Zimmer® MIS™ Multi-Reference® 4-in-1 Femoral Instrumentation

Surgical Technique

For *NexGen*® Cruciate Retaining &
NexGen Legacy® Posterior Stabilized Knees

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Surgical Technique For MIS Multi-Reference 4-in-1 Femoral Instrumentation

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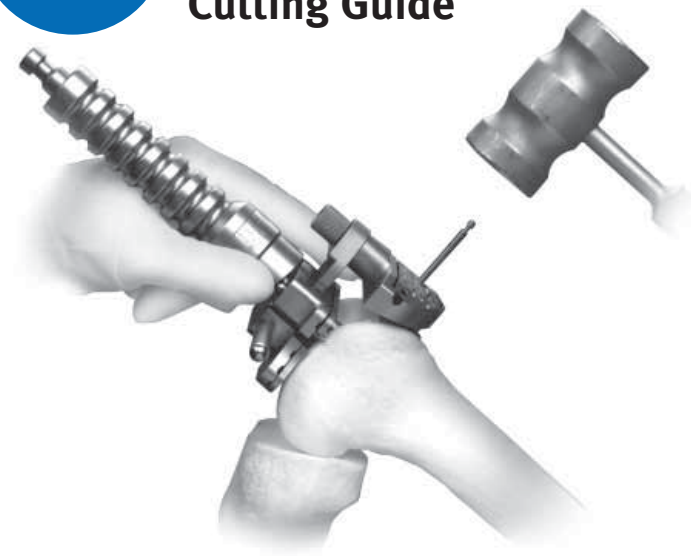
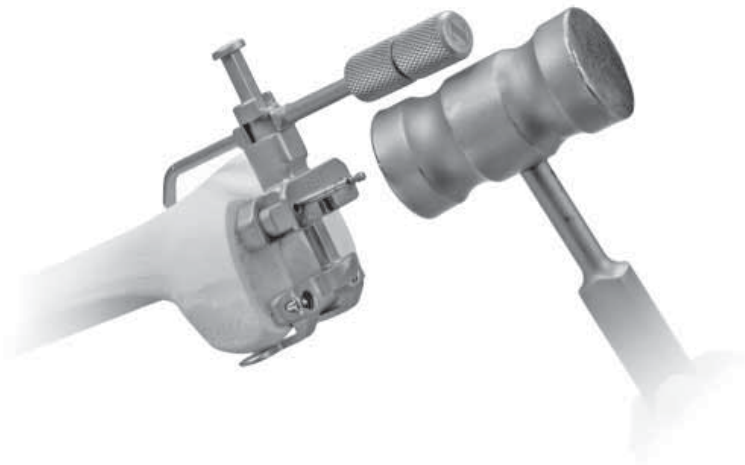
Table of Contents

1 Drill 8mm Pilot Hole

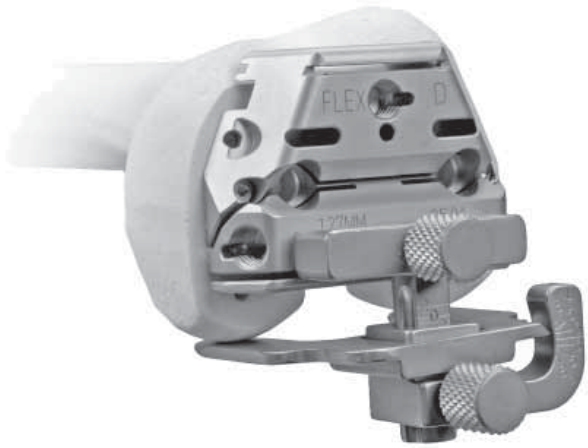
2 Insert and Secure Mini Distal Femoral Cutting Guide



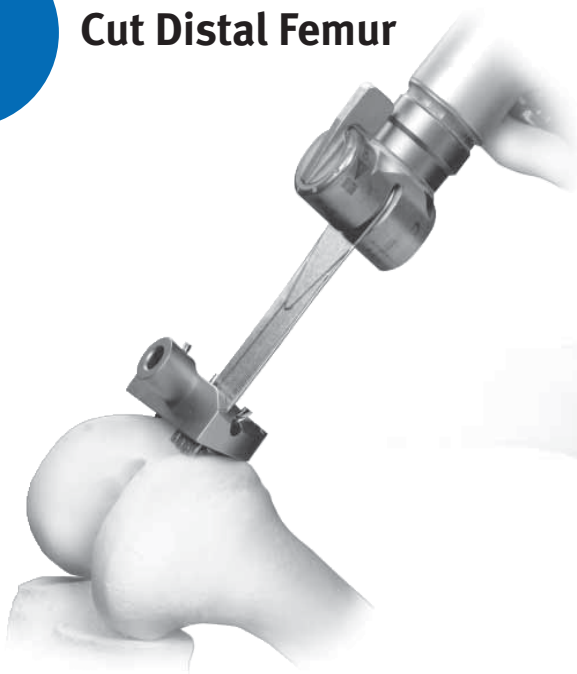
5a Set External Rotation (Anterior Referencing)



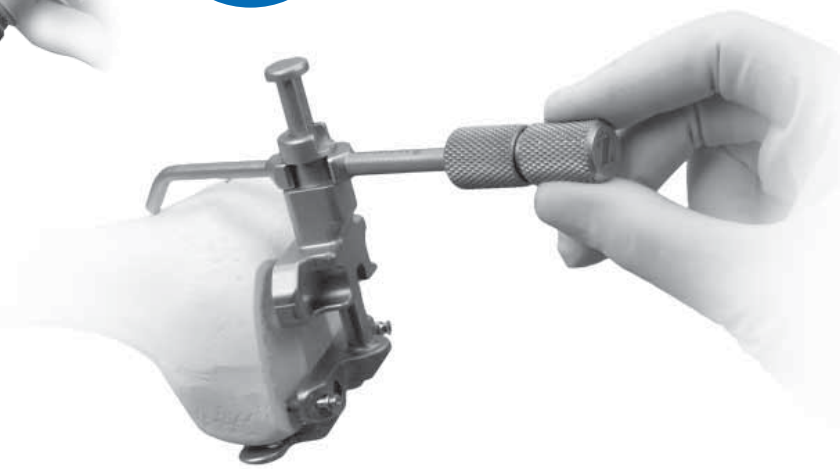
5b Set External Rotation (Posterior Referencing)



3 Cut Distal Femur



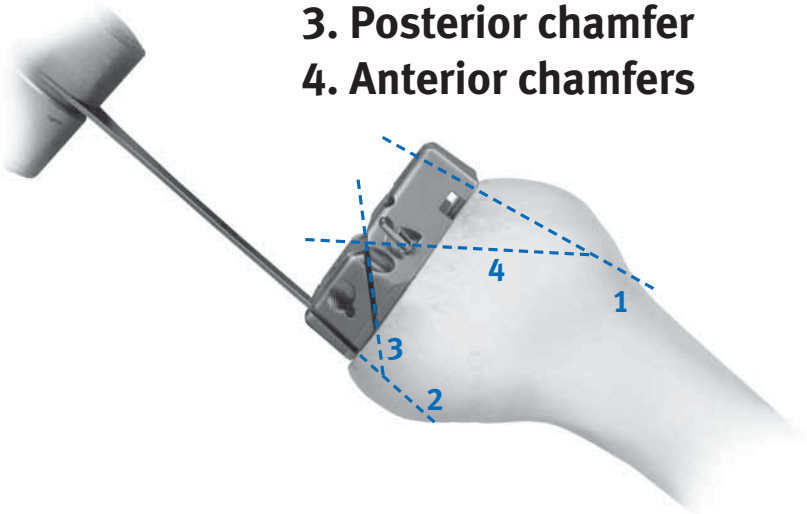
4 Size the Femur



6 Place Femoral Finishing Guide; Adjust M/L & Pin (Anterior Referencing)

7 Finish the Femur

1. Anterior condyles
2. Posterior condyles
3. Posterior chamfer
4. Anterior chamfers



Introduction

Successful total knee arthroplasty depends in part on re-establishment of normal lower extremity alignment, proper implant design and orientation, secure implant fixation, and adequate soft tissue balancing and stability. The *NexGen* Complete Knee Solution and *Multi-Reference* 4-in-1 Instruments are designed to help the surgeon accomplish these goals by combining optimal alignment accuracy with a simple, straight-forward technique.

The instruments and technique assist the surgeon in restoring the center of the hip, knee, and ankle to lie on a straight line, establishing a neutral mechanical axis. The femoral and tibial components are oriented perpendicular to this axis. Femoral rotation is determined using the posterior condyles or epicondylar axis as a reference. The instruments promote accurate cuts to help ensure secure component fixation. Ample component sizes allow soft tissue balancing with appropriate soft tissue release.

The femur, tibia, and patella are prepared independently, and can be cut in any sequence using the principle of measured resection (removing enough bone to allow replacement by the prosthesis). Adjustment cuts may be needed later.

The *Multi-Reference* 4-in-1 instruments provide a choice of either anterior or posterior referencing techniques for making the femoral finishing cuts. The anterior referencing technique uses the anterior cortex to set the A/P position of the femoral component. The posterior condyle cut is variable. The posterior referencing technique uses the posterior condyles to set the A/P position of the femoral component. The variable cut is made anteriorly.

The Mini-Incision TKA technique has been developed to combine the alignment goals of total knee arthroplasty with less disruption of soft tissue. To accommodate this technique, some of the original *Multi-Reference* 4-in-1 Instruments have been modified. However, if preferred, a standard incision can be used with the instruments. Prior to using a smaller incision, the surgeon should be familiar with implanting *NexGen* components through a standard incision.

Total knee arthroplasty using a less invasive technique is suggested for nonobese patients with preoperative flexion greater than 90°. Patients with varus deformities greater than 17° or valgus deformities greater than 13° are typically not candidates for an *MIS* technique.

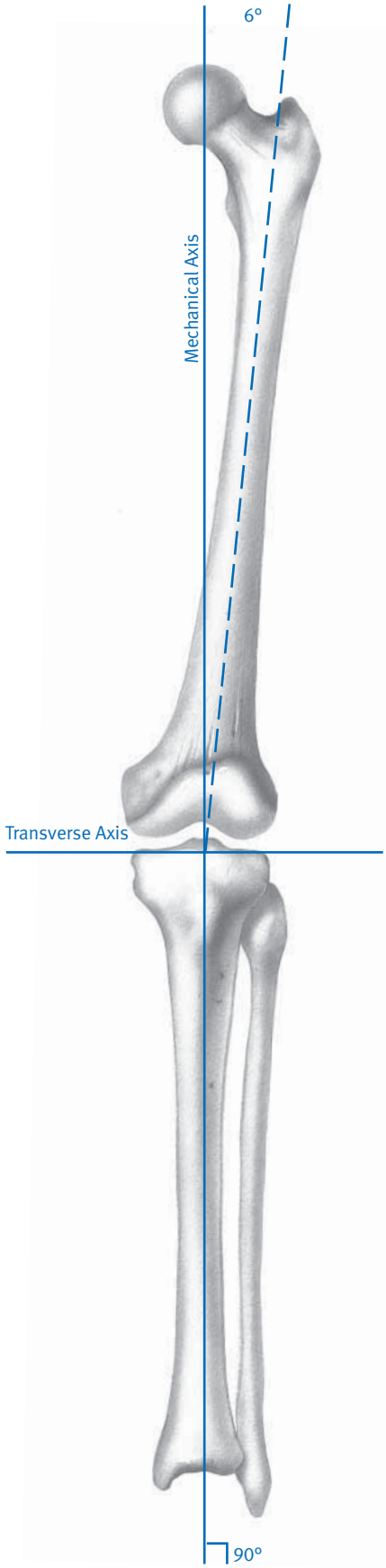
Please refer to the package inserts for complete product information, including contraindications, warnings, precautions, and adverse effects.

Preoperative Planning

Use the template overlay (available through your Zimmer Representative) to determine the angle between the anatomic axis and the mechanical axis. This angle will be reproduced intraoperatively. This surgical technique helps the surgeon ensure that the distal femur will be cut perpendicular to the mechanical axis and, after soft tissue balancing, will be parallel to the resected surface of the proximal tibia.

Surgical Approach

The femur, tibia, and patella are prepared independently, and can be cut in any sequence using the principle of measured resection (removing enough bone to allow replacement by the prosthesis). Adjustment cuts may be needed later.



Patient Preparation

To prepare the limb for *MIS* total knee arthroplasty, adequate muscle relaxation is required. This may be accomplished with a short-acting, nondepolarizing muscle relaxant. The anesthesiologist should adjust the medication based on the patient's habitus and weight, and administer to induce adequate muscle paralysis for a minimum of 30-40 minutes. It is imperative that the muscle relaxant be injected prior to inflation of the tourniquet. Alternatively, spinal or epidural anesthesia should produce adequate muscle relaxation.

If desired, apply a proximal thigh tourniquet and inflate it with the knee in hyperflexion to maximize that portion of the quadriceps that is below the level of the tourniquet.

Once the patient is draped and prepped on the operating table, determine the landmarks for the surgical incision with the leg in extension.

Incision and Exposure

The incision may be made with the leg in extension or flexion depending on surgeon preference. The surgeon can choose a midvastus approach, a subvastus approach, or a parapatellar medial arthrotomy. Also, depending on surgeon preference, the patella can be either everted or subluxed.

The length of the incision is dependent on the size of the femoral component needed. Although the goal of a *MIS* technique is to complete the surgery with an approximately 10cm-14cm incision, it may be necessary to extend the incision if visualization is inadequate or if eversion of the patella is not possible without risk of avulsion at the tibial tubercle. If the incision must be extended, it is advisable to extend it gradually and only to the degree necessary. The advantage of a *MIS* technique is dependent on maintaining the extensor mechanism insertion.

Make a slightly oblique parapatellar skin incision, beginning approximately 2cm proximal and medial to the superior pole of the patella, and extend it approximately 10cm to the level of the superior patellar tendon insertion at the center of the tibial tubercle (Fig. 1). Be careful to avoid disruption of the tendon insertion. This will facilitate access to the vastus medialis obliquis, and allow a minimal split of the muscle. It will also improve visualization of the lateral aspect of the joint obliquely with the patella everted. The length of the incision should be about 50% above and 50% below the joint line. If the length of the incision is not distributed evenly relative to the joint line, it is preferable that the greater portion be distal.

Divide the subcutaneous tissue to the level of the retinaculum.

Note: Using electrocautery to complete the exposure will help minimize bleeding after deflation of the tourniquet, as well as late muscle bleeding.

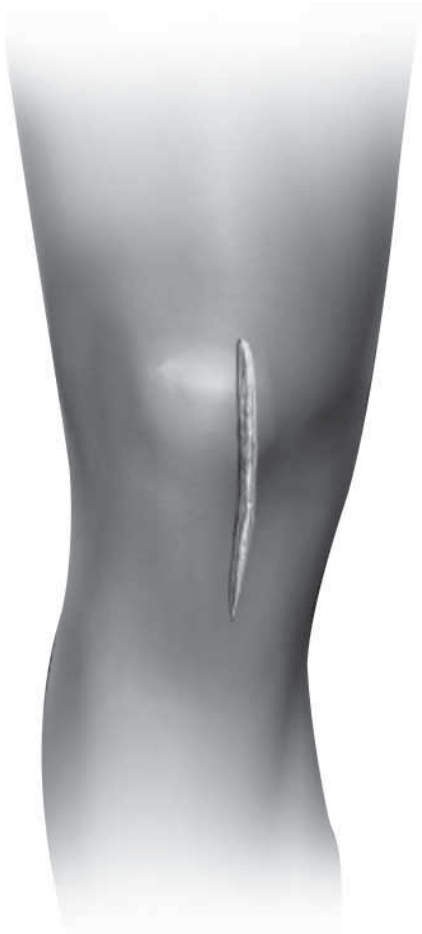


Fig. 1

MIS Midvastus Approach

Developed in conjunction with Luke M. Vaughan, M.D.

Make a medial parapatellar incision into the capsule, preserving approximately 1cm of peritenon and capsule medial to the patellar tendon. This is important to facilitate complete capsular closure.

Split the superficial enveloping fascia of the quadriceps muscle percutaneously in a proximal direction over a length of approximately 6cm. This will mobilize the quadriceps and allow for significantly greater lateral translation of the muscle while minimizing tension on the patellar tendon insertion.

Split the vastus medialis obliquis approximately 1.5cm-2cm (Fig. 2).

Use blunt dissection to undermine the skin incision approximately 1cm-2cm around the patella.

Slightly flex the knee and remove the deep third of the fat pad.

The patella can be either everted or subluxed. If everting the patella, release the lateral patellofemoral ligament to facilitate full eversion and lateral translation of the patella. Then use hand-held three-pronged or two-pronged hooks to begin to gently evert the patella. Be careful to avoid disrupting the extensor insertion. To help evert the patella, slowly flex the joint and externally rotate the tibia while applying gentle pressure. Once the patella is everted, use a standard-size Hohmann retractor or two small Hohmann retractors along the lateral flare of the tibial metaphysis to maintain the eversion of the patella and the extensor mechanism.

Note: It is imperative to maintain close observation of the patellar tendon throughout the procedure to ensure that tension on the tendon is minimized, especially during eversion of the patella and positioning of the patient.

Remove any large patellar osteophytes.

Release the anterior cruciate ligament, if present. Perform a subperiosteal dissection along the proximal medial and lateral tibia to the level of the tibial tendon insertion. Then perform a limited release of the lateral capsule (less than 5mm) to help minimize tension on the extensor mechanism.

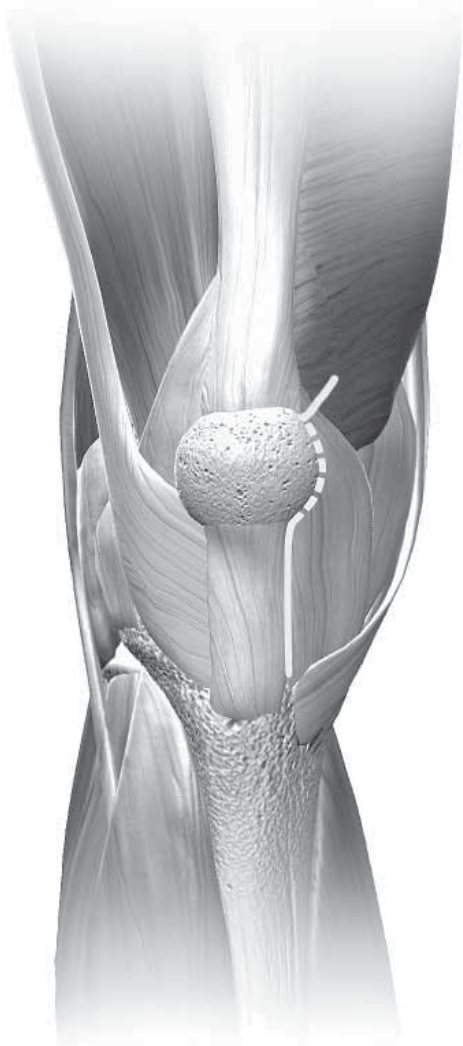


Fig. 2

MIS Subvastus Approach

Developed in conjunction with Mark W. Pagnano, M.D.

The subvastus medial arthrotomy has been slightly modified to optimize minimally invasive surgery. It provides excellent exposure for TKA while preserving all four attachments of the quadriceps to the patella. This approach does not require patellar eversion, minimizes disruption of the suprapatellar pouch, and facilitates rapid and reliable closure of the knee joint.

Dissect the subcutaneous tissue down to but not through the fascia that overlies the vastus medialis muscle.

Identify the inferior border of the vastus medialis muscle, and incise the fascia at approximately 5cm to 8cm medial to the patellar border (Fig. 3) to allow a finger to slide under the muscle belly but on top of the underlying synovial lining of the knee joint. Use the finger to pull the vastus medialis obliquis muscle superiorly and maintain slight tension on the muscle.

Use electrocautery to free the vastus medialis from its confluence with the medial retinaculum, leaving a small cuff of myofascial tissue attached to the inferior border of the vastus medialis.

The tendonous portion of the vastus medialis extends distally to insert at the midpole of the medial border of the patella. Be careful to preserve that portion of the tendon to protect the vastus medialis muscle during subsequent steps. An incision along the inferior border of the vastus medialis to the superior pole of the patella will result in a tear, split, or maceration of the muscle by retractors. Incise the underlying synovium in a slightly more proximal position than is typical with a standard subvastus approach. This will allow a two-layer closure of the joint. The deep layer will be the synovium, while the superficial layer will be the medial retinaculum and the myofascial sleeve of tissue that has been left attached to the inferior border of the vastus medialis.

Carry the synovial incision to the medial border of the patella. Then turn directly inferiorly to follow the medial border of the patellar tendon to the proximal portion of the tibia. Elevate the medial soft tissue sleeve along the proximal tibia in a standard fashion.

Place a bent-Hohmann retractor in the lateral gutter and lever it against the robust edge of the tendon that has been preserved just medial and superior to the patella. Retract the patella and extensor mechanism into the lateral gutter. If necessary, mobilize the vastus medialis either from its underlying attachment to the synovium and adductor canal, or at its superior surface when there are firm attachments of the overlying fascia to the subcutaneous tissues and skin. Depending on surgeon preference, the fat pad can be excised or preserved.

Flex the knee. The patella will stay retracted in the lateral gutter behind the bent-Hohmann retractor, and the quadriceps tendon and vastus medialis will lie over the distal anterior portion of the femur. To improve visualization of the distal anterior portion of the femur, place a thin knee retractor along the anterior femur and gently lift the extensor mechanism during critical steps of the procedure. Alternatively, bring the knee into varying degrees of extension to improve visualization by decreasing the tension on the extensor mechanism.

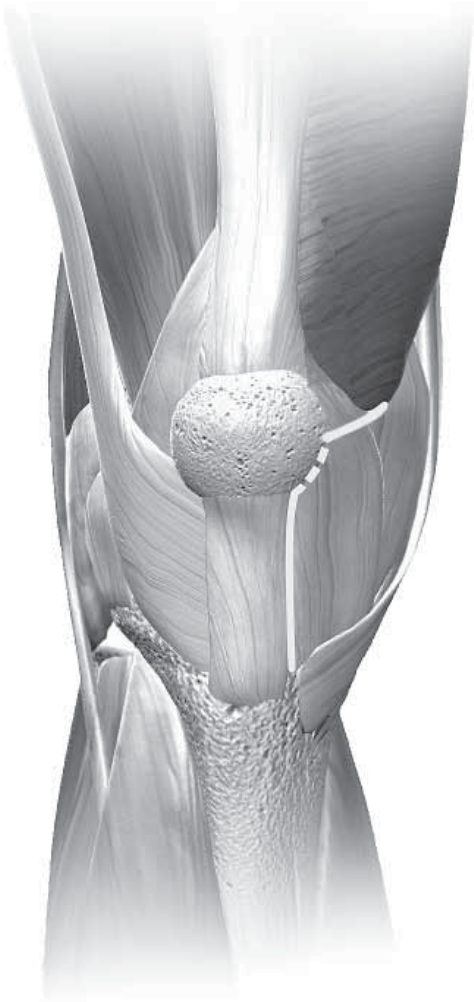


Fig. 3

MIS Medial Parapatellar Arthrotomy

Developed in conjunction with Giles R. Scuderi, M.D.

Minimally invasive total knee arthroplasty can be performed with a limited medial parapatellar arthrotomy. Begin by making a 10cm-14cm midline skin incision from the superior aspect of the tibial tubercle to the superior border of the patella. Following subcutaneous dissection, develop medial and lateral flaps, and dissect proximally and distally to expose the extensor mechanism. This permits mobilization of the skin and subcutaneous tissue as needed during the procedure. In addition, with the knee in flexion, the incision will stretch 2cm-4cm due to the elasticity of the skin, allowing broader exposure.

The goal of minimally invasive surgery is to limit the surgical dissection without compromising the procedure. The medial parapatellar arthrotomy is used to expose the joint, but the proximal division of the quadriceps tendon should be limited to a length that permits only lateral subluxation of the patella without eversion (Fig. 4). Incise the quadriceps tendon for a length of 2cm-4cm initially. If there is difficulty displacing the patella laterally or if the patellar tendon is at risk of tearing, extend the arthrotomy proximally along the quadriceps tendon until adequate exposure is achieved.

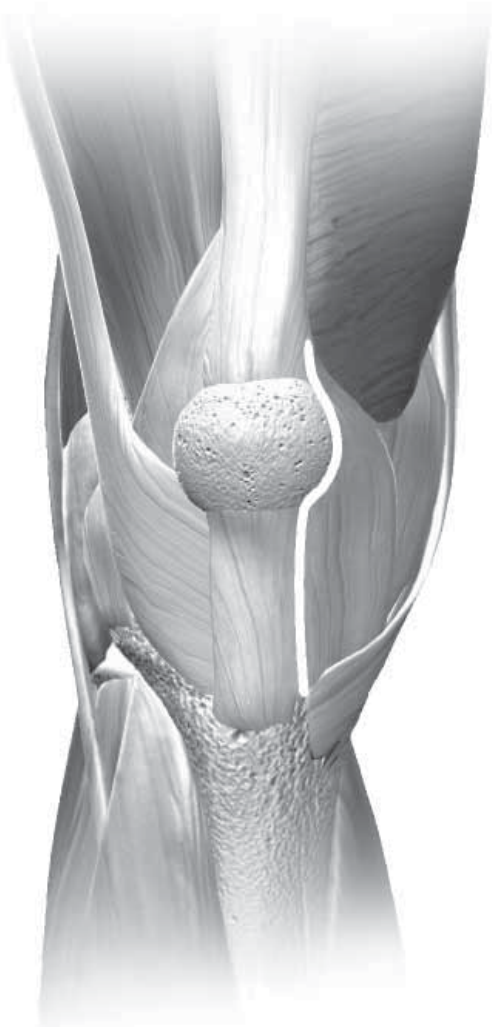


Fig. 4

Step One
Establish Femoral Alignment

Use the 8mm IM Drill w/Step to drill a hole in the center of the patellar sulcus of the distal femur (Fig. 1a), making sure that the drill is parallel to the shaft of the femur in both the anteroposterior and lateral projections. The hole should be approximately one-half to one centimeter anterior to the origin of the posterior cruciate ligament. Medial or lateral displacement of the hole may be needed according to preoperative templating of the A/P radiograph.

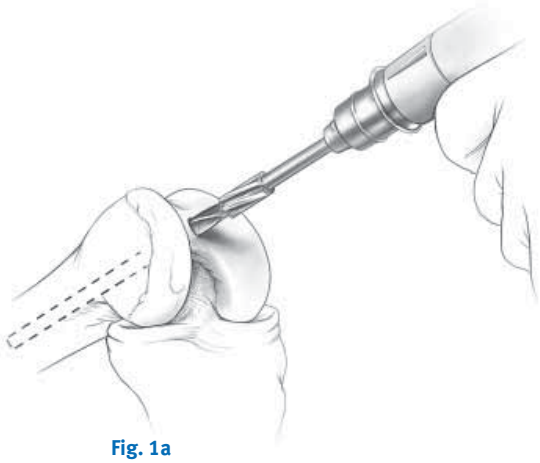


Fig. 1a

The step on the drill will enlarge the entrance hole on the femur to 12mm. This will reduce intramedullary pressure during placement of subsequent IM guides. Suction the canal to remove medullary contents.

The Mini Adjustable IM Alignment Guide is available with two intramedullary rod lengths. The rod on the standard instrument is 229mm (9 inches) long and the rod on the short instrument is 165mm (6.5 inches). Choose the length best suited to the length of the patient's leg, which will provide the most accurate reproduction of the anatomic axis. If the femoral anatomy has been altered, as in a femur with a long-stemmed hip prosthesis or with a femoral fracture malunion, use the Adjustable IM Alignment Guide, Short and use the optional extramedullary alignment technique.

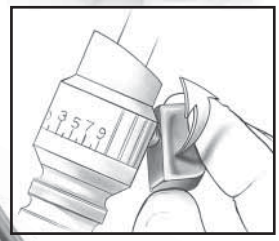
Note: The Mini Adjustable IM Alignment Guide, Short (Fig. 1b) is a shortened version of the Mini Adjustable IM Alignment Guide, Long. When the Mini Standard Cut Plate is attached to the Mini Adjustable IM Alignment Guide, Short, the same amount of bone is removed as when it is attached to the Mini Adjustable IM Alignment Guide, Long. This is different than the original *Multi-Reference* 4-in-1, Micro IM Alignment Guide 165mm (6.5 inch) which was intended for use with Micro implants. When the Standard Cut Plate was attached, the Micro IM Alignment Guide removed one millimeter less distal bone than the standard Adjustable IM Alignment Guide with the Standard Cut Plate attached. The new Mini IM Alignment Guides accommodate the resection for the Micro implants with the Mini Micro Cut Plate.

Fig. 1b

Note: It is preferable to use the longest intramedullary rod to help ensure the most accurate replication of the anatomic axis.

Set the Mini Adjustable IM Alignment Guide to the proper valgus angle as determined by preoperative radiographs. Check to ensure that the proper "Right" or "Left" indication (Fig. 1c) is used and engage the lock mechanism (Fig. 1d).

Fig. 1c



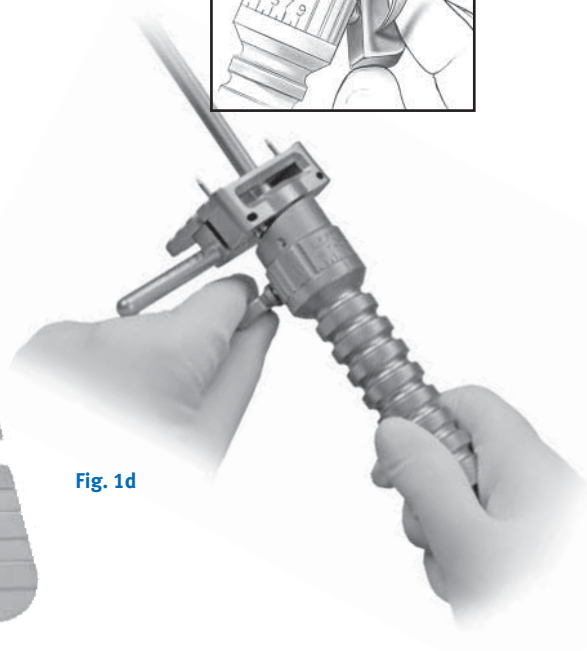


Fig. 1d

The Standard Cut Plate must be attached to the Adjustable IM Alignment Guide for a standard distal femoral resection. Use a hex-head screwdriver to tighten the plate on the guide prior to use (Figs. 1e & 1f), but the screws should be loosened for sterilization. If preferred, remove the Standard Cut Plate if a significant flexion contracture exists. This will allow for an additional 3mm of distal femoral bone resection.

Note: The Mini Micro Cut Plate can be used when templating has indicated that a Micro implant is likely. When the Mini Micro Cut Plate is attached to the *MIS* Adjustable IM Alignment Guide, Short, one millimeter (1mm) less bone is removed. However, if a significant flexion contracture exists and no plate is attached, an additional 4mm will be removed compared to the distal femoral cut when the Mini Micro Cut Plate is attached. For less bone resection, adjustments can be made using the +2mm/-2mm holes on the Mini Distal Cut Guide.

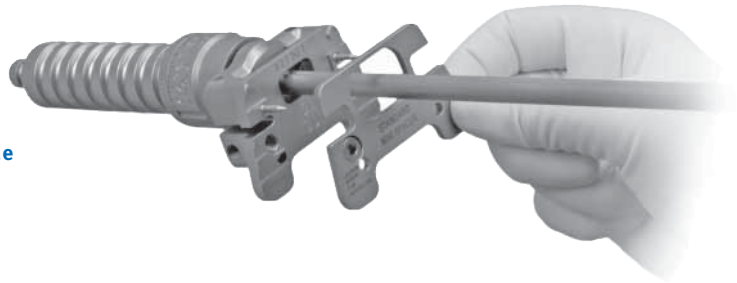


Fig. 1e

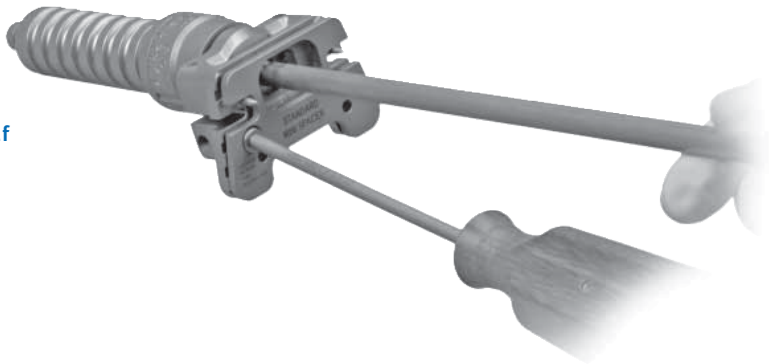


Fig. 1f

Insert the IM guide into the hole in the distal femur. If the epicondyles are visible, the epicondylar axis may be used as a guide in setting the orientation of the Adjustable IM Alignment Guide. If desired, add the Threaded Handles to the guide and position the handles relative to the epicondyles. This does not set rotation of the femoral component, but keeps the distal cut oriented to the final component rotation.

Once the proper orientation is achieved, impact the IM guide until it seats on the most prominent condyle. After impacting, check to ensure that the valgus setting has not changed. Ensure that the guide is contacting at least one distal condyle. This will set the proper distal femoral resection.

Optional Technique: An Extramedullary Alignment Arch and Alignment Rod can be used to confirm the alignment. If this is anticipated, identify the center of the femoral head before draping. If extramedullary alignment will be the only mode of alignment, use a palpable radiopaque marker in combination with an A/P x-ray film to help ensure proper location of the femoral head.

Step Two
Cut the Distal Femur

While the Adjustable IM Alignment Guide is being inserted by the surgeon, the scrub nurse should attach the Mini Distal Femoral Cutting Guide to the 0° Distal Placement Guide (Fig. 2a).

Fig. 2a

Ensure that the attachment screw is tight. Insert the Distal Placement Guide with the cutting guide into the Adjustable IM Alignment Guide until the cutting guide rests on the anterior femoral cortex (Fig. 2b). The Mini Distal Femoral Cutting Guide is designed to help avoid soft tissue impingement.

Fig. 2b

Optional Technique: The 3° Distal Placement Guide can be used to place the Mini Distal Femoral Cutting Guide in 3° of flexion to protect the anterior cortex from notching.

Using the 3.2mm drill bit, drill holes through the two standard pin holes marked “0” in the anterior surface of the Mini Distal Femoral Cutting Guide, and place Headless Holding Pins through the holes (Fig. 2c).

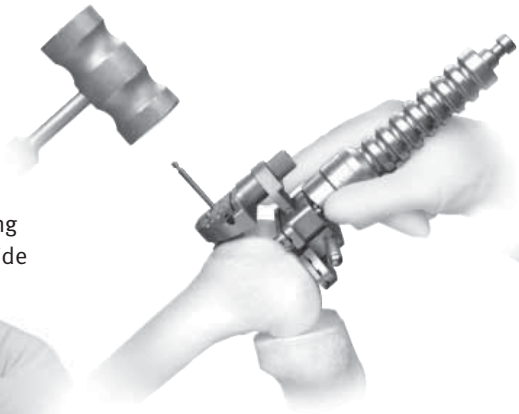


Fig. 2c

Additional 2mm adjustments may be made by using the sets of holes marked -4, -2, +2, and +4. The markings on the cutting guide indicate, in millimeters, the amount of bone resection each will yield relative to the standard distal resection set by the Adjustable IM Alignment Guide and Standard Cut Plate.

If more fixation is needed, use two 3.2mm Headed Screws or predrill and insert two Hex-head Holding Pins in the small oblique holes on the Mini Distal Femoral Cutting Guide, or Silver Spring Pins may be used in the large oblique holes (Fig. 2d).

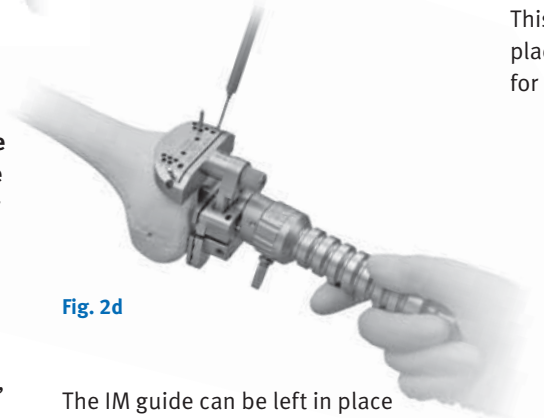


Fig. 2d

The IM guide can be left in place during resection of the distal condyle, taking care to avoid hitting the IM rod when using the oscillating saw.

Completely loosen the attachment screw (Fig. 2e) in the Distal Placement Guide. Then use the Slaphammer Extractor to remove the IM guide and the Distal Placement Guide (Fig. 2f).

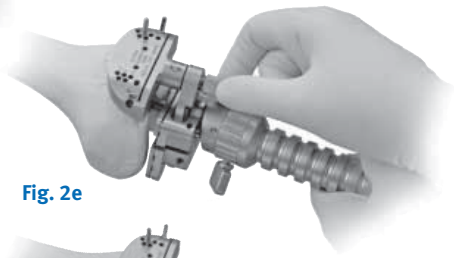


Fig. 2e

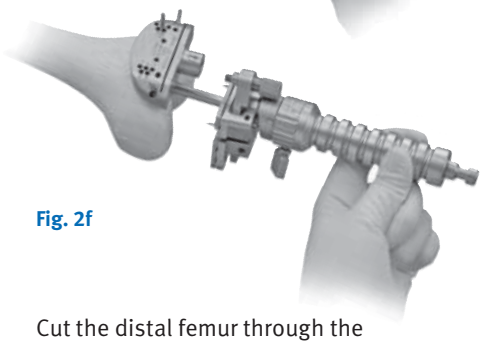


Fig. 2f

Cut the distal femur through the cutting slot in the cutting guide using a 1.27mm (0.050-in.) oscillating saw blade (Fig. 2g). Then remove the cutting guide.

Check the flatness of the distal femoral cut with a flat surface. If necessary, modify the distal femoral surface so that it is completely flat. This is extremely important for the placement of subsequent guides and for proper fit of the implant.

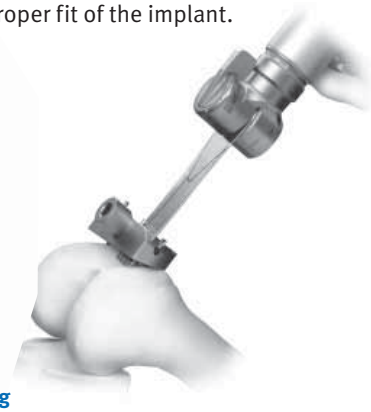


Fig. 2g

If you prefer to complete tibial cuts prior to completing the femur, refer to page 22.

Step Three
Size Femur and Establish External Rotation

Flex the knee to 90°. Attach the *MIS* Threaded Handle to the Mini A/P Sizing Guide, and place the guide flat onto the smoothly cut distal femur (Fig. 3a). Apply the guide so that the flat surface of the Mini A/P Sizing Guide is flush against the resected surface of the distal femur and the feet of the Mini A/P Sizing Guide are flush against the posterior condyles.

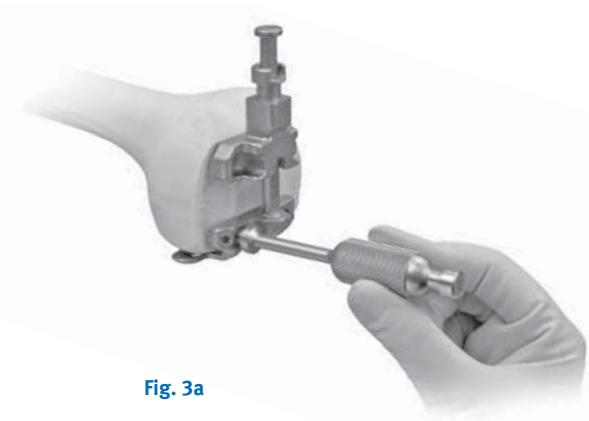


Fig. 3a

Slide the body of the Mini A/P Sizing Guide along the shaft to the level of the medullary canal. Position the guide mediolaterally, and check the position by looking through both windows of the guide to ensure that the medullary canal is not visible through either.

Note: Remove any osteophytes that interfere with instrument positioning.

While holding the Mini A/P Sizing Guide in place, secure the guide to the resected distal femur using short 3.2mm (1/8 inch) Headed Screws or predrill and insert short head Holding Pins into one or both of the holes in the lower portion of the guide. Do not overtighten or the anterior portion will not slide on the distal femur.

MIS Screws are available in 3 lengths (27mm, 33mm, 48mm). The length needed will vary depending on the patient's bone dimensions.

Note: Remove the Threaded Handle before using the Screw Inserter/ Extractor.

Slightly extend the knee and retract soft tissues to expose the anterior femoral cortex. Clear any soft tissue from the anterior cortex. Ensure that the leg is in less than 90° of flexion (70°-80°). This will decrease the tension of the patellar tendon to facilitate placement of the guide.

Attach the *MIS* Locking Boom to the Mini A/P Sizing Guide. Ensure that the skin does not put pressure on the top of the boom and potentially change its position. The position of the boom dictates the exit point of the anterior bone cut and the ultimate position of the femoral component. When the boom is appropriately positioned, lock it by turning the knurled knob (Fig. 3b).

Fig. 3b

See Appendix 1 for alternative *MIS* Telescoping Locking Boom technique.

Read the femoral size directly from the guide between the engraved lines on the sizing tower (Fig. 3c). There are eight sizes labeled "A" through "H". If the indicator is between two sizes, the closest size is typically chosen. If using a posterior referencing technique, and the indicator is between two sizes, the larger size is typically chosen to help prevent notching of the anterior femoral cortex.

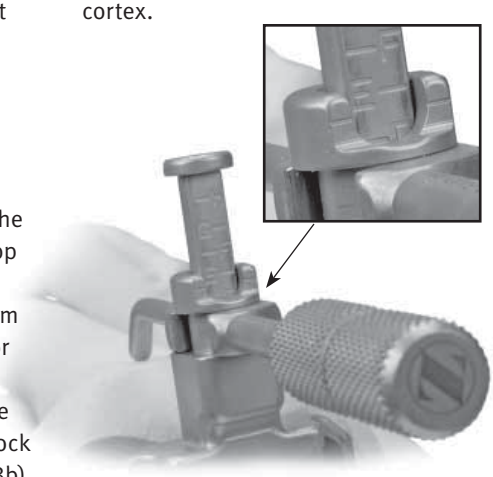


Fig. 3c

If using a posterior referencing technique, remove the Mini A/P Sizing Guide and go to page 19, "Step Four – Finish the Femur, Posterior Referencing Technique."

There are four External Rotation Plates: 0°/3° Left, 0°/3° Right, 5°/7° Left, and 5°/7° Right. Choose the External Rotation Plate that provides the desired external rotation for the appropriate knee. The 0° option can be used when positioning will be determined by the A/P axis or the epicondylar axis. Use the 3° option for varus knees. Use the 5° option for knees with a valgus deformity from 10° to 13°. The 7° option requires a standard exposure, and is for knees with patellofemoral disease accompanied by bone loss and valgus deformity greater than 20°. In this case, use the A/P axis to double check rotation.

Attach the selected plate to the Mini A/P Sizing Guide (Fig. 3d). Place two Headless Holding Pins in the plate through the two holes that correspond to the desired external rotation, and impact them (Fig. 3e). Leave the pins proud of the guide.

Note: Do not impact the Headless Holding Pins flush with the External Rotation Plate.

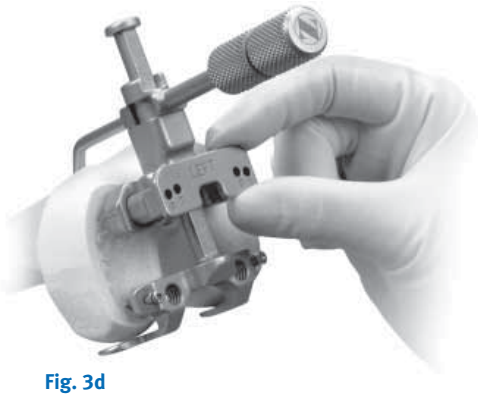


Fig. 3d

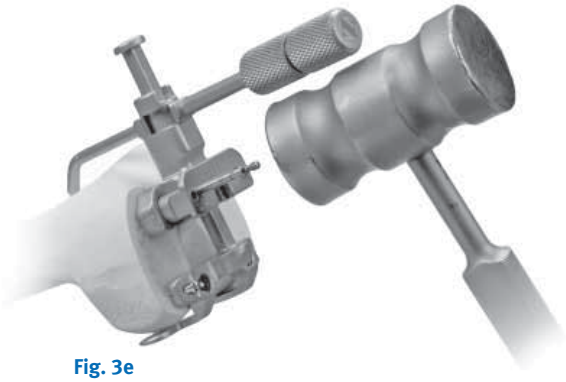


Fig. 3e

Careful attention should be taken when placing the headless pins into the appropriate External Rotation Plate as these pins also set the A/P placement for the *MIS* Femoral Finishing Guide in the next step of the procedure. It is important to monitor the location of the anterior boom on the anterior cortex of the femur to help ensure the anterior cut will not notch the femur. Positioning the anterior boom on the "high" part of the femur by lateralizing the location of the boom can often lessen the likelihood of notching the femur.

Unlock and rotate the boom of the guide medially until it clears the medial condyle. Then remove the guide, but leave the two headless pins. These pins will establish the A/P position and rotational alignment of the Femoral Finishing Guide.

Step Four
Finish the Femur

Anterior Referencing Technique

Select the correct size *MIS* Femoral Finishing Guide (silver colored) or *MIS* Flex Femoral Finishing Guide (gold colored) as determined by the measurement from the A/P Sizing Guide. An additional 2mm (approximately) of bone is removed from the posterior condyles when using the Flex Finishing Guide.

Place the finishing guide onto the distal femur, over the headless pins (Fig. 4a). This determines the A/P position and rotation of the guide. Remove any lateral osteophytes that may interfere with guide placement. Position the finishing guide mediolaterally by sliding it on the headless pins. The width of the finishing guide replicates the width of the *NexGen* CR Femoral Component. The width of the flex finishing guide replicates the width of the *NexGen* LPS, LPS-Flex, and CR-Flex Femoral Components.

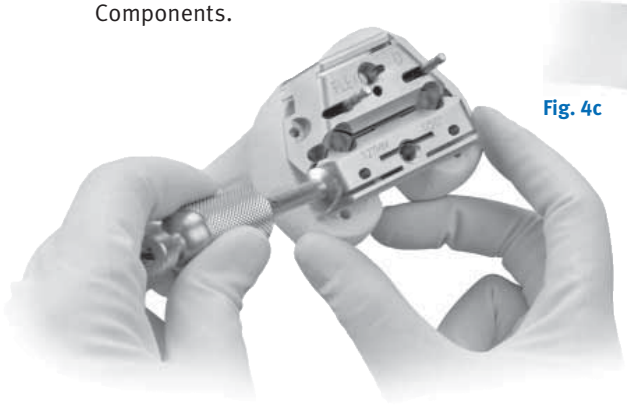


Fig. 4a

When the M/L position of the Femoral Finishing Guide is set, use the Screw Inserter/Extractor to insert a 3.2mm Headed Screw or predrill and insert a Hex-head Holding Pin through the superior pinhole on the beveled medial side of the guide (Fig. 4b). Then secure the lateral side in the same manner. If needed, predrill and insert two Short-head Holding Pins through the inferior holes on one or both sides of the guide. For additional stability, use 6.5mm screws in the peg holes.

Fig. 4b

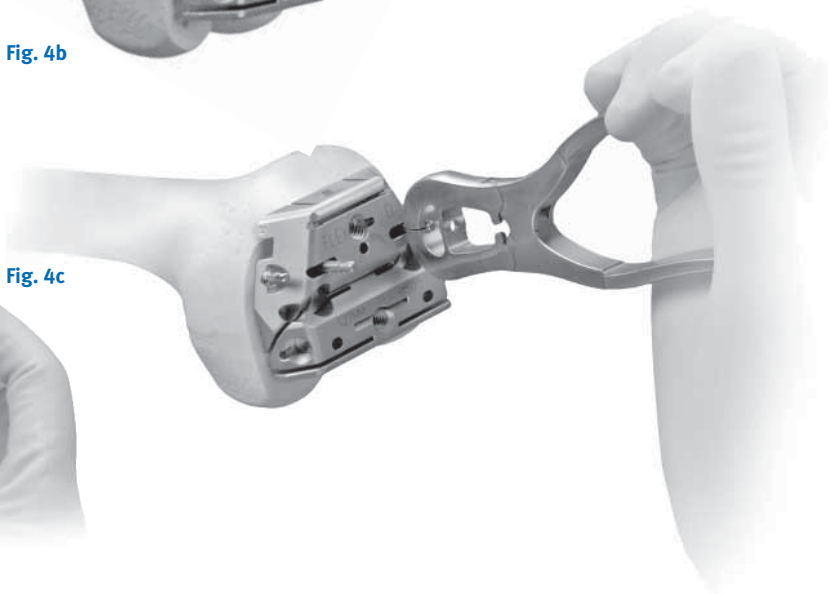


Fig. 4c

Remove the headless pins from the Femoral Finishing Guide (Fig. 4c) with the Headless Pin Puller.

Use the Resection Guide through the anterior cutting slot of the finishing guide, and check the medial and lateral sides to be sure the cut will not notch the anterior femoral cortex (Fig. 4d).

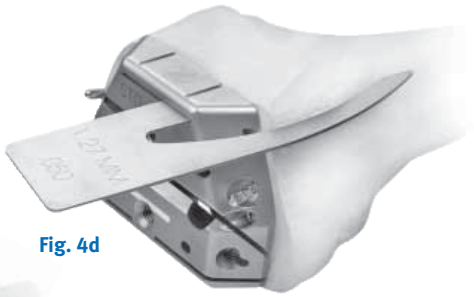


Fig. 4d

Optional Technique
To check the location of the anterior cut and determine if notching will occur, securely tighten the Locking Boom Attachment to the face of the finishing guide. Make certain that the attachment sits flush with the Femoral Finishing Guide (Fig. 4e). Connect the *MIS* Locking Boom to the attachment (Fig. 4f). The boom indicates the depth at which the anterior femoral cut will exit the femur.

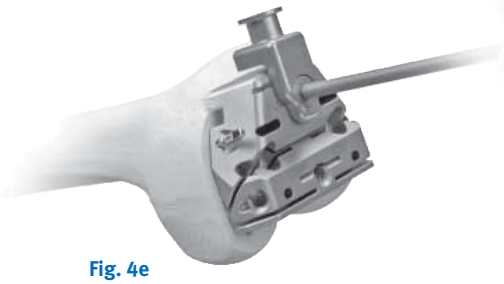


Fig. 4e

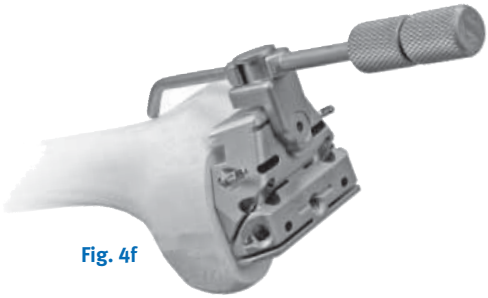


Fig. 4f

Use a 1.27mm (0.050-in.) narrow, oscillating saw blade to cut the femoral profile in the following sequence for optimal stability of the finishing guide (Fig. 4g):

1 Anterior condyles

2 Posterior condyles

3 Posterior chamfer

4 Anterior chamfers

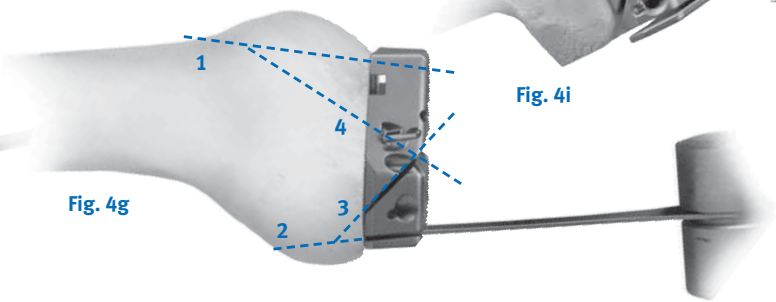


Fig. 4g

Use the Patellar/Femoral Drill Bit to drill the post holes (Fig. 4h).

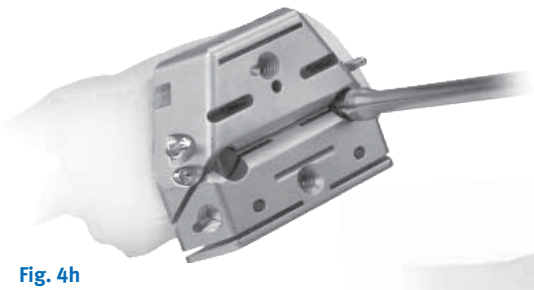


Fig. 4h

Use the 1.27mm (0.050-in.) narrow, reciprocating saw blade to cut the base of the trochlear recess (Fig. 4i) and score the edges (Fig. 4j). Remove the finishing guide to complete the trochlear recess cuts.

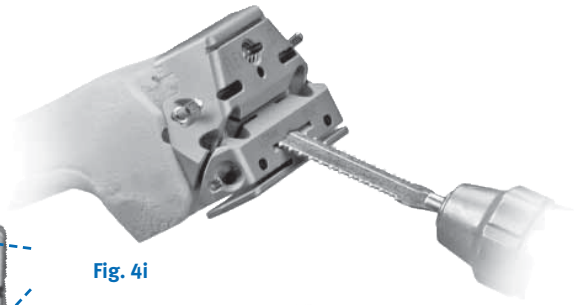


Fig. 4i

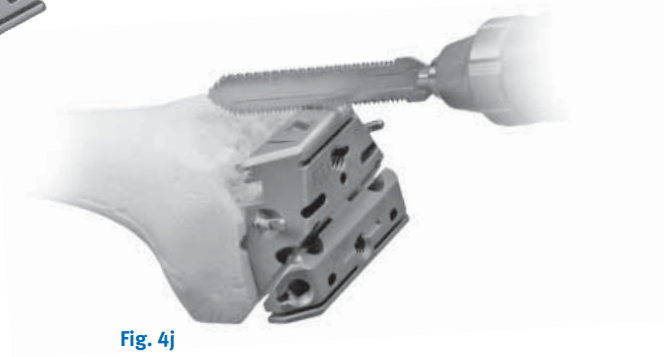


Fig. 4j

Posterior Referencing Technique
Select the correct size *MIS* Femoral Finishing Guide (silver colored) or *MIS* Flex Femoral Finishing Guide (gold colored) as determined by the measurement from the A/P Sizing Guide. An additional 2mm (approximately) of bone is removed from the posterior condyles when using the flex finishing guide.

Attach the Posterior Reference/ Rotation Guide to the selected femoral finishing guide (Fig. 4k). Lock the femoral position locator on the rotation guide to the zero position (Fig. 4l). This zero setting helps to ensure that, when the feet are flush with the posterior condyles, the amount of posterior bone resection will average 9mm when using the standard *MIS* Femoral Finishing Guides, and approximately 11mm when using the *MIS* Flex Femoral Finishing Guides.

Place the finishing guide on the distal femur, bringing the feet of the rotation guide flush against the posterior condyles of the femur (Fig. 4m).

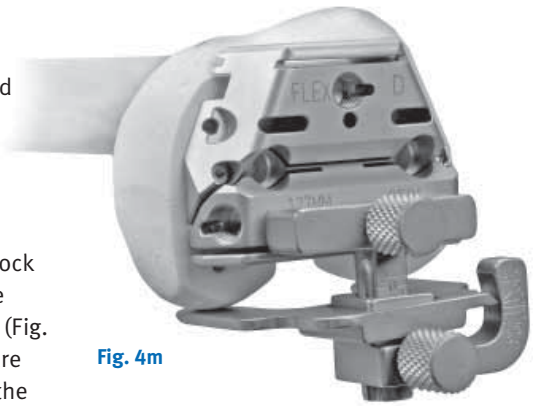


Fig. 4m

Set the rotation of the finishing guide parallel to the epicondylar axis. Check the rotation of the guide by reading the angle indicated by the Posterior Reference/Rotation Guide. The epicondylar line is rotated externally 0° to 8°, (4±4°), relative to the posterior condyles. The external rotation angle can also be set relative to the posterior condyles, lining up the degrees desired.

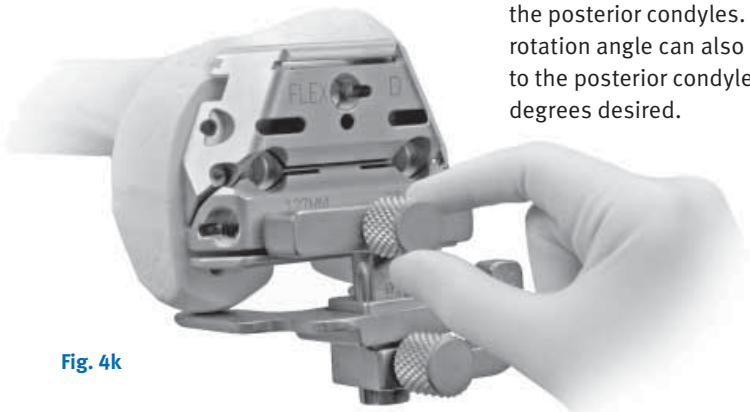


Fig. 4k

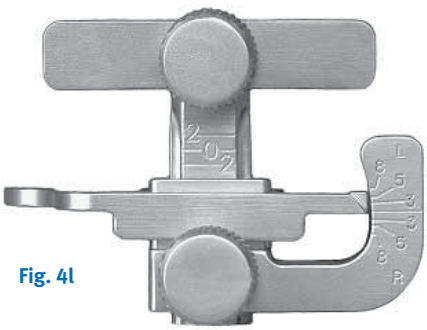


Fig. 4l

Fig. 4n

When the proper rotation and the mediolateral and anteroposterior position are achieved, secure the finishing guide to the distal femur. Use the Screw Inserter/Extractor to insert a 3.2mm Headed Screw or predrill and insert a Hex-head Holding Pin through the superior pinhole on the beveled medial side of the Femoral Finishing Guide (Fig. 4o). Then secure the lateral side in the same manner. For additional stability, predrill and insert two Short-head Holding Pins through the inferior holes on one or both sides of the guide.

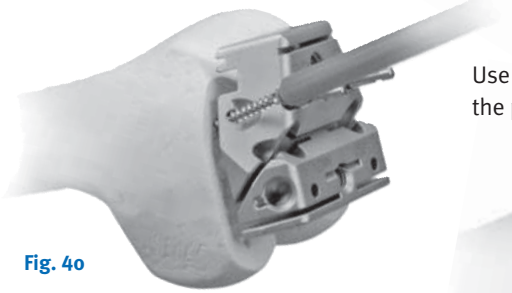


Fig. 4o

Use a 1.27mm (0.050-in.) narrow, oscillating saw blade to cut the femoral profile in the following sequence for optimal stability of the finishing guide (Fig. 4p):

1 Anterior condyles

2 Posterior condyles

3 Posterior chamfer

4 Anterior chamfers

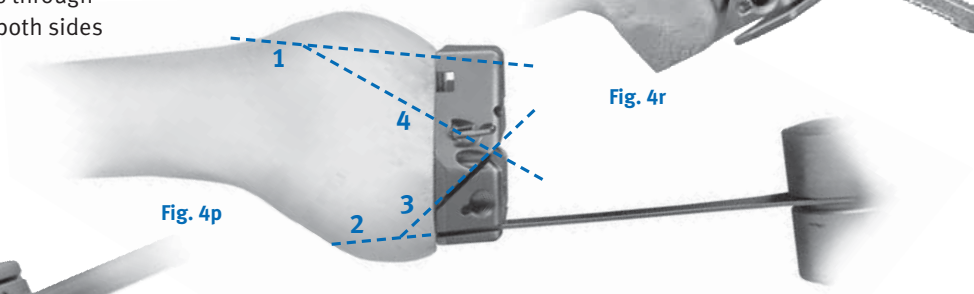


Fig. 4p

Use the Patellar/Femoral Drill Bit to drill the post holes (Fig. 4q).

Fig. 4q

Use the 1.27mm (0.050-in.) narrow, reciprocating saw blade to cut the base of the trochlear recess (Fig. 4r) and score the edges (Fig. 4s). Remove the finishing guide to complete the trochlear recess cuts.

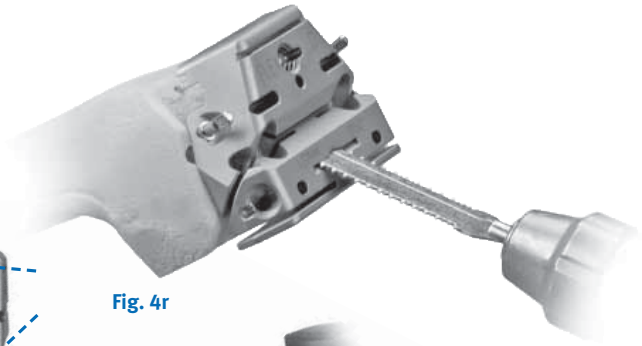


Fig. 4r

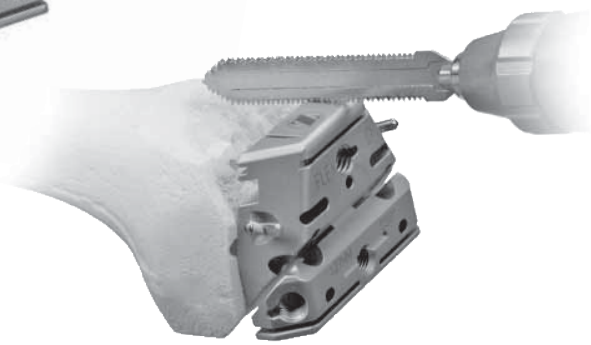


Fig. 4s

Option 1
MIS Notch/Chamfer Trochlear Guide

The *MIS* Notch/Chamfer Trochlear Guide consists of 2 pieces for each size, the *MIS* Notch/Chamfer Guide and the *MIS* Trochlear Guide. Matching sizes must be used.

The *MIS* Notch/Chamfer Trochlear Guide may be used to complete the chamfer cuts, the trochlear groove, the intercondylar box and to drill the peg holes after the anterior and posterior cuts have been made with the *MIS* Femoral Finishing Guide.

After the anterior and posterior cuts have been made, check the flexion gap and the extension gap using the *MIS* Spacer Block. Make the necessary adjustments.

Knee in slight flexion

Position the appropriate size *MIS* Notch/Chamfer Guide onto the femur so it is flush against the resected surfaces both distally and anteriorly. Ensure that no soft tissue or osteophytes interfere with instrument positioning. Position the guide mediolaterally (Fig. 4t).

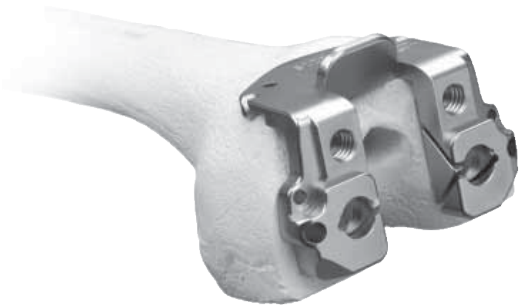


Fig. 4t Position the *MIS* Notch/Chamfer Guide flush against the femur

Note: The distal mediolateral profile of the *MIS* Notch/Chamfer Guides, anterior to the tabs, can be used to position the guide referencing the lateral condyle.

Insert two short headed pins or short screws through the anterior flange of the guide to secure the guide in position (Fig. 4u).

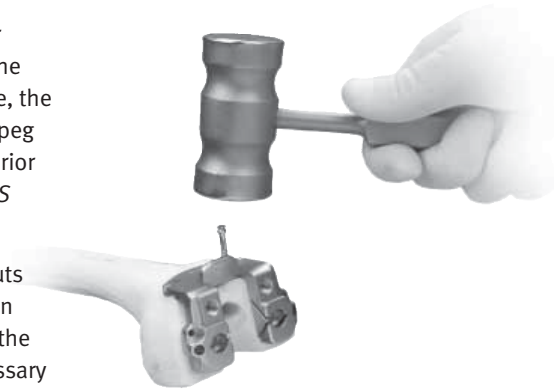


Fig. 4u Insert two short headed pins or short screws through the anterior flange

Knee in 90° flexion

Secure the *MIS* Notch/Chamfer Guide to the femur distally with two Short Spring Screws or 3.2mm (1/8-inch) headed screws. Alternatively, insert two headed pins (Fig. 4v).

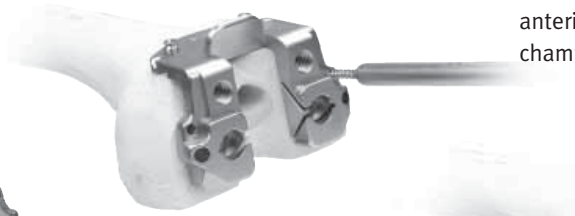


Fig. 4v Secure the *MIS* Notch/Chamfer Guide to the femur

Use a reciprocating saw to cut the sides and base of the intercondylar box (Fig. 4w). Protect the tibia with a wide osteotome.

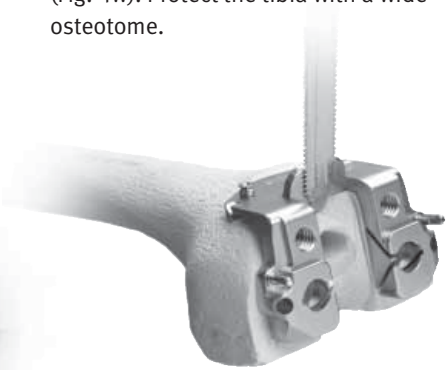


Fig. 4w Cut the sides and base of the intercondylar box

Use the Patellar/Femoral Drill to drill the femoral post holes.

Note: Do not use the LPS-Flex Femur Peg Drill, size A, B with the *MIS* Notch/Chamfer Guide as there is no stop on the guide for this smaller drill. If using a micro size (A, B) LPS-Flex Femoral Component, the femoral post holes must be drilled when the anterior and posterior condyle cuts are made using the appropriate size *MIS* Flex Femoral Finishing Guide and the LPS-Flex Femur Peg Drill.

Then use an oscillating saw to cut the anterior chamfer and the posterior chamfer (Fig. 4x).

Fig. 4x Cut the anterior and posterior chamfers

Apply the matching size *MIS* Trochlear Guide to the *MIS* Notch/Chamfer Guide with the holes in the Trochlear Guide aligned with the threaded holes in the Notch/Chamfer Guide (Fig. 4y). Thread the *MIS* Threaded Handle through one of the threaded holes to secure the Trochlear Guide to the *MIS* Notch/Chamfer Guide (Fig. 4z).

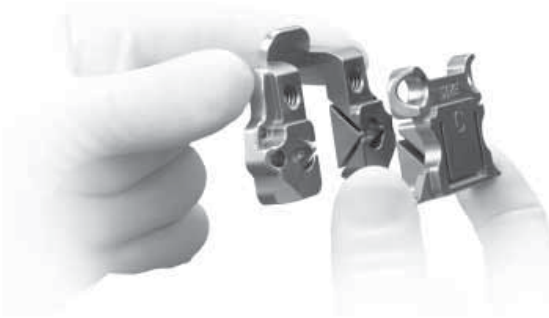


Fig. 4y Apply the matching size *MIS* Trochlear Guide with the holes aligned

Fig. 4z *MIS* Trochlear Guide secured to *MIS* Notch/Chamfer Guide

Protect the tibia. Use a reciprocating saw through the slots in the Trochlear Guide to cut the sides and base of the trochlear groove (Fig. 4aa). Remove the Trochlear Guide, and insert an osteotome over the resected tibial surface below the trochlear groove. Then use the reciprocating saw to finish the trochlear cuts.

Fig. 4aa Cut the sides and base of the trochlear groove

Remove the *MIS* Notch/Chamfer Guide.

Using the MIS Notch/Chamfer Guide to downsize the femur

If there is a need to downsize the femur, the *MIS* Notch/Chamfer and Trochlear Guide can be used for sizes C-G Standard implants and the Notch/Chamfer Guide can be used for all flex sizes.

Note: Size A, B and H *MIS* Trochlear Guides cannot be used for downsizing.

Select the preferred size Notch/Chamfer Guide and pin to the distal femur with two Short Spring Screws or 3.2mm (1/8-inch) headed screws (48mm length). Alternatively, insert two Hex Headed pins. Ensure that the guide is seated on the anterior and distal femur. Use a reciprocating saw to recut the sides of the intercondylar box. Use an oscillating saw to recut the anterior and posterior chamfers.

If downsizing for a CR-Flex or LPS-Flex implant, use the posterior surface of the *MIS* Notch/Chamfer Guide for the posterior cut. If downsizing for a CR or LPS implant, use the *MIS* Threaded Handle to attach the matching size *MIS* Trochlear Guide to the Notch/Chamfer Guide, and use the posterior surface of the *MIS* Trochlear Guide for the posterior cut.

Remove the *MIS* Trochlear and Notch/Chamfer Guides.

Surgeon Notes & Tips

- Although a sequence of femoral cuts has been provided, the cuts may be made in any sequence. It is recommended for the surgeon to complete the cuts in a consistent sequence to help ensure that all cuts are performed. However, the peg holes should be drilled prior to assembling the *MIS* Trochlear Guide.
- If the *MIS* Femoral Finishing Guide is used, the flexion gap should equal the extension gap.
- If the *MIS* Flex Femoral Finishing Guide is used, then the flexion gap will be approximately 2mm greater. For an LPS-Flex implant, use an *MIS* Spacer Block with the *MIS* Spacer Block Flex Adapter (available soon) to check flexion gap.
- An oscillating saw with a narrow blade may also be used, or a reciprocating blade may be used to cut the sides and a chisel or osteotome used to cut the base of the notch.
- Remember that the incision can be moved both medial-to-lateral and superior-to-inferior as needed to gain optimal exposure.
- To facilitate the use of the mobile window, when resecting on the medial side, use retraction on the medial side while relaxing the lateral side. Likewise, when resecting on the lateral side, use retraction on the lateral side while relaxing the medial side.

Option 2
MIS QS Notch Guide

Position the appropriate size *MIS* QS Notch Guide onto the femur so it is flush against the resected surfaces both distally and anteriorly. The *MIS* QS Notch Guide will not contact the anterior chamfer. Use the previously prepared trochlear recess and/or the femoral post holes to position the *MIS* QS Notch Guide mediolaterally.

Secure the *MIS* QS Notch Guide to the femur with two 3.2mm (1/8-inch) Headed Screws or predrill and insert two 3.2mm (1/8-inch) Holding Pins (Fig. 4bb). Use a reciprocating saw to cut the sides and the base of the intercondylar notch (Fig. 4cc). Then remove the *MIS* QS Notch Guide (Fig. 4dd).

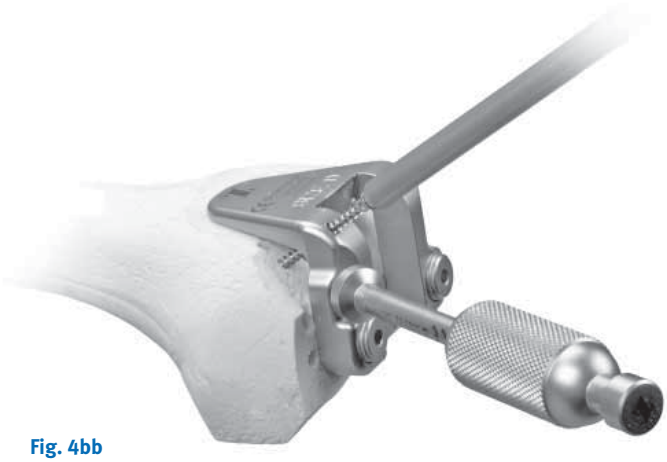


Fig. 4bb

Fig. 4cc

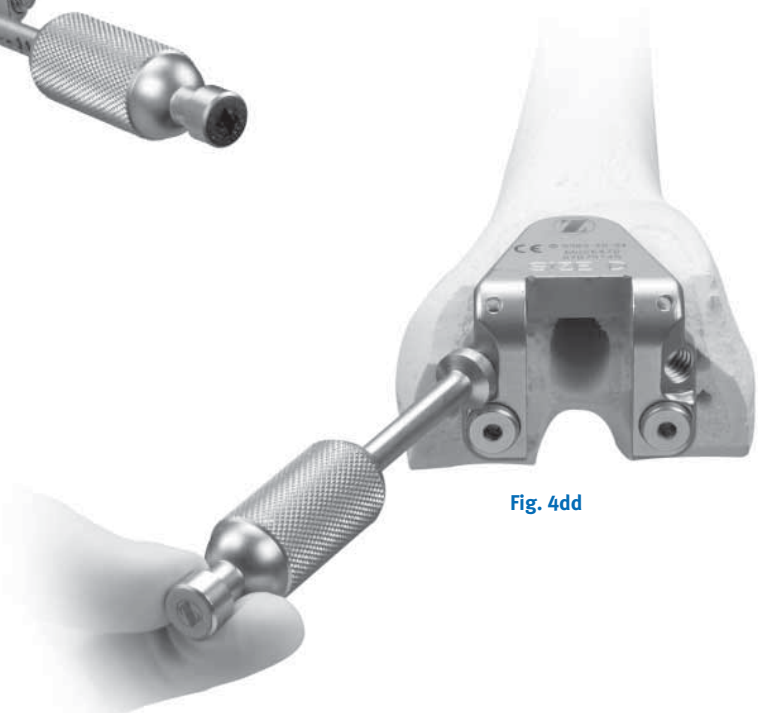


Fig. 4dd

Step Five
Resect Proximal Tibia

This step explains the alignment of the tibial cut to help ensure proper posterior slope and rotation, and the resection of the tibia perpendicular to the mechanical axis. The *MIS* Tibial Cut Guide Assembly is designed to facilitate tibial preparation through a shorter incision and without everting the patella.

Instruments Used

***MIS* Tibial Cut Guide Assembly**

- *MIS* Tibial Cut Guide (Right or Left)
- *MIS* Tubercle Anchor (Right or Left)
- *MIS* Tibial Adjustable Rod
- *MIS* Distal Telescoping Rod
- Ankle Clamp or Spring
- Ankle Bar

Resection Guide

***MIS* Tibial Depth Resection Stylus**

Osteotome

Various retractors

Kocher clamp

Hex-head Screwdriver

Drill/Reamer

***MIS* Screw Inserter/Extractor**

***MIS* Screws**

Assemble the Guide

The *MIS* Tibial Cut Guide Assembly consists of instruments for right or left (Fig. 5a).

- Tibial Cut Guide
- Tubercle Anchor
- *MIS* Tibial Adjustable Rod
- *MIS* Distal Telescoping Rod
- Ankle Clamp or Spring
- Ankle Bar

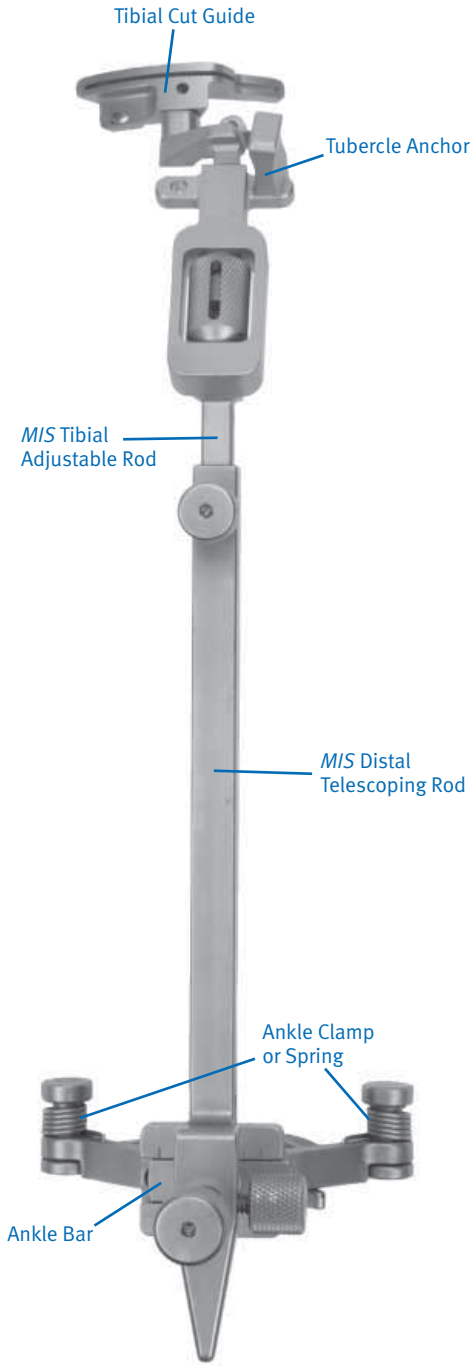


Fig. 5a *MIS* Tibial Cut Guide Assembly

Attach the Ankle Clamp or optional Spring to the Ankle Bar. Then slide the Ankle Bar onto the dovetail at the bottom of the *MIS* Distal Telescoping Rod. Turn the knob opposite the dovetail to temporarily hold the bar in place.

Arrows are etched onto both the *MIS* Tibial Adjustable Rod and the *MIS* Distal Telescoping Rod to indicate the correct orientation during assembly. With the arrows aligned, insert the *MIS* Tibial Adjustable Rod into the Distal Telescoping Rod (Fig. 5b). Adjust the length to approximate the length of the patient's tibia and temporarily tighten the thumb screw at the proximal end of the distal rod.

Fig. 5b Arrows showing correct alignment

Attach the correct right or left Tubercle Anchor onto the corresponding side of the *MIS* Tibial Adjustable Rod. For a left knee, the left anchor is inserted into the right hole (Fig. 5c).

Fig. 5c

For a right knee, the right anchor is inserted into the left hole (Fig. 5d).

Fig. 5d

Be sure that the etched line on the side of the Tubercle Anchor aligns with the corresponding etched line on the anterosuperior face of the Adjustable Rod (Fig. 5e).

Fig. 5e

Note: The Tibial Cut Guide and Tubercle Anchor are available in left and right configurations. If the incorrect Tubercle Anchor is used, the Cut Guide will not fully retract into the Adjustable Rod and the varus/valgus angle of the tibial cut may be affected.

Insert the correct right or left Tibial Cut Guide into the Adjustable Rod and rotate the thumb wheel counterclockwise until the threads engage (Fig. 5f).

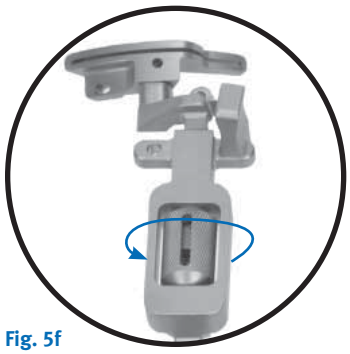


Fig. 5f

Continue to rotate the thumb wheel until the guide is approximately midway through its range of travel. This will allow the depth of the tibial resection to be adjusted after the assembly is secured to the bone via the Tubercle Anchor.

Position the Guide

Place the spring arms of the Ankle Clamp around the ankle proximal to the malleoli and loosen the anterior knob that provides mediolateral adjustment at the ankle. If preferred, the Ankle Spring may be used instead of the Ankle Clamp.

Loosen the knob on the proximal end of the Distal Telescoping Rod and adjust the length of the guide until the Tibial Cut Guide is positioned at the approximate depth of cut. With the Tibial Cut Guide and Tubercle Anchor contacting the bone, move the Tibial Cut Guide mediolaterally to align the rod with the medial third of the tibial tubercle (Fig. 5g). This will usually place the proximal end of the Adjustable Rod so it is centered below the intercondylar eminence. The Tibial Cut Guide will contact the tibia at an oblique angle and the low-profile portion of the cutting head will fit under the patellar tendon. The Tubercle Anchor is shaped to fit between the patellar tendon and the base of the cutting head.

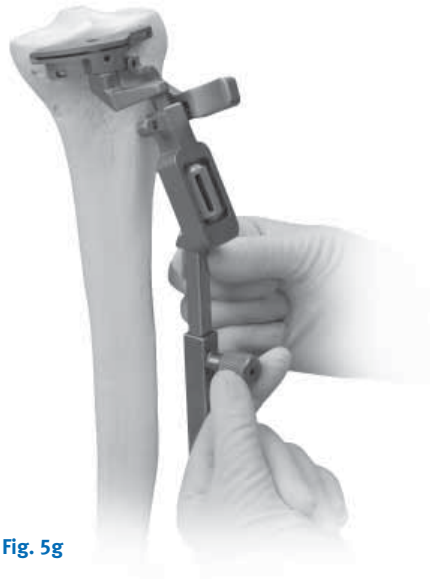


Fig. 5g

Note: Be sure that only the low-profile portion of the cutting head extends beneath the patellar tendon (Fig. 5h).

Fig. 5h

When correctly aligned, the Distal Telescoping Rod and Adjustable Rod should be parallel to the tibia in the coronal and sagittal planes. To help avoid rotational malalignment of the rod, check its position from a direct anterior view, ie, stand at the foot of the operating table.

Adjust the distal end of the *MIS* Distal Telescoping Rod by moving the slide at the foot of the rod medially or laterally until the guide is aligned with the mechanical axis of the tibia. The end of the *MIS* Distal Telescoping Rod should be positioned about 5mm-10mm medial to the midpoint between the palpable medial and lateral malleoli. The tip should point to the second toe (Fig. 5i). When the proper M/L position is achieved, tighten the anterior knob to secure the *MIS* Distal Telescoping Rod to the Ankle Bar.

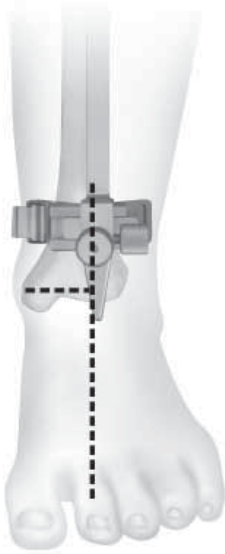


Fig. 5i

Loosen the knob on the side of the distal end of the *MIS* Distal Telescoping Rod. Then use the slide adjustment to align the rod in the sagittal plane so it is parallel to the anterior tibial shaft. This will create a 7° posterior tibial slope. If more or less slope is desired, use the slide adjustment to obtain the desired slope. Then tighten the knob. If there is a bulky bandage around the ankle, adjust the rod to accommodate the bandage. This will help ensure that the tibia will be cut with the proper slope.

Insert an *MIS* Screw near the tibial tubercle through the hole in the Tubercle Anchor (Fig. 5j).

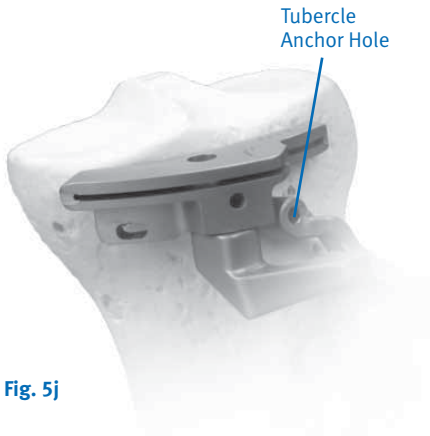


Fig. 5j

Note: The Tubercle Anchor position does not determine the varus/valgus of the tibial cut.

Then use the Resection Guide through the cutting slot to assess the slope of the cut (Fig. 5k).

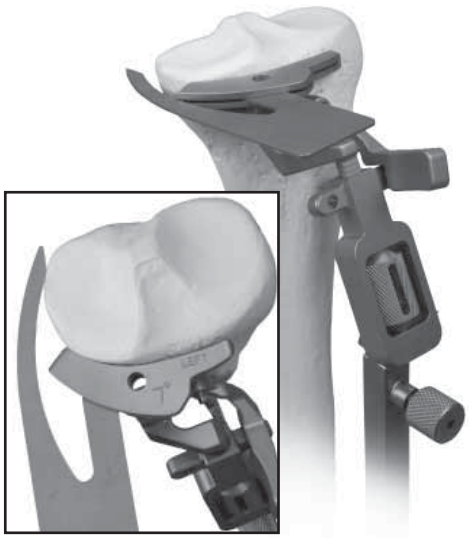


Fig. 5k

Set the Final Resection Level

With the Tibial Cut Guide flush against the anteromedial edge of the tibia, insert the *MIS* Tibial Depth Resection Stylus into the hole on the top of the Tibial Cut Guide. For a minimal cut, swing the 2mm arm of the stylus over the defective tibial condyle. Adjust the Tibial Cut Guide up or down by rotating the thumb wheel until the tip of the 2mm stylus rests on the surface of the condyle (Fig. 5l). This will position the Tibial Cut Guide to remove 2mm of bone below the tip of the stylus.

Fig. 5l

Alternatively, swing the 10mm arm of the *MIS* Tibial Depth Resection Stylus over the least involved tibial condyle. Adjust the Tibial Cut Guide until the tip of the 10mm arm rests on the surface of the condyle (Fig. 5m). This will position the Tibial Cut Guide to remove 10mm of bone below the tip of the stylus.

Fig. 5m

These two points of resection will usually not coincide. The surgeon must determine the appropriate level of resection based on patient age, bone quality, and the type of prosthetic fixation planned.

Note: The grooves on the stem of the Tibial Cut Guide represent 2mm increments (Fig. 5n).

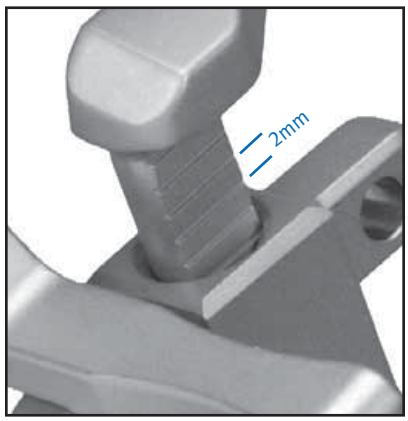


Fig. 5n

Use the Hex-head Screwdriver to tighten all of the screws on the tibial assembly to maintain position.

Insert an *MIS* Screw through the medial oblong hole on the cutting head (Fig. 5o). This hole is angled to facilitate screw insertion.

Fig. 5o

Place another *MIS* Screw through the central anterior hole on the cutting head (Fig. 5p).

Fig. 5p

Resect the Proximal Tibia

Use a 1.27mm (0.050-in) oscillating saw blade through the slot on the Tibial Cut Guide to cut the proximal surface of the tibia flat (Fig 5q). After cutting through the medial side and as far as possible into the lateral side, remove the cut guide assembly. Extend the knee and retract soft tissue on the lateral side.

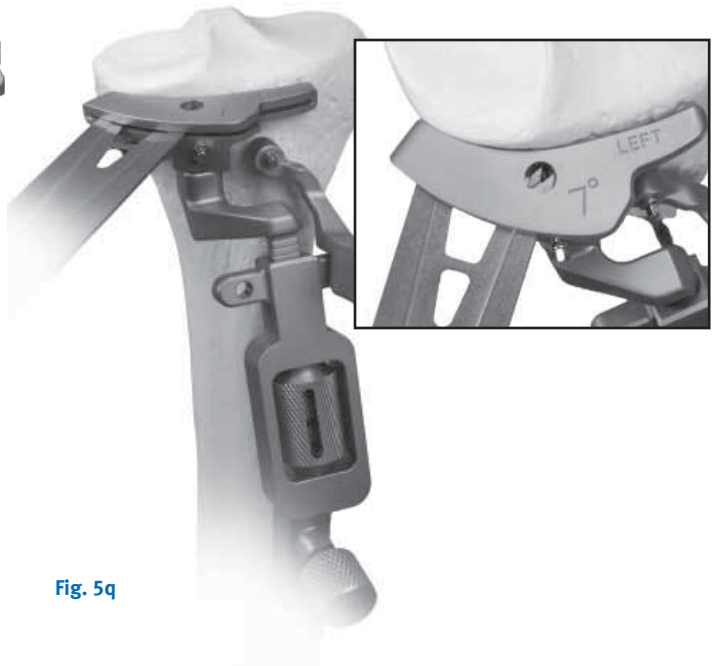


Fig. 5q

Note: Take care to protect the patellar tendon when cutting the lateral side.

Use a Kocher clamp to remove the tibial bone fragment. Then trim any remaining bone spikes and meniscus on the posterior and lateral aspects of the resected tibial surface.

Step Six
Check Flexion/Extension Gaps

Use the Spacer/Alignment Guides to check the flexion and extension gaps. With the knee in extension, insert the thinnest appropriate Spacer/Alignment Guide between the resected surfaces of the femur and tibia (Fig. 6a). Insert the Alignment Rod into the guide and check the alignment of the tibial resection (Fig. 6b). If necessary insert progressively thicker Spacer/Alignment Guides until the proper soft tissue tension is obtained.

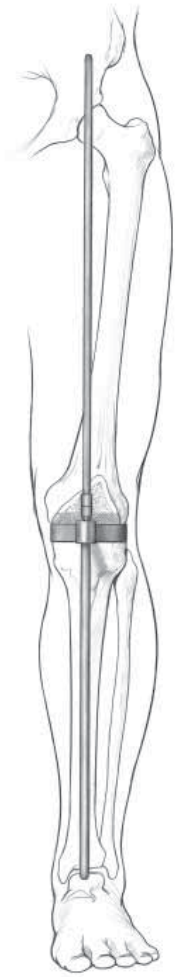


Fig. 6a

Then flex the knee and check ligament balance and joint alignment in flexion. When using the *MIS* Flex Femoral Finishing Guide, the flexion gap will be approximately 2mm greater than the extension gap. For example, if the extension gap is 10mm, the flexion gap will be 12mm. The 2mm end of the Tension Gauge can be used to tighten the flexion gap when checking ligament balance.

If the tension is significantly greater in extension than in flexion, re-cut the distal femur using the appropriate instrumentation. This will enlarge the extension space.

If the tension is significantly less in extension than in flexion, either downsize the femur or perform additional ligament releases.

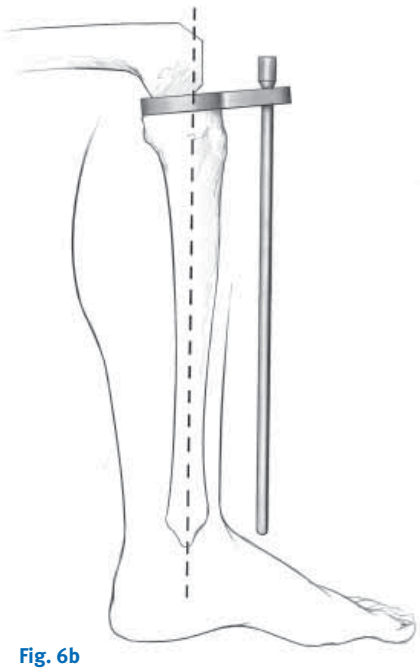


Fig. 6b

Step Seven
Prepare the Patella

Sharply dissect through the prepatellar bursa to expose the anterior surface of the patella. This will provide exposure for affixing the anterior surface into the Patellar Clamp.

Remove all osteophytes and synovial insertions from around the patella. Be careful not to damage tendon insertions on the bone. Use the Patellar Caliper to measure the thickness of the patella (Fig. 7a). Subtract the implant thickness from the patella thickness to determine the amount of bone that should remain after resection.

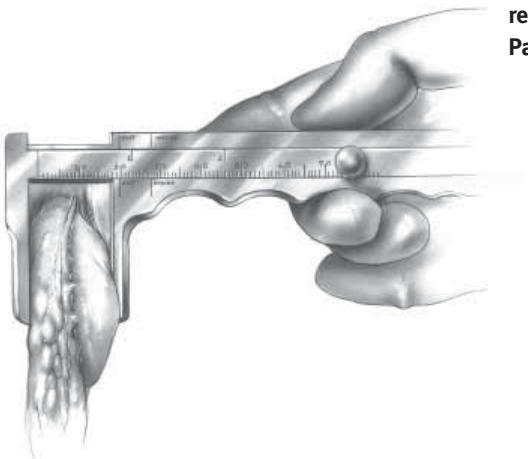


Fig. 7a

Patella Thickness – Implant Thickness = Bone Remaining

Implant Thicknesses

	Micro	Standard
26mm	7.5mm	–
29mm	7.5mm	8.0mm
32mm	8.0mm	8.5mm
35mm	8.0mm	9.0mm
38mm	–	9.5mm
41mm	–	10.0mm

Note: At least 11mm of total bone will remain to allow for implant pegs if the Patella Reamer is used.

Resect the Patella

Universal Saw Guide Technique

Apply the Universal Patellar Saw Guide in line with the patellar tendon. Push the patella up between the jaws of the saw guide. Level the patella within the saw guide jaws and use the thumbscrew to tighten the guide.

The amount to be resected across the top of the saw guide jaws should be approximately the same on all sides. Check to be sure that the 10mm gauge does not rotate beneath the anterior surface of the patella. If the gauge hits the anterior surface of the patella as it is rotated, this indicates that at least 10mm of bone stock will remain after the cut (Fig. 7b).

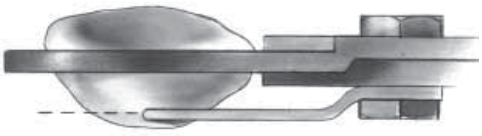


Fig. 7b

Cut the patella flat so that a smooth surface remains (Fig. 7c).

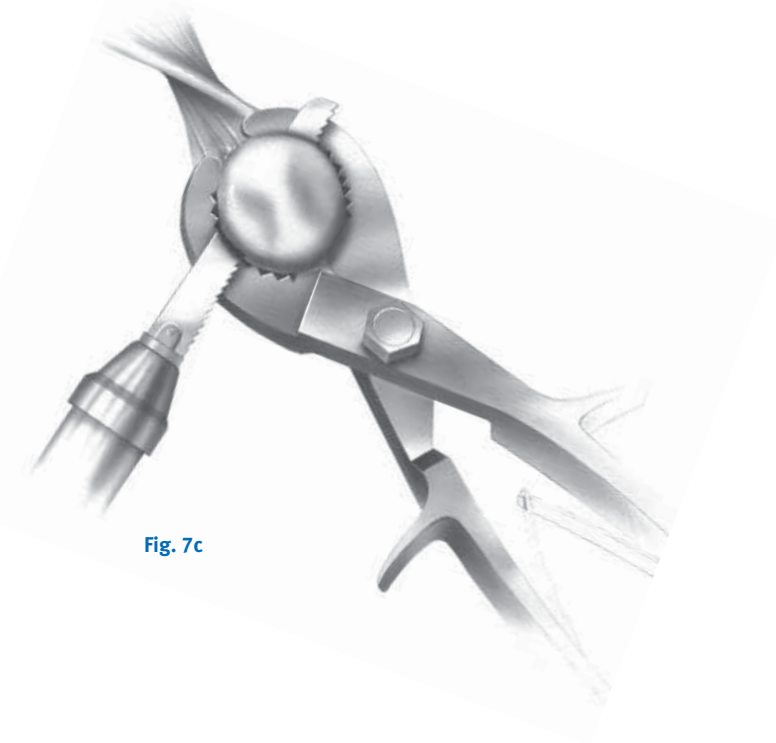


Fig. 7c

Patellar Reamer Technique Total Surfacing Procedure

Use the Patellar Reamer Surfacing Guides as templates to determine the appropriate size guide and reamer. Choose the guide which fits snugly around the patella, using the smallest guide possible (Fig. 7d). If the patella is only slightly larger than the surfacing guide in the mediolateral dimension, use a rongeur to remove the medial or lateral edge until the bone fits the guide.

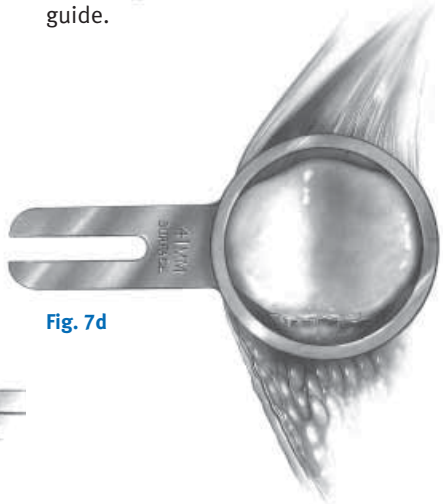


Fig. 7d

Insert the appropriate size Patellar Reamer Surfacing Guide into the Patella Reamer Clamp (Fig. 7e). Turn the locking screw until tight.

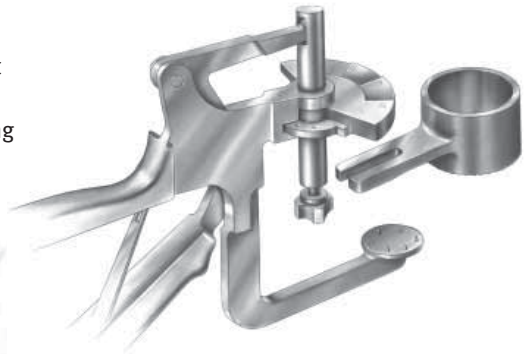


Fig. 7e

Apply the Patellar Reamer Clamp at a 90° angle to the longitudinal axis with the Patellar Reamer Surfacing Guide encompassing the articular surface of the patella. Squeeze the clamp until the anterior surface of the patella is fully seated against the fixation plate (Fig. 7f). Turn the clamp screw to hold the instrument in place. The anterior surface must fully seat upon the pins and contact the fixation plate.

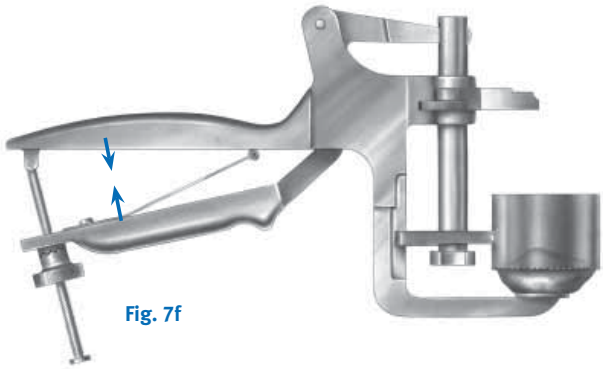


Fig. 7f

Turn the depth gauge wing on the Patellar Reamer Clamp to the proper indication for the correct amount of bone that is to remain after reaming (Fig. 7g).

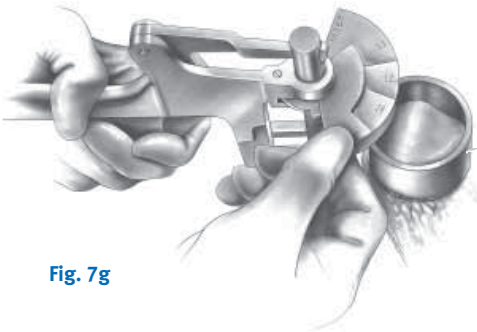


Fig. 7g

Attach the appropriate size Patellar Reamer Blade to the appropriate size Patellar Reamer Shaft (Fig. 7h). Use only moderate hand pressure to tighten the blade.

Fig. 7h

Do not overtighten the blade. Insert the Patellar Reamer Shaft into a drill/reamer. Insert the reamer assembly into the Patellar Reamer Surfacing Guide. Raise the reamer slightly off the bone and bring it up to full speed. Advance it slowly until the prominent high points are reamed off the bone. Continue reaming with moderate pressure until the step on the reamer shaft bottoms out on the depth gauge wing of the Patellar Reamer Clamp. Remove the reamer clamp assembly.

Proceed to “Finish the Patella” on page 31.

Insetting Technique

Use the Patellar Reamer Insetting Guides as templates to determine the appropriate size guide and reamer. Choose the guide which will allow approximately 2mm between the superior edge of the patella and the outer diameter of the guide (Fig. 7i).

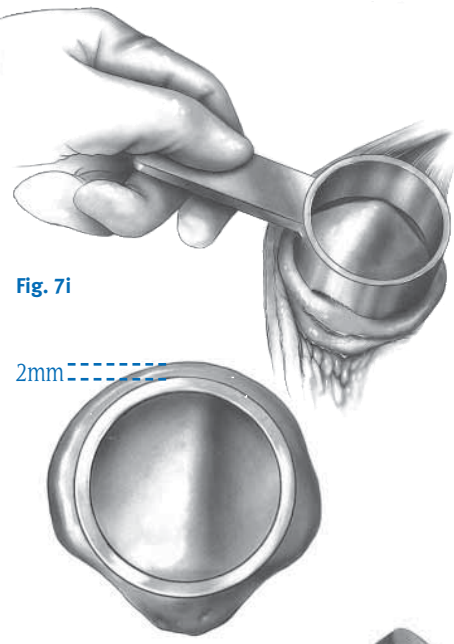


Fig. 7i

Insert the appropriate size Patellar Reamer Insetting Guide into the Patellar Reamer Clamp. Turn the locking screw until tight. Apply the Patellar Reamer Clamp at a 90° angle to the longitudinal axis with the Patellar Reamer Insetting Guide on the articular surface. Squeeze the clamp until the anterior surface of the patella is fully seated against the fixation plate. Turn the clamp screw to hold the instrument in place. The anterior surface must fully seat on the pins and contact the fixation plate.

Turn the clamp wing to the “inset” position.

Attach the appropriate size Patellar Reamer Blade to the appropriate size Patellar Reamer Shaft (Fig. 7j). Use only moderate hand pressure to tighten the blade. **Do not overtighten the blade.** Insert the Patellar Reamer Shaft into a drill/reamer.

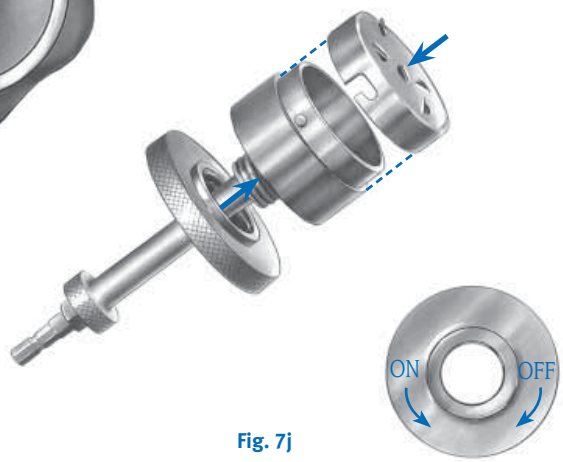


Fig. 7j

Use the Patellar Reamer Depth Stops to control the amount of bone to be removed based on the thickness of the implant chosen.

Note: If using a Primary Porous Patella with *Trabecular Metal*™ Material, all implants are 10mm thick.

The depth gauge wing on the Patellar Reamer Clamp can be used instead of the stops to control the amount of bone remaining, rather than the amount of bone removed.

Insert the reamer assembly into the Patellar Reamer Insetting Guide. Raise the reamer slightly off the bone and bring it up to full speed. Advance it slowly until the prominent high points are reamed off the bone. Continue reaming with moderate pressure. Remove the reamer clamp assembly.

Finish the Patella

For the NexGen Primary Porous Patella With Trabecular Metal Material

Center the appropriate Patellar Drill Guide over the resected patella surface with the handle on the medial side of the patella and perpendicular to the tendon. Press the drill guide firmly in place so that the teeth fully engage and the drill guide sits flat on the bone surface (Fig. 7k). Drill the peg hole making sure the drill stop collar contacts the top of the drill guide (Fig. 7l).

Fig. 7k

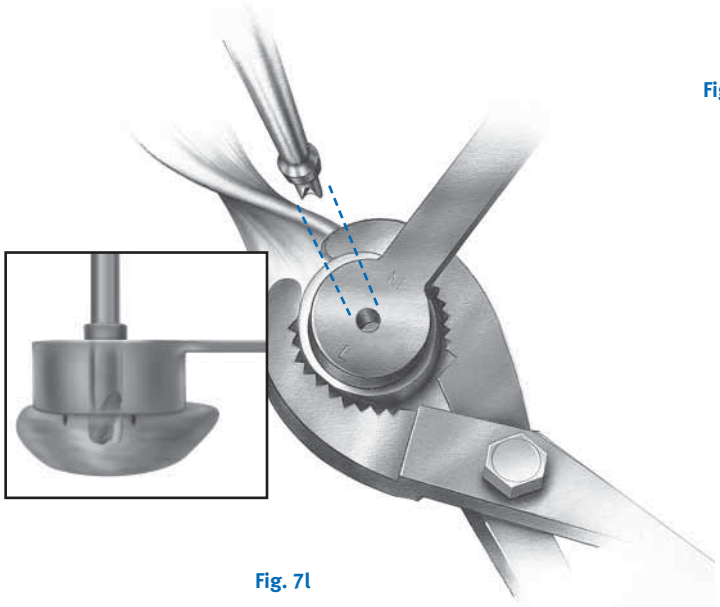


Fig. 7l

Note: The Primary Porous Patellar Clamp may be used to fully seat the drill guide on hard sclerotic bone surfaces.

For the NexGen All-Polyethylene Patella

Center the appropriate Patellar Drill Guide over the patella with the handle on the medial side of the patella and perpendicular to the tendon. Holding the drill guide firmly in place, drill the three peg holes using the Patellar/ Femoral Drill Bit (Fig. 7m).

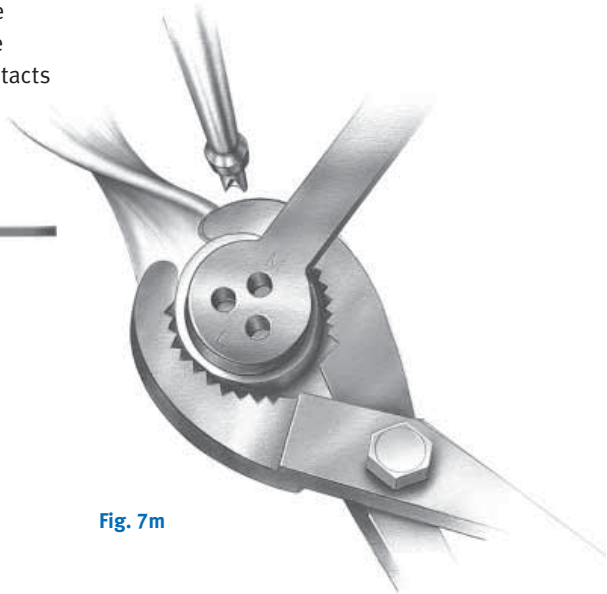


Fig. 7m

Option 1
Patella Protectors

Note: If the patella will not be resurfaced, be careful to avoid injury to the patella during surgery.

Note: The Patella Protectors are not recommended for use in an insetting technique.

There are 3 sizes of Patella Protectors available to cover the patella while completing the remaining bone resections. Choose the size that best covers the patella – 26mm, 32mm, or 38mm. Handle with care; the spikes may be sharp.

A suture needs to be placed through the hole in the Patella Protector (Fig. 7n). Loosely tie a suture through the hole on the Patella Protector. Attach a hemostat to the end of the suture material. Leave an adequate amount of suture material to position the hemostat away from the incision.

After the initial patella cut is completed, use thumb pressure to press the Patella Protector against the bone. If the bone is particularly hard, apply the Patellar Clamp against the Patella Protector. Squeeze the clamp until the Patella Protector is fully seated against the bone.

The Patella Protector should be part of the instrument count before closing the wound. It is not intended for implantation. Completely remove the suture material at the end of the operation and before sending the instrument for cleaning.

Surgeon Notes & Tips

- The suture placed through the hole in the Patella Protector provides a tether for finding and removing the Patella Protector.

Fig. 7n

Step Eight
Perform a Trial Reduction

After preparing the tibia, select the appropriate Pegged or Stemmed Tibial Sizing Plate/Provisional that provides the desired tibial coverage. Check the size matching chart (for the style of *NexGen* Knee implant) for component matching instructions.

Insert the Femoral Provisional, Patellar Provisional, Tibial Sizing Plate/ Provisional, and Articular Surface Provisional.

Flex and extend the knee with the provisionals in place. Check the range of motion and ligament stability. Perform any necessary soft tissue releases. With proper soft tissue balancing complete the tibial component tends to seat itself in the position where it best articulates with the femur (Fig. 8a)

Note: During the trial reduction, observe the relative position of the Femoral Provisional on the tibial Articular Surface Provisional by using the lines on both provisionals. The lines can be used to determine if posterior rollback is occurring, whether the PCL is functional, and if the femoral component will contact the tibial articular surface in the proper location. If the PCL is properly balanced, the Femoral Provisional should sit near the anterior or center lines on the tibial Articular Surface Provisional in extension and near the posterior line in flexion.

If the Femoral Provisional sits posterior to the lines, the PCL may be too tight or the articular surface may be too thick. If the Femoral Provisional sits anterior to the lines, the PCL may be too loose.

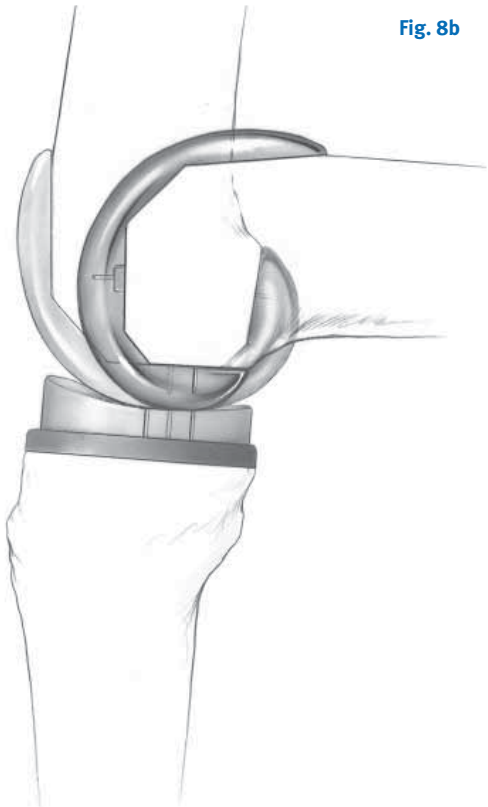


Fig. 8a

After this self-centering process has occurred, mark the position of the component with methylene blue or electrocautery (Fig. 8b). Then remove the provisional components. The Femoral Extractor can be used to remove the Femoral Provisional.

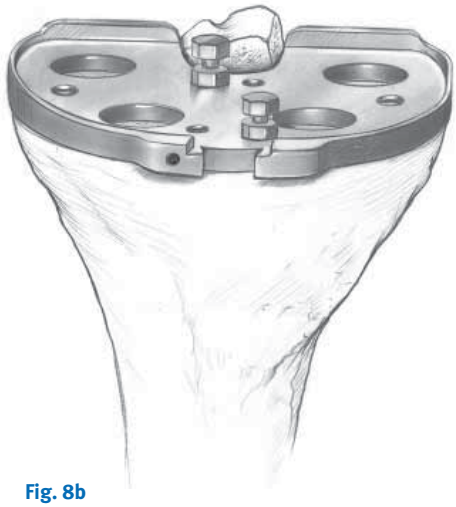
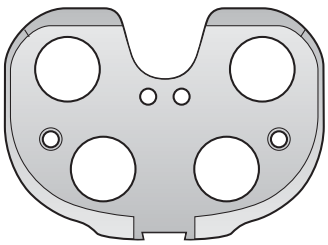


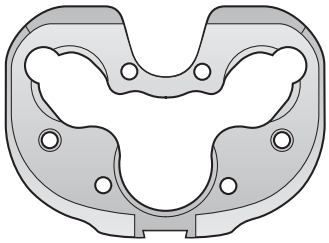
Fig. 8b

Option 1
Tibial Position based on Anatomic Landmarks

The position of the tibial component can also be determined based on anatomic landmarks prior to trial reduction. Select the appropriate Pegged or Stemmed Tibial Sizing Plate/Provisional that provides the desired tibial coverage (Fig. 8c). Please refer to the *Zimmer® NexGen® MIS™ Tibial Component Cemented Surgical Technique* (97-5950-002-00) for complete product information and instructions for the *MIS* Tibial Pegged Stemmed component.



Pegged Tibial Sizing Plate



Stemmed Tibial Sizing Plate

Fig. 8c

Attach the Universal Handle to the selected Tibial Sizing Plate/Provisional by depressing the button on the handle and engaging the dovetail on the handle with the dovetail on the sizing plate/provisional and secure it by tightening the thumbscrew (Fig. 8d).

Fig. 8d

Generally, the handle aligns with the anterior aspect of the tibia. Rotate the sizing plate/provisional so the handle points at, or slightly medial to, the tibial tubercle (Fig. 8e). The Alignment Rod can be used to aid in double checking varus/valgus alignment.

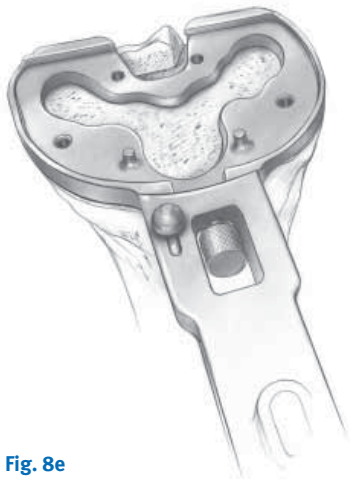


Fig. 8e

Pin the plate in place with two Short Head Holding Pins.

Step Nine
Perform Trial Reduction

In this step, a trial reduction is performed to check component position, patellar tracking, ROM, and joint stability.

The Tibial Sizing Plate is in place.

Knee in 70°-90° flexion

Place the Collateral Retractor laterally, an Army-Navy retractor anteriorly, and a rake retractor on the meniscal bed medially.

Insertion of Femoral Provisional using Optional MIS Femoral Inserter/Extractor

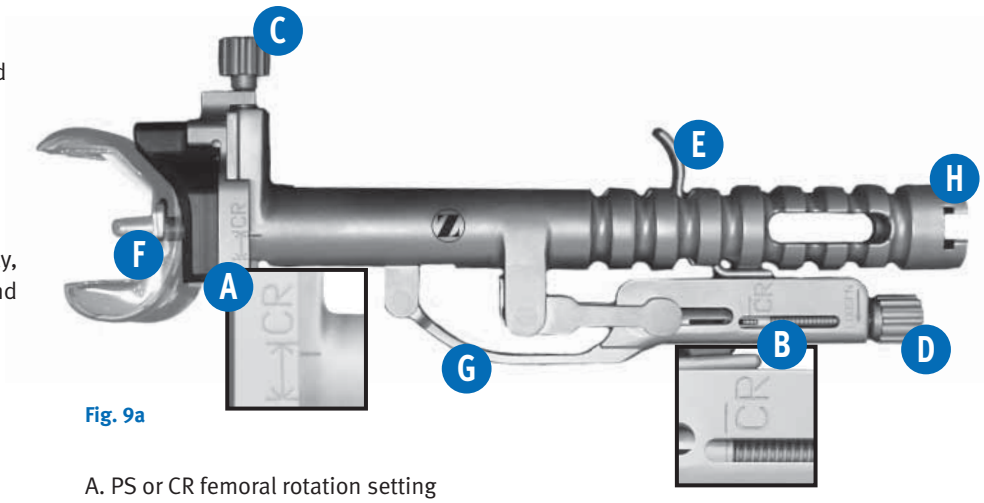


Fig. 9a

A. PS or CR femoral rotation setting
B. PS or CR tension setting
C. Femoral rotation adjustment knob
D. Tension adjustment knob
E. Trigger
F. Instrument hook
G. Locking handle
H. Slaphammer slot

Determine type of *NexGen* implant or provisional being used – Posterior Stabilized (PS) or Cruciate Retaining (CR). Refer to the side of the instrument, labeled PS or CR (see (A) & (B)) which corresponds with the implant or provisional type (Fig. 9a).

Initially adjust femoral rotation setting and tension setting. For the femoral rotation setting, a good starting point is between the lines of the implant type (A). For the tension setting, start with the two lines aligned (B).

Open locking handle (G) to attach implant or provisional. Attach implant or provisional by positioning the instrument hook (Fig. 9b).

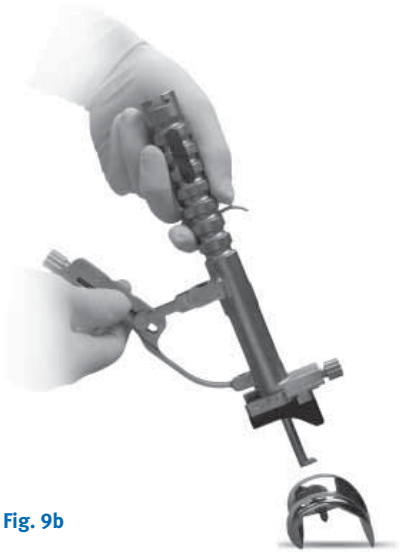


Fig. 9b

If needed, turn adjustment knob (C) to achieve desired rotation of the femoral component (Fig. 9c).

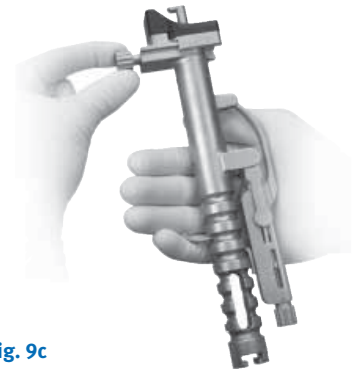


Fig. 9c

Turn tension adjustment knob (D) to increase (tighten) or decrease (loosen) the clamping force (Fig. 9d).

Fig. 9d

Close locking handle to secure instrument to implant or provisional (Fig. 9e).

Fig. 9e

Align implant or provisional onto prepared bone, impact end (H).

Open locking handle by pressing trigger (E) to release instrument from implant or provisional.

If preferred, the Femoral Provisional may be positioned by hand.

Translate the Femoral Provisional laterally until the lateral peg of the provisional aligns with the drill hole in the lateral femoral condyle. Push the provisional in place beginning laterally, then medially. Be sure that soft tissue is not trapped beneath the provisional component.

Knee in extension

Check to ensure that the Femoral Provisional is flush against the resected surface on the medial condyle. Then retract the lateral side and check to make sure it is flush on the lateral side. The Femoral Provisional should be centered mediolaterally on the distal femur.

Attach the appropriate Tibial Articular Surface Provisional and perform a trial reduction. Check ligament stability in extension and in 30°, 60°, and 90° flexion. Attempt to distract the joint in flexion to ensure that it will not distract. If a posterior stabilized component is used, hyperflex the knee and check to make sure that the spine still engages the cam.

Insert the Patellar Provisional onto the resected patellar surface. Perform a ROM to check patellar tracking.

When component position, ROM, and joint stability have been confirmed, remove all provisional components.

Removal of Femoral Provisional using Optional MIS Femoral Inserter/Extractor

Ensure (A) and (B) are still set properly for provisional type being used (PS or CR).

Position instrument hook under provisional (F) (Fig. 9f).

Fig. 9f

Turn tension adjustment knob (D) to tighten or loosen as needed.

Close locking handle (G).

Attach slaphammer (H), extract.

Surgeon Notes & Tips

- In performing the trial reduction and during implantation of the Femoral Provisional or prosthesis, make certain that no portion of the quadriceps or soft tissue is pinned beneath the component.

Step Ten
Implant Components

In this step, the final components are implanted, and the tibial articular surface is secured to the implanted tibial base plate. When using cemented components, it is recommended to use two batches of cement.

After the implants have been chosen, make a final check to ensure that the femoral, tibial base plate, and tibial articular surface components match. If using a cemented component, mix the first batch of cement. The cement should have a doughy consistency when ready for use.

Tibial Base Plate

If a stemmed tibial base plate will be used with a stem extension, attach the desired stem extension to the stem and strike it once with a mallet. If a 10mm-14mm thick tibial articular surface will be used, insert the locking screw for the stem extension.

If a stemmed tibial base plate will be used without a stem extension, consider the need for a taper plug. If a 17mm or 20mm articular surface will be used, a stem extension or taper plug is required. A taper plug also can be used with the 10mm-14mm tibial articular surface. If it is planned to use a 14mm articular surface or if the flexion and extension gaps are not balanced, consider using the taper plug in case the final reduction reveals that it is necessary to switch to a 17mm or 20mm articular surface. Furthermore, if the articular surface should ever require revision with a 17mm or 20mm thick component, the taper plug is already in place and revision of the tibial base plate may not be necessary. Assemble the taper plug onto the tibial plate by striking it several times with a mallet to allow the ring on the taper to deform.

Position the PCL Retractor posteriorly, the Collateral Soft Tissue Protector laterally, and the Collateral Retractor medially. Sublux the tibia anteriorly. Place a layer of cement on the underside of the tibial base plate and on the resected tibial surface. Position the tibial base plate onto the tibia and use the Tibial Impactor to impact it until fully seated (Fig. 10a). Thoroughly remove any excess cement in a consistent manner.

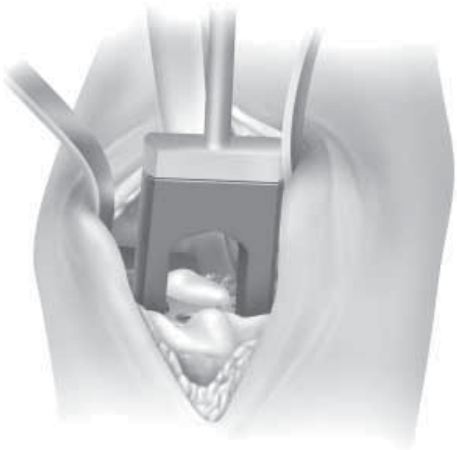


Fig. 10a Use the Tibial Impactor to impact the tibial base plate.

Femoral Component

Attach the femoral component to the Femoral Impactor/Extractor.

Knee in 70°-90° flexion

Place the Collateral Retractor laterally, an Army-Navy retractor anteriorly, and a rake retractor on the meniscal bed medially.

Place a layer of cement on the underside of the prosthesis and in the holes drilled in the femur.

Attach the Femoral/Impactor/Extractor to the femoral component. Insert the femoral component onto the distal femur by translating the component laterally until the lateral peg aligns with the drill hole in the lateral femoral condyle. Take care to avoid scratching the implant component surfaces. Disposable, plastic Tibial Plate Protectors (available at later date) may be temporarily inserted onto the Tibial Base Plate to protect the implant surfaces during insertion of the femoral component. Remove the Tibial Plate Protector after the femur is seated. Be sure tat soft tissue is not trapped beneath the implant. Use a mallet to impact the component until fully seated.

Remove the Femoral Impactor/ Extractor, and the retractors. Check the medial and lateral sides to make sure the femoral component is fully impacted. Remove any excess cement in a thorough and consistent manner.

Alternatively, push the component in place by hand beginning laterally, then medially.

Component Implantation

After the implants have been chosen, make one last check to ensure that the femoral, tibial, and articular surface components match.

Articular Surface Insertion

The Articular Surface Inserter applies both downward and rearward forces to aid in the insertion of the articular surface onto the tibial base plate. Push the lever on the inserter fully to either side. Place the articular surface onto the tibial base plate, engaging the dovetails (Fig. 10b). Steady the surface on the base plate with one hand by applying downward pressure near the posterior cruciate cutout. Engage the hook on the inserter with the mating slot in the front of the base plate and close the lever with your index finger. This should lock the inserter to the base plate. Squeeze the handles of the inserter to seat the articular surface (Fig. 10c). Open the lever and remove the inserter. **Insert an articular surface only once. Never reinsert the same articular surface onto a tibial base plate.**

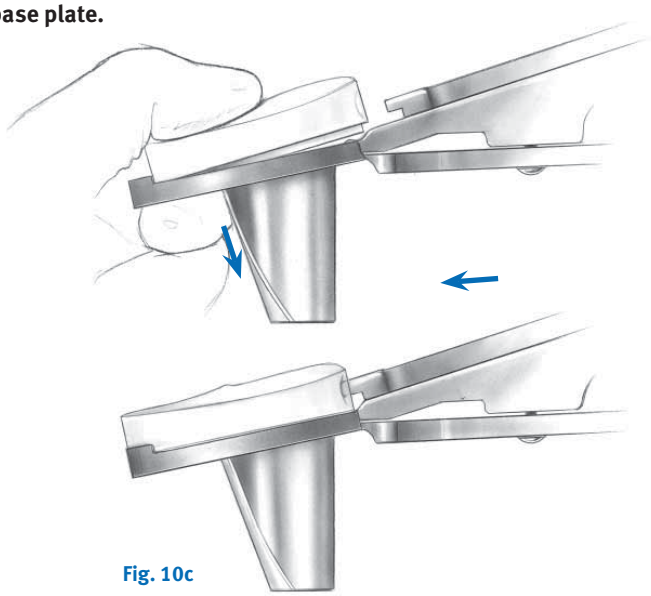


Fig. 10c

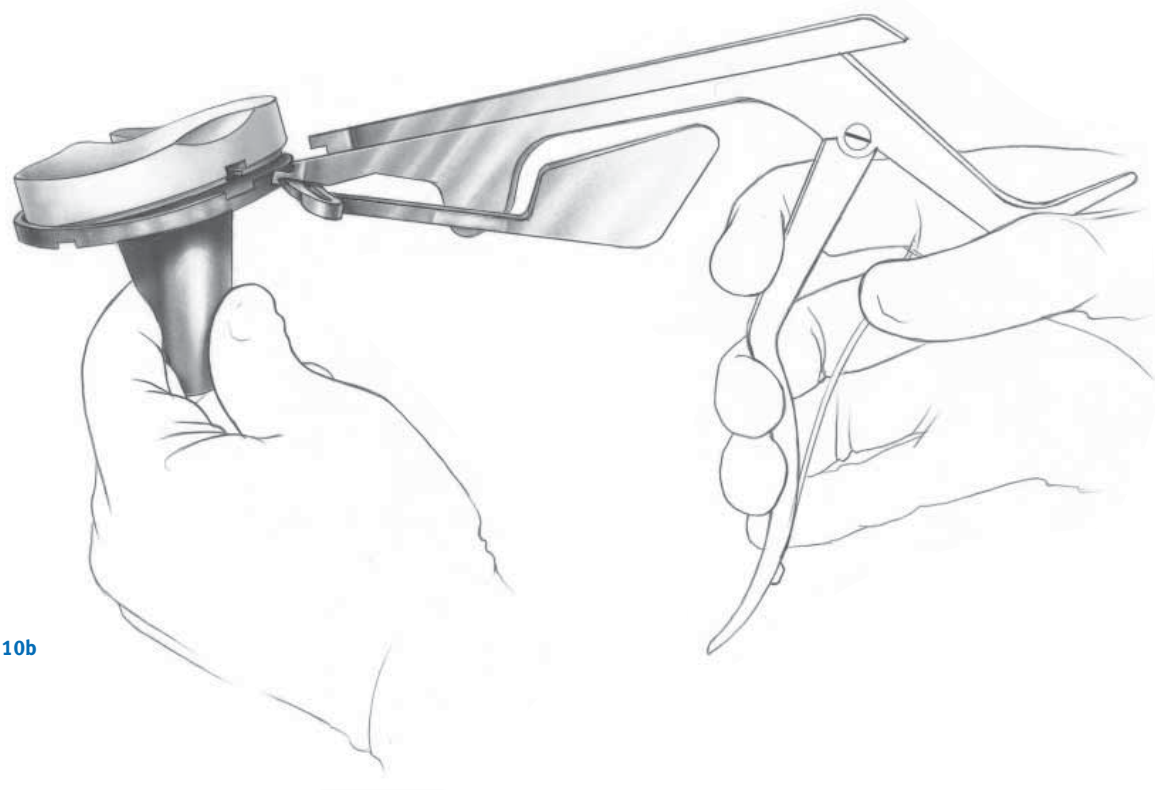


Fig. 10b

Patellar Component
NexGen Primary Porous Patella with Trabecular Metal Material
Knee in 70°-90° flexion

Note: If the implant post begins to engage at an angle, the implant should be removed and repositioned perpendicular to the resected surface. Insert the patella again and reclamp, applying an even distribution of pressure on the patellar surface.

NexGen All-polyethylene Patella
Knee in 70°-90° flexion

Apply cement to the anterior surface and pegs of the patellar component while in a doughy consistency. Locate the drilled peg holes and use the Patellar Clamp to insert and secure the patella in place. Fully open the jaws of the clamp and align the teeth to the anterior surface of the patella and the plastic ring to the posterior surface of the implant. Use the clamp to apply a significant amount of pressure to the implant to fully seat the implant on the patellar surface. Then remove excess cement.

Tibial Articular Surface
Knee in 70°-90° flexion

Use the Articular Surface Insertion Instrument to attach the appropriate tibial articular surface onto the tibial base plate (Fig. 10d).

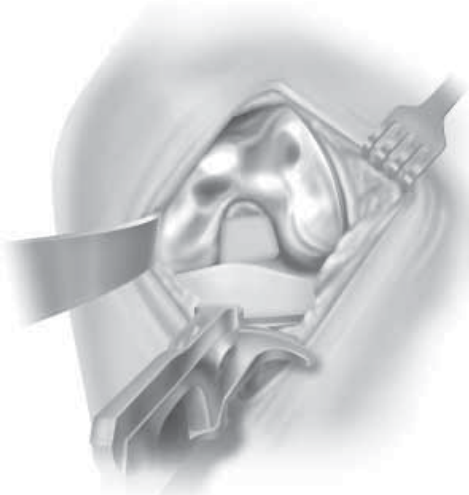
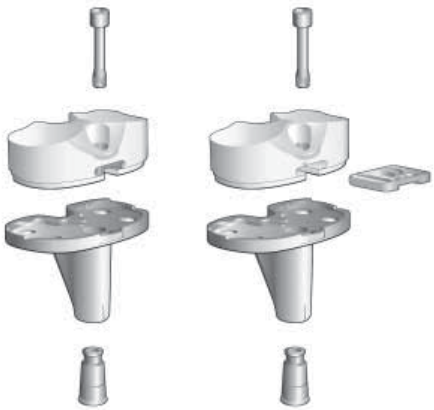


Fig. 10d Insert the tibial articular surface onto the tibial base plate.

Technique for 27mm and 20mm Tibial Articular Surface Assemblies

A secondary locking screw is required for the 17mm and 20mm tibial articular surface components if using a Flex Femoral Component. Therefore, stemmed tibial base plates with either a stem extension or taper plug must be used with these thicker components (Fig. 10e). This assists in lift off resistance at higher flexion positions.



Net-Shape Molded *Prolong* Polyethylene

Fig. 10e

Note: The pegged plate cannot be used with the 17 or 20mm Net-Shape molded or *Prolong*™ Highly Crosslinked Polyethylene articular surface.

With the *Prolong* Highly Crosslinked Polyethylene Articular Surface Component (17mm and 20mm only), the metal locking clip and screw are packaged separately from the tibial articular surface container, but in the same box. Before inserting the tibial articular surface, insert the metal locking clip into the anterior slot of the compartment. The rail should be aligned with the space in the slot. There is an arrow on the superior side of the locking clip that indicates the correct direction for insertion. The purpose of the rail is to prevent the clip from being assembled incorrectly. The metal locking clip should glide easily into the slot. The clip is properly seated when a click is heard. For the molded tibial articular surface, the metal locking clip is preassembled into the component.

A taper plug also can be used with the 10mm to 14mm articular surface components. If you plan to use a 14mm component or the flexion and extension gaps are not balanced, consider using the taper plug in case, during final reduction, it would be necessary to use a 17mm or 20mm component. Then, if the articular surface should ever require revision with a 17mm or 20mm thick component, the taper plug is already in place and revision of the tibial plate component may not be necessary.

If bone cement was used to implant the tibial base plate, wait for the cement to completely sure before attaching the tibial articular surface. Select the LCCK Tibial Plate Wrench that matches the size of the implant to be assembled. Place the end of the wrench over the tibial base plate. Ensure that the wrench is in line with the base of the tibial base plate.

Place the locking screw through the hole in the tibial articular surface. Then use the LCCK Deflection Beam Torque Wrench with the 4.5mm Hex Driver Bit to torque the screw to 95 in.-lbs. Do not overtorque or undertorque.

Recheck the ROM and stability of the knee.

Surgeon Notes & Tips

- Take care that the retractors not inadvertantly dislodge the tibial base plate, particularly on the posterolateral corner.
- Verify that the femoral component is fully seated before closing the wound.
- Confirm that no portion of the quadriceps mechanism has been pinned beneath the femoral component.

Surgical Support Team Tips

- The cement may need to be prepared in two separate batches to implant the components.
  - Place cement onto the tibial bone, position the implant, and impact into place. Remove excess cement.
  - Place cement onto the femoral component, then position the implant and impact into place. Remove all excess cement in a consistent manner.
- After the tibial base plate component has been implanted, ensure that the tibial base plate component has not been dislodged when the femur is subluxed anteriorly to implant the femoral component.

Apply cement to the *Trabecular Metal* surface and post while in a doughy consistency. Locate the drilled post hole and use the Primary Porous Patellar Clamp to insert and secure the patella in place. Fully open the jaws of the clamp and align the teeth to the anterior surface of the patella and the plastic ring to the posterior surface of the implant. Use the clamp to apply a significant amount of pressure to the implant to fully seat the implant on the patellar surface (Fig. 10f). Remove excess cement.

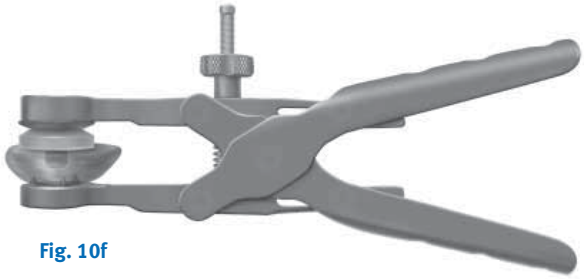


Fig. 10f

Note: If the implant post begins to engage at an angle, the implant should be removed and repositioned perpendicular to the resected surface. Insert the patella again and reclamp, applying an even distribution of pressure on the patellar surface.

Apply cement to the anterior surface and pegs of the patellar component while in a doughy consistency. Locate the drilled peg holes and use the Patellar Clamp to insert and secure the patella in place. Fully open the jaws of the clamp and align the teeth to the anterior surface of the patella and the plastic ring to the posterior surface of the implant. Use the clamp to apply a significant amount of pressure to the implant to fully seat the implant on the patellar surface. Remove excess cement.

Step Eleven
Close Incision

Freely irrigate the wound with the solution of choice. A drain may be placed intracapsularly. Then close the wound with sutures, and apply a bandage.

Appendix 1

This appendix should be used as a supplement to the *MIS Quad-Sparing* and *MIS Multi-Reference* 4-in-1 surgical technique when the optional *MIS* Telescoping Locking Boom (Fig. A) is used. Follow the instructions for the *MIS* Locking Boom (00-5983-028-00) within the *MIS Quad-Sparing* and *MIS Multi-Reference* 4-in-1 surgical techniques with the following additional instructions.

Surgical Technique

Attach the *MIS* Telescoping Locking Boom to the yoke on the appropriate *MIS Quad-Sparing* A/P Sizing Tower or *MIS Multi-Reference* 4-in-1 A/P Sizing Guide. The position of the boom dictates the exit point of the saw blade for anterior bone cut and the desired anterior position of the femoral component.

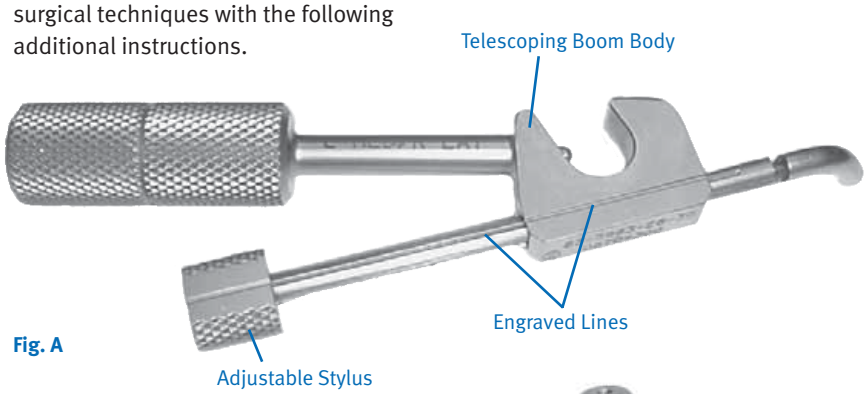


Fig. A

Adjustable stylus: The Telescoping Boom is attached to the yoke of the A/P Sizing instrument (Fig. B). The Stylus Tip is extended to the ideal point on the anterior femoral cortex which is located slightly lateral of patellar femoral groove, proximal of the lateral condyle where the slope begins to flatten (i.e. valley).

The Telescoping Boom can easily be adapted for use on either left medial/right lateral or right medial/left lateral cases. For left medial/right lateral use, the etching - L MED/R LAT must be facing up with the stylus tip pointing down. If the stylus tip is pointing up, slide the stylus fully distally using the knob and rotate the knob 180 degrees counterclockwise. **Note: The Stylus is designed to be rotated at only one position.**

The engraved lines on the stylus and the Body of the Telescoping Locking Boom must be in alignment during sizing.

Note: Clear any soft tissue or bony fragments that interfere with the Telescoping Boom Body prior to sizing.

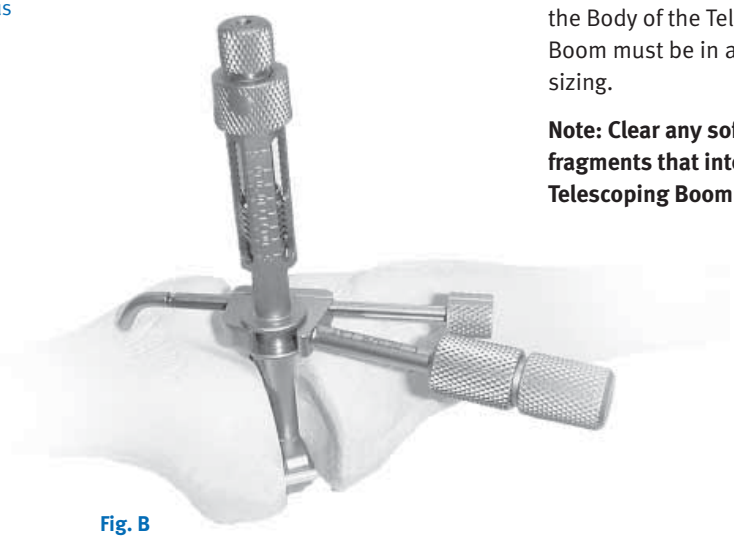


Fig. B

Please refer to package insert for complete product information, including contraindications, warnings, precautions, and adverse effects.

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