. 1806-0085S) following successful placement of the nail (Figure 25).

With the Gamma3 Nail in place, check the anteversion of the nail. If the K-Wire Clip (Cat. No. 1320-0110) is used to check anteversion, it is mounted onto the slots with the u wire (1320-0112) in the Targeting Arm by depressing the clip flanges (Figure 26).

Before proceeding ensure the Nail Holding Bolt is fully tightened to the nail.

The Lag Screw should be placed in the central position of the femoral head in the lateral view (Figure 27).

Figure 23

Figure 23a

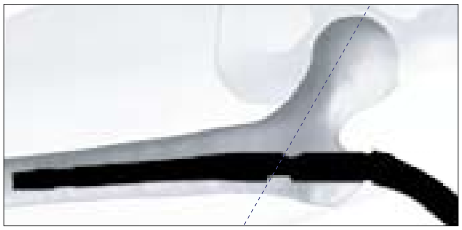


Figure 24

Figure 25

Figure 26

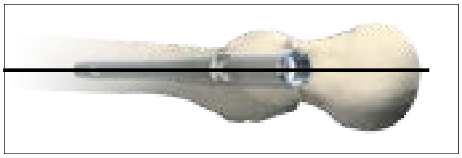


Figure 27

Optional Technique

Lag Screw Positioning using the One Shot Device

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

The One Shot Device (Cat. No. 1320-3010) is recommended for establishing whether the Lag Screw is in the optimal position. This device enables correct positioning of the K-Wire for Lag Screw placement before performing the lateral skin incision and opening of the lateral cortex (Figure 28).

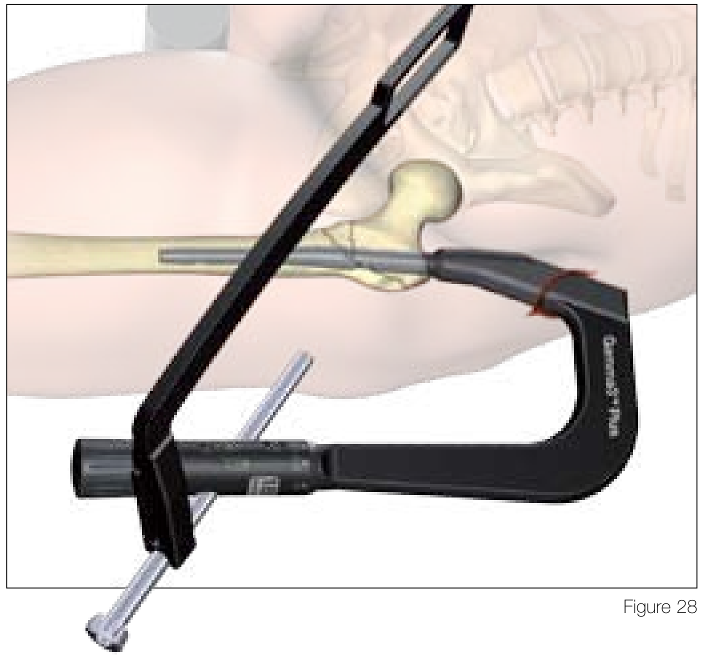


Figure 28

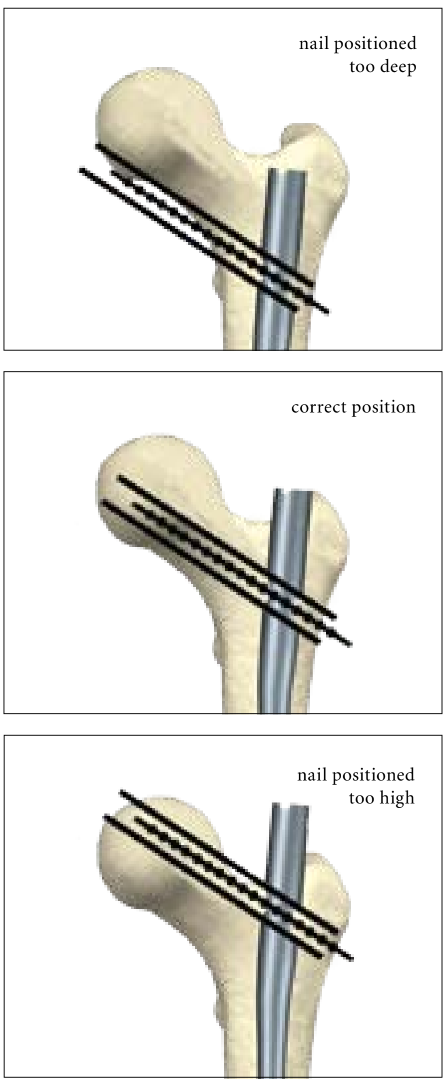


Figure 28a
A/P view

Figure 29

Lag Screw Insertion

Insert the Lag Screw Guide Sleeve with the 4.2mm Drill Guide Sleeve (green, Cat No. 1320-0140) through the Targeting Sleeve to the level of the skin. Make the appropriate incision and advance the Guide Sleeve to the bone (Figure 29).

Note:

For accurate **Lag Screw measurement the Guide Sleeve must be in contact with the bone**. Once the Guide Sleeve is on the bone, it is locked in place to stabilize the Targeting Assembly, by turning the Knob clockwise (Figure 30 and 31).

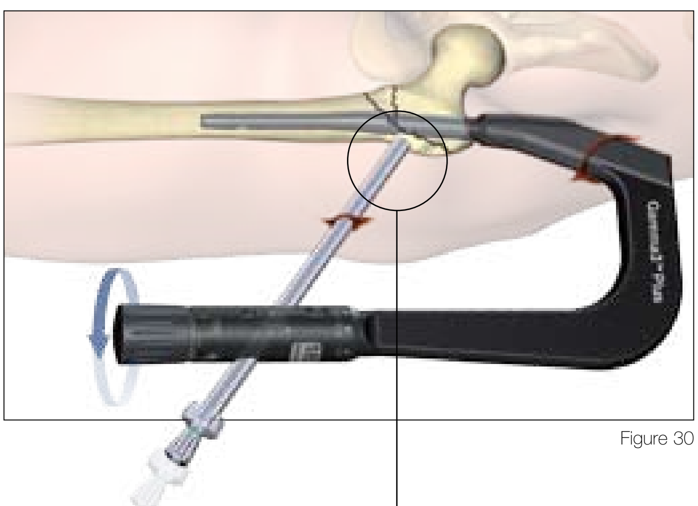


Figure 30

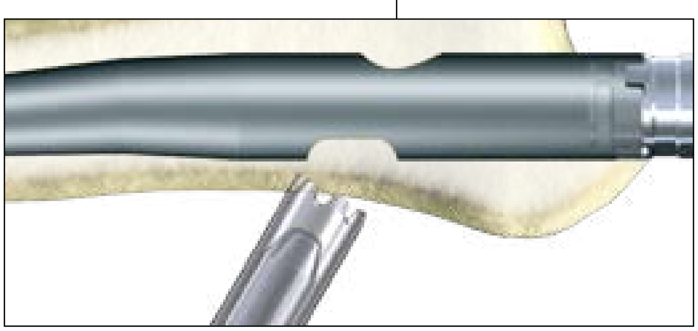


Figure 31
Lag Screw Guide Sleeve in good contact to the lateral cortex

Lag Screw Insertion

With the Lag Screw Guide Sleeve firmly in place the 4.2×300mm Center Tipped Drill (Cat No. 1320-3042S), is used to open the first cortex. (Figure 32).

The green coded 4.2mm Lag Screw Drill Guide Sleeve is then replaced by the K-Wire Sleeve (Cat. No. 1320-0150).

The sleeves look similar, but have different inner hole diameters. The K-Wire Sleeve has no colored ring (Figure 33).

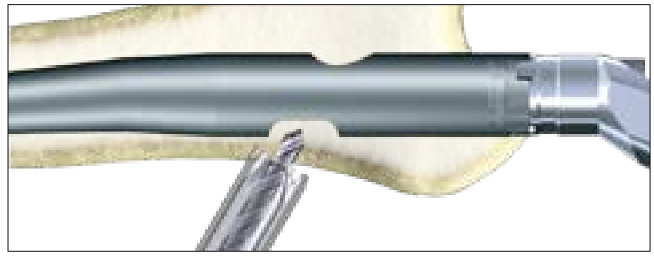


Figure 32
Opening of the lateral cortex

Lag Screw Drill Guide Sleeve
Cat. No. 1320-0140

K-Wire Sleeve
Cat. No. 1320-0150

Figure 33

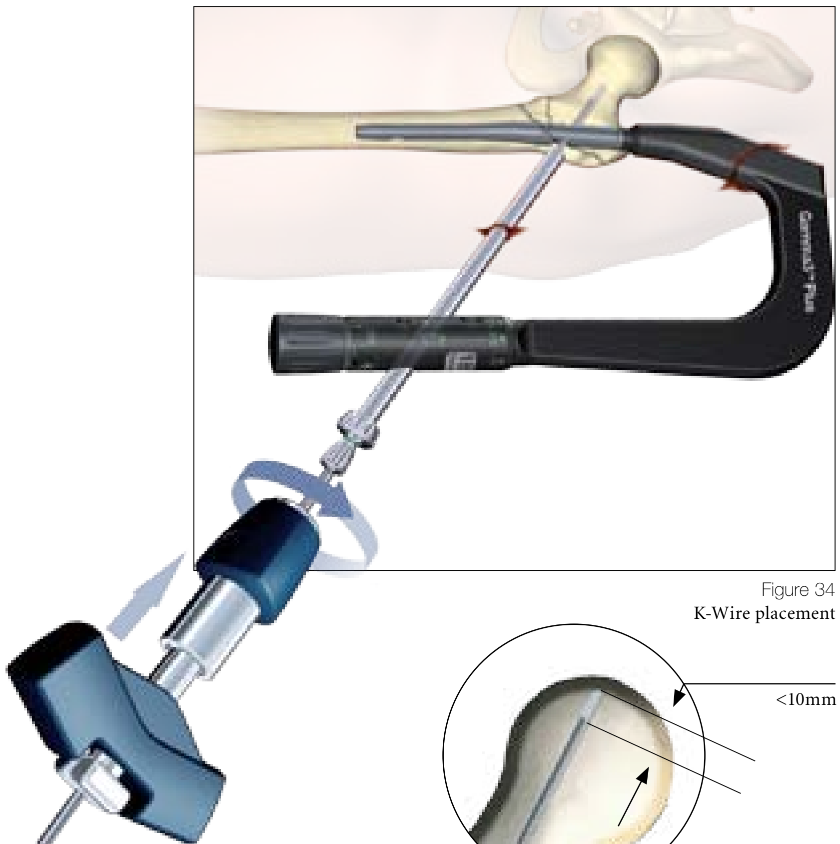


Figure 34
K-Wire placement

The 3.2 x 450mm K-Wire (Cat No. 1210-6450S) is inserted through the K-Wire Sleeve and advanced to the bone (Figure 34), using the Guide Wire Handle (Cat No. 1806-0095 and 1806-0096). 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 mid-line in the lateral plane (Figure 35).

Check the position with the image intensifier in both the A/P and M/L views to ensure proper K-Wire positioning.

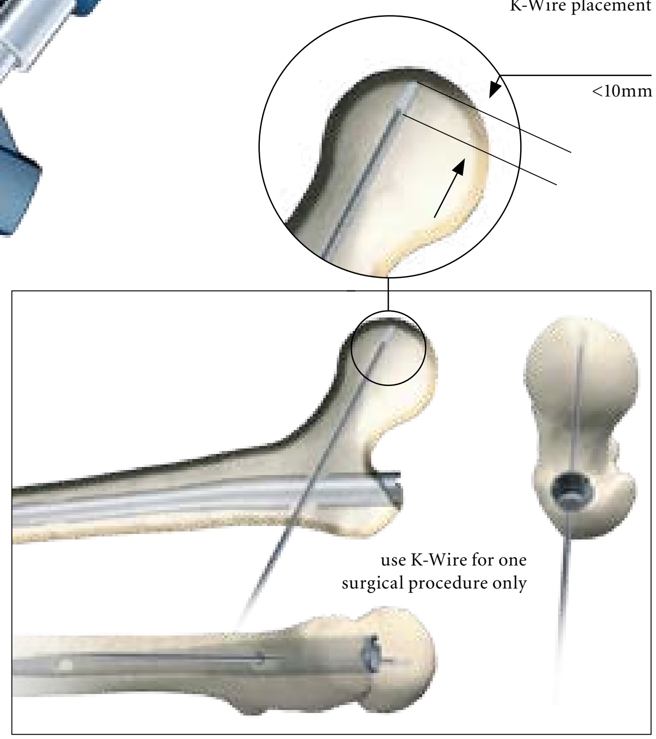


Figure 35
K-Wire placement

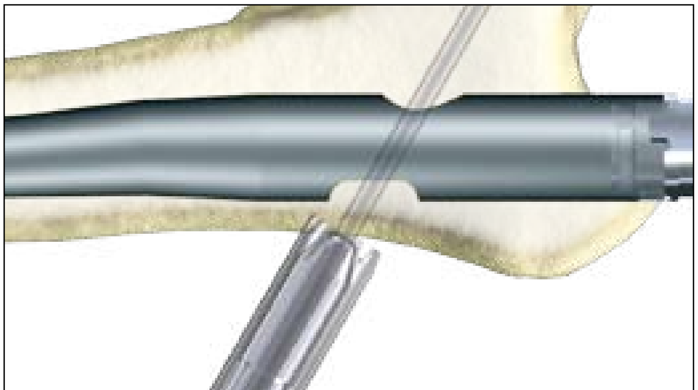


Figure 36

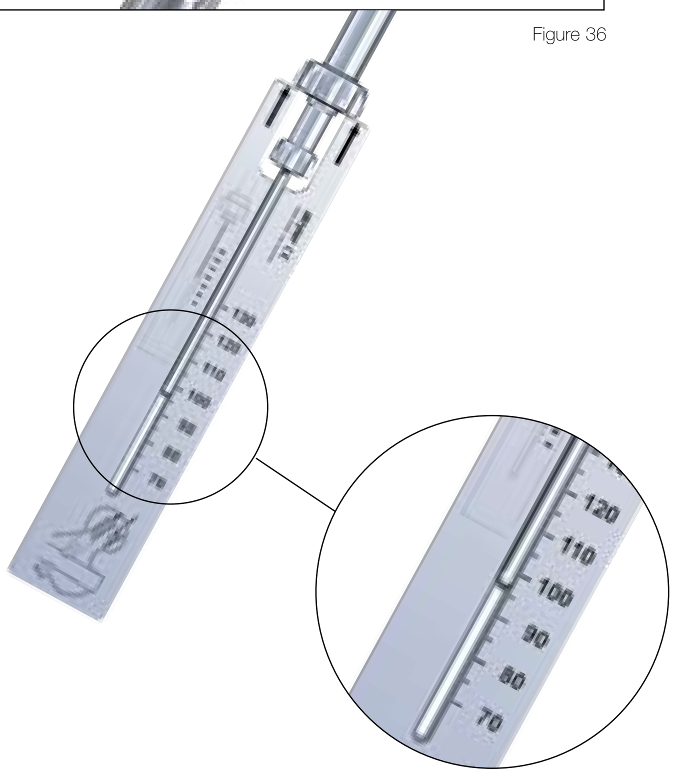


Figure 37
Lag Screw Length Measurement

Lag Screw Insertion

After proper positioning of the K-Wire, the required Lag Screw length is measured using the Lag Screw Ruler (Cat. No. 1320-0180).

Note:

Before measuring, ensure that the Lag Screw Guide Sleeve is still pressed firmly against the bone (Figure 36).

Measure the appropriate Lag Screw length directly off of the Guide Wire with the Lag Screw Ruler (Figure 37).

If the measurement falls between markings on the scale, e. g. 97mm, it should always be rounded up to the next higher value, e. g. 100mm.

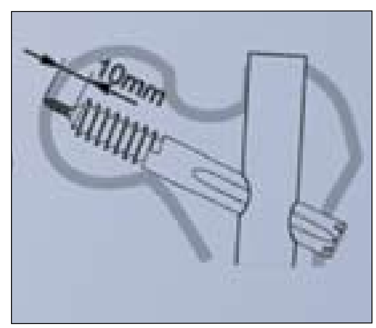


Figure 37a
Suggested Pin Placement

The Lag Screw length measurement is set with the adjustable stop on the Lag Screw Step Drill (Cat. No. 1320-0190). The appropriate length must be visible in the Step Drill "window". (Figure 38 & 39).

The K-Wire Sleeve is removed and the Lag Screw Step Drill, set to the appropriate length, is passed over the K-Wire, through the Lag Screw Guide Sleeve (Figure 40).

The channel for the Lag Screw may be prepared using the T-Handle (Cat. No. 702628) connected to the Lag Screw Step Drill.

Drilling should continue until the Step Drill Stop comes into contact with the Lag Screw Guide Sleeve (Figure 40a).

Drilling should be performed under image intensifier control to avoid penetration of the hip joint. The K-Wire may also be observed in the K-Wire window of the Step Drill (Figure 40b).

Note:

It is important to observe the K-Wire tip during drilling on the C-Arm. Additionally, the K-Wire window provides another means for monitoring the K-Wire position.

Figure 38

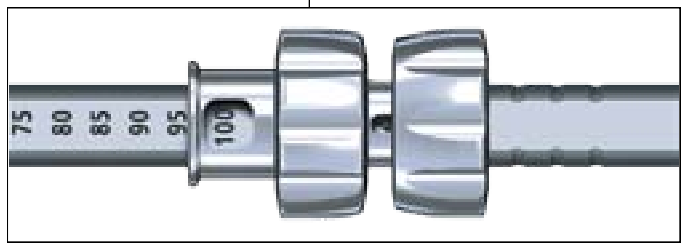


Figure 39

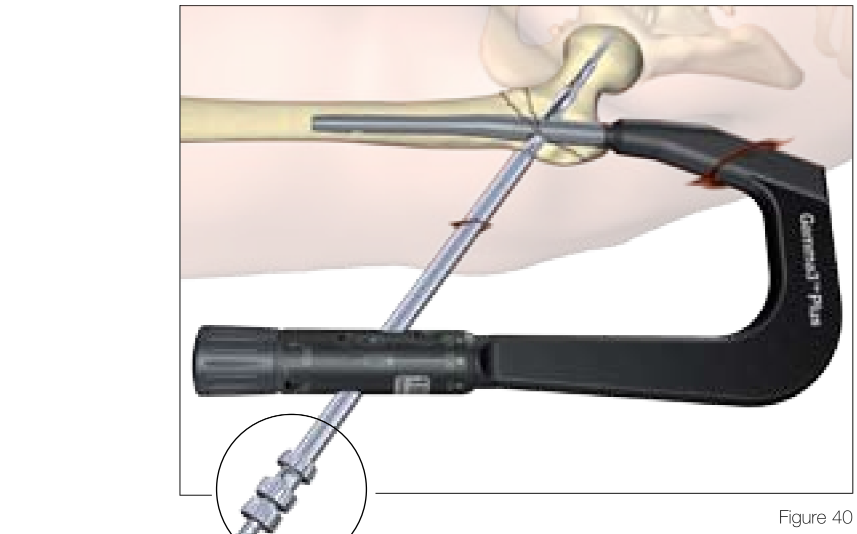


Figure 40

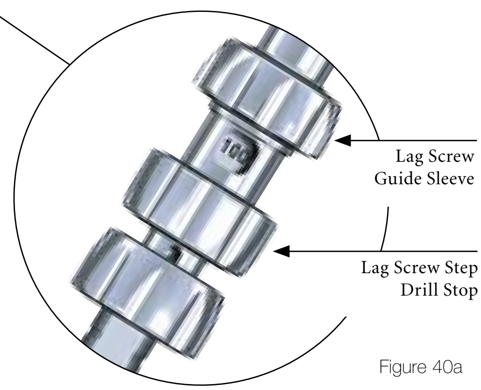


Figure 40a

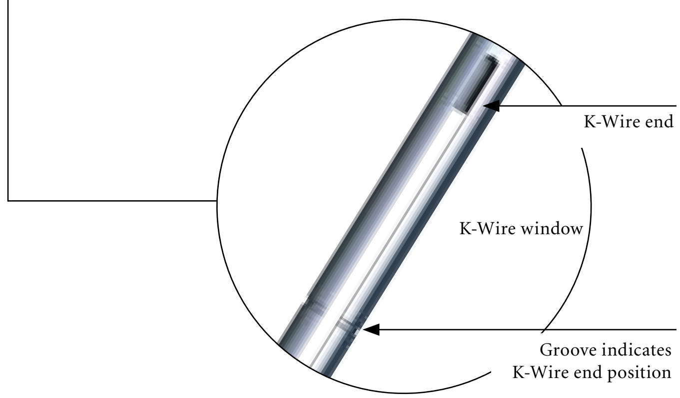


Figure 40b

Figure 41

Check on image intensifier during drilling to monitor the depth of the drill as it approaches subchondral bone.

Approximately 8 to 10mm of K-Wire will remain outside of the Step Drill. This additional length of K-Wire is to provide a margin of safety so that the Step Drill does not penetrate the joint (Figure 41).

The appropriate length of the Lag Screw should be the same as that of the Step Drill. The screw is then assembled to the Lag Screwdriver (Cat. No. 1320-0200).

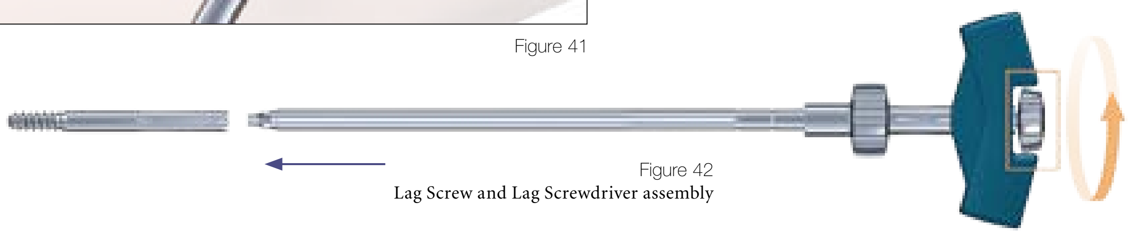


Figure 42
Lag Screw and Lag Screwdriver assembly

Figure 43

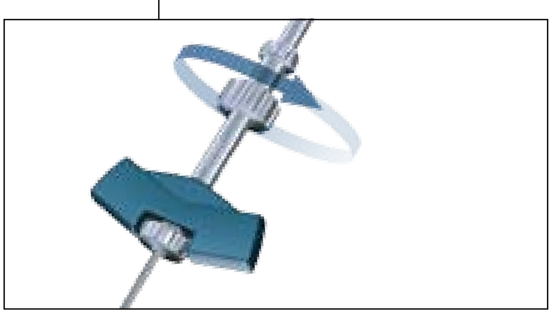


Figure 43a

Ensure that the Lag Screw is firmly attached to the Lag Screwdriver (Figure 42).

Compression across the fracture site may be applied by selecting a Lag Screw 5mm shorter than originally measured (see Compression/Apposition below).

The Lag Screw assembly is now passed over the K-Wire, through the Lag Screw Guide Sleeve and threaded into the femoral head. Check the end position of the Lag Screw on the image intensifier.

Compression / Apposition

If compression or apposition of the fracture gap is required, this can be achieved by gently turning the thumbwheel of the Lag Screwdriver clockwise against the Guide Sleeve (Figure 43). Before starting compression, make sure that the Lag Screw Guide Sleeve is unlocked to allow for free sliding. To unlock the Lag Screw Guide Sleeve, the Knob is turned counter-clockwise. In osteoporotic bone, care must be taken to prevent Lag Screw pullout in the femoral head. The Lag Screw chosen should be shorter depending on the expected amount of compression.

Gamma3 Nail
Operative Technique

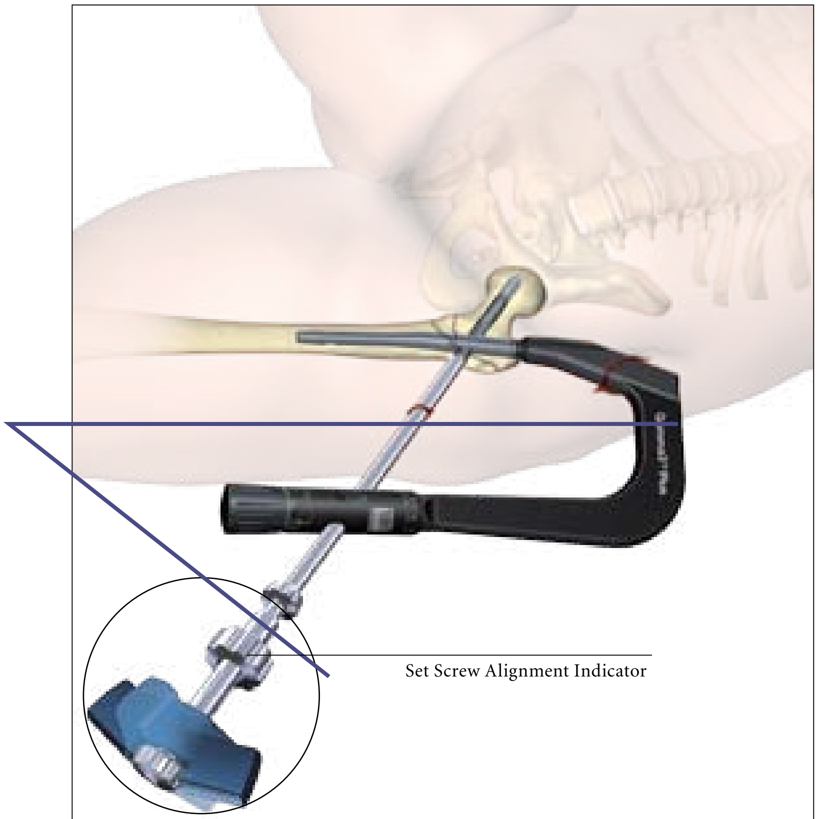


Figure 44
T-handle end position

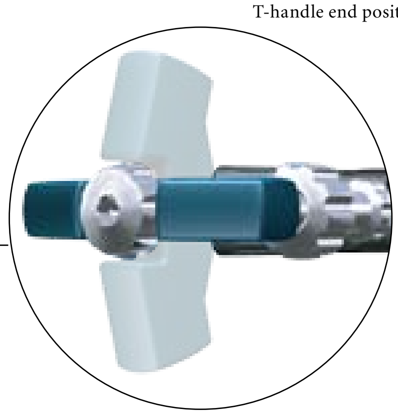


Figure 45
Set Screw insertion

Lag Screw Fixation

The handle of the Lag Screwdriver must either be parallel or perpendicular (90°) to the Targeting Arm so that the Set Screw will engage one of the grooves of the Lag Screw shaft (Figure 44).

If the T-Handle is not perpendicular or parallel to the Targeting Arm, turn it clockwise until it reaches this position.

DO NOT TURN THE LAG SCREW COUNTER-CLOCKWISE.

If the K-Wire is inadvertently removed, the Lag Screw may still be inserted without it, provided that the Guide Sleeve is still in contact with the cortex.

Note:

The Lag Screw should be placed in the pre-drilled hole in order to provide maximum resistance to cut out. The Lag Screw should not be turned counter-clockwise after the final position is reached, otherwise the Lag Screw may lose bony contact at the tip.

The Set Screw is inserted through the Targeting Device and Nail Holding Bolt, and while in place, attached to the nail with the Set Screwdriver. Turn the Set Screw until contact is made with one of the grooves of the Lag Screw (Figure 45).

Note:

The handle of the Lag Screwdriver is either parallel or at right angles (90°) to the Targeting Arm for proper placement of the Set Screw.

To verify the correct position of the Set Screw, turn the Lag Screwdriver gently clockwise and counter-clockwise. If resistance is met, the Set Screw is in place. If the Lag Screw moves, re-align the handle and tighten the Set Screw again until it engages in one of the four grooves.

After slightly tightening the Set Screw it should then be backed out by one quarter (¼) turn. This allows the Lag Screw to slide freely while maintaining rotational control of the Lag Screw (Figure 46).

Note:

Proper Set Screw placement is critical to the sliding characteristics of the Lag Screw. Do not unscrew the Set Screw more than ¼ turn.

If distal locking is not indicated, an End Cap may be inserted at this point to prevent bony ingrowth at this stage of the procedure. To insert the appropriate size End Cap the Lag Screwdriver is left in place as the Nail Holding Bolt is removed. Once the Nail Holding Bolt is removed an End Cap may be inserted through the Targeting Arm.

Alternatively the End Cap may be inserted free-hand after removal of the Targeting Device.

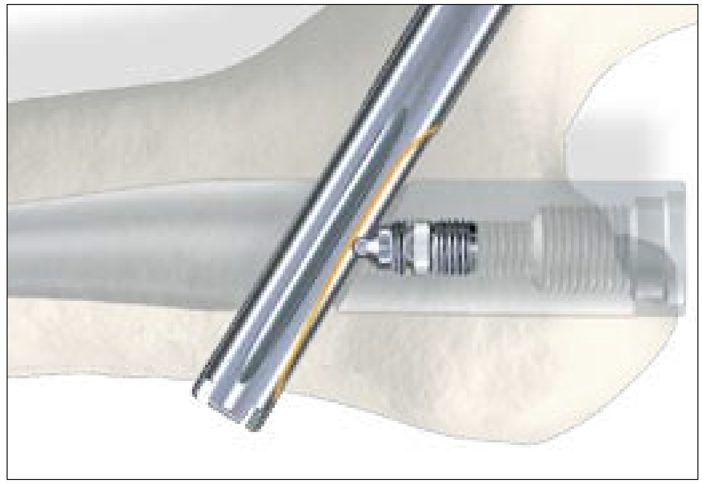


Figure 46

Distal Screw Locking

Disconnect the Lag Screwdriver by loosening the end thumbwheel, remove the Lag Screwdriver, Lag Screw Guide Sleeve and the K-Wire. The nature of the fracture determines whether the distal Locking Screw is used.

It should be used:
• If the fracture is unstable
• If rotational stability is required
• When there is a wide disparity between the diameter of the nail and the femoral cavity

Gamma3 nails offer the possibility to be locked distally either dynamically or statically. The fracture pattern determines the method of distal locking.

Note:
These following points must be considered in order to perform a proper distal locking procedure:

• Ensure that the Nail Holding Bolt is still fully tightened
• Avoid soft tissue pressure on the distal locking sleeve assembly; therefore, the skin incision should be made co-linear in the direction of the sleeve assembly
• Check that the distal locking sleeve assembly, with the trocar removed, is in contact with the lateral cortex of the Femur and is locked securely with the Knob. Confirm final locking screw placement with A/P and Lateral flouroscopic X-Ray views
• Neutralize the power tool weight during drilling procedure and do not apply force to the Targeting Arm
• Start the power tool before having bone contact with the drill
• Use sharp and center tipped drills only

The Carbon Fiber Targeting Device offers the options of guided distal locking in a dynamic or static position of the nail. The green coded Targeting Sleeve of the Target Arm has to be adjusted in the required position. In the following description, a dynamic locking will be described. Turn the Targeting Sleeve until you reach the dynamic position with the point on the Target Sleeve is in line where the arrow on the target arm. Push the sleeve up in the cranial direction. Now assemble the Distal Tissue Protector, Drill Guide Sleeve and Trocar and advance it through the hole of the Target Arm down to the skin.

A small incision is started at the tip of the Trocar, and is extended down to the lateral cortex (Fig. 48). The Trocar will extend back of the sleeve by approx. 3mm when the Tissue Protection Sleeve has reached the lateral cortex (Fig. 49).

Figure 47

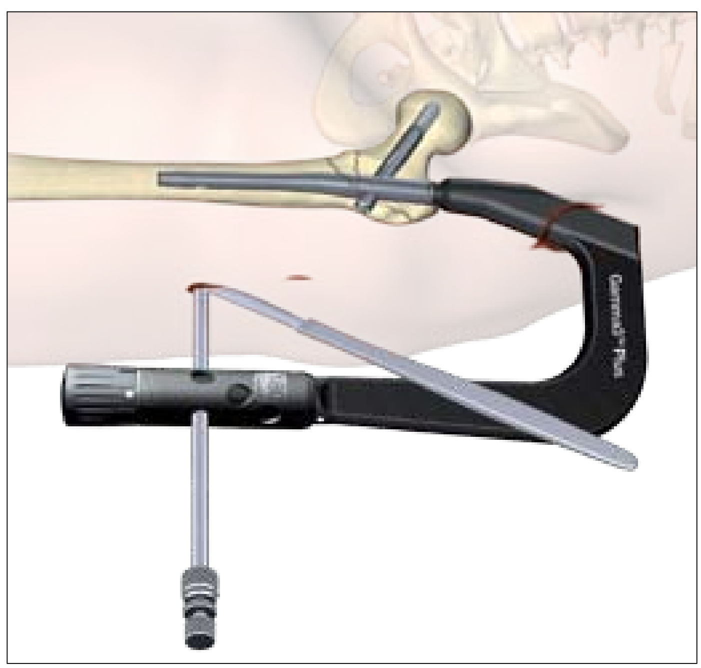


Figure 48

Before locking the sleeve, gently turn the Knob clockwise, making sure that the Tissue Protection Sleeve is in good contact to the bone (Fig. 49).

The Trocar is now removed and replaced by the calibrated green coded 4.2mm × 300mm drill. Drill through the first cortex and as the second cortex is reached read off the measurement on the drill scale. Add the thickness of the cortex, which is approximately 5mm, to this measurement to select the correct screw length (Fig. 49a).

Alternatively, the drill can be drilled through the second cortex and monitored by X-ray or image intensifier. The screw length can then be **read directly** from the scale on the drill (Fig. 49a). Proceed to drill the second cortex.

It is also possible to measure the correct screw length using the Screw Gauge after drilling through the second cortex. The Drill Guide Sleeve must be removed and the Screw Gauge may be advanced through the Tissue Protection Sleeve. Put the small hook behind the medial cortex and read the required locking screw length from the scale.

Insert the 5mm distal Locking Screw through the Distal Tissue Protector by using the 3.5mm Screwdriver until the mark on the Screwdriver shaft approaches the Protector; advance the screw head carefully until it is slightly in direct contact with the cortex (Fig. 49a).

Note:
When the mark on the Screwdriver shaft reaches the Tissue Protection Sleeve, this indicates that the screw head is near the cortex (Fig. 49a). Take care not to overscrew. The screw head should come just into contact with the cortex and resistance should be felt.

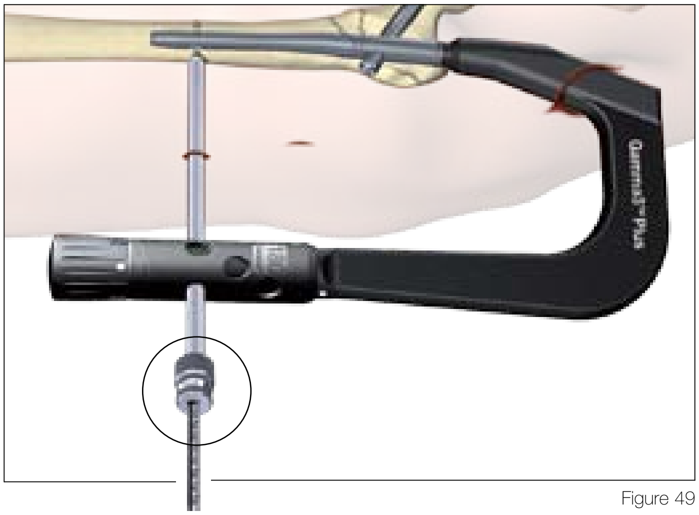


Figure 49

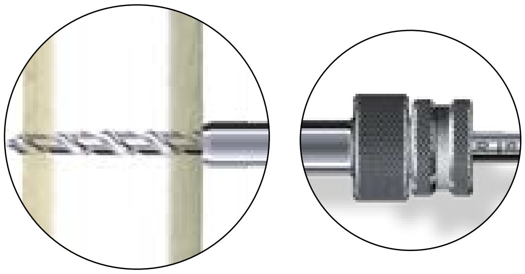


Figure 49a

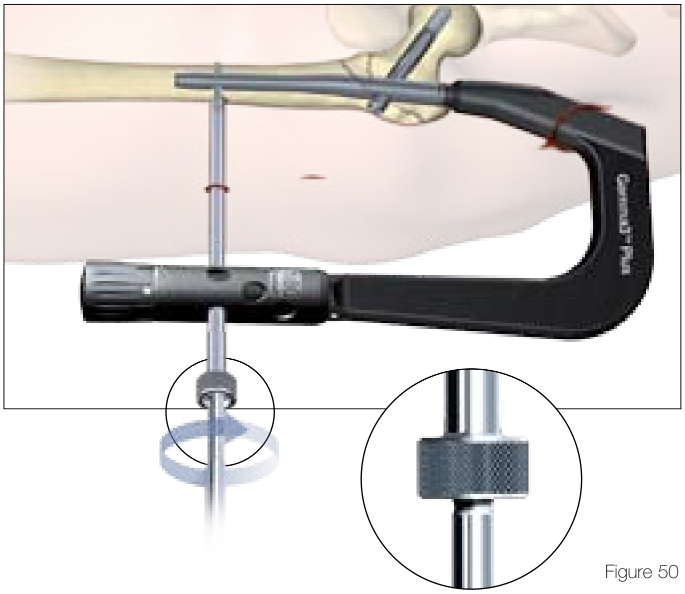


Figure 50

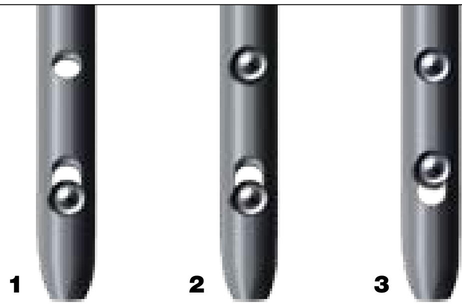


Figure 51

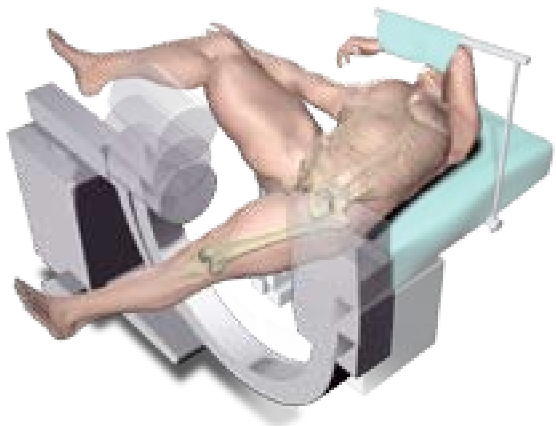
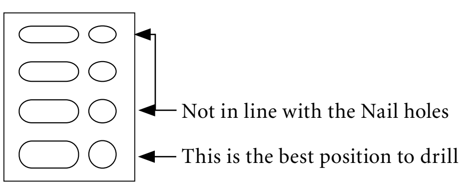


Figure 51a



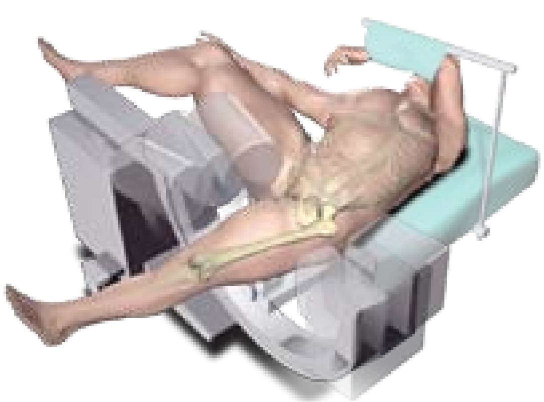
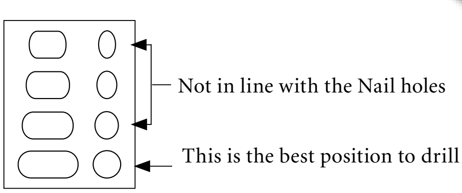


Figure 51b



Distal Screw Locking of the Long Gamma3 Nail

For distal locking, the Long Gamma3 Nail offers the following three options (Figure 51).

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 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 portion of the oblong hole.

Disconnect the Lag Screwdriver by loosening the end thumbwheel, remove the Lag Screwdriver, Lag Screw Guide Sleeve and the K-Wire. The nature of the fracture determines whether the distal Locking Screw is used.

It should be used:

- If the fracture is unstable
- If rotational stability is required
- When there is a wide disparity between the diameter of the nail and the femoral cavity

Visualizing the Distal Holes

The essential first step in distal targeting is to position the image intensifier so that the upper 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 51a and 51b). It is advised to correct image in one plane at a time.

Distal Screw Locking of the Long Gamma3 Nail

Free-hand Technique

The free-hand technique is used to insert Locking Screws into the distal holes of the nail. Rotational alignment must be checked prior to locking the nail. Distal nail locking is described as follows, using the Static Locking mode according to Figure 51, Number 3.

The center-tipped 4.2 x 180mm Drill (Cat. No. 1806-4270S) is held at an oblique angle to the center of the locking hole (Figure 53). Upon X-ray verification, the Drill is placed perpendicular to the nail and drilled through the lateral and medial cortex. Confirm in both the A/P and M/L planes by X-ray that the Drill passes through the hole in the nail.

After drilling both cortices, the screw length may be read directly off of the Long Screw Scale (Cat. No. 1806-0365) at the green ring on the center tipped Drill.

It is also possible to measure the correct screw length using the Screw Gauge (Cat. No. 1806-0480) after drilling through the second cortex. Put the small hook behind the medial cortex and read the required locking screw length from the scale (Figure 53).

Insert the 5mm distal Locking Screw (Figure 54) using the 3.5mm Screwdriver and advance the screw carefully until it comes into contact with the cortex (Figure 55).

Important Note:

Take care not to over tighten. The screw head should come just into contact with the cortex and resistance felt.

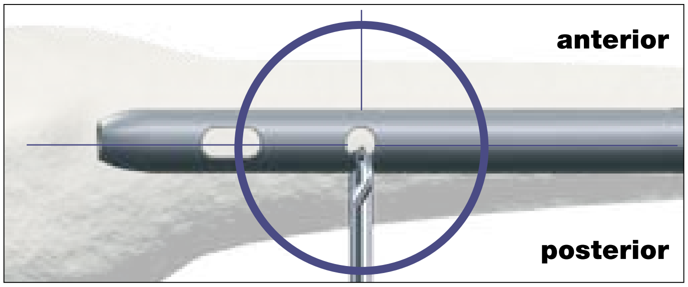


Figure 52

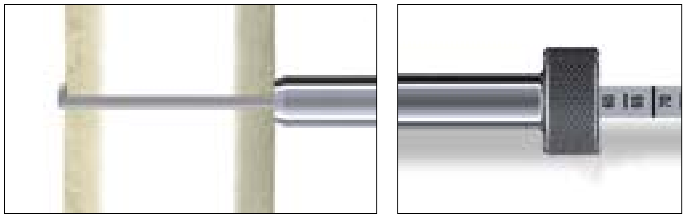


Figure 53

Figure 54

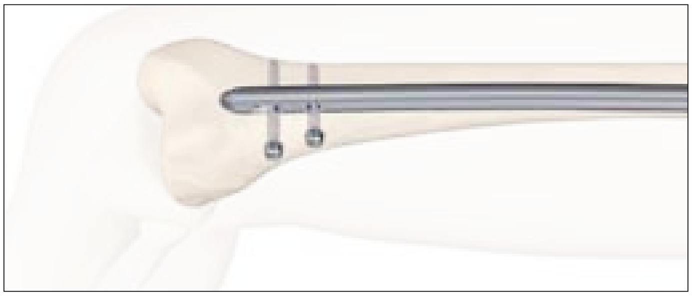


Figure 55

End Cap Insertion

It is recommended to use an End Cap to prevent bony ingrowth.

Leave the Screwdriver for distal locking in place to stabilize the Targeting Device and remove the Nail Holding Bolt. Load the Standard Size End Cap (Cat. No. 3005-1100S) onto the Screwdriver (Cat. No. 1320-0065) and pass the assembly through the top of the Targeting Device down into the nail (Figure 56).

Alternatively, the End Cap may be inserted free hand after removal of the Targeting Device.

End Cap (size Standard)
Cat. No. 3005-1100S

Once the End Cap is in place, remove the Distal Screwdriver and Targeting Device (Figure 57). The wounds are closed in the usual manner.

Figure 56
End Cap assembly

Figure 57
Final Nail assembly

Gamma3 Nail
Operative Technique

Nail Extension End Caps

If the proximal end of the nail is counter sunk into the bone and cortical bone support is required, End Caps in sizes +5mm and +10mm are available.

Note:

Extended End Caps may only be inserted free hand after the Targeting Device has been removed.

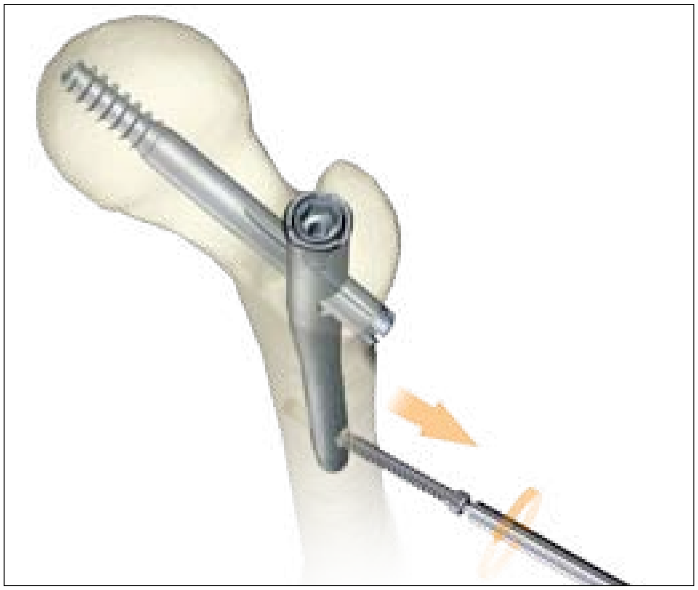


Figure 58

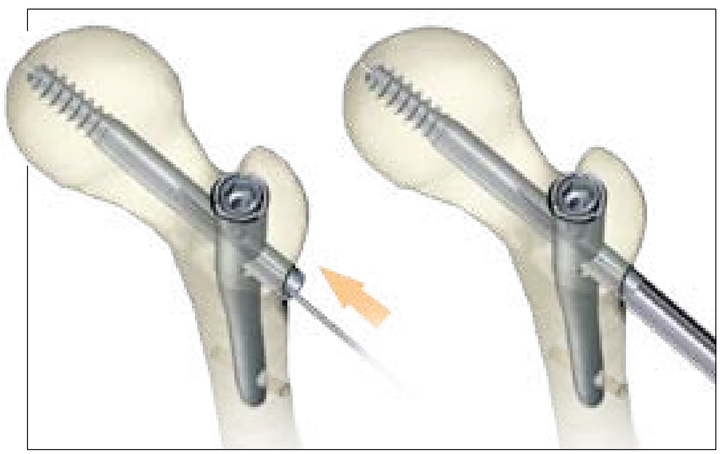


Figure 59

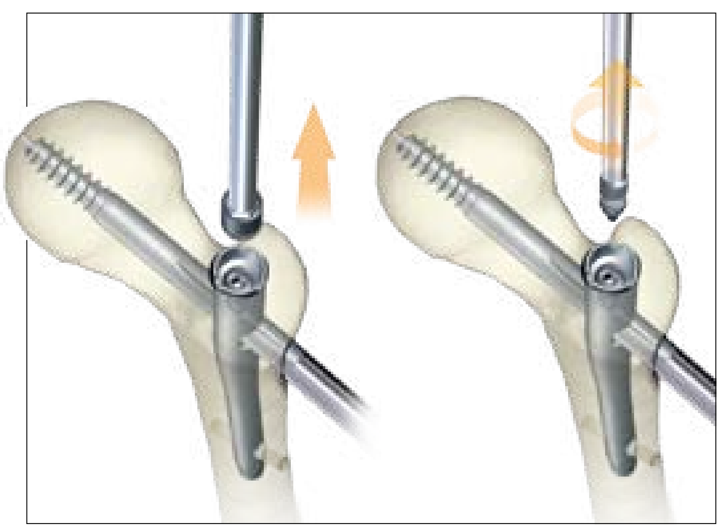


Figure 60

Extraction of the Gamma3 Implants

When implant extraction is indicated, please proceed as follows:

Step I (Figure 58)

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

Step II (Figure 59)

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.

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 may be much more difficult. Tighten the Lag Screwdriver to the Lag Screw by turning the thumbwheel clockwise.

Step III (Figure 60)

An incision is made over the proximal end of the nail. The proximal End Cap if present is removed using the Ball Tip Screwdriver or Strike Plate (Cat. No. 1320-0070), and the Set Screwdriver is engaged into the Set Screw. The screw is rotated counter-clockwise until it is removed.

Step IV (Figure 61)

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

Step V (Figure 62)

An appropriate Sliding Hammer assembly is attached to the Extraction Rod and the nail is extracted.

Note:

It may be useful to turn the Lag Screw Screwdriver slightly clockwise to loosen any bony ingrowth into the screw threads before turning it counter-clockwise.

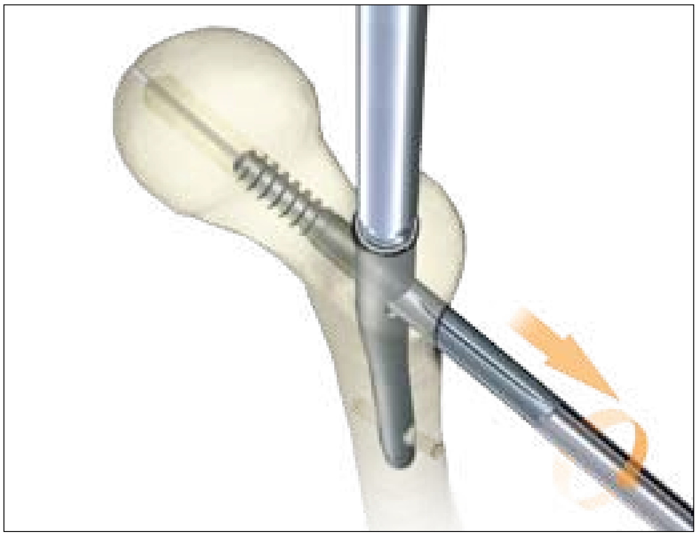


Figure 61

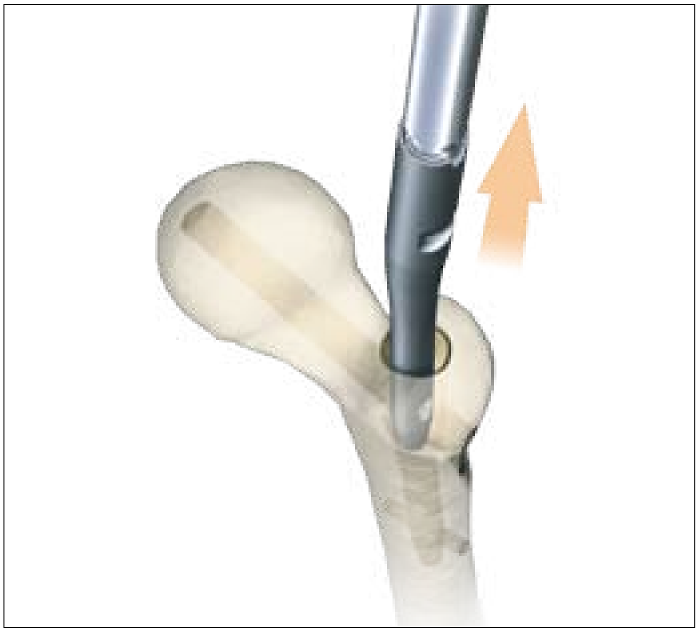
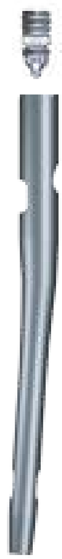


Figure 62

Ordering Information
Titanium Implants

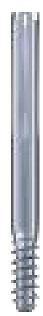
Gamma3 Trochanteric Nail Kit, Ti (includes Set Screw)

Cat. No.	Diameter mm	Length mm
3120-1180S	15.5/11	180mm x 120°
3125-1180S	15.5/11	180mm x 125°
3130-1180S	15.5/11	180mm x 130°



Lag Screw, Ti

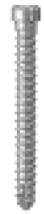
Cat. No.	Diameter mm	Length mm
3060-0075S	10.5	75mm
3060-0080S	10.5	80mm
3060-0085S	10.5	85mm
3060-0090S	10.5	90mm
3060-0095S	10.5	95mm
3060-0100S	10.5	100mm
3060-0105S	10.5	105mm
3060-0110S	10.5	110mm
3060-0115S	10.5	115mm
3060-0120S	10.5	120mm



Set Screw, Ti
(available separately)

Cat. No.	Diameter mm	Length mm
3003-0822S	8	17.5mm

5mm Fully Threaded Locking Screw, Ti



Cat. No.	Diameter mm	Length mm
1896-5025S	5.0	25
1896-5027S	5.0	27.5
1896-5030S	5.0	30
1896-5032S	5.0	32.5
1896-5035S	5.0	35
1896-5037S	5.0	37.5
1896-5040S	5.0	40
1896-5042S	5.0	42.5
1896-5045S	5.0	45
1896-5050S	5.0	50
1896-5055S	5.0	55
1896-5060S	5.0	60
1896-5065S	5.0	65
1896-5070S	5.0	70
1896-5075S	5.0	75
1896-5080S	5.0	80
1896-5085S	5.0	85
1896-5090S	5.0	90
1896-5095S	5.0	95
1896-5100S	5.0	100
1896-5105S	5.0	105
1896-5110S	5.0	110
1896-5115S	5.0	115
1896-5120S	5.0	120

End Caps, Ti

Cat. No.	Diameter mm	Length mm
3005-1100S	11.0	Standard
3005-1105S	15.5	+5
3005-1110S	15.5	+10

S=Sterile

Ordering Information
Titanium Implants

Long Gamma3 Nail Kit
R2.0, Ti (includes Set Screw)
Right

Cat. No.	Diameter mm	Length mm
3220-0280S	11	280 x 120°, Right
3220-0300S	11	300 x 120°, Right
3220-0320S	11	320 x 120°, Right
3220-0340S	11	340 x 120°, Right
3220-0360S	11	360 x 120°, Right
3220-0380S	11	380 x 120°, Right
3220-0400S	11	400 x 120°, Right
3220-0420S	11	420 x 120°, Right
3220-0440S	11	440 x 120°, Right
3220-0460S	11	460 x 120°, Right
3220-0480S*	11	480 x 120°, Right
3225-0280S	11	280 x 125°, Right
3225-0300S	11	300 x 125°, Right
3225-0320S	11	320 x 125°, Right
3225-0340S	11	340 x 125°, Right
3225-0360S	11	360 x 125°, Right
3225-0380S	11	380 x 125°, Right
3225-0400S	11	400 x 125°, Right
3225-0420S	11	420 x 125°, Right
3225-0440S	11	440 x 125°, Right
3225-0460S	11	460 x 125°, Right
3225-0480S*	11	480 x 125°, Right
3230-0280S	11	280 x 130°, Right
3230-0300S	11	300 x 130°, Right
3230-0320S	11	320 x 130°, Right
3230-0340S	11	340 x 130°, Right
3230-0360S	11	360 x 130°, Right
3230-0380S	11	380 x 130°, Right
3230-0400S	11	400 x 130°, Right
3230-0420S	11	420 x 130°, Right
3230-0440S	11	440 x 130°, Right
3230-0460S	11	460 x 130°, Right
3230-0480S*	11	480 x 130°, Right

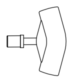
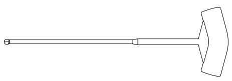
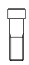
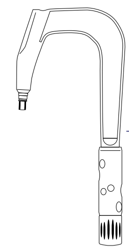
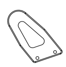
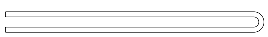
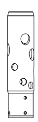
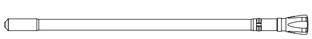
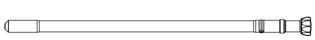
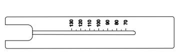
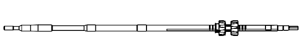
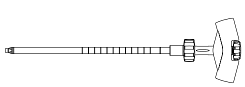
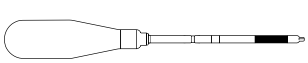
Long Gamma3 Nail Kit
R2.0, Ti (includes Set Screw)
Left

Cat. No.	Diameter mm	Length mm
3320-0280S	11	280 x 120°, Left
3320-0300S	11	300 x 120°, Left
3320-0320S	11	320 x 120°, Left
3320-0340S	11	340 x 120°, Left
3320-0360S	11	360 x 120°, Left
3320-0380S	11	380 x 120°, Left
3320-0400S	11	400 x 120°, Left
3320-0420S	11	420 x 120°, Left
3320-0440S	11	440 x 120°, Left
3320-0460S	11	460 x 120°, Left
3320-0480S*	11	480 x 120°, Left
3325-0280S	11	280 x 125°, Left
3325-0300S	11	300 x 125°, Left
3325-0320S	11	320 x 125°, Left
3325-0340S	11	340 x 125°, Left
3325-0360S	11	360 x 125°, Left
3325-0380S	11	380 x 125°, Left
3325-0400S	11	400 x 125°, Left
3325-0420S	11	420 x 125°, Left
3325-0440S	11	440 x 125°, Left
3325-0460S	11	460 x 125°, Left
3325-0480S*	11	480 x 125°, Left
3330-0280S	11	280 x 130°, Left
3330-0300S	11	300 x 130°, Left
3330-0320S	11	320 x 130°, Left
3330-0340S	11	340 x 130°, Left
3330-0360S	11	360 x 130°, Left
3330-0380S	11	380 x 130°, Left
3330-0400S	11	400 x 130°, Left
3330-0420S	11	420 x 130°, Left
3330-0440S	11	440 x 130°, Left
3330-0460S	11	460 x 130°, Left
3330-0480S*	11	480 x 130°, Left

*Special order only

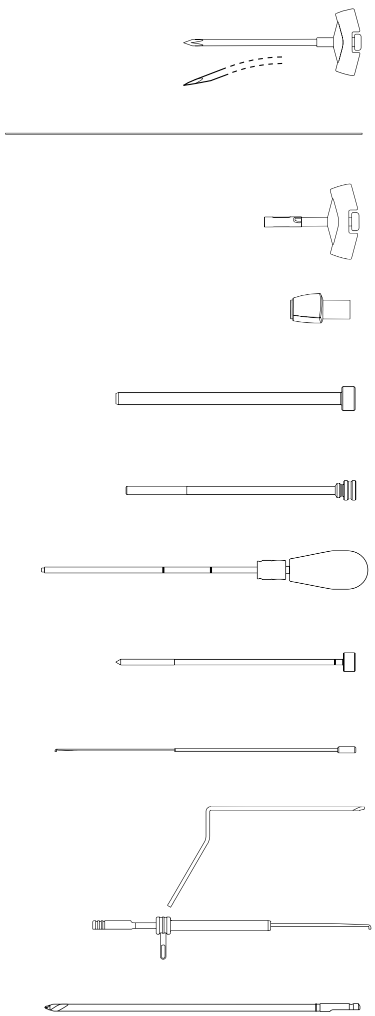
Ordering Information
Instruments

Gamma3 Plus Instruments

	Cat. No	Description
	702628	T-Handle, Quicklock
	1210-6450S	K-Wire, 3.2 x 450mm, Sterile
	1320-0065	Screwdriver 8mm, Ball-Tip, T-Handle
	1320-0990	Nail Holding Bolt
	1320-1000	Gamma3 Plus Targeting Arm
	1320-0105	Knob for Targeting Sleeve
	1320-0110	Clip for K-Wire
	1320-0112	Clip for U-Wire
	1320-0118	Targeting Sleeve
	1320-0130	Lag Screw Guide Sleeve
	1320-0140	Drill Guide Sleeve (4.2mm for Drill Cat. No. 1320-3042S)
	1320-0150	K-Wire Sleeve
	1320-0180	Lag Screw Ruler
	1320-0190	Lag Screw Step Drill
	1320-0200	Lag Screwdriver
	1320-0232	Set Screwdriver 4mm, Flexible Shaft
	1320-3042S	Drill, 4.2 x 300mm, AO Small, Sterile

Ordering Information
Instruments

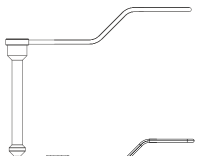
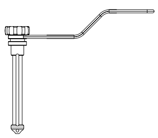
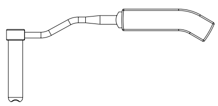
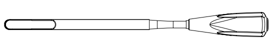
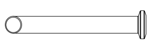
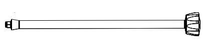
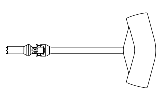
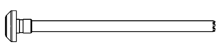
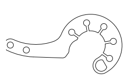
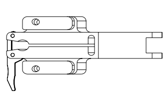
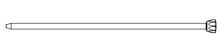
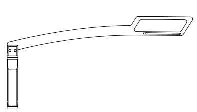
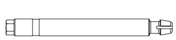
Gamma3 Plus Instruments



Cat. No	Description
1806-0041	Awl, Curved, Cannulated
1806-0085S	Guide Wire, Ball Tipped 3 x 1000mm, Sterile
1806-0095	Guide Wire Handle
1806-0096	Guide Wire Handle Chuck
1806-0185	Tissue Protection Sleeve, Long (Distal)
1320-0215	Drill Sleeve, Long (Distal)
1806-0232	Screwdriver, Long
1320-0315	Trocar, Long (Distal)
1806-0325	Screw Gauge, Long
1806-0365	Screw Scale, Long (for Long Nail)
1806-0480	Screw Gauge (for Long Nail)
1806-4270S	Drill, 4.2 x 180mm, AO Small, Sterile (for Long Nail)
1320-9210	Instrument Set, Plus, Complete with Instruments
1320-9200	Instrument Tray, Basic, Empty
1320-0002	X-Ray Template Trochanteric Gamma3
1320-0005	X-Ray Template Long Gamma3, R 2.0

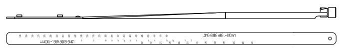
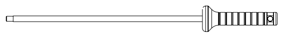
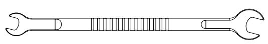
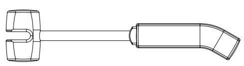
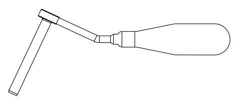
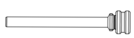
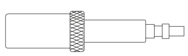
Ordering Information
Instruments

Gamma3 Optional Instruments

	Cat. No	Description
	1213-9091S	Guide Pin for Cannulated Cutter, 4.0 x 400mm, Sterile
	1320-0011	One Step Conical Reamer
	1320-0021 1320-0022	Conical Reamer, Trocar, Short (Shown) Conical Reamer, Trocar, Long
	1320-0026 1320-0027	Multi-hole Trocar, Short (Shown) Multi-hole Trocar, Long
	1320-0031 1320-0032	Conical Reamer Sleeve, Short (Shown) Conical Reamer Sleeve, Long
	1320-0041	Cannulated Cutter
	1320-0042	Sleeve for Cannulated Cutter
	1320-0070	Screwdriver Strike Plate
	1320-0080	Universal Socket Wrench (for Nail Holding Bolt)
	1320-0131	Lag Screw Guide Sleeve, Navigated
	1320-0135	Adaptor for One Shot Device, Gamma
	1320-0160	Fragment Control Clip not compatible with Gamma3 Plus Targeting System
	1320-0170	Fragment Control Sleeve
	1320-3010	One Shot Device, Gamma3
	1320-3030S	Drill, 3.0 x 300mm, AO Small, Sterile
	1407-4006	Nail Extraction Adapter

Ordering Information
Instruments

Gamma3 Optional Instruments

	Cat. No	Description
	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
	1806-0450	Tissue Protection Sleeve
	1806-0460	Drill Sleeve 4.2mm
	1806-4290S	Drill, 4.2 x 230mm, AO Small, Sterile (for Long Nail)
	702634	Large A/O Hall Adaptor
	1320-9005	Optional Instrument Tray, Empty

Notes

Notes

Joint Replacements

Trauma, Extremities & Deformities

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MS/GS 02/09