

ETN

Expert Tibial Nail System
Surgical Technique



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Warning:

This instruction is for reference only.

Operation must be performed under the guide of professional doctors.

Indications

The CanETN Expert Tibial Nail is Indicated for below tibial fractures:

- All kinds of tibial shaft fractures
- Tibial metaphyseal fracture
- Tibial intraarticular fracture
- Tibial proximal and distal fracture
- Tibial malunion and ununion



Features

Proximal

- Three very proximally oblique interlocking options
- Three lateral interlocking options including one dynamic and two static lockings

Distal

- Two lateral locking options
- Two vertical locking options
- Very distally interlocking distancing only 5mm from nail head.



Locking Screws

3.9mm locking screws / 18 - 80mm

4.9mm locking screws / 26 - 100mm

5.0mm cancellous locking screws / 30 - 90mm

End Cap

End cap / 0mm - 15mm

AO / ASIF Principles of internal fixation

Anatomic reduction

CanETN intramedullary nail is designed according anatomic structure.

Stable fixation

Intramedullary nail acts as an internal splint providing relative stability that leads to an indirect healing through callus formation

Preservation of blood supply

When the intramedullary canal is not reamed, intramedullary nailing generates minimal trauma to the soft tissue and maximize blood supply. Reaming the canal temporarily disrupts the endosteal blood supply but stimulates the revascularization which accelerates bone healing.

Early mobilization

Intramedullary nail with AO technique, provides relative stable fracture fixation with minima trauma to vascular supply and create an improved condition for bone healing that accelerates patient's early mobility and function.

Surgical technique

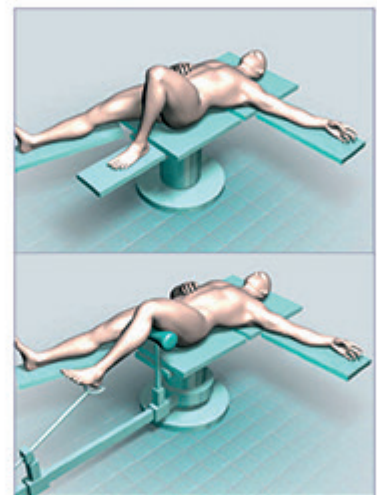
1 Position patient

Position the patient supine on the radiolucent table.

Ensure that the knee of the injured leg can be flexed

Until at least 90 – 100 degrees or more.

Position the image intensifier in way that visualization of the tibia including the articular surface proximal and distal is possible in AP(antero-posterior) and lateral views.



2 Reduce fracture

Perform closed reduction manually by axial traction under image intensifier.

The reduction can be temporarily fixed with reduction clamps. In epiphyseal

Fractures the condyles or the pilon tibiale are fixed first in order to enable the nail insertion.

3 Determine nail length and diameter

There are two options.

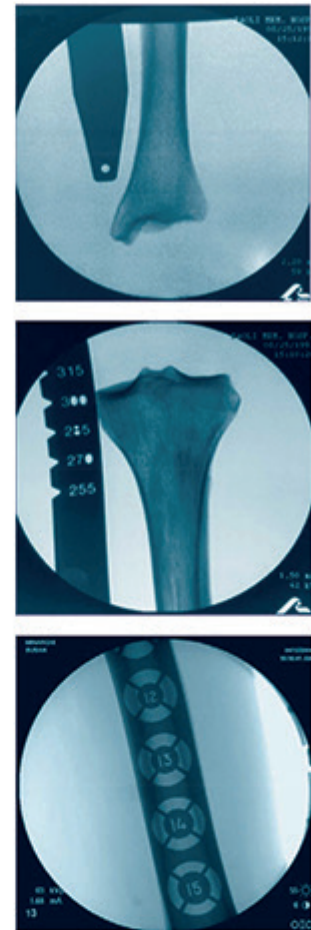
a. measure and judge with X ray film

b. use the radiographic ruler to get medullary canal diameter and tibial length, with the injured or uninjured leg. Normally the ruler is parallel with tibia outside of the skin instead of directly on artificial tibia. Align the ruler with ventral edge of tibial plateau and read off length under image intensifier.

Also read off and choose canal diameter by comparing with four markings on the ruler.

Instruments

115710001 Radiographic Ruler



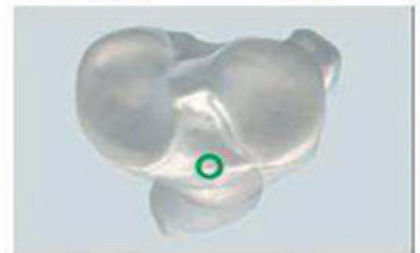
4 Determine entry point and insert guide wire

The entry point is determinant for the optimal final position of the Expert Tibial Nail in the intramedullary canal. This is mostly important for proximal and distal metaphyseal fractures regarding fragment non-displacement.

The entry point is at intersection of ventral edge of tibial plateau and lateral of tibial crest.

Insert guide wire, using Ø3.2mm guide wire connected to universal chunk with T-handle. Use the shortest possible guide wire to control direction and strength better.

If there is resistance during insertion, insert by way of rotation. Remove the chunk with T-handle and check under image intensifier that the guide wire is in line with the axis of medullary canal both in AP(antero-posterior) and lateral view.



Instruments

115400016 Universal chunk with T-handle

115400033 Drill bit(Guide wire) Ø3.2x400

5 Open medullary canal

a. Use cannulated awl. Push it over guide wire for opening.

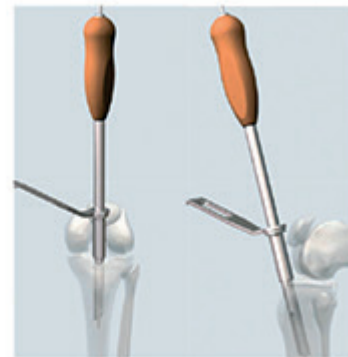
Use entry with rotation. When it reaches the space limit at the corner of the awl, the opening is done.

Instruments:

115710002 Cannulated awl



b. Use cannulated hole punch. Push the protection sleeve and the hole punch over the guide wire and open the medullary canal with entry of rotation. The hole punch has depth limit, when the upper notch of the hole punch is aligned with proximal end of sleeve, stop opening and remove sleeve. The opening is complete when the lower notch is in line with ventral edge of tibial plateau.



Instruments:

115710003 Protection sleeve

115710005 Cannulated hole punch

c. Use drill bit. Through the protection sleeve. Instead of manual, open dynamically with electric drill. The sleeve has depth limiter. Drill over the guide wire and stop until it touches limiter.



Instruments:

115710003 Protection sleeve

115710004 Cannulated drill bit

Remove the guide wire and approach medullary canal reaming.

6 Reaming medullary canal

Insert the ball head guider in the medullary canal.

Use the shortest ball head guider over the rod extractor, and fasten its nut.

Insert the reaming guider through the opening under the navigation of image intensifier, for guider to pass through fracture ends.

After insertion in place, start reaming by using the soft reamer, soft reamer head and electric drill.

Connect the soft reamer to electric drill, and tighten by L wrench



Start reaming with the diameter 8.5mm. The diameter of the ready canal is normally 1~1.5mm larger than the tibial nail diameter. If the nail is 8mm, ream until 9~9.5mm. Use 8.5mm soft reamer head and soft reamer to insert over ball head guider to apply 8.5mm soft reaming. Then use 9mm reamer head for 9mm reaming.

Dynamic reaming instrument set

115410007 Ball head guider

115410001 Reset rod with T-handle

115410002 Ball head guider

115410003 Extractor for guide wire

115410004 Soft reamer

115410005/115410010/115410011/115410012/115410013/115410014/115410015/1154100

16/115410017/115410018/115410019 Soft reamer head

7 Test distal and proximal nail aiming

Before nail mounting, the distal and proximal aiming is strongly suggested for securing the correspondence of nail and aiming arms. This is tested outside of body.

Mount nail on insertion handle.

Thread the connecting nut into insertion handle into proximal nail end by wrench for connecting nut.

Instruments:

115500007 Wrench for connecting nut

115710008 Connecting nut

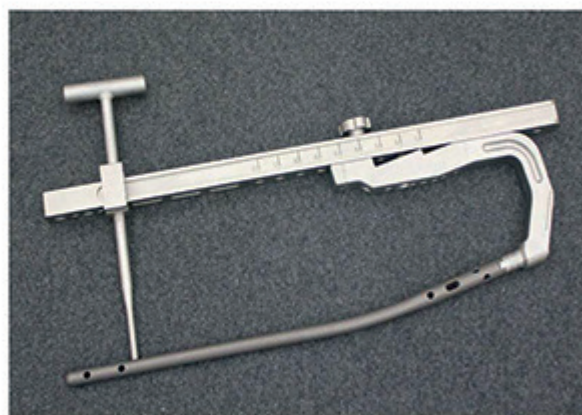
115710007 Insertion handle

a. Distal aiming

Mount connection shaft for distal aiming.

There are notches on the shaft corresponding relative nail lengths, and relevant arrows on insertion handle as well as connection shaft.

If the nail is 360mm, find the 360mm arrow and match the arrow on insertion handle. Fasten with the targeting



device nut for long nail. Fasten the nut to the hole beside the arrow.

Mount distal aiming.

Assemble shaft to insertion handle and mount the distal outrigger at distal side. Insert the location shaft and lock stabilization spacer with its spring bead facing upside and tibial proximally.

Test for distal aiming precision.

Use a sleeve and a drill bit to check for both AP(antero-posterior) and lateral locking positions.

Remarks: Every nut should be tightened by wrench to secure from losing aiming precision.

Notice: Ø3.2 drill sleeve and drill bit are for 3.9mm locking screws and Ø4.3 drill sleeve and drill bit are for 4.9mm locking screws.

Notice: 3.9mm locking screws is for 8mm, 9mm intramedullary nail and 4.9mm locking screws is for 10mm, 11mm intramedullary nail.

Instruments:

115710007 Insertion handle

115400057 Targeting device nut for long nail

115710012 Shaft

115710013 Location shaft

115710014 Stabilization spacer

115710015 Distal outrigger

115710016 Distal outrigger nut

115710019 Protection drill sleeve Ø4.3

115710020 Protection drill sleeve Ø3.2

115710017 Protection sleeve

115710028/115710031/115710032/115710033 Drill bit



8 Insert nail

Insert nail over the soft ream guide wire. Insert by hand with rotation or insert by using hammer when encounter resistance. Connect the Driving cap with handle adaptor tightly to the handle, and use hammer to knock on it for delivering nail gently into the canal.

Try to choose insertion by hand if it's possible. When the nail is delivered in place: the proximal end of the nail is aligned with the ventral edge of tibial plateau, remove the guide rod.

Remarks: Directly hammer to the insertion handle is not allowed. This very possibly could influence distal aiming precision, causing inaccurate screw locking. Therefore this manner shall be voided.

Instruments:

115710007 Insertion handle

115710009 Driving cap with handle adaptor

115400032 Slotted hammer



9 Distal locking

Mount Location Shaft

Insert 5.2mm sleeve to the location hole and use 5.2 drill bit to drill through the sleeve and open cortex of the isthmus of tibial ventral edge.

Stop at hearing the drill colliding with the nail. Clean the bone debris.

Remove 5.2 sleeve and drill bit, and insert the location shaft to the predrilled hole. Mount the stabilization spacer to fix the location shaft, with its bead facing upside and tibial proximally.

Notice: Cleaning the bone debris is important because it can influence precision of aiming.

AP interlock (antero-posterior)

Start by AP two interlocking screws, together with the protection sleeve and tissue distracter to interlock the one screw very distally.

Remove the distracter. If nail is 8mm, choose the 3.9mm screws. Use the 3.2 drill sleeve and 3.2 drill bit to drill through both cortices. Measure the depth with depth gauge and make sure the sleeve is pressed against the near cortex while reading off measurement.

Select screw of proper length. The screws are all self-tapping and no need for pre-threading before screw insertion. There is notch on the screwdriver and when it is aligned with sleeve's upper edge, the screw is properly inserted in the cortex.

Use the same way to insert the second AP locking screw. The AP screws are counter rotation effect.

Remarks: AP screw locking is necessary in spiral fracture and optional in ordinary transversal fracture.

Notice: Ø3.2 drill sleeve and drill bit are for 3.9mm locking screws and Ø4.3 drill sleeve and drill bit are for 4.9mm locking screws. Ø5.2 drill sleeve and drill bit are for location shaft.

Notice: 3.9mm locking screws is for 8mm,9mm intramedullary nail and 4.9mm locking screws is for 10mm, 11mm intramedullary nail.

Instruments:

115710007 Insertion handle

115400057 Targeting device nut for long nail

115710012 Shaft

115710014 Stabilization spacer

115400023 Ø5.2 drill bit

115710035 Ø5.2 drill sleeve

115710013 Location shaft

115710019 Protection drill sleeve Ø4.3

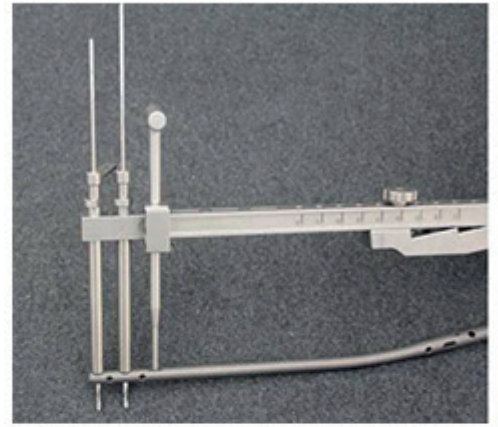
115710020 Protection drill sleeve Ø3.2

115710017 Protection sleeve

115710018 Tissue distracter

115710028/115710031/115710032/115710033 Drill bit

115710021 Depth gauge



Lateral interlock

After AP(antero-posterior) locking, lock the lateral screws.

The insertion of screw is from inner side of tibia since fibula is on the other side.

Use distal outrigger, and mount to the shaft and tighten it.

Use the same way to insert the very distal parallel screws and the second parallel screws. The whole distal aiming and locking is then complete.

Notice: Ø3.2 drill sleeve and drill bit are for 3.9mm locking screws and Ø4.3 drill sleeve and drill bit are for 4.9mm locking screws.

Notice: 3.9mm locking screws is for 8mm,9mm intramedullary nail and 4.9mm locking screws is for 10mm, 11mm intramedullary nail.

Instruments:

115710007 Insertion handle

115400057 Targeting device nut for long nail

115710012 Shaft

115710014 Stabilization spacer

115710013 Location shaft

115710016 Distal outrigger nut

115710015 Distal outrigger

115710019 Protection drill sleeve Ø4.3

115710020 Protection drill sleeve Ø3.2

115710017 Protection sleeve

115710018 Tissue distracter

115710028/115710031/115710032/115710033Drill bit

115710021 Depth gauge



10 Compression

Disassemble distal targeting shaft and assemble the proximal targeting. Before assembly, it involves compression for the fracture.

Two operative options:

a. traditional way . Connect nail extractor and hammer guide to the insertion handle.
Use hammer to gently strike in reverse direction to apply compression by pulling the far fracture.

Instruments:

115710034 Extractor for nail

115710011 Hammer Guide

115400032 Slotted hammer

b. use the compression bolt. Insert a interlocking screw in dynamic hole at the proximal end,
every further insertion of the compression bolt pushes the locking screw down in the
dynamic hole little by little, and create compression between the fragments.

Instruments:

115710029 Compression bolt

11 Proximal locking

Two aiming arms needed, with corresponding markings:
Proximal.

Mount the proximal aiming arm with nut and tighten with wrench. Similarly,
8mm nail, 3.9 screws, 3.2 drill bit, protection and drill sleeves. Drill through
both cortices, measure depth and insert screws.

Use the same way to insert the other parallel
Interlocking screw in distaller end and dismantle the
proximal aiming arm.

Notice: Ø3.2 drill sleeve and drill bit are for 3.9mm
locking screws and Ø4.3 drill sleeve and drill bit are for
4.9mm locking screws.

Notice: 3.9mm locking screws is for 8mm,9mm
intramedullary nail and 4.9mm locking screws is for 10mm, 11mm
intramedullary nail.

Instruments:



- 115710023 Proximal aiming arm
- 115400059 Distal outrigger nut for long nail
- 115710017 Protection sleeve
- 115710019 Protection drill sleeve Ø4.3
- 115710020 Protection drill sleeve Ø3.2
- 115710028/115710031/115710032/115710033 Drill bit
- 115710021 Depth gauge

Then mount the aiming arm for cancellous screw for proximal locking.

On the arm there is arrow pointing at tibial plateau. Lock the nut and use 5.0mm protection sleeve for cancellous screw. The directions for three screws are separately oblique from inner towards outer lateral, AP(Antero-Posterior) medio, and oblique from outer towards inner lateral.

For insertion from inner towards outer, remove the trocar, drill with 3.2 bit(5.0 screws all correspond with 3.2 drill bit).

Drill through the near cortex and stop immediately before getting the far cortex. Measure the depth and insert the 5.0 screw directly without threading.

Similarly, insert the other two screws for interlocking.

WARNING: Be cautious there are arteries and nerves behind the tibial plateau, so drilling through both cortices is strictly prohibited.

Instruments:

- 115710007 Insertion handle
- 115710024 Proximal aiming arm for cancellous bone
- 115400059 Distal outrigger nut for long nail
- 115710026 Drill sleeve
- 115710027 Trocar
- 115710028/115710033 Drill bit
- 115710021 Depth gauge



12 Insert end cap

Dismantle the whole aiming arm including insertion handle and insert end cap. We have T driver and holding driver. The holding driver can hold the screw from dropping during pre-fastening. Then fasten end cap with T driver. Then the whole ETN locking is complete.

Instruments:

115710030 Plug for end cap

115710022 T-handle

Remove implant

he extraction of implant.

Remove end cap and attach the extractor for nail and the hammer guide.

Remove the interlocking screws with T handle.

Extract the nail by applying gentle blows with hammer.

Remarks: No violent knock to prevent refracture of healing end.

Instruments:

115710011 Hammer Guide

115710034 Extractor for nail

115400032 Slotted hammer

115710022 T-handle

