Orthofix VeroNail
Trochanteric Nail
INTRODUCTION

FEATURES AND BENEFITS

INDICATIONS

EQUIPMENT REQUIRED

Cleaning, disinfection, sterilisation and maintainance of instrumentation

OPERATIVE TECHNIQUE

Fracture reduction in the frontal plane

Fracture reduction in the sagittal plane with the “PORD” device

Nail insertion

Proximal locking

Distal locking

POST-OPERATIVE MANAGEMENT

NAIL EXTRACTION

Orthofix wishes to thank the following surgeons for their contribution to the development of the technique:

A. ARAZOZA, MD
R. AULISA, MD
F. CHERUBINO, MD
O. DEWITT, MD
P.L. DI SEGLIO, MD
N. GALANTE, MD
R. GORMAN, MD
F. LAVINI, MD
W. LEONARDI, MD
M. MANCA, MD
U. MARKERT, MD
T. OLIVER, MD
L. RENZI-BRIVIO, MD
INTRODUCTION

Pertrochanteric fractures are becoming more frequent as the average age of the population increases. Around 80% of these fractures occur in patients over 70 years of age, with the incidence in women twice that of men. In 1990 there were about 1.7 million proximal femoral fractures worldwide, and the projected estimate in 2050 is for around 4.5 million. The effect of these fractures is frequently devastating. As a result, the social impact is high and the relative costs of treatment are increasing. For this reason, surgeons are looking for methods of osteosynthesis that will permit early mobilisation of the patient and a rapid return to pre-injury levels of independence.

Treatment of these fractures requires internal fixation with a sliding hip screw or intramedullary nail. Most established nail systems have a single cephalic screw, but implants with a double cephalic screw have been developed to improve rotational stability, reduce the torque on the head during insertion of a single large diameter screw, and provide improved stability in osteoporotic bone, reducing the incidence of cut-out (3.8%) present in nailing with a single cephalic screw.

The results of a study have recently been published, comparing single screw and double axis nails, showing that there are no significant differences between the two types of nail in terms of functional recovery or healing time (12 weeks on average). With regard to the most significant complications, diaphyseal fractures and cut-out phenomena were greater with the single cephalic screw, while secondary varus was seen more with the double cephalic screw. The Orthofix Trochanteric nail aims to combine the advantages of intramedullary nailing with high cephalic stability. Its proximal and distal diameter permits percutaneous insertion without reaming in the majority of elderly patients. The unique feature that distinguishes it from other double axis systems is the alternative configuration of the cephalic screws, with either two parallel sliding screws or two convergent screws locked to the nail. The surgeon therefore has a versatile instrument to treat all types of trochanteric fractures. The inventory is thus contained and the appropriate stability provided for early rehabilitation.

References


Bibliography

FEATURES AND BENEFITS

**Short nail (T79020)**

- *Titanium nail and locking screws*
  - Allow MRI investigation, if necessary

- **15 mm proximal diameter**
  - Avoids Trochanteric damage

- **10 mm distal diameter**
  - Reduces anterior cortex impingement
  - Reduces need for reaming

- **5 degree M/L bend**
  - Facilitates trochanteric insertion

- **200 mm length**
  - Addresses most fracture indications

**Long nail**

- **Length from 280 to 440 mm, in 20 mm increments**

Same features and benefits of Short Nail, plus:

- **Left and Right available**
  - Allow for anatomic reduction

- **280-440 mm (20 mm increments)**
  - Address anatomy and fracture needs

- **2000 mm radius**
  - Matches the average procurvatum of the femur

- **10 degree anteversion**
Proximal locking

Proximal locking is with two possible configurations: parallel by means of two sliding screws that permit controlled impaction of the fracture site, or convergent with two screws converging in the femoral head and locked firmly to the nail.

**Parallel Configuration**

The sliding screws (parallel configuration) are telescopic with a sleeve which is screwed into the nail, and a screw with a self drilling and tapping thread. In the parallel configuration the screw-nail angle is 128°. This combination of an angle favorable for sliding and the double axis fixation provides excellent rotational stability and conditions for controlled fracture impaction.

**Convergent Configuration**

In the convergent configuration the distal cephalic screw has a 128° neck angle and the proximal cephalic screw a 120° angle. The convergent configuration allows cephalic screws to be fitted in very narrow necks, and provides very stable fixation with locked screws for subtrochanteric fractures.

Distal locking

Distal locking is usually with a single screw that, depending on the type of fracture, may be static or dynamic, according to whether the screw is positioned in the round or oval hole. The non threaded, pegged design, allows for increased fatigue resistance of locking screw.
INDICATIONS


Fractures 31.A3 according to the AO classification.

31.A1
Static Distal Locking Screw Optional

31.A2
Static Distal Locking Screw Recommended

Dynamic Distal Locking Screw Recommended

Sliding Cephalic Screws when crossing the trochanteric fracture line

Converging Fixed Cephalic Screws when not crossing the fracture line

When using the long nail, distal locking will be static or dynamic depending upon the stability of the diaphyseal fracture pattern.

THE SLIDING SCREWS SHOULD NEVER BE INSERTED IN CONVERGENT MODE. THERE IS A RISK OF DIFFERENTIAL SCREW LOADING WHICH MIGHT CAUSE SCREW FAILURE.
EQUIPMENT REQUIRED

Nails and Nail End Cap

<table>
<thead>
<tr>
<th>Veronail Titanium Trochanteric Nail</th>
<th>99-T79020</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ø 15/10 mm L. 200 mm</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Veronail Titanium Trochanteric Long Nail, Left</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ø 15/10 L 280 mm</td>
</tr>
<tr>
<td>Ø 15/10 L 300 mm</td>
</tr>
<tr>
<td>Ø 15/10 L 320 mm</td>
</tr>
<tr>
<td>Ø 15/10 L 340 mm</td>
</tr>
<tr>
<td>Ø 15/10 L 360 mm</td>
</tr>
<tr>
<td>Ø 15/10 L 380 mm</td>
</tr>
<tr>
<td>Ø 15/10 L 400 mm</td>
</tr>
<tr>
<td>Ø 15/10 L 420 mm</td>
</tr>
<tr>
<td>Ø 15/10 L 440 mm</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Veronail Titanium Trochanteric Long Nail, Right</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ø 15/10 L 280 mm</td>
</tr>
<tr>
<td>Ø 15/10 L 300 mm</td>
</tr>
<tr>
<td>Ø 15/10 L 320 mm</td>
</tr>
<tr>
<td>Ø 15/10 L 340 mm</td>
</tr>
<tr>
<td>Ø 15/10 L 360 mm</td>
</tr>
<tr>
<td>Ø 15/10 L 380 mm</td>
</tr>
<tr>
<td>Ø 15/10 L 400 mm</td>
</tr>
<tr>
<td>Ø 15/10 L 420 mm</td>
</tr>
<tr>
<td>Ø 15/10 L 440 mm</td>
</tr>
</tbody>
</table>

| Veronail Titanium Nail End Cap, sterile      | 99-T79401  |

* in blue: primary nails

Cephalic Screws*

<table>
<thead>
<tr>
<th>Parallel (yellow)</th>
<th>Length</th>
<th>Convergent (green)</th>
<th>Length</th>
</tr>
</thead>
<tbody>
<tr>
<td>Parallel</td>
<td></td>
<td>Convergent</td>
<td></td>
</tr>
<tr>
<td>Length</td>
<td></td>
<td>Length</td>
<td></td>
</tr>
<tr>
<td>70</td>
<td>T79770</td>
<td>70</td>
<td>T79670</td>
</tr>
<tr>
<td>75</td>
<td>T79775</td>
<td>75</td>
<td>T79675</td>
</tr>
<tr>
<td>80</td>
<td>T79780</td>
<td>80</td>
<td>T79680</td>
</tr>
<tr>
<td>85</td>
<td>T79785</td>
<td>85</td>
<td>T79685</td>
</tr>
<tr>
<td>90</td>
<td>T79790</td>
<td>90</td>
<td>T79690</td>
</tr>
<tr>
<td>95</td>
<td>T79795</td>
<td>95</td>
<td>T79695</td>
</tr>
<tr>
<td>100</td>
<td>T79700</td>
<td>100</td>
<td>T79600</td>
</tr>
<tr>
<td>105</td>
<td>T79705</td>
<td>105</td>
<td>T79605</td>
</tr>
<tr>
<td>110</td>
<td>T79710</td>
<td>110</td>
<td>T79610</td>
</tr>
<tr>
<td>115</td>
<td>T79715</td>
<td>115</td>
<td>T79615</td>
</tr>
</tbody>
</table>

Distal Locking Screws (Ø 4.8 mm)

<table>
<thead>
<tr>
<th>Length</th>
<th>Length</th>
</tr>
</thead>
<tbody>
<tr>
<td>25</td>
<td>T79925</td>
</tr>
<tr>
<td>30</td>
<td>T79930</td>
</tr>
<tr>
<td>35</td>
<td>T79935</td>
</tr>
<tr>
<td>40</td>
<td>T79940</td>
</tr>
<tr>
<td>45</td>
<td>T79945</td>
</tr>
<tr>
<td>50</td>
<td>T79950</td>
</tr>
<tr>
<td>55</td>
<td>T79955</td>
</tr>
<tr>
<td>60</td>
<td>T79960</td>
</tr>
<tr>
<td>65</td>
<td>T79965</td>
</tr>
<tr>
<td>70</td>
<td>T79970</td>
</tr>
<tr>
<td>75</td>
<td>T79975</td>
</tr>
<tr>
<td>80</td>
<td>T79980</td>
</tr>
<tr>
<td>85</td>
<td>T79985</td>
</tr>
<tr>
<td>90</td>
<td>T79990</td>
</tr>
</tbody>
</table>

Cleaning, disinfection, sterilisation and maintenance of instrumentation

Orthofix supplies the titanium trochanteric nail, locking screws and end caps in a STERILE package, while the instruments are supplied NON-STERILE. Please check the sterility of each device on the product label.

The surgeon must check that the package has not been damaged and has not expired. The sterilised instruments used during the operation may be cleaned, disinfected and re-sterilised in an autoclave, as described in the instructions for use PQ TTN that accompany the product. If the package is damaged, or if there are doubts about its sterility, the implant may be re-sterilised in an autoclave, using a validated sterilisation protocol. The instruments are supplied in a non-sterile state and therefore must be cleaned before use, as described for new products. The whole cleaning, disinfection and sterilisation cycle must be followed before each use, as described in the instructions for use PQ TTN.

NB: Disassemble all instruments, including the Cephalic Screw Driver, for thorough cleaning and disinfection prior to sterilization.

* The Yellow, Sliding Screws are supplied with an integral sleeve that is screwed into the nail.
Instrumentation
The instruments are available in a specific sterilisation box (17995) that can contain:

**UPPER TRAY**

<table>
<thead>
<tr>
<th>No.</th>
<th>Instrument</th>
<th>Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Radiolucent Handle</td>
<td>17915</td>
</tr>
<tr>
<td>2</td>
<td>Insertion Knob</td>
<td>17935</td>
</tr>
<tr>
<td>3</td>
<td>Locking Rod</td>
<td>17930</td>
</tr>
<tr>
<td>4</td>
<td>Cannulated Awl</td>
<td>17975</td>
</tr>
<tr>
<td>5</td>
<td>Screw Guide Locking Cam</td>
<td>17926</td>
</tr>
<tr>
<td>6</td>
<td>Universal Chuck with T-Handle</td>
<td>17955</td>
</tr>
<tr>
<td>7</td>
<td>Protection Sleeve</td>
<td>17947</td>
</tr>
<tr>
<td>8</td>
<td>Wire Guide, 16 mm/3.5 mm, L 125 mm</td>
<td>17948</td>
</tr>
<tr>
<td>9</td>
<td>3 mm Trocar, 145 mm</td>
<td>17973</td>
</tr>
<tr>
<td>10</td>
<td>Cannulated Drill Bit</td>
<td>17974</td>
</tr>
<tr>
<td>11</td>
<td>6 mm Polyhedral T-Handle Wrench</td>
<td>17965</td>
</tr>
<tr>
<td>12</td>
<td>Wire 3x400 mm</td>
<td>173288</td>
</tr>
</tbody>
</table>
LOWER TRAY

1) Cephalic Screw Guide 17940
2) Screw Guide 17942
3) Drill Guide 17943
4) Cephalic Wire Guide 17944
5) Calcar Drill Stop 17946
6) Trocar 17950
7) Cephalic Screwdriver 17960
8) Cephalic Drill Bit, Ø 7.5 mm 17970
9) Optional Calcar Drill Bit, Ø 7.5 mm 17971
10) Screw Ruler 17980
11) K-Wire 2x220 mm 173287
12) Cannulated Screw Driver 173320
13) Graduated Drill Bit 4.8x330 mm 1102001
14) Locking Screw Extractor 17652
15) Short Graduated Drill Bit 4.8x180 mm 17976
16) Short Drill Guide 17949
17) Cephalic Wire 4x400 mm 17972

ORTHOFIX FLEXIBLE REAMER SYSTEM COMPLETE KIT

1) Modular Reamer Heads (Ø 9-17 mm) in 0.5 mm increments
2) Flexible Nitinol Reamers Shafts
3) Adapter
4) Cannulated Universal Chuck with T Handle
5) Soft Tissue Protector
6) Guide Wire Exchange Tube

1) Guide Wire 3x980 with Olive 173281
2) Guide Wire 2.5x980 without Olive 176281
3) Orthofix Flexible Reamer System Complete Kit 172000
4) Including:
   - Modular Reamer Heads (Ø 9-17 mm) in 0.5 mm increments
   - Flexible Nitinol Reamers Shafts
   - Adapter
   - Cannulated Universal Chuck with T Handle
   - Soft Tissue Protector
   - Guide Wire Exchange Tube

1) Lower Tray
2) Screw Guide 17942
3) Drill Guide 17943
4) Cephalic Wire Guide 17944
5) Calcar Drill Stop 17946
6) Trocar 17950
7) Cephalic Screwdriver 17960
8) Cephalic Drill Bit, Ø 7.5 mm 17970
9) Optional Calcar Drill Bit, Ø 7.5 mm 17971
10) Screw Ruler 17980
11) K-Wire 2x220 mm 173287
12) Cannulated Screw Driver 173320
13) Graduated Drill Bit 4.8x330 mm 1102001
14) Locking Screw Extractor 17652
15) Short Graduated Drill Bit 4.8x180 mm 17976
16) Short Drill Guide 17949
17) Cephalic Wire 4x400 mm 17972

ORTHOFIX FLEXIBLE REAMER SYSTEM COMPLETE KIT

1) Guide Wire 3x980 with Olive 173281
2) Guide Wire 2.5x980 without Olive 176281
3) Orthofix Flexible Reamer System Complete Kit 172000
4) Including:
   - Modular Reamer Heads (Ø 9-17 mm) in 0.5 mm increments
   - Flexible Nitinol Reamers Shafts
   - Adapter
   - Cannulated Universal Chuck with T Handle
   - Soft Tissue Protector
   - Guide Wire Exchange Tube
Fracture reduction in the frontal plane

The patient is placed supine on a fracture table, and initial reduction obtained by traction under image intensification. Traction and abstraction are then adjusted if necessary, to arrive at a neck-shaft angle of 128°.

Fracture reduction in the sagittal plane with the “PORD” device

Any posterior sagging at the fracture site should now be corrected and maintained using the dedicated Posterior Reduction Device (PORD™). This device is easily attached to most fracture tables.

1. Slide the Clark Attachment on to the side rail of the fracture table. Insert the vertical post of the Box Bracket into the Clark Attachment from beneath and tighten the clamp on the post so that the bracket is held securely.

2. Assemble the PORD™ device in the following way: Slide the Horizontal Bar through the Box Bracket with its curved portion facing the fracture table. This curved section is designed to allow for unobstructed multiple plane imaging using the C-arm of the Image Intensifier.

3. The Screw Jack of the Limb Support should be positioned in the housing at the end of the horizontal bar, with the nut under the radiolucent support. Turning the nut clockwise will then raise the support.
The Limb Support is positioned beneath that portion of the fracture which requires elevating. The correct position of the support is confirmed on the AP view (the shadow of the support can be seen). Using the lateral view, the limb support is raised by turning the nut (a) clockwise until exact posterior reduction has been achieved. The position of the Support is now maintained by tightening the Lug Screw on the housing (b). There is tendency for the Limb Support to rotate when its position is being adjusted, due to the conical cross-section of the thigh. It should therefore be held firmly during this procedure, and while tightening the Lug Screw.

The PORD device will now remain in position throughout surgery. It can be draped and therefore does not require sterilization. It may be cleaned following surgery using a detergent solution and dried thoroughly.
Nail insertion

The patient is prepped and draped in the normal manner. A skin incision of about 3-5 cm is made proximal to the tip of the greater trochanter, angled posteriorly at its proximal end.

**Trochanteric Entry System**

*Option 1: Cannulated Awl (Short Nail)*

The point of the Cannulated Awl (17975) is placed on the tip of the greater trochanter, and the entry point confirmed in both projections with the Image Intensifier. A 980 mm Guide Wire without Olive (176281) with the Universal Chuck with T-Handle (17955) is inserted through the Awl into the medullary canal, and its position checked in both planes. The Awl is now inserted with rotary movements over the guide wire until its tip reaches the level of the lesser trochanter. The Awl is removed.
Option 2: Cannulated Drill Bit (Short Nail)
Insert the Protection Sleeve (17947) with the Wire Guide (17948) into the incision. Insert the 3 mm Trocar (17973) down to the bone so that it rests on the apex of the greater trochanter.

Remove the Trocar and drill the 3x400 mm Wire (173288) 3-5 cm into the medullary canal, centering it in AP and lateral views.

Remove the Wire Guide and use the Cannulated Drill Bit over the guide wire until the stop comes in contact with the Protection Sleeve.

The Protection Sleeve and Cannulated Drill bit are now removed.
Option 3: Flexible Reamer (Long Nail)
If the femoral diaphysis has an internal diameter smaller than 10 mm, reaming up to 11 mm is advisable. If reaming is performed, the Cannulated Awl is placed on the tip of the greater trochanter, and the entry point confirmed in both projections with the Image Intensifier. The Awl is now inserted with rotatory movements until its tip reaches the level of the lesser trochanter. The Awl is removed and the 980 mm Guide Wire with Olive (173281) inserted centrally in the medullary canal. This is ensured by driving it down until its tip sits in the subchondral bone exactly on the roof of the intercondylar notch, midway between the femoral condyles. Use image intensification when passing the fracture. Using the Soft Tissue Protector (172220) or the Protection Sleeve, ream to a width 1.5-2.0 mm greater than the proposed nail. Remove the protection sleeve.

N.B. For the first 72 mm all long nails are 15 mm in diameter, and the proximal femur should therefore be reamed to this diameter.

Measurement of Nail Length
Hold a second guide wire of equal length alongside the inserted wire with the tip just at the entry portal. An artery forceps is attached to it at the level of the end of the inserted wire, and the remaining length of the second wire represents the length of nail required. N.B. If this technique is followed exactly, the end of the nail will be where the tip of the wire is; in some cases this may be too distal. Alternatively, lay a guide wire over the anterior aspect of the femur to match the position of the implanted wire, and clip it at the entry portal. The nail length is then measured directly from the guide wire. Guide wire exchange is facilitated using the Guide Wire Exchange Tube (17353).
The Locking Rod (17930) is inserted into the Radiolucent Handle (17915), and the nail into the nail support. The Rod is tightened firmly with the 6 mm Polyhedral T-Handle Wrench (17965), and the nail inserted over the guide wire without hammering. If hammering is needed, insert the Insertion Knob (17935) (see inset 1).

The correct insertion depth is reached when the distal cephalic hole is at the level of the calcar. The guide wire is now removed.

Proximal locking

The Cephalic Screw Guide (17940) is inserted into the distal hole in the Handle to mark the skin incision. The incision is made to the deep fascia, and continued down to the bone with blunt dissection. The Cephalic Screw Guide, with the Trocar (17950), is advanced down to the bone, and locked in place with the appropriate Screw Guide Locking Cam (17926).
The Cephalic Wire Guide (17944) is now inserted. The Cephalic Wire has a minimized lateral diameter which allows for wire driver adaptability. The 4 mm Cephalic Wire (17972) is inserted through the K-Wire Guide, so that it is 2-5 mm proximal to the calcar in the AP plane and central in the axial plane. The tip of the wire should be 5-10 mm from the articular surface.

The Screw Ruler (17980) is inserted into the recess on the handle so that the arrow on the scale is pointing towards the measurement face of the handle (choose correct side, LEFT or RIGHT, as appropriate). The length of the proximal and distal cephalic screws is read from the position of the end of the Kirschner Wire.

If the length measured is between two readings, the smaller reading should be selected. In the illustration the correct value is 100 mm for the distal screw and 90 mm for the proximal.

Note: The proximal cephalic screw is ALWAYS 10 mm shorter than the distal one.
The wire is kept in this position and, depending on parallel or convergent configuration of the proximal screw, the skin incision area is identified using the Cephalic Screw Guide inserted in the correct position on the Handle and pushed down to the skin. The skin is incised and a track made down to the bone by blunt dissection as before. The Screw Guide with Trocar is inserted down to the bone and locked in place with the Screw Guide Locking Cam (17926).

The Trocar is removed, and the Cephalic Drill Bit (17970) inserted until its wider base reaches the top of the Screw Guide.
The Drill Bit is removed, and the correct length screw inserted with the Cephalic Screwdriver (17960).

The Cephalic Screwdriver comprises:

a) Rod with a Handle (marked 2) and External Knob (marked 1)
b) Cylinder (marked 4) with a Locking Nut (marked 3)

The Locking Nut is loosened to permit the Rod to be inserted into the cylinder until the Handle is in contact with the Locking Nut.

The Locking Nut is then locked with the hexagon protruding from the end of the cylinder.
Parallel sliding screws
The screw should ALWAYS be yellow for parallel sliding screw configuration.

YELLOW SLIDING AND GREEN FIXED SCREWS SHOULD NEVER BE USED TOGETHER, because there is a risk of screw breakage owing to differential loading.

With the screw placed into the appropriate recess in the steri-box, the hexagon of the screwdriver is inserted into the end of a sliding screw of the correct length.

1. The screw is locked in place by turning the External Knob (marked 1).

2. The Locking Nut (marked 3) is unscrewed. The Handle (marked 2) is pulled back gently until the projections on the end of the cylinder are located in the matching recesses in the screw sleeve (barrel portion), which is now pushed up to the base of the screw thread.

3. The Rod is locked in this position by tightening the Locking Nut.
The screw is now inserted through the Screw Guide into the hole in the nail. The Handle (marked 2) is turned to engage the thread on the outer surface of the screw sleeve in the nail, until it is tight.

The screw sleeve must be firmly screwed into the nail before the screw is advanced.
The Locking Nut is now loosened to allow the screw to be inserted into the femoral head.

The screw is inserted by turning the Handle (marked 2), until the tip of the screw is within 5 mm of the articular surface, as checked on the Image Intensifier. At this point the Handle is normally in contact with the Locking Nut.

When the screw is fully inserted, the Screwdriver is disengaged by turning the External Knob anti-clockwise.

If fracture compression is needed, the nut between the Locking Nut (marked 3) and the Handle (marked 2) is turned clockwise under image intensification to ensure that the screw threads remain in place and do not tear the fragile trabecular of the femoral head during this procedure.
The distal K-Wire and related Wire Guide are removed. The Cephalic Drill Bit (17970) is used as before until it will pass no further.

The Drill Bit is removed, and the correct size of screw inserted with the Cephalic Screwdriver. Care should be taken that the sleeve of the sliding screw or the shaft of the locked screw are tightened firmly into the nail.

Note: If the distal screw is very close to the calcar and screw insertion is difficult, the 7.5 mm diameter Optional Calcar Drill Bit (17971) can be used to open up the screw track. The Calcar Drill Stop (17946) must be set to the correct length before starting drilling. The drilled section will then be the same length as the unthreaded portion of the screw.

If the fracture has been compressed, check the position of the distal K-Wire and reassess the length of the distal screw using the Screw Ruler.
The second screw is then inserted using the same procedure as described for the first cephalic screw.
Convergent locked screws
The screws should ALWAYS be green for convergent locked screw configuration.

Green screws: these are locked into the nail and do not slide. They should NOT be used in trochanteric fractures of types 31.A1 and 31.A2, but only in trochanteric fractures types 31.A3 and in fractures in which the screws will not cross the fracture site. The green screws are normally used in a convergent configuration.

YELLOW SLIDING AND GREEN FIXED SCREWS SHOULD NEVER BE USED TOGETHER, because there is a risk of screw breakage owing to differential loading.

The locking nut is loosened to permit the Rod to be inserted into the cylinder until the Handle is in contact with the locking nut.

1 The Locking Nut is then locked with the hexagon protruding from the end of the cylinder. With the Cephalic Screwdriver locked in the position described, the hexagon is inserted into the head of the screw, which was previously placed into the appropriate recess in the steri-box.

2 The screw is locked in place by pushing and turning the External Knob, ensuring that the projections on the end of the cylinder fit into the matching recesses in the screw.
The screw is inserted through the Screw Guide into the nail, and screwed into place until a firm end point is reached. The screw should now be completely inserted and locked into the nail, and the position is confirmed by Image Intensifier.

The Screwdriver is disengaged by turning the External Knob anti-clockwise.
Distal locking

**Short nail**
Distal locking, when necessary, is performed in the proximal position (round hole) for static locking, or in the distal position (oval hole) for dynamic locking, as shown by the markings on the Handle. The Screw Guide (17942) is used to mark the skin, which is incised and the bone exposed by blunt dissection. The screw guide is inserted with a Trocar down to the bone and locked in place. By using the Trocar, the Screw Guide is inserted until it comes into contact with bone.

The trocar is removed, the Drill Guide (17943) inserted, and both cortices drilled with the 4.8 mm Graduated Drill Bit (1102001).

The length of the locking screw is read from the scale on the Drill Bit immediately above the top of the Drill Guide (see inset).
The correct size locking screw is inserted with the 3.5 mm Cannulated Screw Driver (173320).

Note: the locking screw is threaded on the external end only, so at first it is just pushed and only afterwards screwed to anchor the thread in the first cortex.

Additionally, the head of the distal locking screw is threaded to permit implant removal if necessary. The head of the screw should not be recessed into the lateral cortex.
Long nail
Distal locking in the long nail is performed with a free hand technique. The Image Intensifier is moved to a true lateral position in the usual way, by obtaining a perfect circle at the level of the static hole. The locking hole is drilled by whatever technique the surgeon favours. Once the 4.8 mm drill bit has been inserted, a screw guide and drill guide can be passed over it down to the bone, and the length of the locking screw read at the top of the drill guide (see insert).

Note: the locking screw is threaded on the external end only, so at first it is just pushed and only afterwards screwed to anchor the thread on the first cortex.
The Screw Guide is removed, and the Locking Rod loosened with the 6 mm Polyhedral T-Handle Wrench and the Handle removed. The nail end cap (T79401) is inserted. For ease of insertion, it is useful to push the cap onto the Cannulated Screw Driver (173320), and the K-Wire (173287) into them both. The wire is inserted into the top of the nail, and used to guide the Screwdriver and end cap into position, where it is tightened.

**POST-OPERATIVE MANAGEMENT**

The patient may be allowed to sit up on the first post-operative day. In stable fractures (31.A1), full weightbearing should begin immediately. In less stable fractures, the patient will generally regulate the amount of weightbearing, and studies have shown that they tend to fully weightbear only when the fracture is stable as a result of compaction and/or callus formation. Therefore the advice should be that they can weightbear as tolerated by the limits of pain. In all cases, hip and knee mobility, within pain limits, should always be encouraged. The best clinical results are obtained by encouraging mobility and full weightbearing as early as possible, within pain limits, and according to the patient’s specific local and general conditions.
NAIL EXTRACTION

Incise the skin at the apex of the greater trochanter. Clean the end of the nail, remove the end cap and insert the Insertion Knob (17935).

Skin incisions are made over the proximal screws, and the screw ends exposed.

Step 1
The Screwdriver is locked to the outer end of the screw by turning the external knob.

Step 2
The screw is withdrawn from the femoral head.

Step 3
The sleeves are withdrawn from the nail.
After exposing and cleaning the screw head through a small incision, the screw extractor is engaged on to the screw head by turning it anti-clockwise, and the screw is removed.

Note: The Locking Screw Extractor (17652) is reverse threaded to facilitate the engagement and removal of the distal locking screw through anti-clockwise turning.

The nail is then extracted by using the 6 mm Polyhedral T-Handle Wrench inserted into the Insertion Knob.

The main wound is sutured over a suction drain.