

Knee Nail for
Retrograde
Femoral Mode



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TRIGEN IM Nail System

Surgical Technique

Knee Nail for Retrograde Femoral Mode

As Described By
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and Roy W. Sanders, M.D.



Nota Bene: The technique described herein is made available to the healthcare professional to illustrate the authors' suggested treatment for the uncomplicated procedure. In the final analysis, the preferred treatment is that which addresses the needs of the patient.

WARNING: This device is not approved for the screw attachment or fixation to the posterior elements (pedicles) of the cervical, thoracic, or lumbar spine.

Indications

The TRIGEN Knee Nail is indicated for shaft fractures between the proximal and distal third of the femur. This includes transverse, comminuted, spiral, oblique, and segmental fractures. The Knee Nail may also be used for nonunions, malunions, prophylactic nailings of impending pathological fractures, supracondylar fractures and periprosthetic fractures.



Surgical Technique



Figure 1



Figure 2

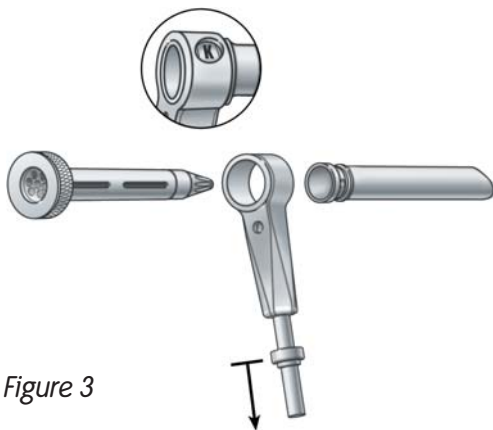


Figure 3

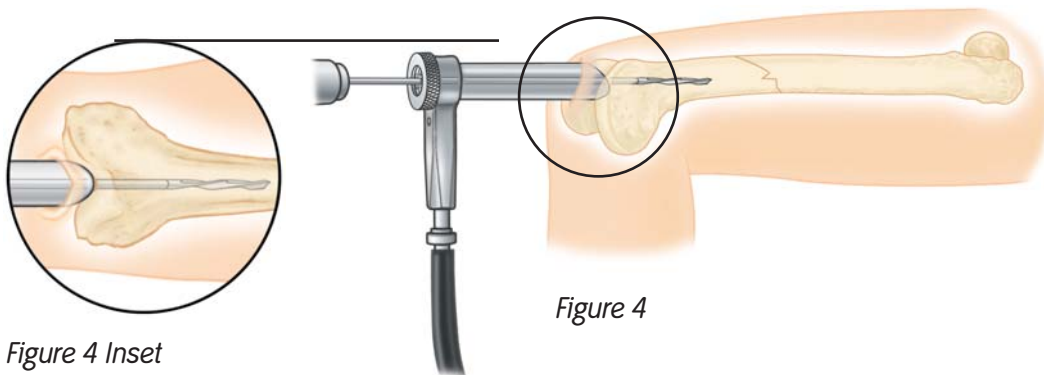


Figure 4 Inset

Patient Preparation

Place the patient in the supine position on a radiolucent table. Flex the knee to 45° with a leg roll beneath the femur. The second option is to use a radiographic positioning table which allows adjustment of the leg and excellent visualization (*Figure 1*).

Make a midline incision and a medial parapatellar capsular incision. Intra-articular fractures should be reduced and fixed with lag screws in the standard fashion. The entry point is made in the intracondylar notch just anterior to the origin of the posterior cruciate ligament (*Figure 2*).

Entry Portal

Rotate the barrel of the Entry Tool (7163-1114) until the "K" is seen, then place the Entry Tool with Honeycomb Insert through the incision to bone (*Figure 3*). Adjust to align the Entry Tool with the axial line of the femoral shaft in the A/P and lateral image views. Insert the Guide Wire (7163-1190) approximately 3 cm in depth, slightly above the cruciate notch. Remove the Honeycomb Insert and confirm that the Guide Wire is centered in A/P and lateral views with the C-Arm (*Figure 4* and *Figure 4 Inset*).

Surgical Technique

Attach suction to the Entry Tool to assist in blood evacuation and minimize aerosolisation of blood to operative team. To open up the distal femur, attach the 12.5 mm Entry Reamer (7163-1116) to power and insert it over the Guide Wire through the Entry Tool (7163-1192). The 12.5 mm Entry Reamer has a flexible shaft to allow it follow the canal (*Figure 5*).

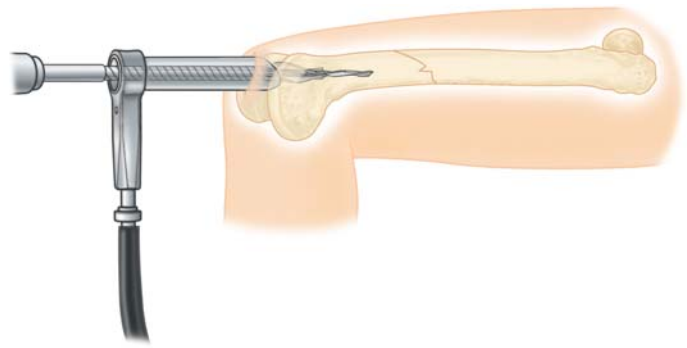


Figure 5

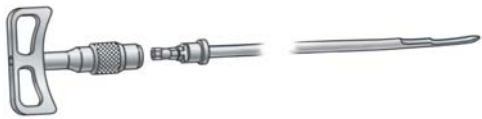


Figure 6

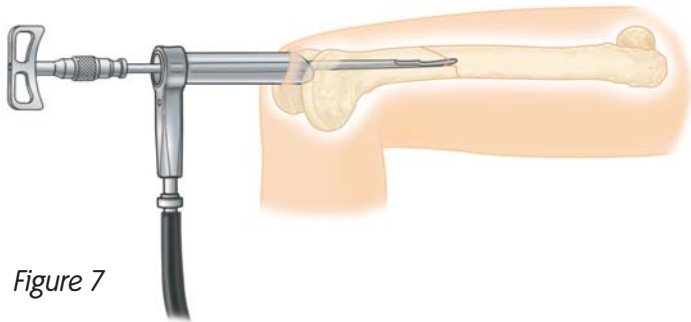


Figure 7

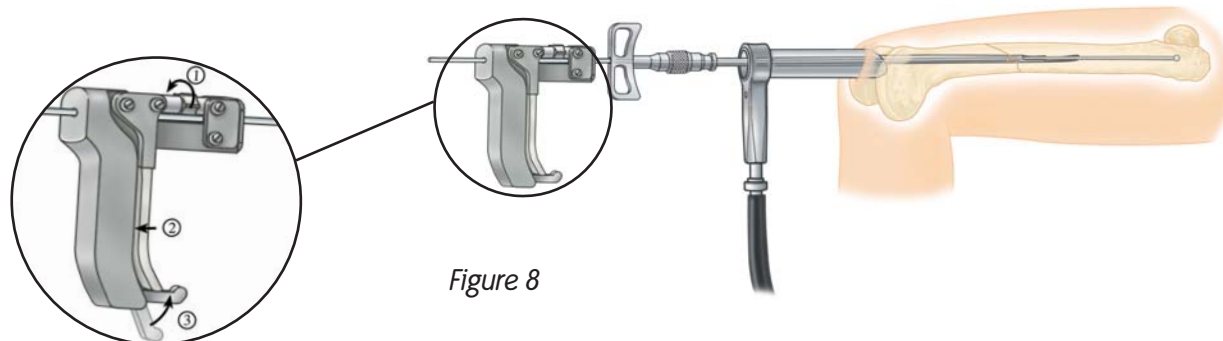


Figure 8

Figure 8 Inset



Figure 9

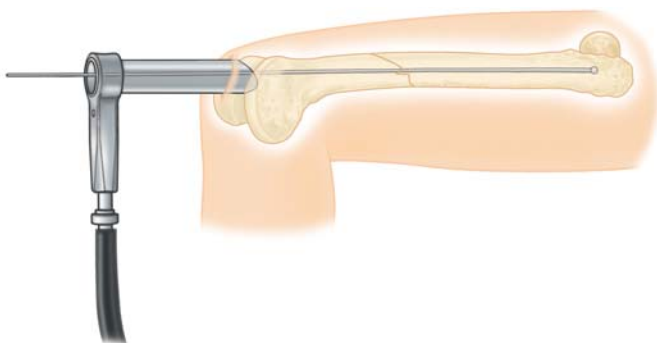


Figure 10

Fracture Reduction

Remove the 12.5 mm Entry Reamer and Guide Pin. Attach the T-Handle (7163-1172) onto the Reducer (7163-1124) (Figure 6). Insert the Reducer through the Entry Tool to reduce the fracture (Figure 7). Attach the Gripper (7163-1100) to the Ball Tip Guide Rod (7163-1126) and insert it through the Reducer (Figure 8 Inset). Allow sufficient length of the nail to engage the diaphysis for translational stability. Remove the Gripper from the guide rod to allow for removal of the Reducer (Figure 8). When Guide Rod is in place, remove the Reducer (Figure 9 and Figure 10).

Surgical Technique

Canal Preparation

Canal preparation is dependent on surgical decision. If reaming is planned, use progressive reamers through the Entry Tool. Unreamed nails are selected based on preoperative planning, but should be of sufficient size to provide translational fill of the intramedullary canal in mid-diaphysis. Proceed to sequentially ream the femoral shaft to .5 mm to 1 mm above the chosen nail diameter (*Figure 11*). The Flex Reamer Extender (7163-1130) is available to extend the reamer shaft for nails longer than 42 cm. For fractures in the mid-diaphysis, insertion of the nail proximal to the lesser trochanter is recommended.

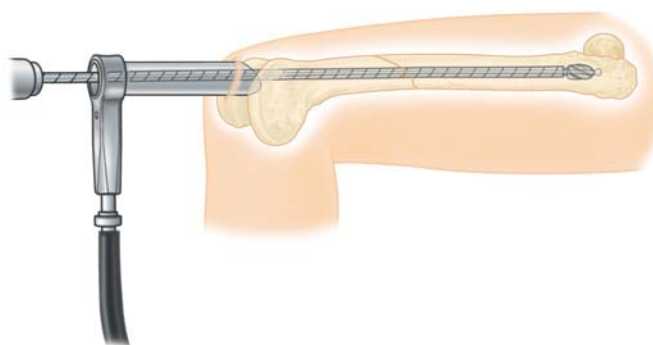


Figure 11

Nail Selection

Determine nail diameter from image intensifier, templating, or sounding the canal. Never insert a nail that has a larger diameter than the last reamer used.

Position the tip of the guide rod at the desired level of the tip of the nail. Insert the Ruler (7163-1128) over the guide rod and through the Entry Tool down to the level of bone. Measure the nail length by positioning the open end of the Ruler (7163-1128) over the exposed end of the guide rod pushing the end down to the level of the bone (*Figure 12*). Confirm the position on the image intensifier at the other end of the nail length gauge. Read the nail length from the calibrations exposed considering fracture patterns and locking screw positioning. Leave the guide rod in place. Exchange of the ball-tipped guide rod is not necessary.

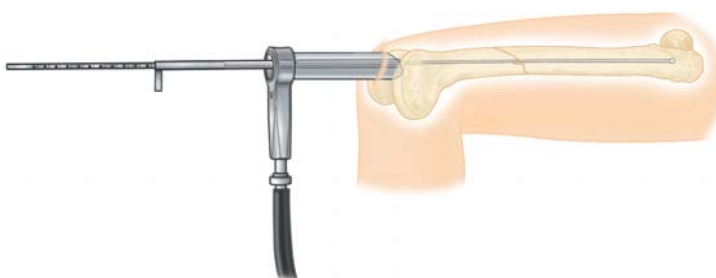


Figure 12



Figure 13

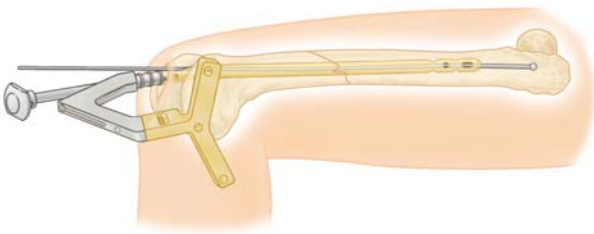


Figure 14

Drill Guide Assembly

For Knee Nails Longer Than 25 CM
(Standard Size)

Attach the Knee Guide (7163-1142) to the Drill Guide (7163-1134). The Drill Guide is keyed so that the Knee Guide will only fit one way. Secure the Knee Guide to the Drill Guide by tightening the “knurled knob” by hand. Final tightening can also be accomplished by placing the end of the Guide Bolt Wrench (7163-1140) into the holes in the knurled knob. Insert Quick Bolt (7163-1138) in the Drill Guide to secure nail (*Figure 13*). The Quick Bolt will also be used to rotate Drill Guide 180° as needed for medial oblique screw insertion. Advance the nail over the guide rod and past the fracture so that the distal end (driving end) of the nail is countersunk 1 mm-2 mm into the intracondylar notch (*Figure 14*). Remove the guide rod after the nail is inserted and before inserting the locking screws. Take care not to distract the fracture during nail insertion. If the femur is distracted or if the nail is countersunk too deep, the Impactor (7163-1189) can be attached to the back of the Quick Bolt and backslapped to pull the nail back out of the bone to the desired location. Pay particular attention to the rotational position of the extremity as this is frequently a complication of retrograde nailing. Rotation should be checked during nail insertion, and at the completion of nail insertion, before locking screws are inserted.

Surgical Technique

Interlocking

For Knee Nails Longer Than 25 CM
(Standard Size)

Distal Screws: Transverse and Lateral Oblique

Placement — Measuring for proper length screw and placement can be accomplished in the following two ways:

A. Predrill Technique — Make a stab incision and insert the Gold Outer Drill Sleeve (7163-1152) to bone through the appropriate hole in the Knee Guide. Place the Silver Inner Drill Sleeve (7163-1156) through the Gold Outer Drill Sleeve. Connect the Long Pilot Drill (7163-1110) to power using the Mini-Connector (7163-1186) and drill through both cortices. The length measurements are taken from the calibrations off the drill in relation to the end of the Silver Inner Drill Sleeve. The appropriate length 5.0 mm screw (GOLD) is selected and attached to the Screwdriver. The drill and Silver Inner Drill Sleeve are removed and the screw is inserted through the Gold Outer Drill Sleeve (*Figure 15*). Attach Screwdriver to power or use manual T-Handle (7163-1172) or Straight Screwdriver Handle (7163-1163) and place screws in bone. The Screwdriver contains a laser-marked ring. This ring should be stopped short of the Gold Outer Drill Sleeve to prevent final seating of the screw by power. Final tightening of the 5.0 mm screws should always be under manual control using the T-Handle (7163-1172) or Straight Screwdriver Handle (7163-1163) (*Figure 16*). (7163-1163) (*Figure 13*).

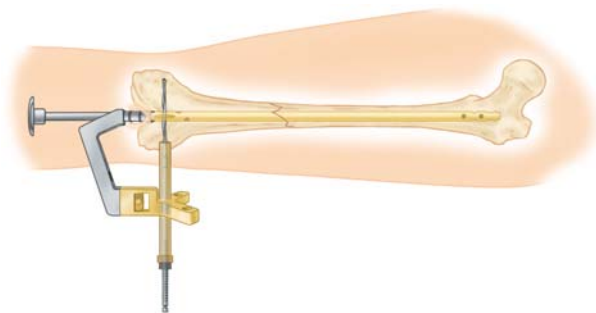


Figure 15

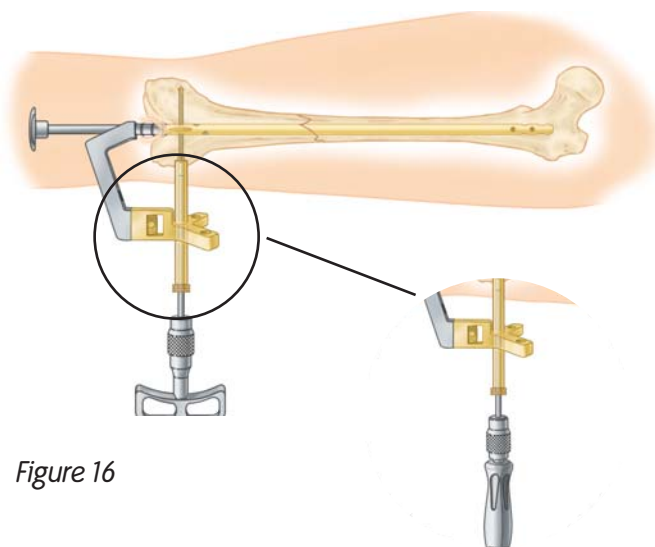


Figure 16

Note: 5.0 mm (GOLD) screws are to be used with 10 mm, 11.5 mm and 13 mm Knee Implants

The 8.5 mm Knee Implants are indicated for use in the TIBIA ONLY. Do not use in the femur.

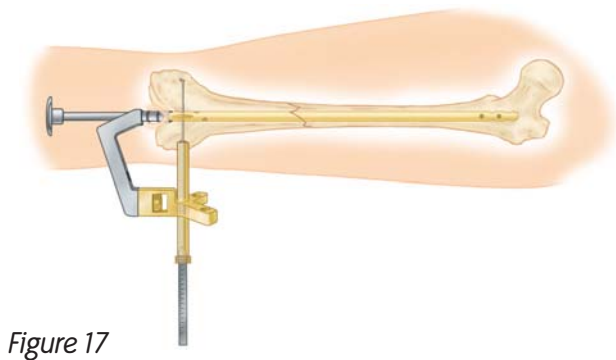


Figure 17

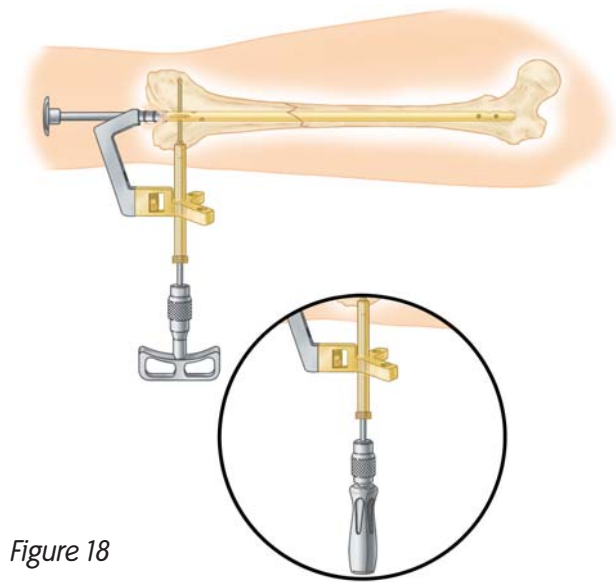


Figure 18

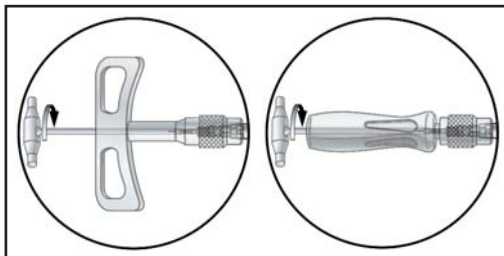


Figure 19

B. Screw Length Gauge Technique— After pre-drilling through both cortices as outlined above, remove the Silver Inner Drill Sleeve, leaving the Gold Outer sleeve in place. Use the Screw Length Gauge (7163-1170) through the Gold Outer Drill Sleeve (7163-1152) from the far cortex to measure for proper 5.0 mm screw (GOLD) length (Figure 17). An alternative option in measuring for screw length is the Direct Measuring Gauge (7163-1189.) The appropriate length 5.0 mm screw (GOLD) is selected and attached to the Medium (7163-1166) or Long (7163-1164) Screwdriver. Attach Screwdriver to power or use manual T-handle (7163-1172) or Straight Screwdriver Handle (7163-1163) and place screws in bone. The Screwdriver contains a laser-marked ring. This ring should be stopped short of the Gold Outer Drill Sleeve to prevent final seating of the screw by power. It is recommended that final tightening of the 5.0 mm screw should always be under manual control using the T-Handle (7163-1172) or Straight Screwdriver Handle (7163-1163) (Figure 18).

Note: Once screw is seated, simply insert the Screwdriver Release Handle (7163-1208) into the cannulation of the T-Handle or Straight Screwdriver Handle and turn counterclockwise. The Screwdriver Release Handle releases the screw from the screwdriver without the need to remove the T-Handle (Figure 19).

Surgical Technique

Continue with the placement of the other lateral screw by following the predrilling technique (Figure 20).

Distal Screws: Medial Oblique Placement — For insertion of the medial oblique screw, the Quick Bolt is loosened and “back-turned” two complete revolutions. This allows the Knee Guide to be lifted (to distract off the nail) and rotated 180° (Figure 21). After rotating the Knee Guide, retighten to the nail with the Quick Bolt (7163-1138) and proceed as outlined in the above options. Be sure the key is engaged before retightening. The guide is now in correct position for placement of the medial oblique screw (Figure 22).

Proximal Screws — Measuring for proper length screw and placement can be accomplished in the following ways:

- A. **Predrilling Technique** — After perfect circles are confirmed, a stab incision is made over the holes and the Long Pilot Drill (7163-1110) is inserted through both cortices. The Mini-Connector (7163-1186) can be used to conveniently connect the drill to power. Remove the Mini-Connector and push the Silver Inner Drill Sleeve (7163-1156) to bone over the drill. The appropriate length measurement is taken from the drill calibrations in relation to the top of the Silver Inner Drill Sleeve (Figure 23). The appropriate length 5.0 mm screw (GOLD) is selected and attached to the Screwdriver. Remove the Long Pilot Drill and Inner Drill Sleeve. Attach Screwdriver to power or use manual T-Handle (7163-1172) or Straight Screwdriver Handle (7163-1163) and place screws in bone. It is recommended that final tightening of the 5.0 mm screw should always be under manual control using the T-Handle (7163-1172) or Straight Screwdriver Handle (7163-1163) (Figure 24).

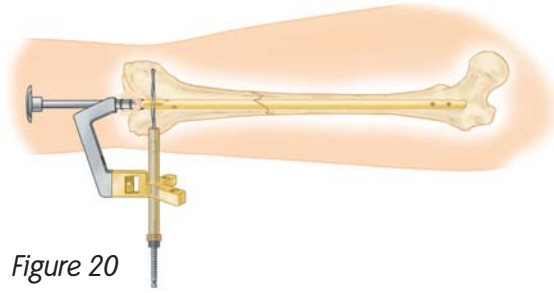


Figure 20

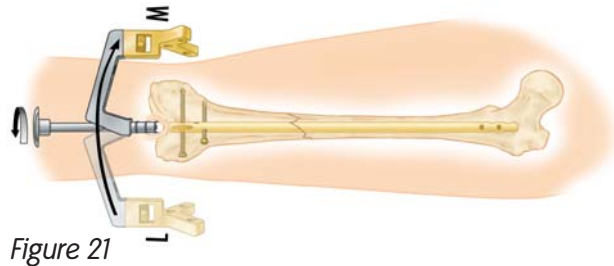


Figure 21

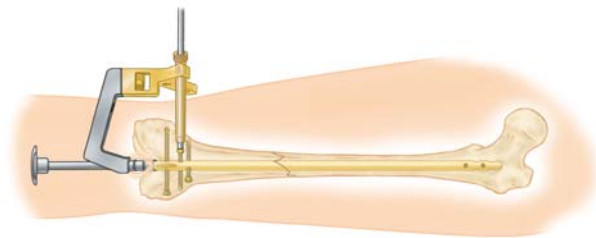


Figure 22

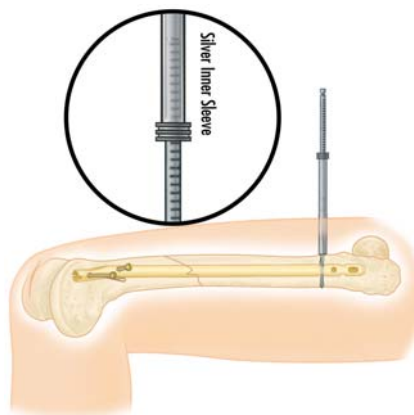


Figure 23

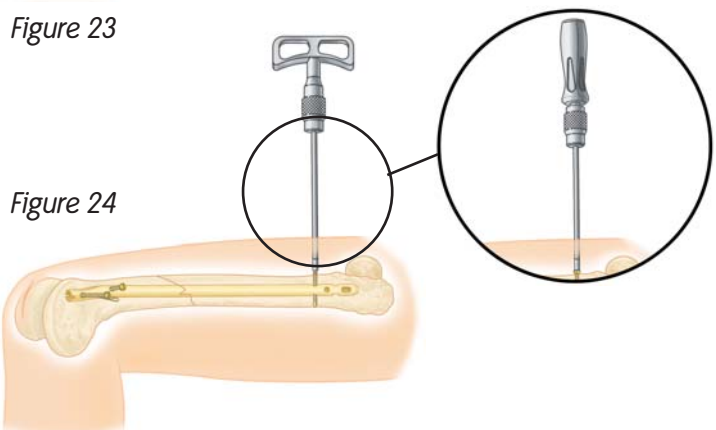


Figure 24

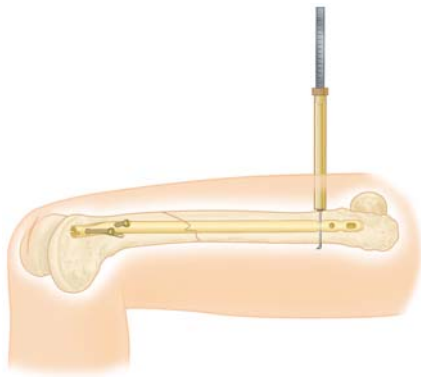


Figure 25

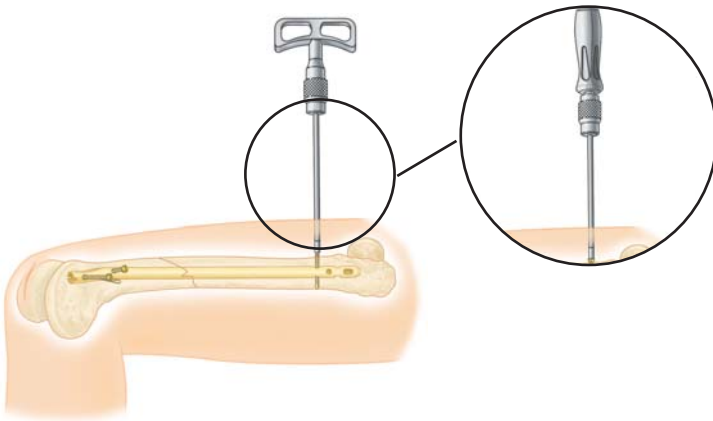


Figure 26

B. Screw Length Gauge Technique—

After predrilling through both cortices as outlined above, insert the Gold Outer Drill Sleeve (7163-1152) to bone and use the Screw Length Gauge (7163-1170) through the Gold Outer Drill Sleeve from the far cortex to measure for proper screw length (Figure 25). An alternative option in measuring for screw length is the Direct Measuring Gauge (7163-1189). The appropriate length 5.0 mm screw (GOLD) is selected and attached to the Screwdriver. Attach Screwdriver to power or use manual T-handle (7163-1172) or Straight Screwdriver Handle (7163-1163) and place screws in bone. The Screwdriver contains a laser-marked ring. This ring should be stopped short of the Gold Outer Drill Sleeve to prevent final seating of the screw by power. It is recommended that final tightening of the 5.0 mm screw should always be under manual control using the T-Handle (7163-1172) or Straight Screwdriver Handle (7163-1163) (Figure 26).

Surgical Technique

Targeter — The Targeter (7163-1174) may be used to assist in placing additional proximal screws after the first screw has been inserted. Be sure to use the Medium Screwdriver (7163-1166) when placing the first screw in bone as outlined in the above options. Leave the Medium Screwdriver attached to the first screw in the bone. Place the hole on the Targeter over the Screwdriver and push to skin. When using the Targeter for A/P locking, the slot marked “dynamic” should be used for the second screw. Make sure that the Targeter can freely rotate. The Short Screwdriver (7163-1168) can also be attached to the side of the Targeter. It acts as a handle to stabilize the Targeter, as well as an aid in reducing exposure of the hand during imaging (*Figure 27 Inset*). Use the C-Arm to rotationally locate the second hole. Once the position is found, place the 3.2 mm Guide Pin (7163-1190) through the wire hole on the Targeter and into bone to maintain position (*Figure 27*). The Mini-Connector (7163-1186) provides a convenient attachment of the drill to power. Make an incision at the tip of the barrel for the second screw and insert the Silver Inner Drill Sleeve and Targeter to bone. Use of the standard predrill technique or power technique can be used to finish screw placement (*Figure 28*). The optional power technique can also be used for the second screw by removing the Silver Inner Drill Sleeve. The Targeter can be used for A/P placement of the second screw. When using the Targeter for A/P locking, the slot marked “dynamic” should be used for the second screw (*Figure 29*).

Note: Once screw is seated, simply insert the Screwdriver Release Handle (7163-1208) into the cannulation of the T-Handle or Straight Screwdriver Handle and turn counterclockwise. The Screwdriver Release Handle releases the screw from the screwdriver without the need to remove the T-Handle or Straight Screwdriver Handle (*Figure 30*).

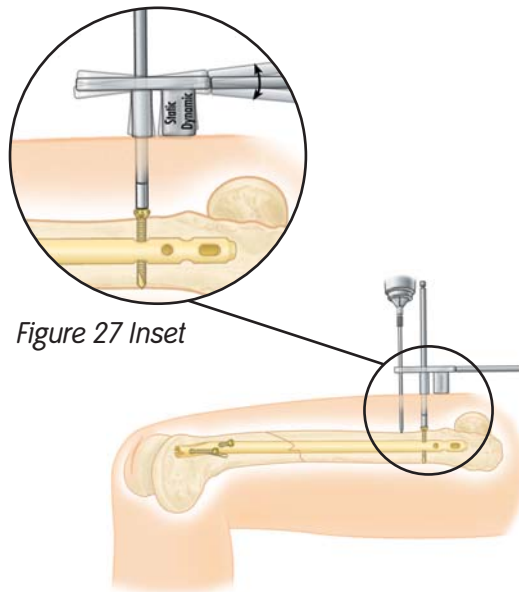


Figure 27

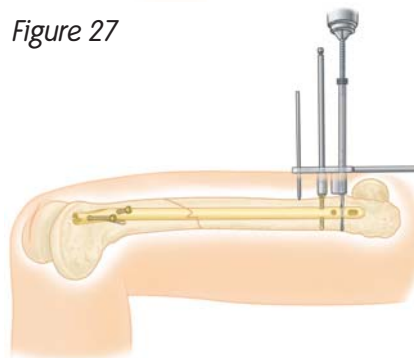


Figure 28

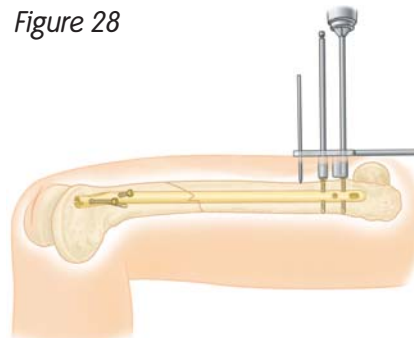


Figure 29

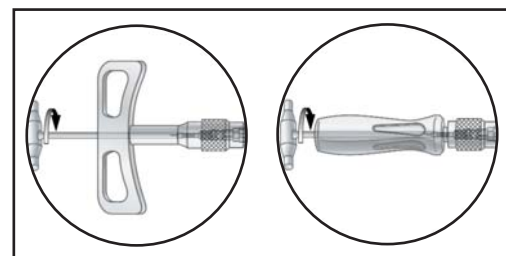


Figure 30



Figure 31

Drill Guide Assembly

For Knee Nails — Lengths of 15 CM, 20 CM and 25 CM (Supracondylar Fractures)

Attach the Knee Guide (7163-1142) to the Drill Guide (7163-1134). The Drill Guide is keyed so that the Knee Guide will only fit one way. The Knee Guide can be secured to the Drill Guide by tightening the gold “knurled knob” by hand. Final tightening can also be accomplished by placing the end of the Guide Bolt Wrench (7163-1140) into the holes in the knurled knob. Insert Quick Bolt (7163-1138) in the Drill Guide to secure nail. The Quick Bolt will also be used to rotate Drill Guide 180° as needed for the medial oblique screw insertion (*Figure 31*). Advance the nail over the guide rod and past the fracture so that the distal end (driving end) of the nail is countersunk 1 mm-2 mm into the intracondylar notch. Remove the guide rod after the nail is inserted and before inserting the locking screws. Take care not to distract the fracture during nail insertion. Pay particular attention to the rotational position of the extremity as this is frequently a complication of retrograde nailing. Rotation should be checked during nail insertion, and at the completion of nail insertion, before locking screws are inserted.

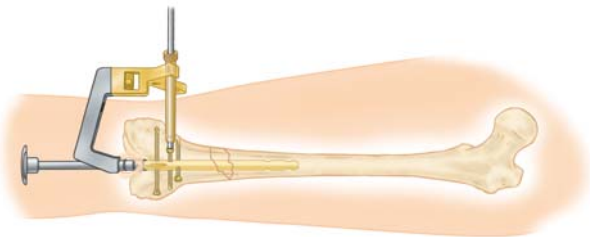


Figure 32

After placing the distal screws using the Knee Guide and technique for standard-sized Knee Nails, (*Figure 32*) attach the Supracondylar Guide (7163-1158) to the Drill Guide (7163-1134) to lock the proximal screws. Make sure the Supracondylar Guide is positioned so that its bend matches the implant (*Figure 33*). The most proximal screw will be in the dynamic slot position when using the Guide. Apex of the bend should be anterior in position. The Supracondylar Guide should be positioned lateral as shown.

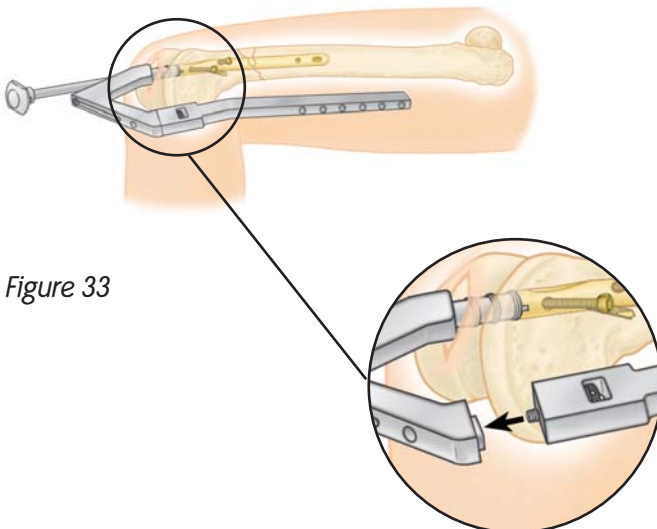


Figure 33

Surgical Technique

Interlocking

For Knee Nails 15 CM, 20 CM and 25 CM
(Supracondylar Fractures)

5.0 mm (GOLD) screws are to be used with 10 mm, 11.5 mm and 13 mm Knee Implants.

The 8.5 mm Knee Implants are indicated for use in the TIBIA ONLY. Do not use in the femur.

Proximal M/L Screws: Measuring for proper length screw and placement can be accomplished in the following three ways:

A. Predrill Technique — Place the Silver Inner Drill Sleeve (7163-1156) into the Gold Outer Drill Sleeve (7163-1152). Insert the stacked sleeves through the appropriate hole on the Supracondylar Guide (7163-1158). A stab incision is made and the sleeves pushed to bone. Attach the Long Pilot Drill (71631110) to power using the Mini-Connector (7163-1186). Insert the drill through both cortices. The length measurements are taken from the calibrations off the drill in relation to the end of the drill sleeves (*Figure 34*). The appropriate length 5.0 mm screw (GOLD) is selected and attached to the Screwdriver. Remove the Long Pilot Drill and Silver Inner Drill Sleeve. Attach Screwdriver to power or use manual T-Handle (7163-1172) or Straight Screwdriver Handle (7163-1163) and place screws in bone (*Figure 35*).

B. Screw Length Gauge Technique — After predrilling through both cortices as outlined above, remove the Silver Inner Drill Sleeve. Insert the Screw Length Gauge (7163-1170) through the remaining Gold Drill Sleeve (7163-1152) to measure for proper screw from the far cortex (*Figure 36*). An alternative option in measuring for screw length is the Direct Measuring Gauge (7163-1189) used without the drill sleeve. The appropriate length 5.0 mm screw (GOLD) is selected and attached to the Screwdriver. Attach Screwdriver to power or use manual T-handle (7163-1172) or Straight Screwdriver Handle (7163-1163) and place screws in bone. The Screwdriver contains a laser-marked ring. This ring should be stopped short of the Gold Outer Drill Sleeve to prevent

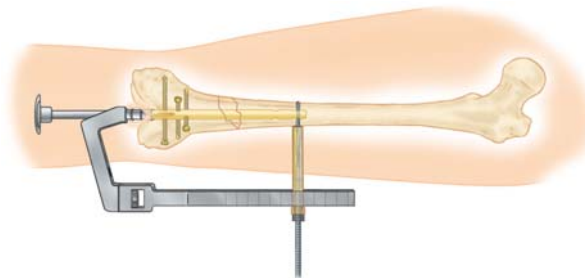


Figure 34

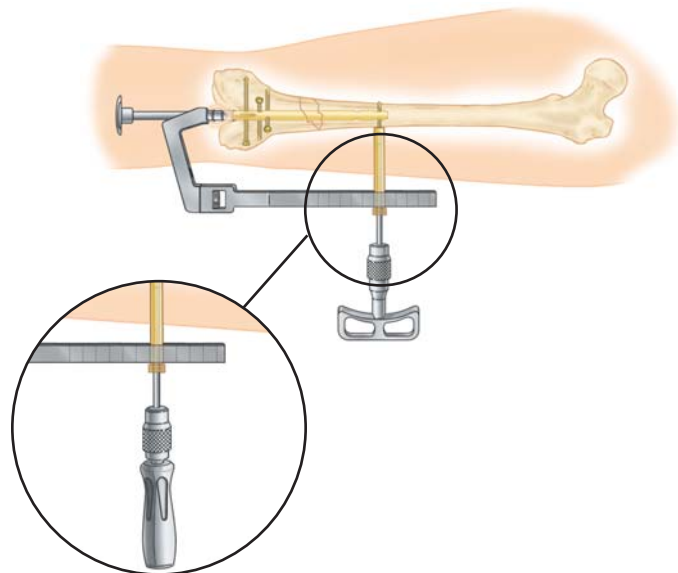


Figure 35

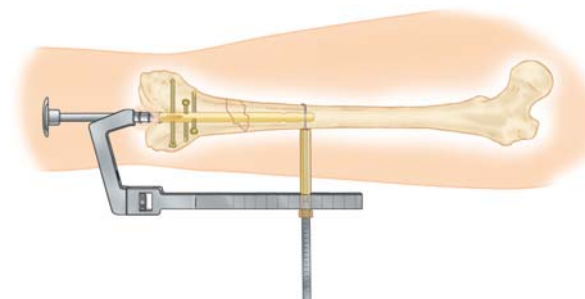


Figure 36

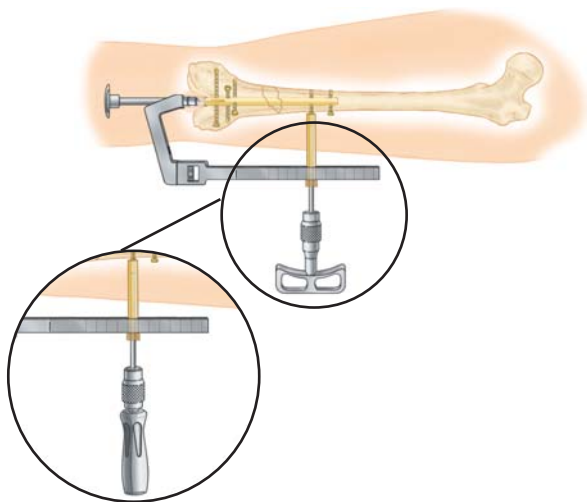


Figure 37

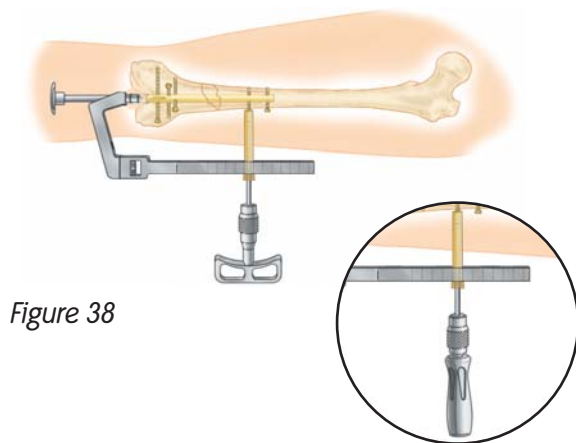


Figure 38

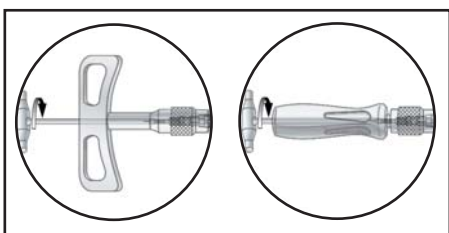


Figure 39

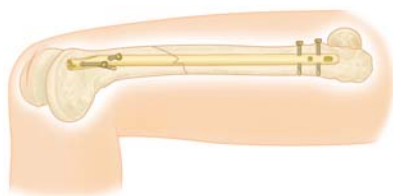


Figure 40



Figure 41

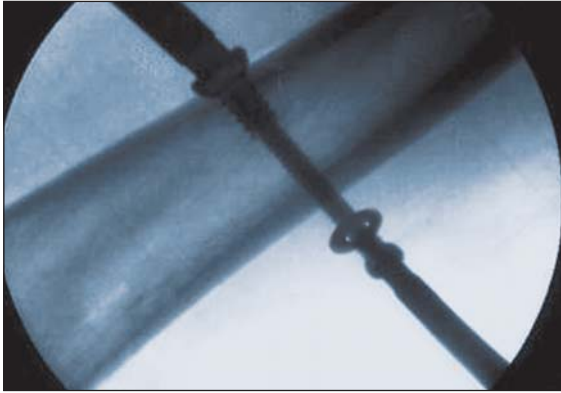
final seating of the screw by power. It is recommended that final tightening of the 5.0 mm screw should always be under manual control using the T-Handle (7163-1172) or Straight Screwdriver Handle (7163-1163) (Figure 37).

Note: Once screw is seated, simply insert the Screwdriver Release Handle (7163-1208) into the cannulation of the T-Handle and turn counterclockwise. The Screwdriver Release Handle releases the screw from the screwdriver without the need to remove the T-Handle (Figure 39).

Closure

Final position of the fracture is confirmed. The Knee Guide/Supracondylar Guide and Drill Guide are disassembled. Confirmation is made that the nail is countersunk within the knee. The wound is irrigated and closed in a standard fashion (Figure 40 and Figure 41).

TRIGEN STABLE-LOK Nut & Washer Surgical Technique



Design Features

Better Fixation & Improved Reduction

The TRIGEN STABLE-LOK Nut and Washer offers increased purchase in low density or osteoporotic bone. Used with a corresponding 5.0mm TRIGEN Internal Hex Head Screw, the STABLE-LOK Nut and Washer provides resistance to screw back out while improving fixation. The implants also improve the ability to address challenging intra-articular fractures.



Unique Design Speeds Surgery

Designed with unique cutting flutes and an external thread, the TRIGEN STABLE-LOK Nut eliminates the need to ream or countersink for bone preparation. To provide an additional secure locking feature, a polyethylene sleeve that captures the cortical screw is built into the nut.



Instruments

The TRIGEN STABLE-LOK Nut and Washer is inserted by using the Multipurpose Driver (Part #7163-1161) attached to the TRIGEN T-Handle (Part #7163-1172). Cortical screw implantation is accomplished by using the TRIGEN 4.0mm Long Pilot Drill (Part #7163-1110), the TRIGEN Screw Depth Gauge (Part #7163-1189) and a second TRIGEN T-Handle (Part #7163-1172) or the optional Straight Screw Driver (Part #7163-1163) attached to a short or medium TRIGEN Hexdriver (Part #7163-1068; 7163-1066).

Technique

Using powered instrumentation, advance the TRIGEN 4.0mm drill bit into the bone and continue advancement until full penetration of the opposite cortex and soft tissue is complete. A small incision is then made over the drill bit down to the cortex to allow a path for the STABLE-LOK Nut. Assure sufficient soft tissue release for proper seating of the nut. After removing the retaining rod from the Multipurpose Driver, the Stable-Lok Nut is assembled onto the driver, guided over the drill bit, and threaded securely into the bone. The drill is then removed and the TRIGEN Screw Depth Gauge is inserted into the 4.0mm hole and hooked onto the far side of the nut. The length of the Internal Hex Head Screw should correspond exactly with the reading on the screw depth gauge.

NOTE: *If a lag technique is desired, then the appropriate amount of compression must be considered when choosing the correct screw length.*

The Washer is then placed on the Internal Hex Head Screw, and the screw is advanced through the pre-drilled hole until it engages the STABLE-LOK Nut on the far cortex. A second T-handle or straight handled screwdriver is used to hold the nut during this step. Advance the screw into the nut for optimal locking compression and/or improved fixation.

TRIGEN Nail Extraction Technique

Patient Positioning

Patient Positioning for Femoral & Trochanteric Antegrade or Knee Nails used Femoral Retrograde

Place the patient in the lateral decubitus or supine position.

Knee Nails Used Tibial Antegrade

Place the patient in the supine position on a radiolucent table with the affected leg in a figure four configuration.



Figure 1



Figure 2



Figure 3



Figure 4

Surgical Technique

After prepping and draping, remove any distal screws and all but one proximal screw from the nail, leaving the screw closest to the driving end of the nail. Under fluoroscopy, percutaneously place a 3.2mm tip-threaded guide pin (*Figure 1*) (7163-1190) into the threaded end of the nail. (If a cap is on the nail, an incision must be made and the cap removed.) A mallet may be used to insert this guide pin, but usually power equipment is available and can be used for percutaneous placement.

When the guide pin is in the nail, make a one-inch incision about the pin and advance the 12.5mm entry reamer (*Figure 2*) (7163-1116) over the pin to remove the tissue and ingrowth overlying the nail. Note that the tip of the reamer is straight for approximately 1/2 inch before flaring out. It is this portion of the reamer that enters the nail.

After reaming, remove the reamer and the guide pin and insert the 3.0 X 1000mm TRIGEN ball tipped guide rod (7163-1126). Attach the extractor to the impactor handle (7163-1185) and tighten, then thread the extractor into the nail (with the guide rod in place) (*Figure 3*). Place the screwdriver shaft into the impactor handle slot and turn until the impactor is securely engaged. This can be verified by fluoroscopy (*Figure 4*).

After the impactor is securely engaged in the nail, remove the last locking screw (Figure 5).

Attach the gripper to the guide rod adjacent to the end of the impactor. The gripper will provide a handle for the surgeon to use while backslapping the impactor with the slotted hammer when extracting the nail (Figure 6).

Note: Use extreme caution not to exert any side loads on the impactor extractor assembly. Excessive pulling and pushing on the end of the impactor handle could result in pre-mature failure of the extraction device. In the event of extractor failure, pull the guide rod until the ball tip engages the extractor, re-tighten the gripper adjacent to the impactor and proceed with the extraction. Recommended usage for extractor: 7-10 times

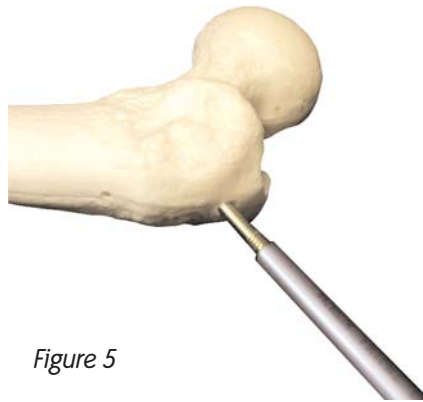


Figure 5



Figure 6

TRIGEN Nail Extraction: Alternative Tips

Alternative Methods For Extraction of TRIGEN Nails

Jamming of the guide rods

Utilizing two guide rods, one 3.0mm ball tip and one 2.0mm smooth, advance the 3.0mm ball tip guide rod past the end of the nail then insert the 2.0mm smooth rod in a similar manner, past the tip of the nail. Once both wires are in place, attach the gripper to the end of the 3.0mm ball tipped rod and pull back to wedge the ball tip with the 2.0 rod and the end of the nail. Backslap against the gripper to remove the nail.

Part #	Description
115120	2.0 x 700mm smooth
71631126	3.0 x 1000mm ball tip
71118280	2.0 x 900mm smooth
71118202	3.0 x 900mm ball tip
112069	3.0 x 900mm ball tip

After following the patient positioning and entry reaming techniques cited at the beginning of this document, proceed with the following substitution for the quick bolt:

Attach the RUSSELL-TAYLOR® Tibial extraction bolt (112041) to the slide hammer (112011). Thread the assembly into the nail and proceed with extracting the nail via the slide hammer mechanism.

Part #	Description
112041	5/16 - 24 extraction bolt
11-2011	Slide hammer

Additional Tips For Extraction

Thoroughly review all extraction alternatives with the surgeon pre-operatively and have access to instrumentation cited in this update.

Other items that may be helpful in removal are as follows:

Part #	Description
115074	Large Extractor Hook
115073	Small Extractor Hook
914659	Small Easy Out
914658	Large Easy Out

Last resort:

In the event that the above techniques are unsuccessful or result in device failure, the screw extractor that is currently available in the cannulated screw sets will remove cannulated extraction devices that have failed during surgery and will also possibly remove the nail. The surgeon should hand tighten the screw extractor (7111-9014) then tap with the hammer to ensure engagement.

At this point, the surgeon can then attempt to remove the nail with the screw extractor and / or back turn the broken piece of extractor and then insert the guide bolt (7163-1136), quick bolt, or R-T tibial extraction bolt into the nail to remove the nail.



Retrograde Femoral or Antegrade Tibial
(Gold)

Cat. No.	Length	Cat. No.	Length
7163-3226	10 mm x 26 cm	7163-3340	11.5 mm x 40 cm
7163-3228	10 mm x 28 cm	7163-3342	11.5 mm x 42 cm
7163-3230	10 mm x 30 cm	7163-3344	11.5 mm x 44 cm
7163-3232	10 mm x 32 cm	7163-3346	11.5 mm x 46 cm
7163-3234	10 mm x 34 cm	7163-3348	11.5 mm x 48 cm
7163-3236	10 mm x 36 cm	7163-3350	11.5 mm x 50 cm
7163-3238	10 mm x 38 cm	7163-3426	13 mm x 26 cm
7163-3240	10 mm x 40 cm	7163-3428	13 mm x 28 cm
7163-3242	10 mm x 42 cm	7163-3430	13 mm x 30 cm
7163-3244	10 mm x 44 cm	7163-3432	13 mm x 32 cm
7163-3246	10 mm x 46 cm	7163-3434	13 mm x 34 cm
7163-3248	10 mm x 48 cm	7163-3436	13 mm x 36 cm
7163-3250	10 mm x 50 cm	7163-3438	13 mm x 38 cm
7163-3326	11.5 mm x 26 cm	7163-3440	13 mm x 40 cm
7163-3328	11.5 mm x 28 cm	7163-3442	13 mm x 42 cm
7163-3330	11.5 mm x 30 cm	7163-3444	13 mm x 44 cm
7163-3332	11.5 mm x 32 cm	7163-3446	13 mm x 46 cm
7163-3334	11.5 mm x 34 cm	7163-3448	13 mm x 48 cm
7163-3336	11.5 mm x 36 cm	7163-3450	13 mm x 50 cm
7163-3338	11.5 mm x 38 cm		



Short
(Gold)

Cat. No.	Length
7163-3315	11.5 mm x 15 cm
7163-3320	11.5 mm x 20 cm
7163-3325	11.5 mm x 25 cm
7163-3415	13 mm x 15 cm
7163-3420	13 mm x 20 cm
7163-3425	13 mm x 25 cm



5.0 mm Internal Captured
Screw

(Gold) For 10 mm,
11.5 mm & 13 mm Implants

Cat. No.	Length
7164-2225	25 mm
7164-2230	30 mm
7164-2235	35 mm
7164-2240	40 mm
7164-2245	45 mm
7164-2250	50 mm
7164-2255	55 mm
7164-2260	60 mm
7164-2265	65 mm
7164-2270	70 mm
7164-2275	75 mm
7164-2280	80 mm
7164-2285	85 mm
7164-2290	90 mm
7164-2295	95 mm
7164-2200	100 mm
7164-2205	105 mm
7164-2210	110 mm



Nail Caps

Cat. No.	Length
7163-4000	0 mm
7163-4005	5 mm
7163-4010	10 mm
7163-4015	15 mm
7163-4020	20 mm



STABLE-LOK Nut
(Used with 5.0 mm
internal captured screws)

Cat. No.
7163-2001

Knee

Gripper

Cat. No. 7163-1100

4.0 mm Long Pilot Drill

Cat. No. 7163-1110

4.0 mm Short Pilot Drill

Cat. No. 7163-1117

4.0 mm Short AO Pilot Drill

Cat. No. 7163-1123

4.0 mm Long AO Pilot Drill

Cat. No. 7163-1121

4.0 mm Short AO Step Drill

Cat. No. 7164-1123

4.0 mm Screw Length Sleeve

Cat. No. 11-0238

Entry Tool

Cat. No. 7163-1114

12.5 mm Entry Reamer

Cat. No. 7163-1116

14 mm Channel Reamer

Cat. No. 7163-1118

Entry Reamer Connector

Cat. No. 7163-1120

Obturator

Cat. No. 7163-1122



Catalog



Reducer

Cat. No. 7163-1124



3.0 mm X 1000 mm Ball Tip Guide Rod

Cat. No. 7163-1126 & 7163-1626 (16 per box)



Ruler

Cat. No. 7163-1128



Flex Reamer Extender

Cat. No. 7163-1130



Skin Protector

Cat. No. 7163-1132



Drill Guide 135°

Cat. No. 7163-1134

Drill Guide 130°

(Not Shown)

Cat. No. 7163-1135



Guide Bolt

Cat. No. 7163-1136



Quick Bolt

Cat. No. 7163-1138



Guide Bolt Wrench

Cat. No. 7163-1140



Knee Guide

Cat. No. 7163-1142

Catalog



One Piece Impactor

Cat. No. 7163-1185



Hammer

Cat. No. 7163-1150



Gold Outer Drill Sleeve

Cat. No. 7163-1152



Silver Inner Drill Sleeve

Cat. No. 7163-1156



6.4 mm Drill

Cat. No. 7163-1160



6.4 mm Tap

Cat. No. 7163-1162



Long External Screwdriver

Cat. No. 7163-1164



Medium External Screwdriver

Cat. No. 7163-1166



Short External Screwdriver

Cat. No. 7163-1168



Screwdriver Replacement Bars for External Screwdrivers

Cat. No.	Description
7163-1165	Large
7163-1167	Medium
7163-1169	Short

Catalog



Hexdriver 4.5 mm, 5.0 mm & 6.4 mm Internal Captured Hex Screws

Cat. No.	Description
7163-1066	Medium
7163-1068	Short
7163-1070	Long



Screw Length Gauge

Cat. No.	7163-1170
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Direct Measuring Gauge

Cat. No.	7163-1189
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T-Handle (Zimmer-Hall)

Cat. No.	7163-1172
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Straight Screwdriver Handle

Cat. No.	7163-1163
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Targeter

Cat. No.	7163-1174
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Large Extractor

Cat. No.	7163-1278
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Small AO Adapter

Cat. No.	7163-1184
----------	-----------



Trinkle Adapter

Cat. No.	7163-1183
----------	-----------



Mini Connector

Cat. No.	7163-1186
----------	-----------

Catalog



Trinkle Mini Connector

Cat. No. 7163-1187



Tip Threaded Guide Wire

Cat. No. 7163-1190 & 7163-1690 (6 per box)



Flex Reamer Shaft

Cat. No. 7163-1192



Screwdriver Release Handle

Cat. No. 7163-1208



Pilot Nose Reamer Heads

Cat. No.	Description
7111-8232	9.0 mm Head
7111-8233	9.5 mm Head
7111-8234	10.0 mm Head
7111-8235	10.5 mm Head
7111-8236	11.0 mm Head
7111-8237	11.5 mm Head
7111-8238	12.0 mm Head
7111-8239	12.5 mm Head
7111-8240	13.0 mm Head
7111-8241	13.5 mm Head
7111-8242	14.0 mm Head
7111-8243	14.5 mm Head
7111-8244	15.0 mm Head
7111-8245	15.5 mm Head
7111-8246	16.0 mm Head
7111-8247	16.5 mm Head
7111-8248	17.0 mm Head



Modular Reamer Box

Cat. No. 7163-1218

Eno Cutting Reamer Heads

Cat. No.	Description
7111-8231	9.0 mm Head

Implant Trays



Small Outer Case 2.4"

Cat. No. 7112-9401



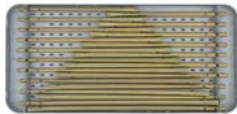
TRIGEN Instrument Tray 1

Cat. No. 7163-1199



TRIGEN Instrument Tray 2

Cat. No. 7163-1201



Knee Nail Case

Cat. No. 7163-1204

Screw Caddy

Cat. No. 7163-1180



Large Outer Case 4.8"

Cat. No. 7112-9400

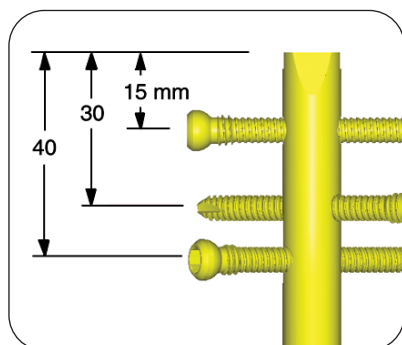


Lid for Outer Case

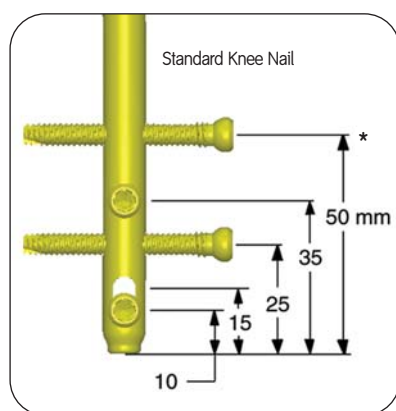
(Shown with Case)

Cat. No. 7112-9402

TRIGEN Knee Nail – Specifications

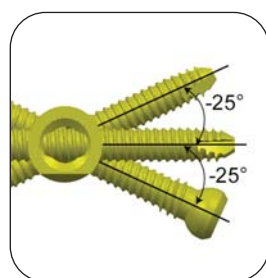


Driving End of Nail (All Knee Nails)



Non-driving End of Nail (M/L view)

***Note:** 8.5 mm is for Tibia Mode only. Locking is the same as standard knee nail except for 50mm.



Top View of Nail

Note: These views are not to scale and should be used as a pictorial representation only.

Specifications	TRIGEN Knee Nail
Material	Ti6AL4V
Diameter	10, 11.5, 13mm
Lengths	26-50cm
Nail Color	Gold
Cross Section	Round
Proximal Diameter (driving end)	11.5mm (10, 11.5 dia.) 13mm (13 dia.)
Proximal Diameter (non-driving end)	10, 11.5, 13mm (dia. of the nail)
Smallest Thru Diameter	5.4mm
Wall Thickness	2.3mm (10 dia.) 3.0mm (11.5 dia.) 3.5mm (13 dia.)
Guide Bolt Thread	5/16 - 24
Alternative Guide Bolts	RT Tibial, Retrograde, IMSC, Revision
Alternative Modes	Retrograde Femoral
Proximal Locking (Driving End)	
Screw Diameter	5.0mm
Hex Size	4.7mm
Alternative Hex Drivers	RT Femoral & Recon 7.0mm Cannulated Screw
Screw Color	Gold
Screw Lengths	25-110mm
Location	15, 30 40mm
Proximal Dynamization Slot	
Proximal Screw Hole Dimensions	5.3mm
Orientation	Transverse, (2) 25 Deg Oblique
Deg of Proximal Bend (Herzog)	10
Location of Proximal Bend	32mm
Distal Locking (Non-Driving End)	
Screw Diameter	5.0mm
Major Diameter	5.0mm
Minor Diameter (core)	4.3mm
Distal Screw Hole Dimensions	5.3mm
Screw Color	Gold
Screw Lengths	25-110mm
Location	10- 15, 25, 35, 50mm
Orientation	Slot/Hole 1&3 - M-L Hole 2&4 - A-P
Dynamization Slot	Yes
Distal Hole Dimensions	5.3mm
AP Bow	Hybrid Bow - Proximal 2.5 meters Distal 3.0 meters
Location of Distal Bend	100mm
Dynamization Slot Location	Most Distal Hole

Notes

Notes

Orthopaedics

Smith & Nephew, Inc.
1450 Brooks Road
Memphis, TN 38116
USA

www.smith-nephew.com

Telephone: 901-396-2121
Information: 1-800-821-5700
Orders/Inquiries: 1-800-238-7538