GREENS SURGICALS

Redefining Excellence

TIBIA AND FEMUR

INSTRUMENT SYSTEM

PREPARED BY: DR. VINAY KUMAR

OPERATIVE TECHNIQUES

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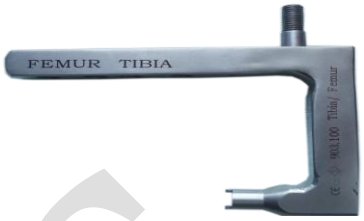
903.100	Proximal Combined Jig for Tibia/Femur.	
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439.500 Screw Driver (Hexagonal) Ø 4.5mm for I.L

903.155 Guide Wire Holding Forceps

903.165 Reaming Rod with Olive Point Ø 2.5mm x 95cm

Insertion Driving Head

Plastic Medullary Nail (Teflon Rod / Teflon Nail).

Distal Zig for femur Right.

BOX NUT


BoneAndSpine.com

IMPLANTS LIST

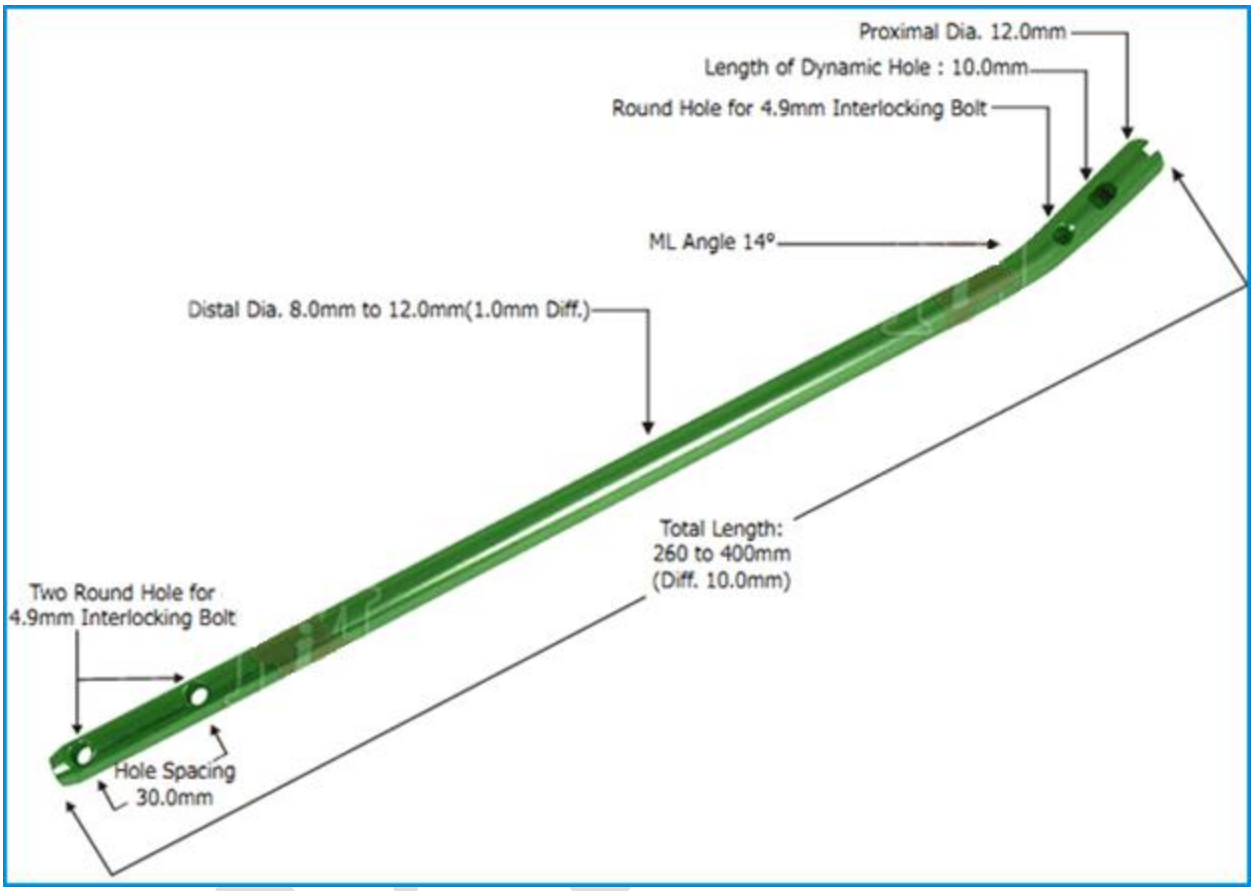
Tibia Nail (Un-Reamed)

Tibia Nail (Reamed)

Interlocking Femoral Nail (Reamed)

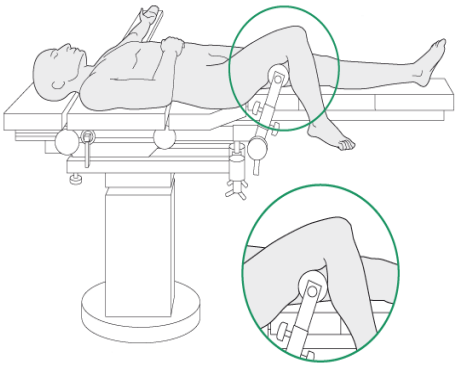
Interlocking Femoral Nail (Un-Reamed)

TIBIA NAIL


Proximal Dia. 12.0mm
Length of Dynamic Hole : 10.0mm
Round Hole for 4.9mm Interlocking Bolt
ML Angle 14°
Distal Dia. 8.0mm to 12.0mm(1.0mm Diff.)
Total Length:
260 to 400mm
(Diff. 10.0mm)
Two Round Hole for
4.9mm Interlocking Bolt
Hole Spacing
30.0mm

Radiolucent table with knee support

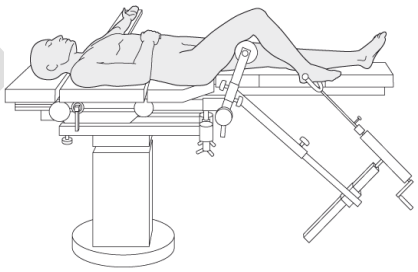
If a radiolucent table with a knee support is used, the padding should be under the distal femur (not compressed under the popliteal fossa).



Traction table

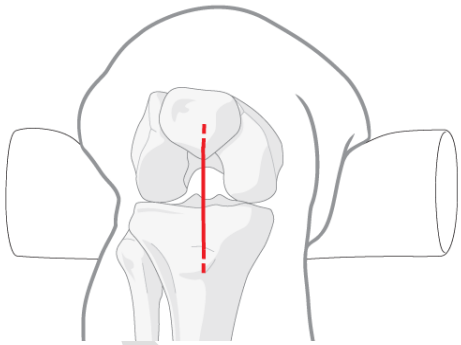
A traction table may be helpful, particularly if a skilled assistant is not available. Counter traction is provided by well-padded support under the distal femur.

The leg position should allow AP and lateral fluoroscopy with the image intensifier on the opposite side of the table.



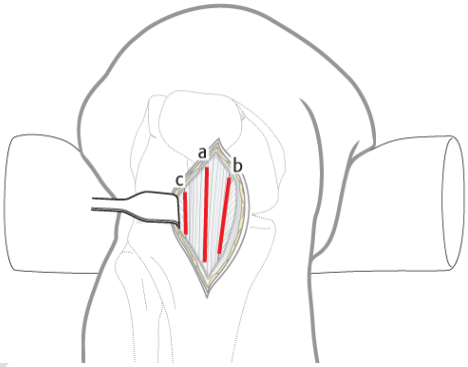
Skin incision

Make a longitudinal skin incision from lower pole patella to the tibial tuberosity. The incision is centered over the patellar ligament.



Relationship to patellar ligament

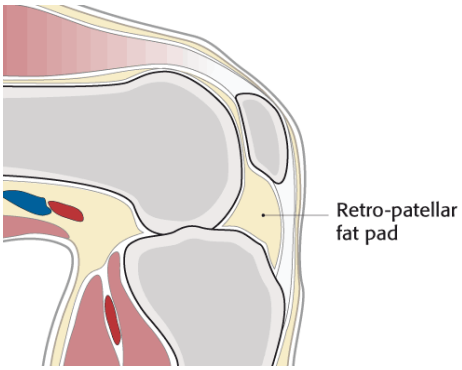
The patellar ligament can either be split in the middle, or retracted after dividing the fascia on either the medial or lateral side. The entry site should be centered over th ibial medullary canal.



Mobilizing the fat pad

Identify the anterior edge of the tibial plateau and release the retro-patellar fat pad from the tibia.

Move it posteriorly without opening the knee joint.

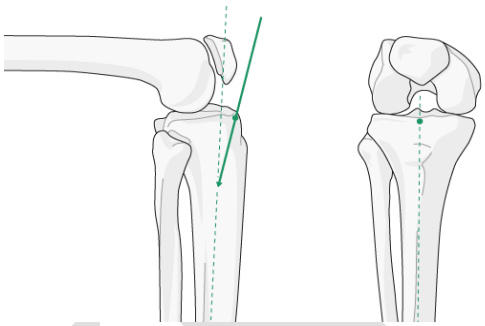


DETERMINATION OF THE ENTRY POINT

The nail entry point, on the lateral view, varies depending on nail design.

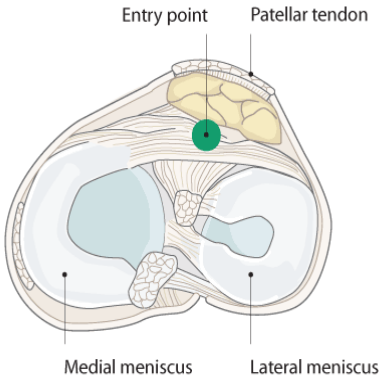
The recommendations for the selected nail must therefore be carefully considered. The more proximal the entry point, the less likely it is to create a larg ıterior tibial defect from reaming.

The nail must clear the patella, but not penetrate the posterior tibial cortex. It is first aimed slightly posteriorly, but then redirected along the medullary canal.



Entry point location

The entry point is between anterior edge of the tibial plateau and tibial tuberosity, and centered over the medullary canal on the AP view.



ENTRY SITE FLUOROSCOPY

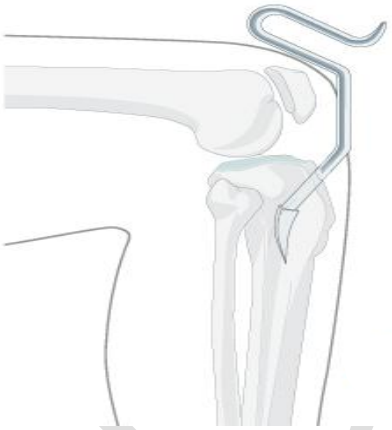
The entry site is just medial to the lateral tibial spine on the AP fluoroscopic view.

Opening the medullary canal with an awl

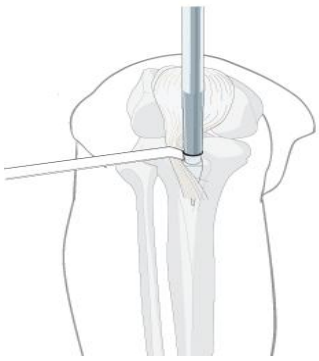
Press the sharp tip of the awl into the cortex at the entry site, aim posteriorly, and advance it, turning the awl back and forth. Stay posterior to the anterior cortex, and in the midline aiming down the medullary canal on the AP view. Gradually rotate the awl to align it with the center of the canal on the lateral view.

The shaft of the awl should finish parallel to the anterior cortex of the tibia.

Protect the patellar tendon with a retractor.

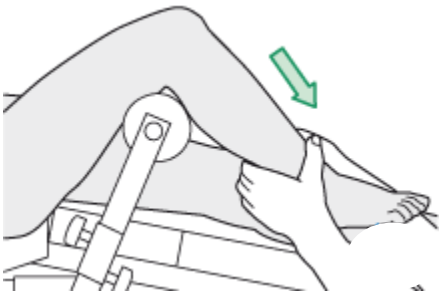


Alternatively: Insertion of centering pin
Insert a 4 mm centering pin (Steinmann pin). Pass the pin distally, angled 14° in the sagittal plane to the axis of the tibial shaft, into the proximal aspect of the medullary canal. In the coronal plane, the pin is inserted in line with the axis of the tibia shaft.
Verify placement under image intensification in both planes.



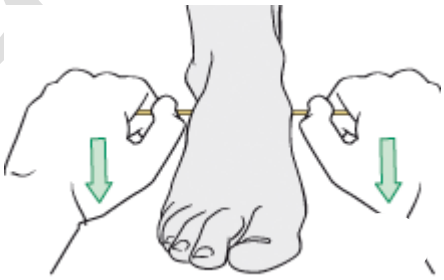
Nail insertion does not reduce a distal tibia fracture the way it does for diaphyseal fractures. There is no cortical bone contact in the distal segment. Accurate provisional reduction of distal fractures is essential. It must be maintained during nail insertion and distal locking.

A variety of provisional reduction methods are possible. The choice depends on personal preference and experience. The following reduction techniques are often well suited for intramedullary fixation of distal tibia fractures.

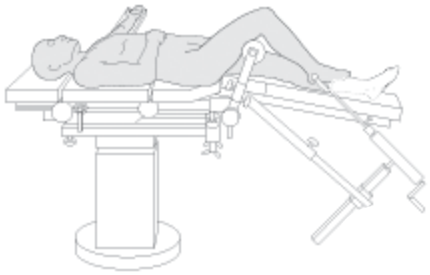


MANUAL TRACTION

The distal femur is supported by a leg rest. Manual traction is applied to the foot, to restore length, and to correct angulation and rotation. Manual support must be maintained as the nail is inserted, typically with back pressure against the nail. For very distal fractures, use of a traction pin in the calcaneus, talus, or distal tibia may be required to apply manual traction.



TRACTION TABLE



The patient is positioned supine on the fracture table. The contralateral uninjured leg is placed on a leg holder.

Place a traction pin or wire in the distal tibia, talus, or calcaneus. The more proximal the fixation point, the easier it is to control the distal tibial segment. However, the pin must not obstruct the nail.

Reduction will be achieved by first pulling in line with the tibial shaft axis. Once the fragments are distracted, angulation and rotation are corrected and the nail can be passed across the fracture. Depending upon soft-tissue integrity, traction may increase angular deformity, and need to be released partially. Reduction should be controlled under image intensification. Rotation must be confirmed by physical exam.

MOBILE REDUCTION FRAME

LARGE DISTRACTOR

Place the large distractor on the medial side of the tibia. The proximal pin should be posterior enough to avoid blocking the nail.

The distal pin may need to be placed in the talus or calcaneus rather than the tibia to provide room for the nail.

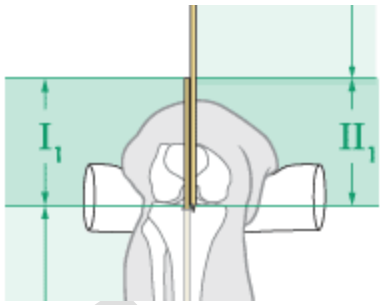
FIBULAR FRACTURE REDUCTION

Preliminary reduction and fixation of an associated distal fibula fracture will often help by indirectly reducing the distal tibial fracture via ligament taxis.

OPEN REDUCTION

In the event of delayed treatment, or if a cortical bone fragment is stuck in the canal, open reduction of the tibia may be required.

For distal tibial fractures, it is essential that the nail be placed as deeply as possible. It thus must be long enough, by nail selection, or with some nail systems by adding a proximal extension. However, the nail must not protrude proximally. The length of the intact opposite tibia may be used as a helpful guide. If comminution is present, make sure that length has been restored accurately before measurement.



GUIDE WIRE MEASUREMENT

First insert the guide wire (I) across the reduced fracture to its maximal depth. Place a second guide wire (II), of equal length, at the entry portal and measure the difference in length between the two wires. This difference represents the proper nail length.

DETERMINATION OF NAIL DIAMETER.

Choose a nail that is big enough to provide adequate fixation and that can be inserted through the tibial isthmus without excessive reaming.

The nail should be strong enough to securely hold adequate distal locking screws. Typically, this requires a nail diameter of 9 -10 mm or larger. This will depend upon the chosen nailing system.

Usually, reaming is necessary to increase the diameter of the tibial isthmus sufficiently for easy insertion of an appropriately sized nail. The distal shaft may not require reaming. However, the dense distal epiphyseal bone usually must be reamed to where the tip of the nail will lie.

Ream the canal to a minimal diameter (reamer size) of at least 1.0 mm greater than that of the selected nail. The nail should fit easily through the tibial isthmus.

PROTECTING THE SOFT TISSUE

Insert the flexible reamer over the reaming rod wire. Use a sleeve or other soft tissue protector.

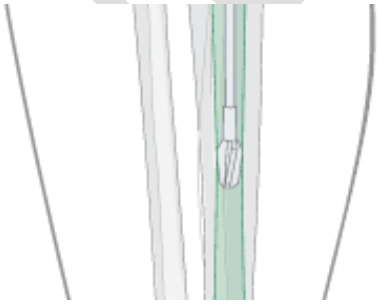
REAMING TECHNIQUE

Reaming is undertaken in sequential steps by increments of 0.5 mm. Do not force the reamer! Frequently retract the reamer partially to clear debris from the medullary canal.

The purpose of reaming is primarily to increase the diameter of the tibial canal isthmus sufficiently for easy insertion of a large enough nail. Distal to the isthmus, canal preparation may not require reaming.

Dense epiphyseal bone usually must be reamed to where the tip of the nail will lie.

Ream the canal to a minimal diameter (reamer size) of at least one millimeter greater than that of the selected nail. This will depend upon the chosen nailing system. Usually, a 9 -10 mm or larger should be chosen.



PITFALL

Flexible reamer moment should always be done in clock wise direction whether going inside into the medullary cavity or taking it out. Anti-clock wise moment will damaged the reamer. It may be unwind the reamer.

Overaggressive reaming should be avoided because it may cause heat necrosis of endosteal tibial bones. This applies especially for narrow midshaft canals (9 mm or less in diameter).

Care should be taken to use sharp reamers, to advance the reamers slowly, and to allow sufficient time between reaming steps in order for the intramedullary pressure to normalize to avoid fat embolism.

SPECIAL SITUATION:

CONVERSION FROM AN EXTERNAL FROM AN EXTERNAL FIXATOR TO AN INTRAMEDUALLARY NAIL.

If an external fixator has been left in place to maintain reduction, the tibial Schanz screws may need to be partially withdrawn to allow the guide wire, the reamers, and later the nail, to pass through.

I.L Tibia Nail (Reamed/Unreamed)	I.L Femur Nail(Reamed/Unreamed)	Ø Drill Bit in MM	Ø Locking Bolt	Ø Guide Wire
8mm	8mm	3.2	3.9	2.5
9mm	9mm	4	4.9	2.5
10mm	10mm	4	4.9	2.5
11mm	11mm	4	4.9	2.5
12mm	12mm	4	4.9	2.5
13mm	13mm	4	4.9	2.5
14mm	14mm	4	4.9	2.5
15mm	15mm	4	4.9	2.5

COMBINED JIG FOR TIBIA AND FEMUR

FIGURE:

INTENDED USE:

This is a combined jig for tibia and femur, it has four holes, two upper holes guide for the two proximal holes of tibia Interlocking nails.

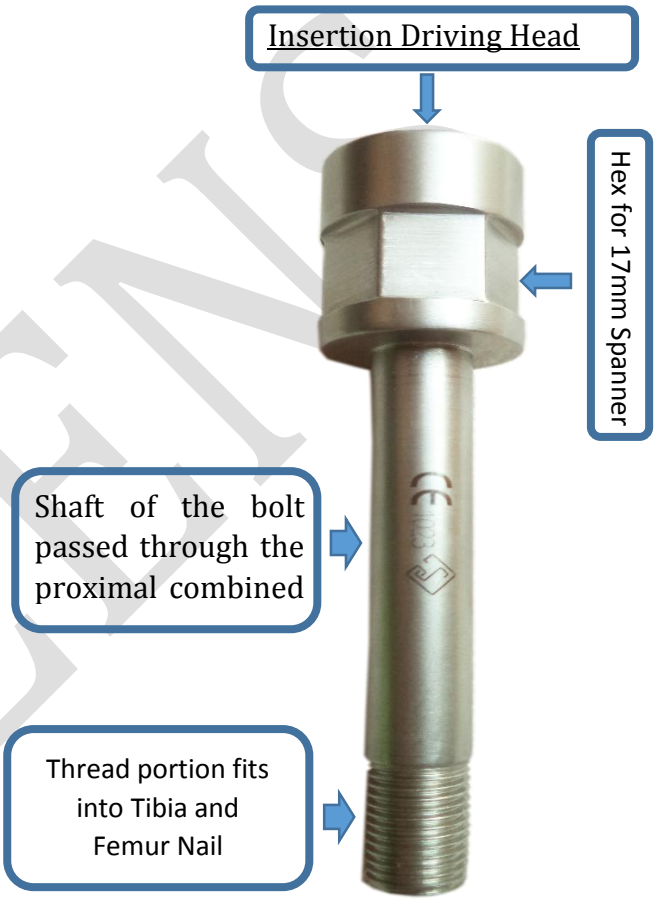
Two lower holes guide for the two proximal holes of the femur interlocking nails.

NAIL CONNECTING BOLT (CANNULATED).

FIGURE:

INTENDED USE:

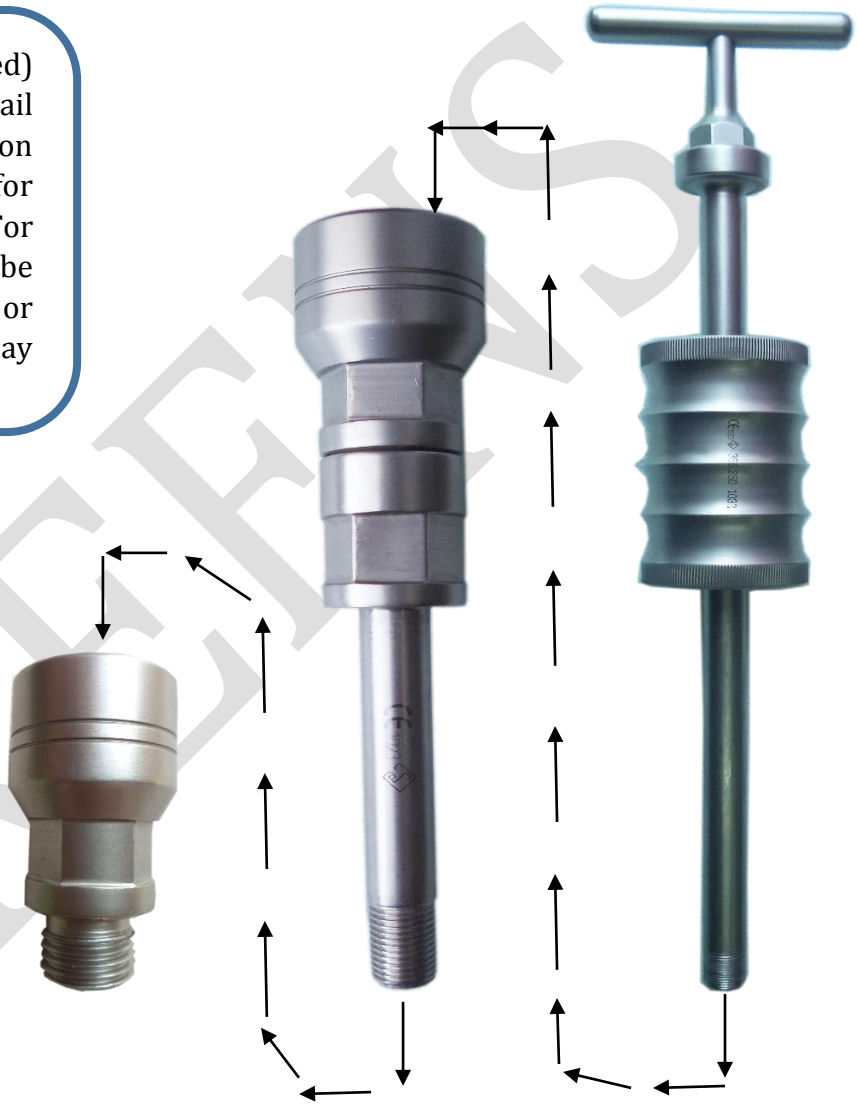
Nail connecting bolt (Cannulated) passes through the combine jig to hold the nail with its threaded portion. On its proximal part there is thread for adaptation of the cannulated insertion driving head.



INSERTION DRIVING HEAD (CANNULATED).

FIGURE:

Insertion driving head (cannulated) has threaded portion attach with nail connecting bolt and proximal portion is having internal threads for adaptation of Ram-Rod with Ram. For mild thrust direct hammering may be done on insertion driving head or alternatively ram with Ram rod may be used.



INSERTION DRIVING HEAD

NAIL CONNECTING BOLT

RAM ROD + RAM

DISTAL TARGETING DEVICE ATTACHED WITH TIBIA NAIL

Below Fig: 1 shows that combined jig (Distal Targeting Device) is attached with Tibia Nail + Nail Connecting Bolt + Insertion Driving Head

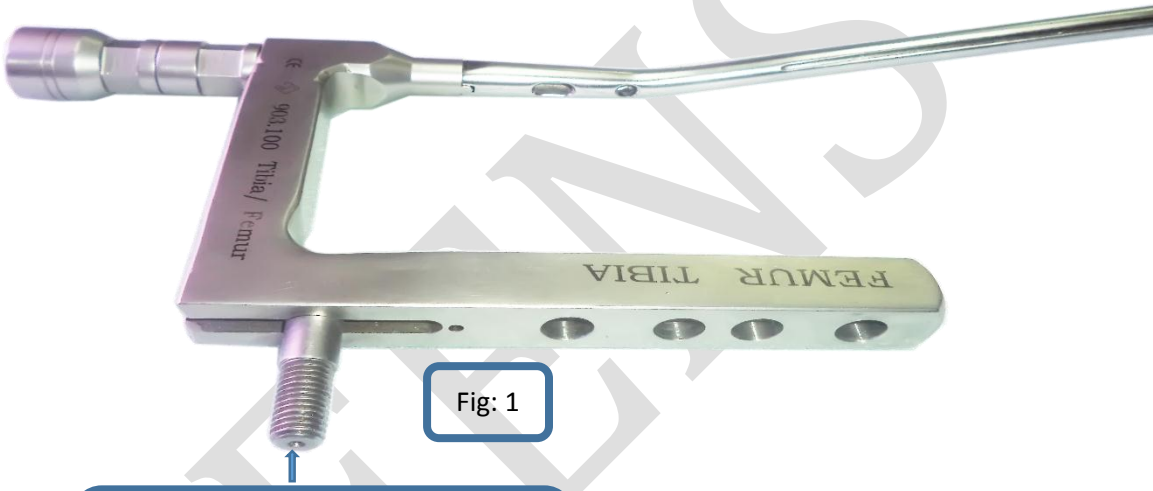


Fig: 1

Knob for the Distal Targeting device for Tibia and femur (Distal Targeting Device).

Combined jig with Nail attached with Tibia Nail + Nail Connecting Bolt + Insertion Driving Head + Ram Rod with Ram.

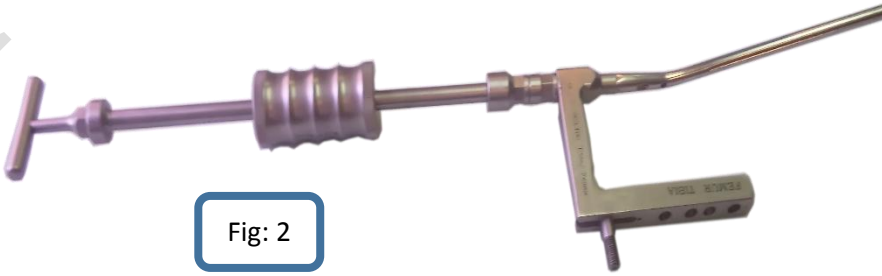


Fig: 2

FIGURE:

Fig: a

After positioning the nail into the medullary cavity we put the sleeves for proximal dynamic hole. Sleeve size (Protection Sleeve 10 x 8.0 mm) & (Drill Sleeve 8 x 4.0 mm)

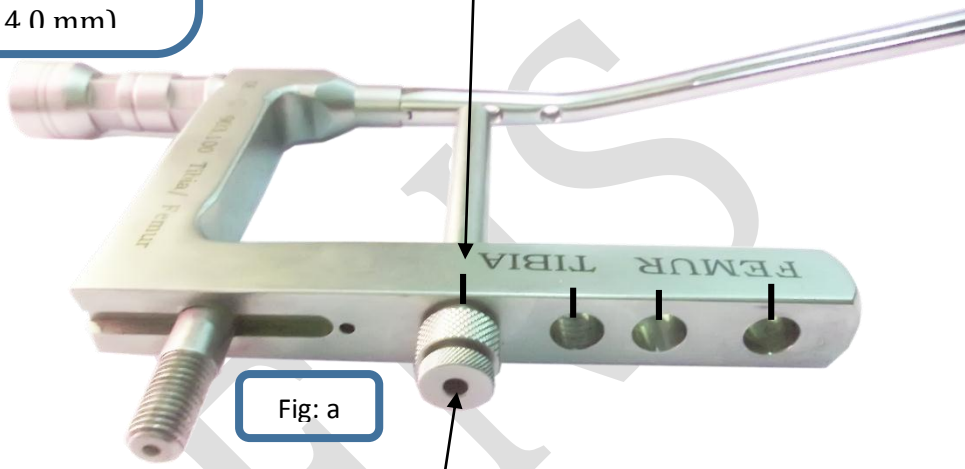


Fig: a

Fig: b

After positioning the nail into the medullary cavity we put the sleeves for proximal Static hole. Sleeve size (Protection Sleeve 10 x 8.0 mm) & (Drill Sleeve 8 x 4.0 mm)

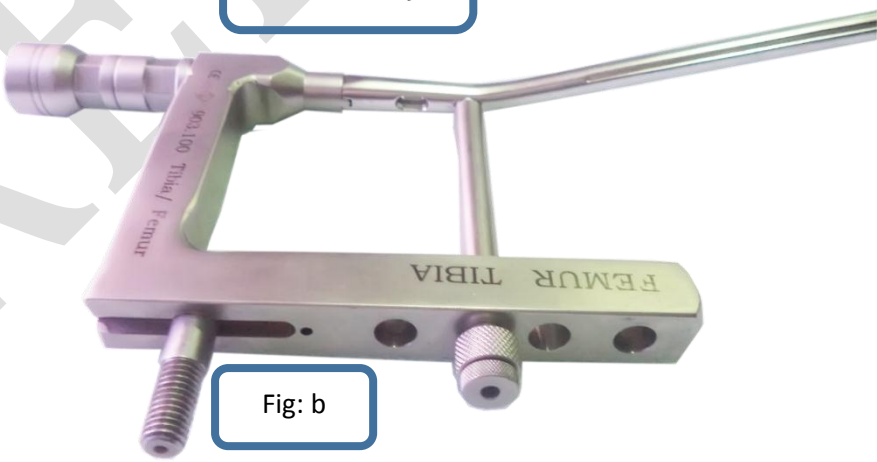


Fig: b

Fig: a

Ø 4.0 x 225 mm Length Drill bit for 9 mm and above Nails.

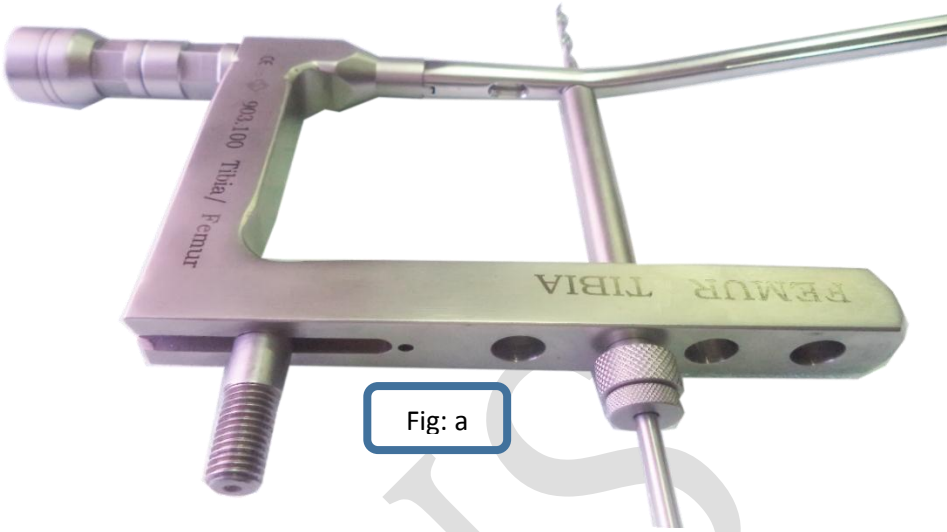


Fig: a

Fig: b

Interlocking Depth Gauge to determine the length of the Locking Bolt.

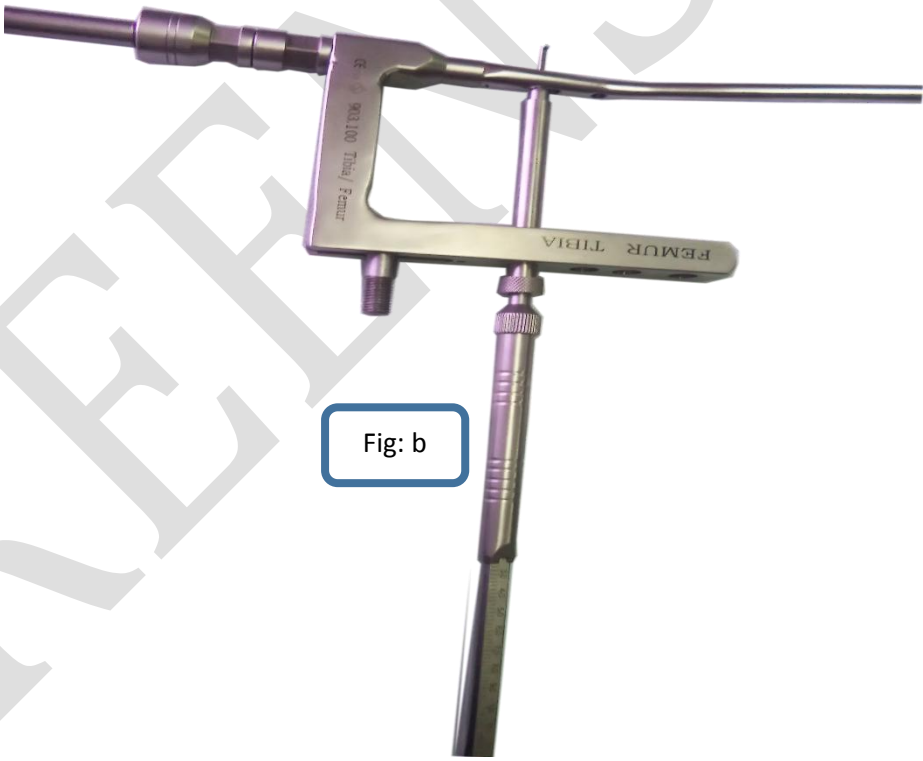


Fig: b

Fig: a

Locking Bolt is Passes through the Protection Sleeve.

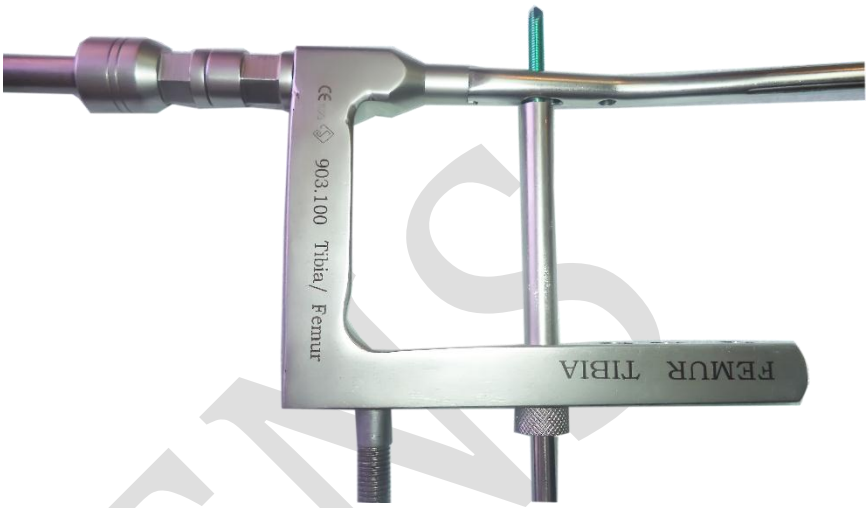


Fig: a

Fig: b

Pic is showing the Drilling in the proximal Static Hole.

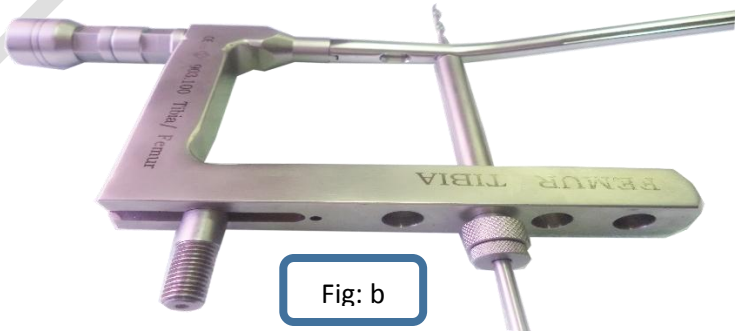


Fig: b

Fig: a

After positioning the nail into the medullary cavity we put the sleeves for proximal Static hole. Sleeve size (Protection Sleeve 10 x 8.0 mm) & (Drill Sleeve 8 x 4.0 mm)

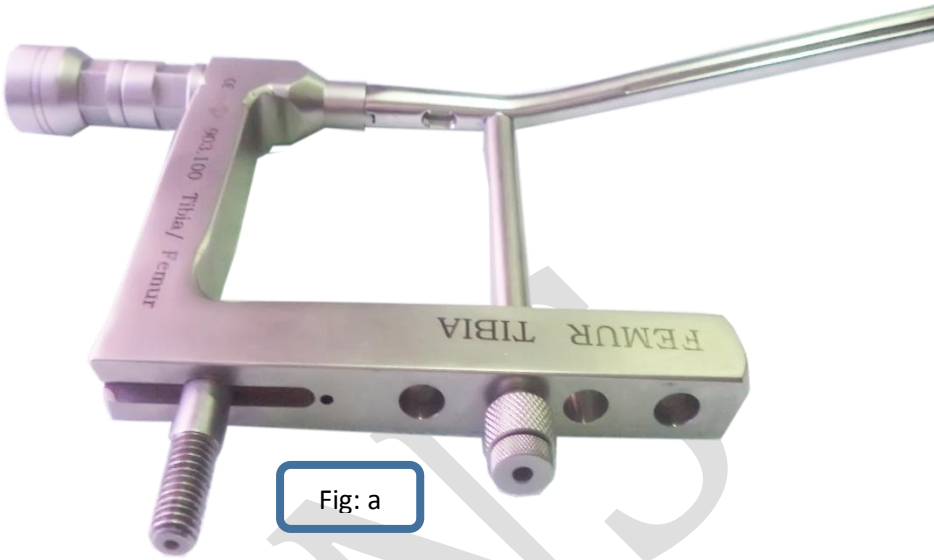


Fig: a

DIFFERENT PARTS OF THE DISTAL TARGETING DEVICE ASSEMBLY.

INSERTION DRIVING HEAD

NAIL CONNECTING BOLT

COMBINED JIG (DISTAL TARGETING DEVICE)

SPANNER

BOX NUT

Attachment of the Distal Targeting Device for locking of two Distal Lateral to Medial Holes and AP Hole may be locked by free hand.

Fig: a

Attachment of the Distal Targeting Device for locking of two Distal Lateral to Medial Holes and AP Hole may be locked by free hand.

Fig: a

Fig: b

Closed view of the above section.

Fig: b

Exchange of reaming rod to guide rod –

1. Put the plastic medullary nail over the reaming rod (Ball Tip) and slide it into the Medullary cavity of the tibia into the distal fragment.
2. Remove the reaming rod.
3. Put the Guide Rod through the plastic medullary Nail .
4. Remove the Plastic medullary Nail leaving the guide rod into the medullary cavity.

Insertion of the cannulated nail

1. Achieving and maintaining an accurate provisional reduction is essential for successful Alignment of distal tibial fractures. Do not lose the reduction during nail insertion.
2. To prevent distraction or displacement of the fracture, it may be necessary to provide Counter-pressure or manual support.
3. The nail should advance easily over the guide wire, by hand or with gentle hammer strokes. Make sure the nail is properly aimed down the tibia.
4. Remove it and ream to a larger diameter if the nail is still hard to insert.

5. The tip of the nail should be placed deeply in the center of the distal tibia, usually to the Level of the physeal scar. Confirm this position with AP and lateral image intensifier views.

Pitfall – Undisplaced intraarticular fracture

Sometimes, a distal tibia fracture that appears to be extra articular may have an Undisplaced extension into the ankle joint. This is typically in the sagittal plane. Displacement may occur as the nail is driven into the distal fragment.

It is wise to have a very low threshold for inserting percutaneous "protection screws" Just above the level of the joint if such a fracture is suspected or develops.

Proximal locking

Proximal locking have:

1. Dynamic hole (Capsule Hole)
2. Static Hole (Round Hole)

Dynamic Hole is used for micro movement at the fracture site.
Static are used to restrict the movement at the fracture site.

Micro movement may be required after initial formation of the callus at the fracture site to enhance the fracture union.
To produce the micro movement (dynamization) the proximal static hole screw has to be removed leaving the dynamic hole screw in-situ.

Distal locking

1. It is important to maintain accurate reduction of the distal segment while distal locking is Carried out.
   The number and position of distal locking screws is determined by the individual locking configuration of the nail and by the fracture morphology.
2. Insert the greatest number of screws distal to the fracture as possible.
3. Screws may injure local vessels and nerves. Bluntly dissect to the bone surface before Drilling to reduce this risk.
4. The most proximal of the distal locking screws can help reduce or fix if more proximal Extension of the fracture pattern.

Note

It is important to assess alignment accurately before completing this step, because the image Intensifier view can be misleading.

Insertion of Nail Cap.

1. After putting the Locking bolts into the Nails instrumentations are removed.
2. Before the Closure the wound Nail Cap at the proximal end of the Nail should be placed to Prevent in-growth of the soft tissue or bone in to the Nail.
   This may help at the time of extraction of the Nail.

Closure of the Soft Tissue.

1. All wounds are irrigated and cleaned.
2. Incised Ligmentum patellae may be sutured.
3. Skin Closure should be performed and antiseptic dressing should be applied.