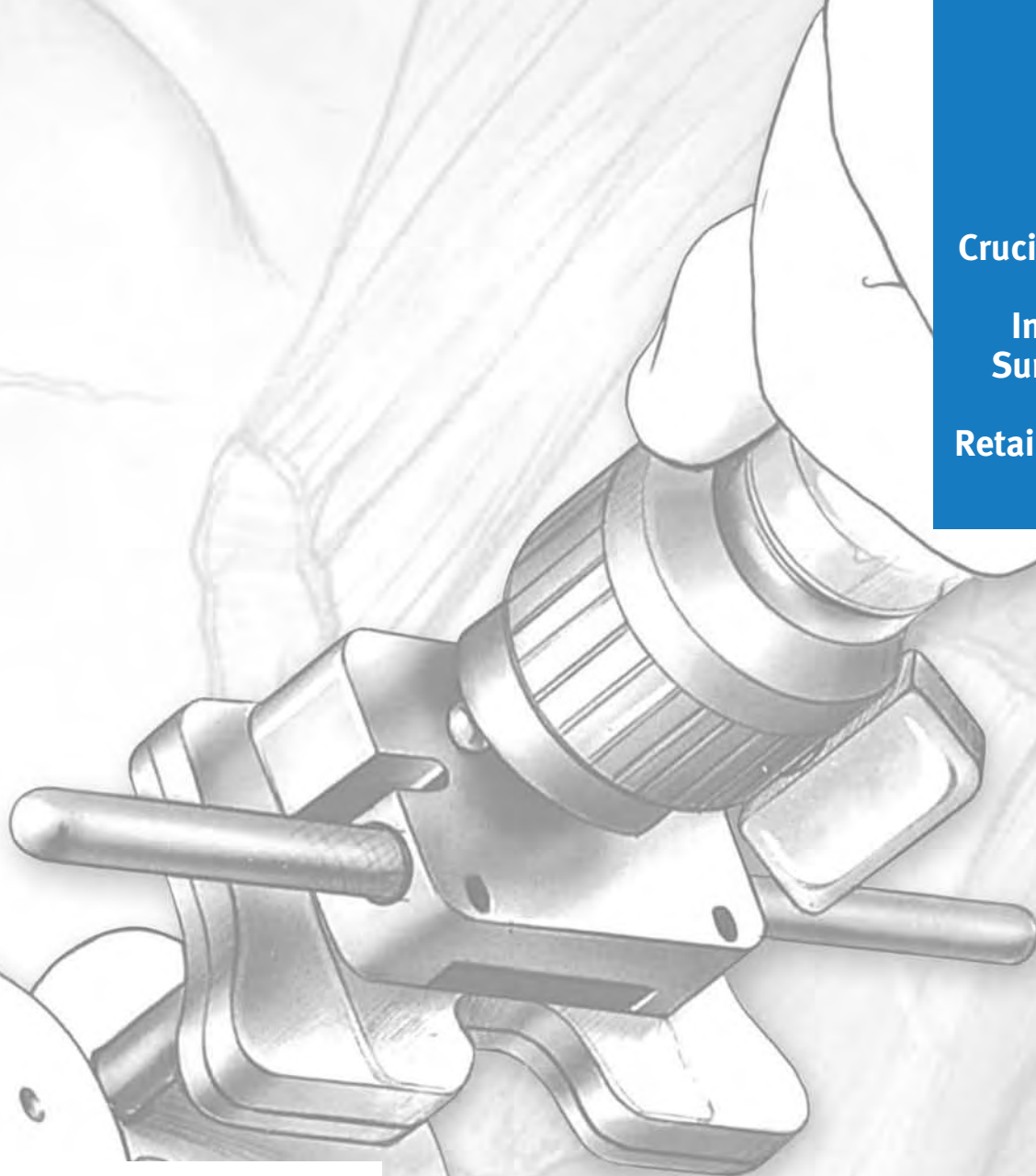




**Cruciate Retaining (CR)
and Revision
Instrumentation
Surgical Technique
for Cruciate
Retaining Augmentable
(CRA) Knees**



NexGen® Complete Knee Solution



zimmer
Confidence in your hands®

INTRODUCTION

This surgical technique document combines the many instrumentation and technique options available to the surgeon when implanting the *NexGen CR* and *NexGen CRA* Total Knee Prostheses. The surgeon should choose the preferred instrumentation system preoperatively. Instruments/techniques for femoral, tibial, and patellar preparation can be chosen independently from the following:

Femoral Preparation

- *Multi-Reference*® 4-in-1 Instrumentation System

This system follows the “distal cut first” philosophy, establishing a flat distal femoral cut on which to position subsequent instruments. It offers a choice of anterior or posterior referencing, and a choice of fixed 3°, 5°, 7° of external femoral rotation or defining femoral rotation by epicondylar referencing.

- *MICRO-MILL*® Instrumentation System

This system provides a single, rigid reference point for all precision femoral cuts. It offers a choice of making the femoral cuts with a saw blade and a single cutting guide, or milling the femur with a cutter that is similar to a router bit and precision milling templates.

Tibial Preparation

- Extramedullary/Intramedullary Tibial Resector

This system provides a choice of four techniques for tibial resection, each offering a number of options to accommodate various anatomical conditions and surgeon preferences. The cutting guide, which can be used for both extramedullary and intramedullary techniques, allows the depth of cut to be adjusted after the guide has been positioned.

- *MICRO-MILL* Instrumentation System

This system offers a choice of making the tibial cut with a saw blade, or milling the tibia with a cutter that is similar to a router bit. Tibial milling templates are provided in a variety of sizes so that bone may be removed without harming the soft tissue, and a solid, well-defined posterior cruciate island may be created.

Patellar Preparation

- Patellar Reamer Technique

This technique uses a reamer to resect the patella, and offers a choice of total surfacing or inseting techniques.

- Universal Saw Guide Technique

This technique uses a universal saw guide and saw blade to resect the patella.





Cruciate Retaining Augmentable (CRA) Technique

- This implant option uses the *NexGen* Revision Instruments to prepare both the tibia and the femur. This intramedullary-referencing system is designed to establish a prosthetic platform on solid existing tibial bone stock, providing a reference plane for evaluating the flexion and extension gaps.

This document also explains the crossover procedure for changing from a cruciate retaining prosthesis to a posterior stabilized prosthesis intraoperatively.

All of these instrumentation systems have been designed to provide simple, precise, and reproducible techniques with a number of options that offer the surgeon more choices and greater flexibility. All procedures are designed to create smooth, accurate resected surfaces and precise knee alignment. In addition, implant flexibility offers the opportunity to switch from a cruciate retaining prosthesis to a posterior stabilized prosthesis quickly and easily.

After choosing the instrumentation system, the technique will list the options available, when appropriate, and guide you to the next step.

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

PREOPERATIVE PLANNING

As with all primary and revision arthroplasty, preoperative planning is essential. Estimate the size of the femoral component by templating from a true lateral x-ray of the contralateral knee.

Primary Arthroplasty

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. These surgical techniques 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.

Revision Arthroplasty

When templating the contralateral knee to help determine the A/P size of the knee, be sure that the CRA Stem Extension Template is centered within the femoral medullary canal. Intraoperative restoration of the appropriate A/P depth of the femur will yield the most appropriate flexion gap which can then be used to help determine the extension gap. Estimate the need for posterior femoral augmentation by overlaying the appropriate size femoral template on the lateral x-ray of the failed total knee replacement. Templating the proximal/distal position of the femoral component on an A/P x-ray film is often difficult. Use the inferior pole of the patella to help determine the appropriate position of the joint line.

Templating the tibial component can yield similar information. Determine the level of bone resection and the possible need for augmentation or an offset stem by centering the tibial stem extension within the tibial canal on the A/P x-ray film. Template the tibia from the lateral x-ray to assure that excessive tibial slope does not significantly change the tibial resection level. Use the lateral x-ray to initially choose among the standard stemmed, fluted stemmed, or A/P wedge stemmed tibial component design.

The Zimmer Revision Knee Arthroplasty Surgical Guidelines is strongly recommended for a more complete discussion on revision total knee arthroplasty technique. (This booklet can be ordered through Zimmer, reference catalog number 97-5224-03).



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FEMORAL PREPARATION

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TIBIAL PREPARATION

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FINISH THE TIBIA

PATELLA PREPARATION

TRIAL REDUCTION/IMPLANTATION

CRA COMPONENT PREPARATION

FEMORAL PREPARATION FOR PRIMARY ARTHPLASTY

Multi-Reference 4-in-1
Instrumentation



FEMORAL PREPARATION

MULTI-REFERENCE 4-in-1 INSTRUMENTATION

MICRO-MILL/5-in-1 INSTRUMENTATION

CROSSOVER TECHNIQUE

TIBIAL PREPARATION

EM/IM TIBIAL RESECTOR

MICRO-MILL/5-in-1 INSTRUMENTATION

FINISH THE TIBIA

PATELLA PREPARATION

TRIAL REDUCTION/IMPLANTATION

CRA COMPONENT PREPARATION

STEP ONE

ESTABLISH FEMORAL ALIGNMENT

Drill a hole in the center of the patellar sulcus of the distal femur (Fig. 1), making sure that the hole 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 pre-operative templating of the A/P radiograph.

Use the 8mm IM Drill with step to enlarge the entrance hole on the femur to 12mm diameter. This will reduce intramedullary pressure during placement of subsequent IM guides. Suction the canal to remove medullary contents.

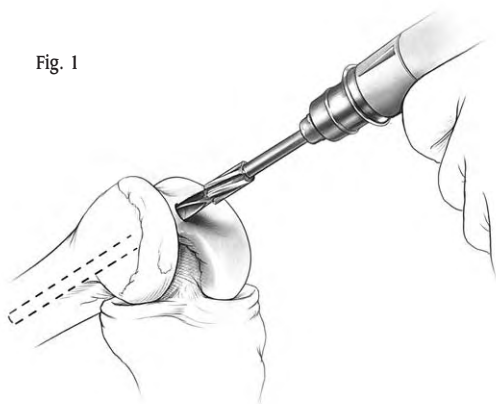


Fig. 1

Set the IM Alignment Guide to the proper valgus angle as determined by preoperative radiographs. Check to ensure that the proper "Right" or "Left" (Fig. 2) indication is used and engage the lock mechanism (Fig. 3).

Fig. 2

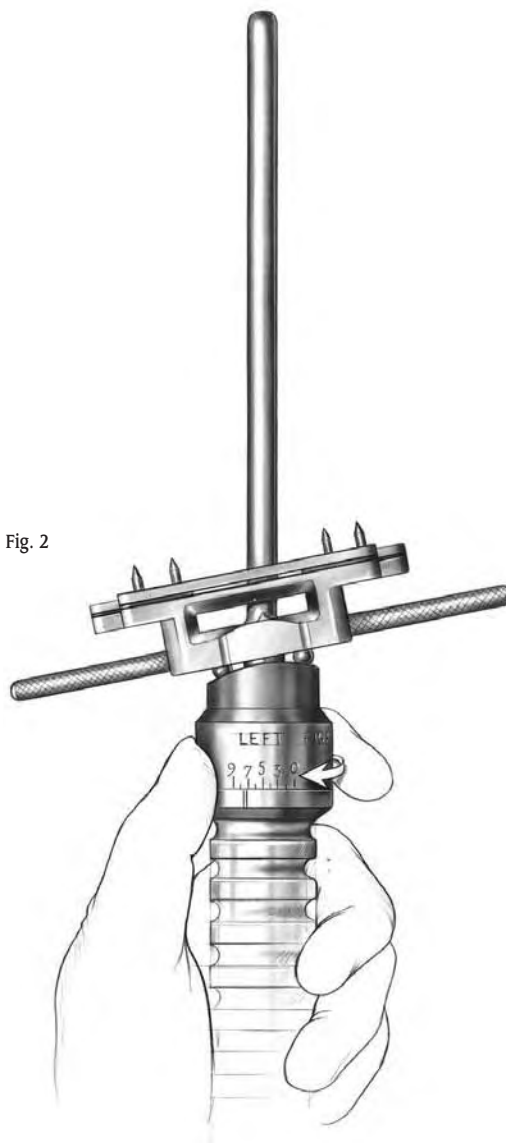
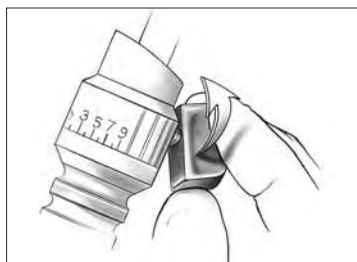


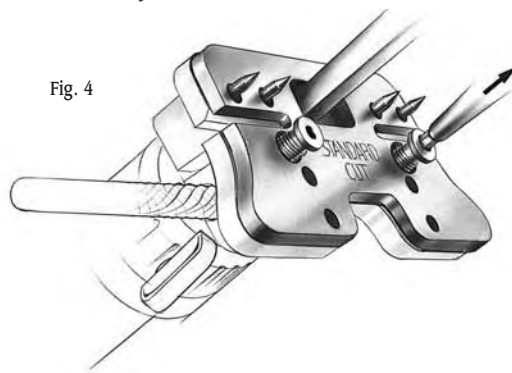
Fig. 3





The Standard Cut Block must be attached to the IM Alignment Guide for a standard distal femoral resection. The plate should be tightened on the guide prior to use, but the screws should be loosened for sterilization. Remove the Standard Cut Block if a large flexion contracture exists. This will allow for an additional 3mm of distal femoral bone resection (Fig. 4). The level of distal resection can also be adjusted with the Epi Distal Cut Guide as shown in **STEP TWO**.

NOTE: Spacer blocks can be used to check flexion-extension gap spacing before recutting the distal femur.



Insert the guide into the IM hole on the distal femur.

Use the epicondylar axis as a guide in setting the orientation of the IM Alignment Guide. Position the handles of the guide 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 to ensure proper location of the femoral head.

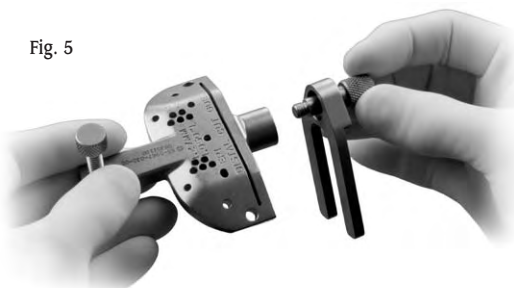
STEP TWO

CUT THE DISTAL FEMUR

While the IM Alignment Guide is being inserted by the surgeon, the scrub nurse should attach the Distal Femoral Cutting Guide to the appropriate Distal Placement Guide. If a posterior referencing technique will be employed, consider using the 3° Distal Placement Guide. This will place the Distal Resection Guide, and therefore the distal cut in 3° of flexion to help prevent notching of the anterior cortex. If an anterior referencing technique will be employed, use the 0° Distal Placement Guide.

Ensure that the attachment screw is tightened (Fig. 5). Verify that the anterior thumb screw is backed out, away from the bone surface.

Fig. 5



Insert the Distal Placement Guide with the cutting guide into the IM Alignment Guide until the cutting guide rests on the anterior femoral cortex.

To further stabilize the guide, turn the anterior screw by hand until it contacts the anterior femoral cortex (Fig. 6). Do not overtighten.

Optional Technique:

The 3° Distal Placement Guide can be used to place the Distal Resection Guide in 3° of flexion to protect the anterior cortex from notching for anterior referencing as well.

Drill two holes using the 1/8 in. drill. Place Headless Holding Pins through the two standard pin holes in the anterior surface of the Distal Femoral Cutting Guide marked "0" (Fig. 7).

Fig. 6

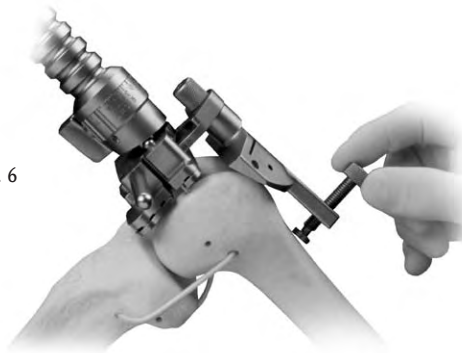


Fig. 7



*Distal Femoral
Cutting Guide-Pin
Hole Locations*



Completely loosen the attachment screw (Fig. 8) in the Distal Placement Guide.

Fig. 8



CRUCIATE RETAINING



Use the Slaphammer Extractor to remove the IM Alignment Guide and the Distal Placement Guide (Fig. 9).

To facilitate flexion/extension gap balancing, 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 Block. Once the distal femoral resection has been determined, use Holding Pins and/or Silver Spring Pins to further stabilize the guide.

Cut the distal femur through the distal cutting slot in the cutting guide using a .050-inch/ 1.27mm oscillating saw blade (Fig. 10).

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. 9



Fig. 10

STEP THREE

SIZE FEMUR & ESTABLISH EXTERNAL ROTATION

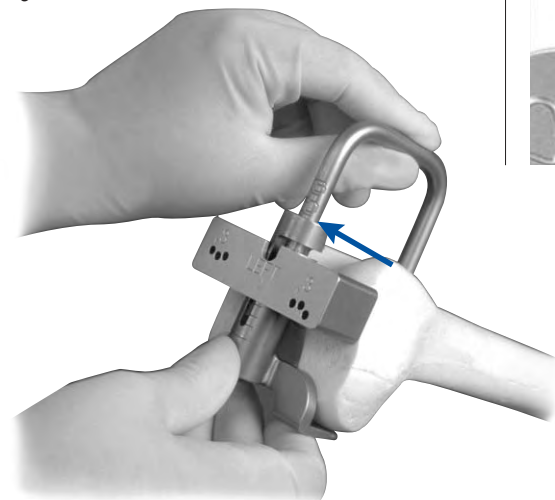
Place the 4-in-1 Femoral A/P Sizing Guide flat onto the smoothly cut distal femur, this is the only sizing guide that can be used with the 4-in-1 system. Check to ensure that the proper "Right" or "Left" designation is showing on the guide. Make sure that the body of the guide maintains contact with the resected distal femur. Compress the guide until the anterior boom contacts the anterior cortex of the femur, and both feet rest on the cartilage of the posterior condyles. Check to ensure that the boom is not seated on a high spot, or an unusually low spot on the anterior cortex. The position of the boom dictates the exit point of the anterior bone cut and the ultimate position of the femoral component.

There are eight sizes labeled "A" through "H."

Anterior Referencing Technique

For an anterior referencing technique, read the femoral size directly from the size guide on the anterior boom (Fig. 11). If the indicator is between two sizes, the smaller size is typically chosen. This prevents excessive ligament tightness in flexion.

Fig. 11

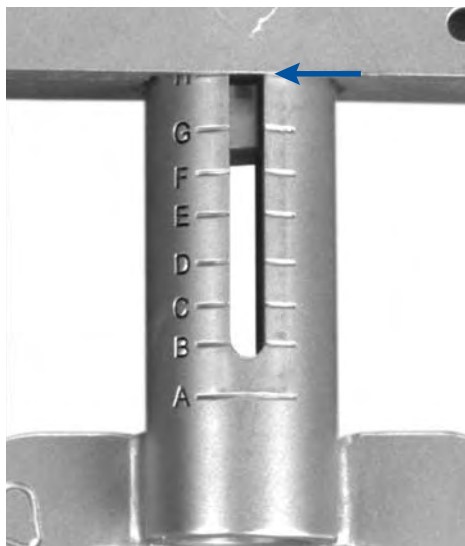


Anterior Referencing

Posterior Referencing Technique

For a posterior referencing technique, identify the femoral size range from the size guide on the posterior cylinder (Fig. 12). If the indicator is between two sizes, the larger size is typically chosen. This prevents notching of the anterior cortex. Adjust the sizing guide placement by moving the anterior boom on the anterior cortex until the guide rests directly on the appropriate size mark on the posterior cylinder. Use the position of the anterior boom to visualize the exit point of the anterior bone cut, and the ultimate A/P position of the femoral component. This discrete placement will ensure that the amount of posterior bone resection will average 9mm (the thickness of the posterior condyles of the standard NexGen Femoral Component, sizes C-H) (Fig. 12).

Fig. 12



Posterior Cylinder detail
Posterior Referencing





DETERMINE PROPER EXTERNAL ROTATION

The 4-in-1 Femoral A/P Sizing Guide offers three external rotation choices: 3°, 5°, and 7°. For all varus knees, use the 3° rotation option (Fig. 13). For knees with a valgus deformity of 10°-20°, use the 5° option (Fig. 14). For knees with patellofemoral disease accompanied by bone loss and valgus deformity greater than 20°, use the 7° option (Fig. 15).

Anterior Referencing

For an anterior referencing technique, place two Headless Holding Pins into the appropriate external rotation holes in the body of the 4-in-1 Femoral A/P Sizing Guide. Impact them flush with the guide (Fig. 16). Remove the sizing guide, but leave the two headless pins. These pins will serve to establish A/P position and rotational alignment of the Femoral Finishing Guide.

Fig. 13

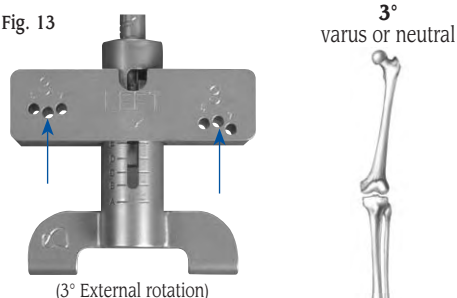


Fig. 14

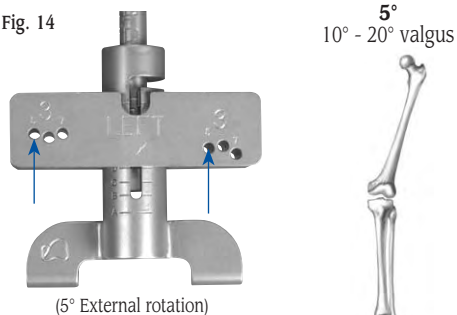
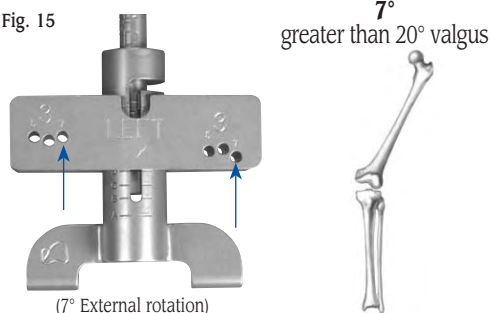


Fig. 15



Optional Technique:

Another method of setting external rotation is to identify the epicondylar axis. To identify the lateral epicondyle, it is necessary to dissect away the patellofemoral ligament. The lateral epicondyle is a discrete point at the center of the lateral collateral ligament attachment. The medial epicondyle can be found by removing the synovium from the medial collateral ligament attachment to the femur. The medial collateral ligament has a broad attachment to the medial epicondyle forming an approximate semicircle (Fig. 17). Choose the center of the diameter. Mark these two points with methylene blue (Fig. 18). Then, draw a line between the two epicondyles on the resected surface of the distal femur (Fig. 19). This line represents the epicondylar axis.

Fig. 16



Fig. 17

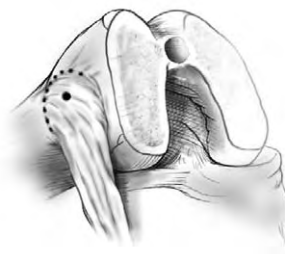


Fig. 18

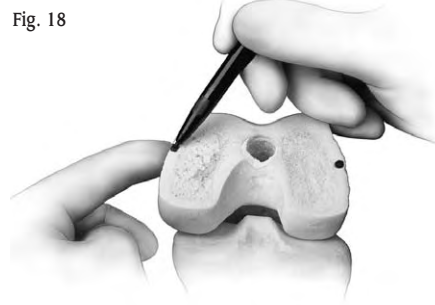
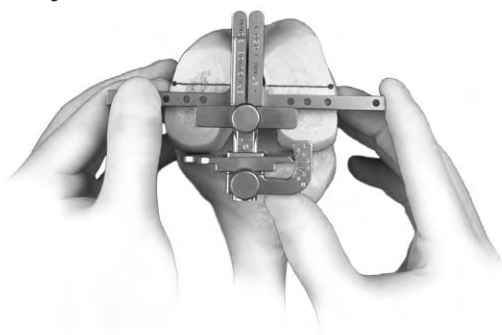


Fig. 19



Attach the Posterior Reference Guide to the Epicondylar Guide. Place the epicondylar guide on the distal femur, bringing the feet of the rotation guide flush against the posterior condyles of the femur. (Fig 20). Set the rotation of the epicondylar guide parallel to the epicondylar axis. Read the angle of external rotation indicated by the Posterior Reference/Rotation Guide. The epicondylar line is rotated externally 0° - 8° , ($4^{\circ} \pm 4^{\circ}$) relative to the posterior condyles¹. Determine the external rotation (3° , 5° , 7°) that most closely matches the indicated rotation.

Fig. 20



Posterior Referencing

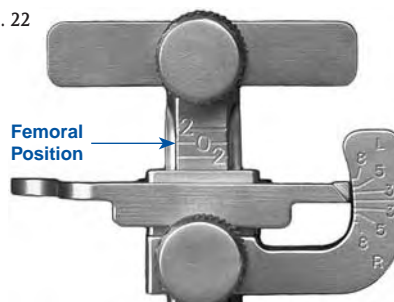
For the posterior referencing technique, select the correct size 4-in-1 Femoral Finishing Guide as determined by the measurement from the A/P Sizing Guide. Assemble the Posterior Reference/Rotation Guide to the selected femoral guide (Fig. 21).

Fig. 21



Lock the femoral position indicator on the rotation guide to the zero position (Fig. 22). This zero setting ensures that, when the feet are flush with the posterior condyles, the amount of posterior bone resection will average 9mm.

Fig. 22



Swing the anterior boom on the finishing guide out of the way. Place the finishing guide on the distal femur, bringing the feet of the rotation guide flush against the posterior condyles of the femur (Fig. 23).

Fig. 23



Set the rotation of the finishing guide to parallel 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° - 8° , ($4^{\circ} \pm 4^{\circ}$), relative to the posterior condyles. Pin the guide to the distal femoral.

¹ Poilvache PL, Insall JN, Scuderi GR, Font-Rodriguez DE. Rotational landmarks and sizing of the distal femur in TKA. *Clin Orthop*. 331: 35-46, 1996.





STEP FOUR

FINISH THE FEMUR

Select the correct size 4-in-1 Femoral Finishing Guide as determined by the measurement from the A/P Sizing/Rotation Guide. Place the finishing guide onto the distal femur, over the headless pins. This determines the A/P position and rotation of the instrument. (The anterior boom on the finishing guide indicates the depth at which the anterior cut will exit the femur and may be used as a check.) The finishing guide may be positioned mediolaterally by sliding it on the headless pins (Fig 24).

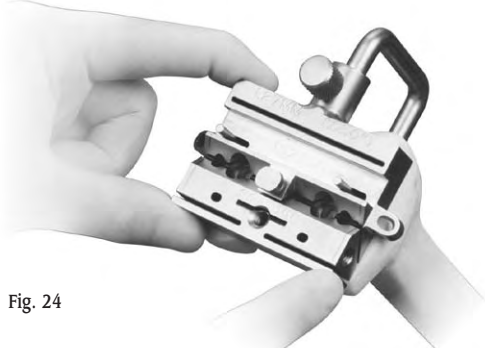


Fig. 24

The width of the finishing guide replicates the width of the distal *NexGen CR Femoral Component*. The etched lines on the posteromedial and posterolateral surface of the guide reference the width of the *NexGen Legacy® Knee Posterior Stabilized (LPS) Femoral Component* (Fig. 25). For the posterior referencing technique, use the Posterior Reference/Rotation Guide to check that the posterior resection is appropriate, that is, reads on the "0" mark.

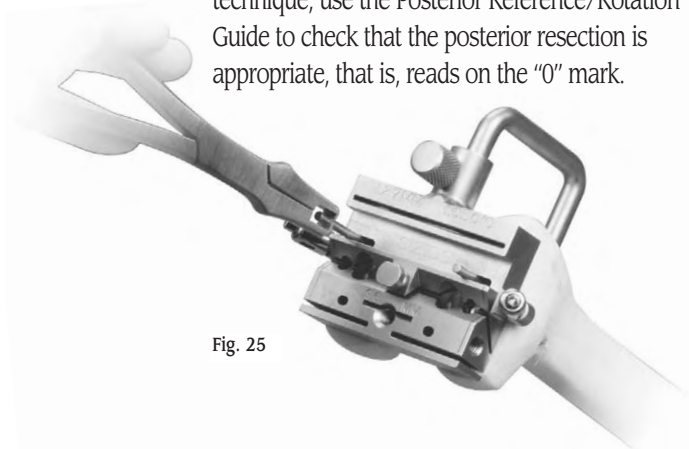


Fig. 25

Pin the 4-in-1 Femoral Finishing Guide to the distal femur with two Short-head Holding Pins through the front. Use the Universal Handle to impact these pins. To further stabilize the guide, insert a Silver Spring Pin through the tab on each side of the guide using the Female Hex Driver and Drill Reamer. The pins are designed to automatically disengage the hex driver when fully seated on the guide. Remove the headless pins (Fig. 25).

Use the .050-inch/1.27mm oscillating saw blade to cut the femur. Perform the final femoral cuts in the following sequence to allow the guide to maintain optimal stability during bone resection (Fig. 26).

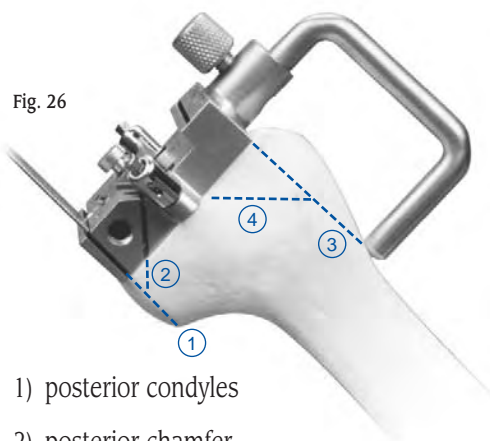


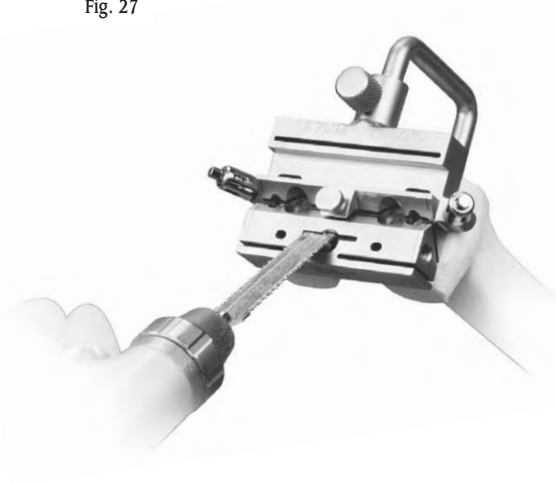
Fig. 26

- 1) posterior condyles
- 2) posterior chamfer
- 3) anterior flange
- 4) anterior condyles
- 5) base of Trochlear Recess
- 6) drill peg holes

CRUCIATE RETAINING

Use the center slot on the distal face of the guide to cut the base of the trochlear recess with a reciprocating saw (Fig. 27). Ensure that the saw blade is in line with the femur throughout the cut, and do not angle or fan the blade medially or laterally.

Fig. 27



Use the two slots on the anterior surface of the guide to make reference marks by scoring the femur with a reciprocating saw blade. This determines the sides of the trochlear recess (Fig. 28).

Drill the holes for the two femoral pegs with the Patella/Femoral Drill Bit (Fig. 29).

Fig. 28

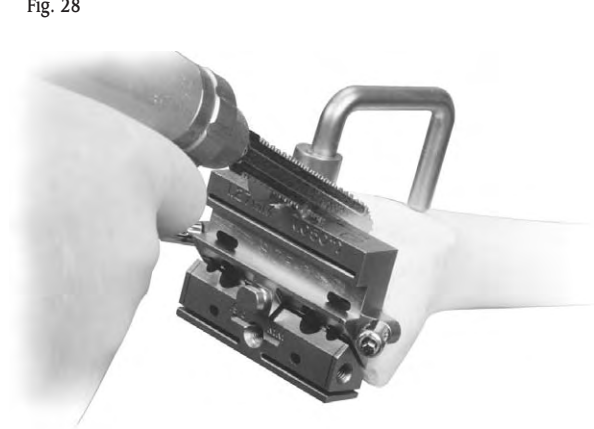
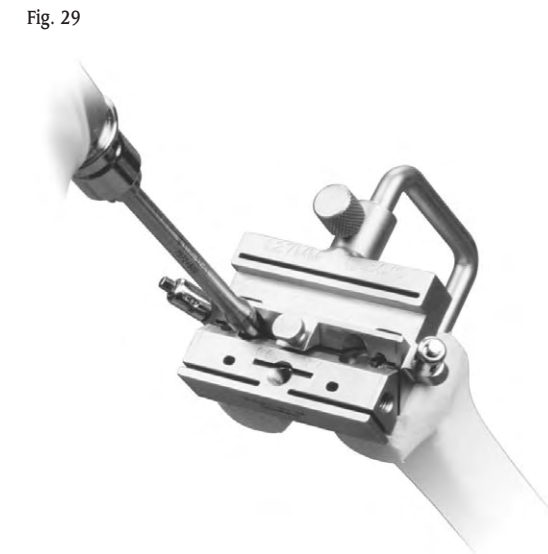


Fig. 29



CRUCIATE RETAINING



When complete, use the Female Hex Driver to remove the two Silver Spring Pins. Place the hex driver over the spring pin and apply a downward force on the driver sleeve (Fig. 30). Start the drill/reamer in reverse, slowly until the driver hex engages the hex-head of the pin. Continue until the spring pin disengages bone.

Use the Slaphammer Extractor to remove the Femoral Finishing Guide, and use a reciprocating saw to complete the sides of the trochlear recess at the two reference marks.

Fig. 30



FEMORAL PREPARATION

MULTI-REFERENCE 4-in-1 INSTRUMENTATION

MICRO-MILL/5-in-1 INSTRUMENTATION

CROSSOVER TECHNIQUE

TIBIAL PREPARATION

EM/IM TIBIAL RESECTOR

MICRO-MILL/5-in-1 INSTRUMENTATION

FINISH THE TIBIA

PATELLA PREPARATION

TRIAL REDUCTION/IMPLANTATION

CRA COMPONENT PREPARATION

**MICRO-MILL
INSTRUMENTATION**





STEP ONE

SIZE THE FEMUR

Drill a hole in the center of the patellar sulcus of the distal femur (Fig. 31), making sure that the hole is parallel to the shaft of the femur in both the anteroposterior and lateral projections. The hole should be approximately 1 cm anterior to the origin of the posterior cruciate ligament. The drill is a step drill and should be used to enlarge the entrance hole on the femur to 12mm in diameter if desired. This will reduce further intramedullary pressure from placement of subsequent intramedullary guides.

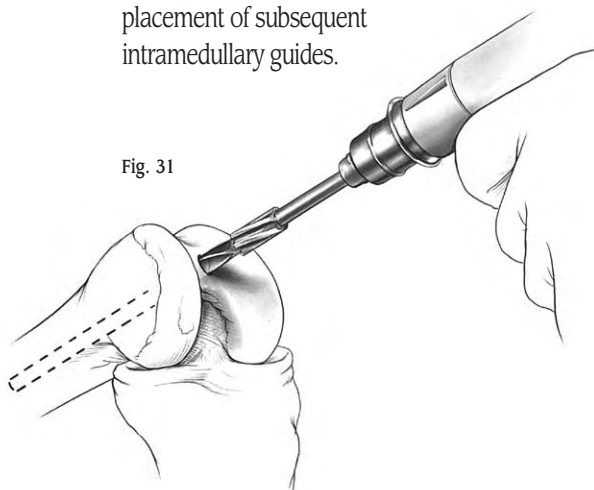


Fig. 31

Insert the IM Femoral A/P Sizing Guide into the hole until it contacts the distal femur. Compress the guide until the anterior boom contacts the anterior cortex of the femur, and both feet rest on the cartilage of the posterior condyles. Placing the guide in flexion or extension can produce inaccurate readings. Check to ensure that the boom is not seated on a high spot, or an unusually low spot.

Read the femoral size directly from the guide (Fig. 32). If the indicator is between two sizes, choose the smaller size. This size indicates the proper size of the Femoral A/P Placement Guide, the Femoral Milling Template or 5-in-1 Femoral Cutting Guide, the Femoral Finishing Guide (milling or 5-in-1), and the femoral component. The sizing can be confirmed at the alignment stage.

The IM Femoral A/P Sizing Guide can also be used to aid in setting 3° of external rotation of the femoral component in relation to the nondeformed posterior condyle. Select and drill through the appropriate holes in the guide being sure that the proper "Right" or "Left" indication is used. Drill one hole on each side, medial and lateral. This will place two reference holes on the femur at 3° of external rotation (Fig 33). These holes will be used in conjunction with the Intramedullary Alignment Guide to set rotation.

Fig. 32

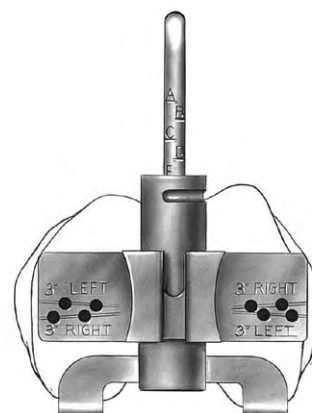
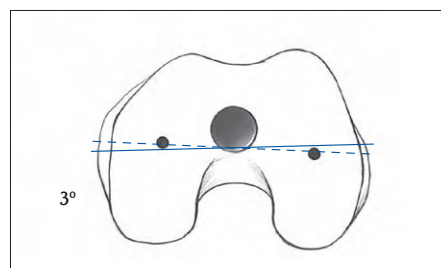
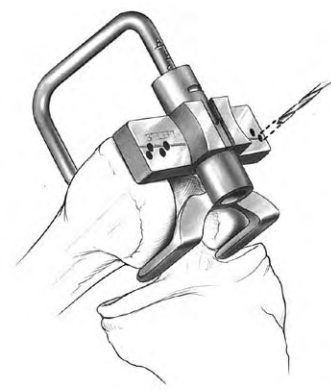


Fig. 33



STEP TWO

ESTABLISH FEMORAL ALIGNMENT

In this step, the valgus angle, depth of distal femoral resection, rotation and anterior/posterior (A/P) placement are set.

First, set the Intramedullary Alignment Guide to the proper valgus angle as determined by preoperative radiographs. Check to ensure that the proper "Right" or "Left" indication is used and engage the lock mechanism (Fig. 34). The Standard Cut Block must be attached to the Intramedullary Alignment Guide for normal distal femoral resection. The plate should be tightened on the guide prior to use and the screws should be loosened for sterilization. If a large flexion contracture exists or, for other reasons, 3mm of additional distal femoral bone needs to be resected, remove the Standard Cut Block (Fig. 35).

Insert the guide into the intramedullary hole on the distal femur.

Optional Technique:

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

Fig. 34

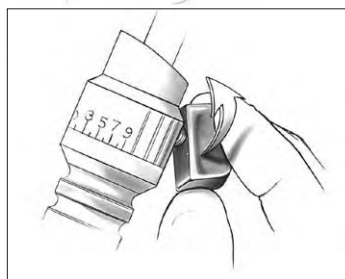
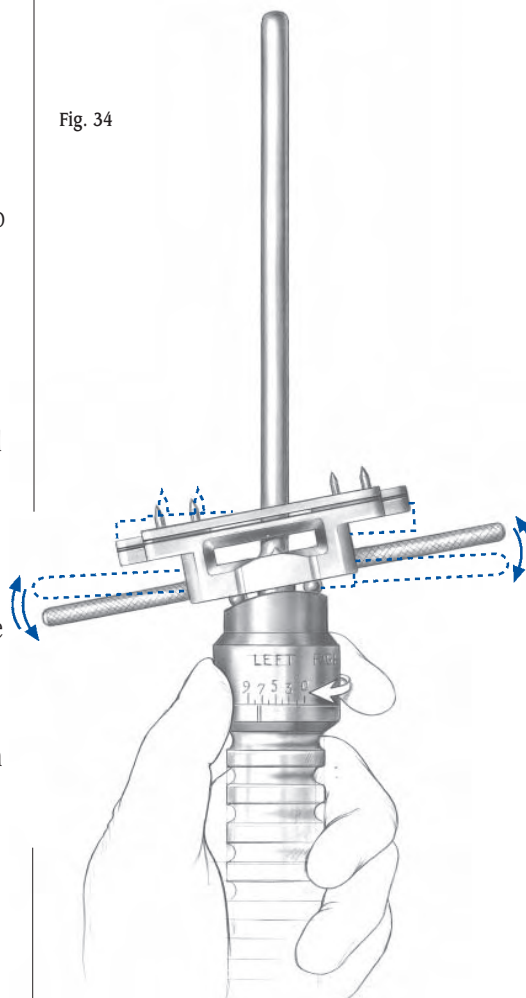
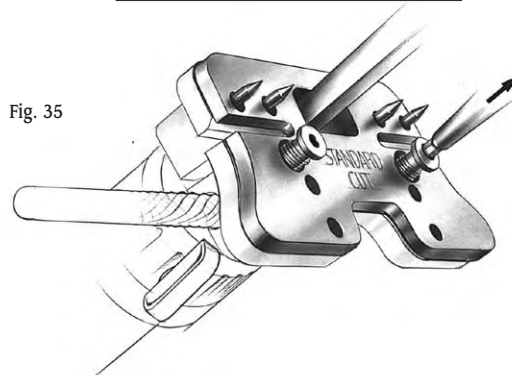


Fig. 35





To achieve 3° of femoral component external rotation, use the alignment holes made when sizing. Line the holes up with the alignment slots on the Intramedullary Alignment Guide (Fig. 36). If needed, 1/8-inch pins can be used to aid alignment with the pin going through the alignment slot on the guide and into the alignment holes.

Once the proper external rotation is achieved, impact the Intramedullary Alignment 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 level.

Optional Technique:

The external rotation can also be set by positioning the handles of the Intramedullary Alignment Guide parallel to the epicondyles, or by using the posterior condyles and referencing the posterior aspect of the guide (Fig. 37). A Rotational Alignment Guide is available for easier referencing of the posterior condyles in large knees.

Fig. 36

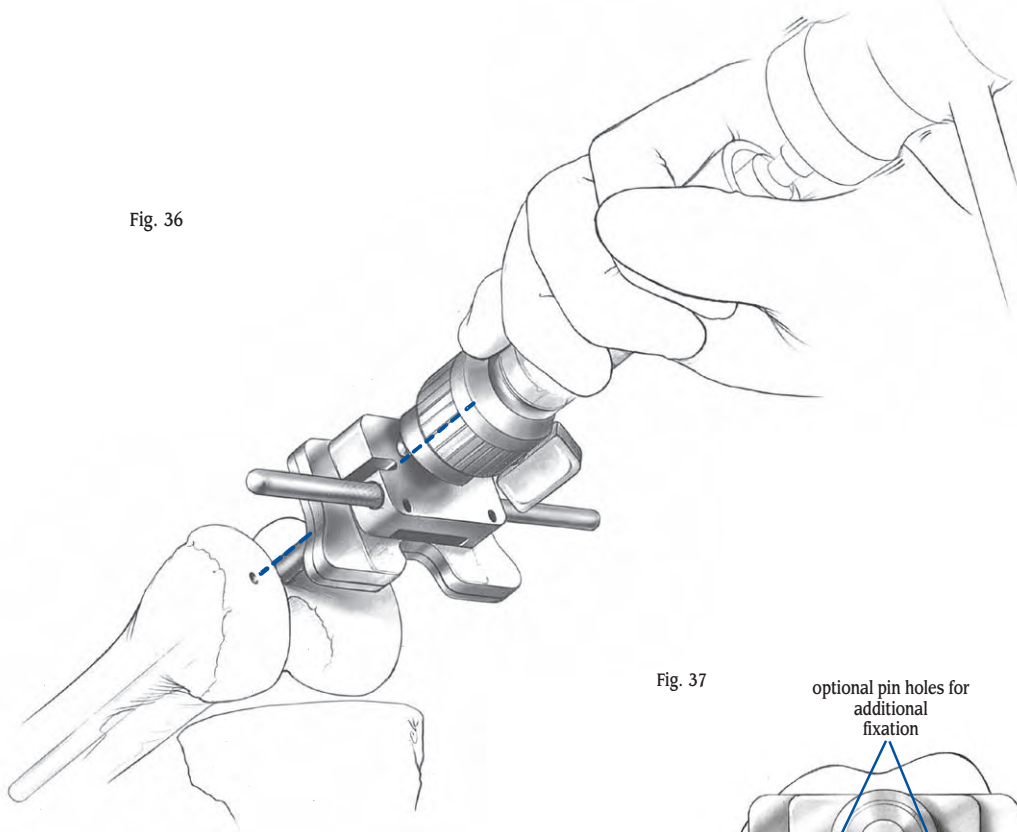
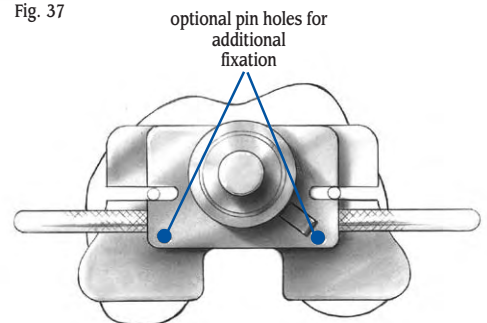


Fig. 37

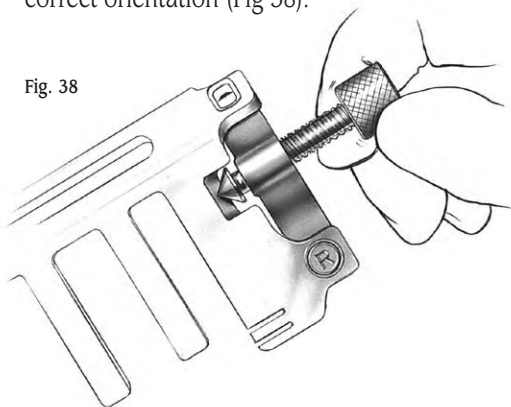


STEP THREE

SET A/P POSITION OF THE FEMUR

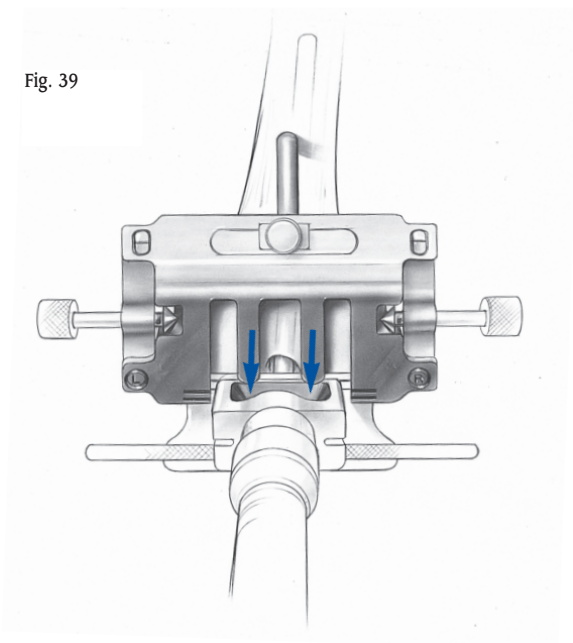
While the Intramedullary Alignment Guide is being inserted by the surgeon, the scrub nurse should attach the two Standard Femoral Mounting Bases (Micro sizes require separate bases) to the correct size Femoral A/P Placement Guide as determined in **STEP ONE**. Tighten the thumb screws. The bases are right/left specific with “R” and “L” indications and can only be assembled in the correct orientation (Fig 38).

Fig. 38



Insert the Femoral A/P Placement Guide with bases attached into the Intramedullary Alignment Guide (Fig. 39) until the boom contacts the anterior femoral cortex.

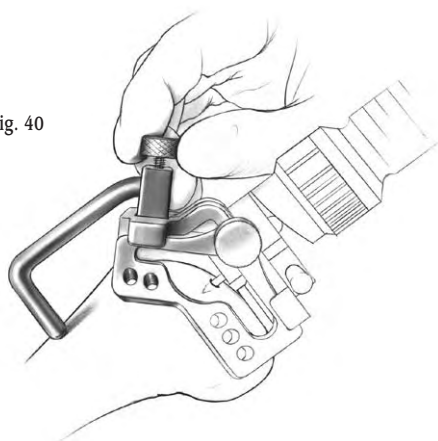
Fig. 39



Note: The 1/8-inch pins must be removed from the external rotation slots for the Femoral A/P Placement Guide to seat properly.

The boom indicates where the anterior cut will exit the femur. To prevent notching of the femur, center the boom over the medullary canal. Be sure that the boom is not on an unusually high or low spot. If it is, adjust the boom to a more appropriate position. When the boom position is set, tighten the boom thumb screw (Fig. 40).

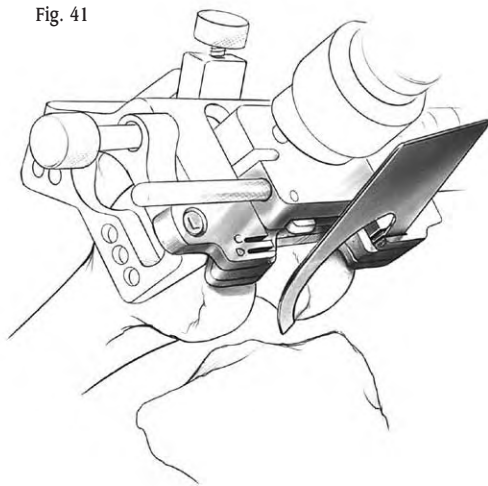
Fig. 40





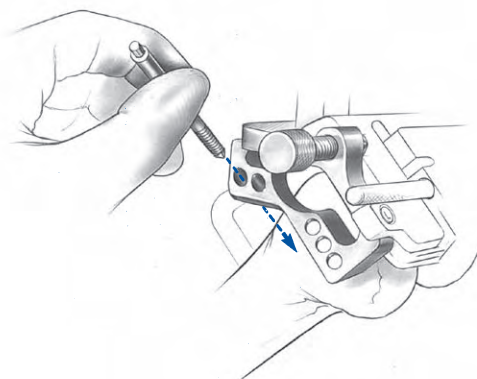
The two slots on the posterior aspect of the Femoral A/P Placement Guide correspond to the posterior femoral resection of the two femoral sizes covered by the guide. This resection level can be checked by placing the Resection Guide through the slots (Fig. 41). Note: More external rotation typically results in removal of more bone on the medial posterior condyle. Depending on posterior condylar bone loss, this may vary.

Fig. 41



If neither of the posterior resection levels are satisfactory, the femoral sizing steps should be re-evaluated.

Fig. 42



STEP FOUR

SECURE FEMORAL MOUNTING BASES

By hand, insert two fixation pins into each side of the two Femoral Mounting Bases. Use the holes that are farthest apart (Fig. 42) and do not impinge soft tissue. Then, while holding the boom of the Femoral A/P Placement Guide to ensure that it is still touching the anterior femoral cortex (Fig. 43), use the Female Hex Driver and drill/reamer to drive each pin into the bone in the order indicated (Fig. 44). The drill/reamer should be set to the "Screw" position. The drill/reamer should be set to the "Screw" position. To prevent galling while screwing a pin in, ensure that the pin remains parallel to the hole. Do not completely bury the threaded portion within the bone. Leave one or two threads visible (Fig. 45).

Fig. 43

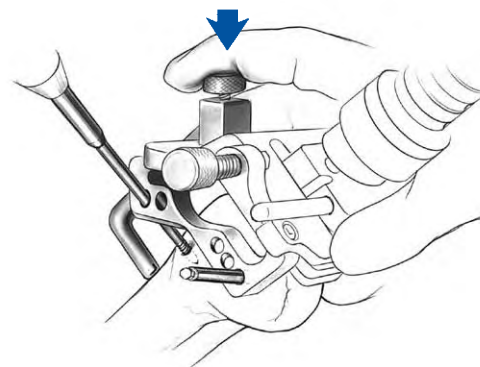


Fig. 44

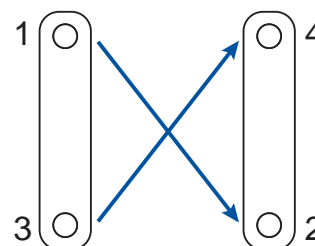
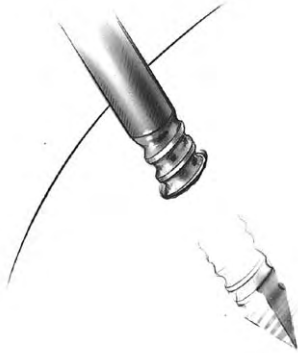


Fig. 45



Remove the placement guide and Intramedullary Alignment Guide with the Slaphammer Extractor (Fig. 47).

The sizing and alignment steps are now complete. All femoral precision cuts will reference off the Femoral Mounting Bases, preventing inaccuracies due to multiple instrument usage and referencing resected surfaces.



Loosen the thumb screw that holds the boom of the Femoral A/P Placement Guide in position and slide the boom to the medial side. Then loosen the two thumb screws on the Femoral Mounting Bases until they are completely free of the Femoral A/P Placement Guide (Fig. 46).

Fig. 46

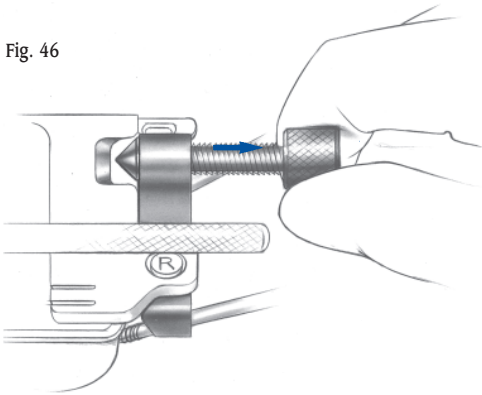
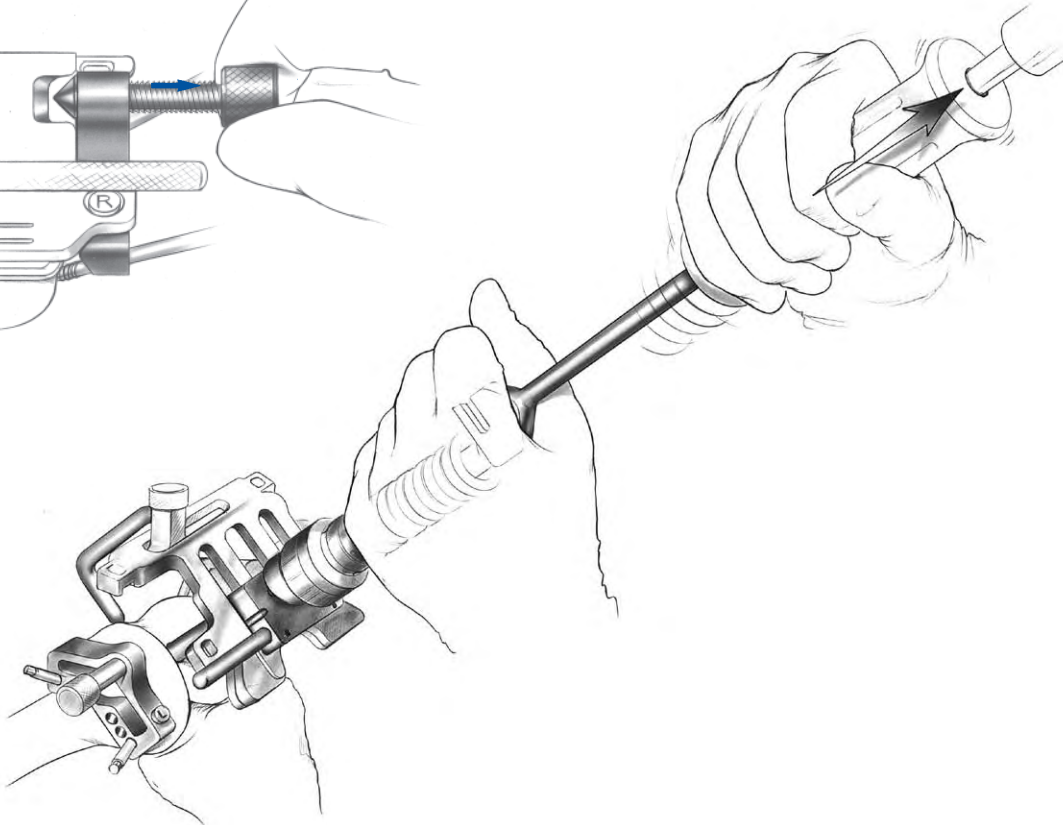


Fig. 47

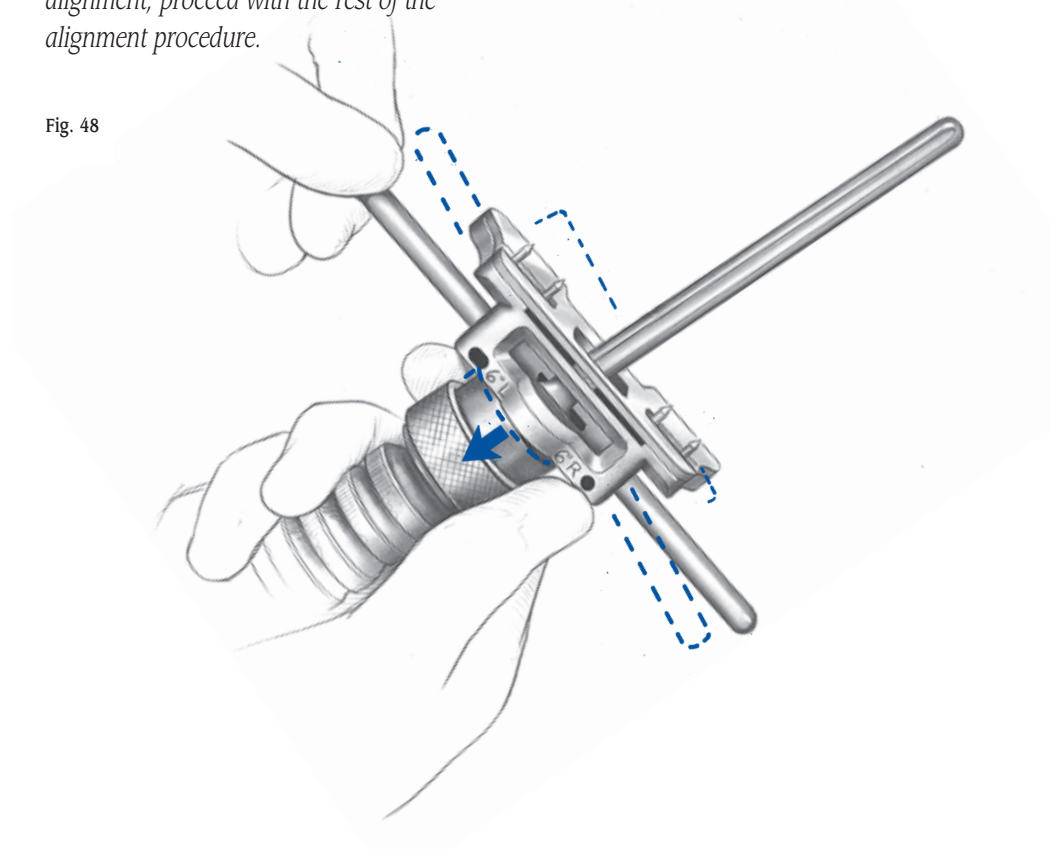




Optional 4-inch Intramedullary Alignment Guide Technique:

*If the femoral anatomy is altered, as in a femur with a long-stem hip prosthesis or with a femoral fracture malunion, then the optional 4-inch Intramedullary Alignment Guide should be used. To use the 4-inch guide, pull the sleeve down and rotate the plate to the proper setting "Right" or "Left". Reference the indication closest to the handle (Fig. 48). This sets the guide to a 6° valgus angle. **The Extramedullary Alignment Arch and Alignment Rods must be used to ensure proper valgus alignment since the shorter rod is not as stable in the medullary canal.** The handle of the guide should be viewed from the side to ensure the component is not in flexion or extension. The handle of the guide should be parallel to the medullary canal. If it is not, adjust the guide and pin it in place. Once satisfied with the alignment, proceed with the rest of the alignment procedure.*

Fig. 48



FEMORAL RESECTION AND FINISHING

In the next two steps, Femoral Resection and Femoral Finishing, the Milling or 5-in-1 Saw Blade Techniques can be used. First, the Milling Technique will be shown and then the 5-in-1 Saw Blade Technique.

STEP FIVE (MILLING)

FEMORAL RESECTION

Attach the proper size Femoral Milling Template onto the two Femoral Mounting Bases. If the template contacts the tibia, flex the knee further. Secure the template by turning the thumb screws on the two bases until they lock on the template (Fig. 49). To further stabilize the template, turn the anterior screw by hand until it contacts the anterior femoral cortex (Fig. 50). Do not overtighten. Check to ensure that there is no soft tissue in the area below the template.

The quadriceps muscle and tendon, as well as the patella, must be protected.

Note: The Milling Depth Resection Guide can be used at this time to verify that the template is correctly positioned for the proper depth of resection.

Fig. 49

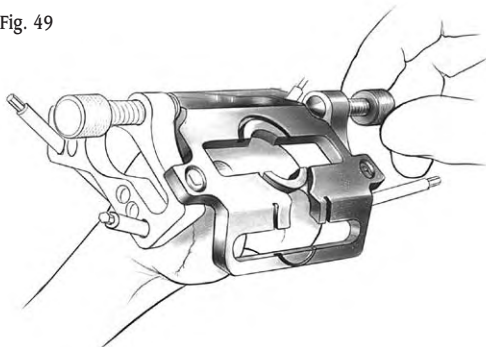
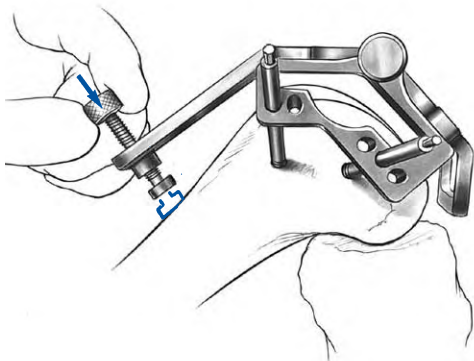


Fig. 50



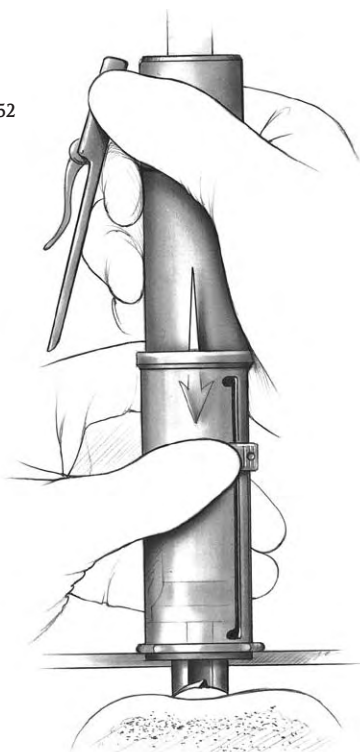
With the shield/plunge guide over the cutter, spread the drape over the operative site and insert the shield/plunge guide into the anterior recessed ring on the template (Fig. 51).

Fig. 51



Disengage the lock on the shield/plunge guide and advance the cutter to the bone (Fig. 52).

Fig. 52



CRUCIATE RETAINING



Turn the *MICRO-MILL* Safety off by placing at least one finger under the safety lever. Raise the cutter slightly off the bone by moving the mill only, and leaving the shield/plunge guide engaged in the template. Then, holding the mill firmly with both hands, start the mill by pressing the throttle lever and plunge the cutter into the bone until the nose of the mill rests on the milling template (Fig. 53). Retract the shield/plunge guide and move the mill through the track of the template in a **clockwise direction**, while keeping the mill against the outside edge of the track (Fig. 54).

Fig. 53

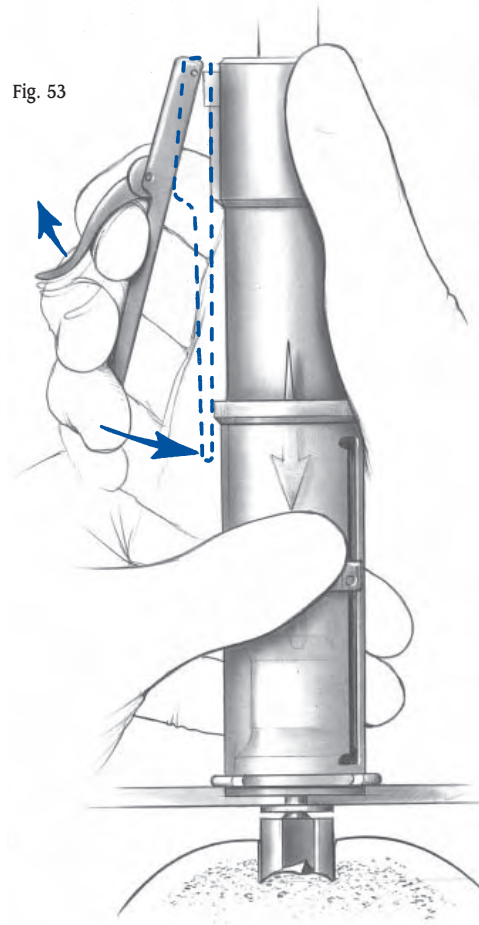
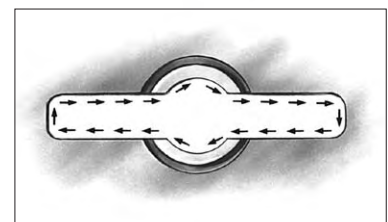
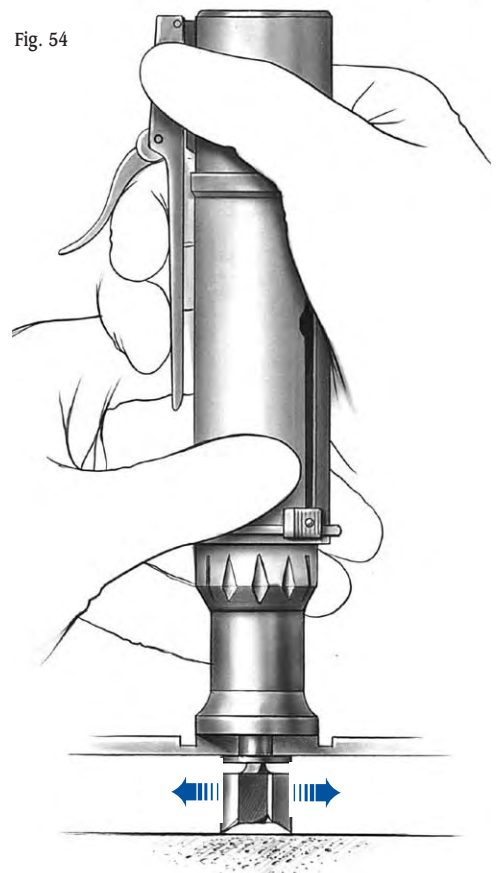


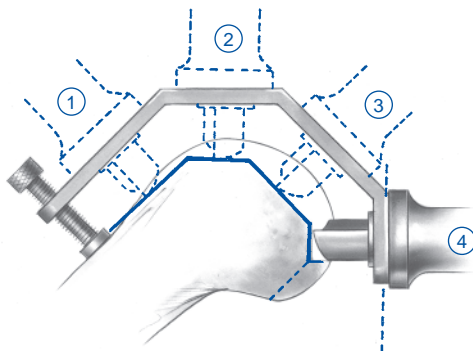
Fig. 54



When each section is complete, turn off the mill and remove it from the track. Pull the shield/plunge guide down to cover the cutter. Repeat the above procedure for each of the template tracks, moving from anterior to posterior. The milling procedure can be stopped at any time. The mill and template can be removed to provide a clear view of the milled surface, then reattached to complete the milling without loss of accuracy.

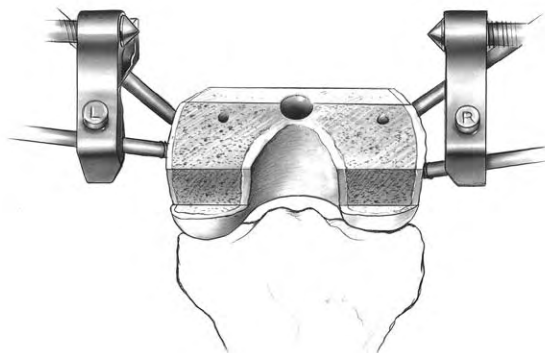
The posterior chamfer region is the most difficult section to mill. This region does not fully support the shield/plunge guide, so care must be taken to ensure that the mill is perpendicular to the Femoral Milling Template when inserting the mill into the template and when milling (Fig. 55). Often, one will not need to use the shield/plunge guide. The mill can engage the template centrally without contacting the bone.

Fig. 55



When all four sections have been milled, remove the mill and template. Check the surfaces of the milled bone (Fig. 56). If milling is complete, proceed to **STEP SIX**. If any areas are unmilled, reattach the Femoral Milling Template and remill the unfinished sections. In some cases, there may be a small step on the anterior cortex since the mill is contained in the template, preventing the cut from extending up the femur. If so, blend it into the anterior cortex with a saw or file.

Fig. 56



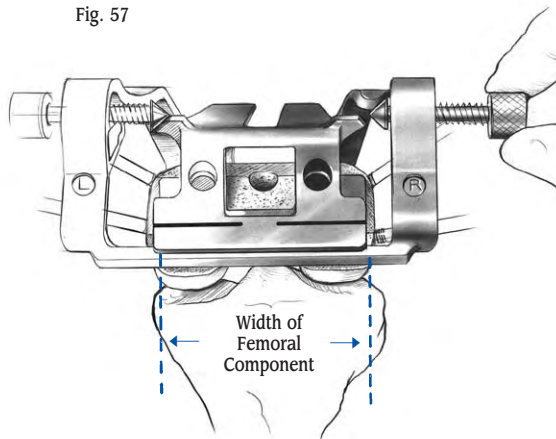


STEP SIX (MILLING)

FINISH THE FEMUR

Place the appropriate size Femoral Finishing Guide onto the Femoral Mounting Bases. Center the guide mediolaterally on the distal femur. Use the mounting base thumb screws for final mediolateral adjustment and secure the guide by tightening both thumb screws (Fig. 57).

Fig. 57



The width of the guide equals the distal width of the femoral component. The position of the guide will determine the position of the implant. Ensuring that the guide does not move, secure the guide to the mounting bases by tightening both thumb screws.

With the milling drape in place and the shield/plunge guide retracted (plunge cut not required), engage the mill into the anterior track of the guide (Fig. 58). Disengage the mill safety and start the mill with the cutter slightly off the bone. Then, holding the mill firmly with both hands and perpendicular to the track, mill the trochlear recess. Move the mill clockwise within the track, keeping the mill pressed against the outside edge (Fig. 59). Remove the mill and pull the shield/plunge guide back over the cutter.

Fig. 58

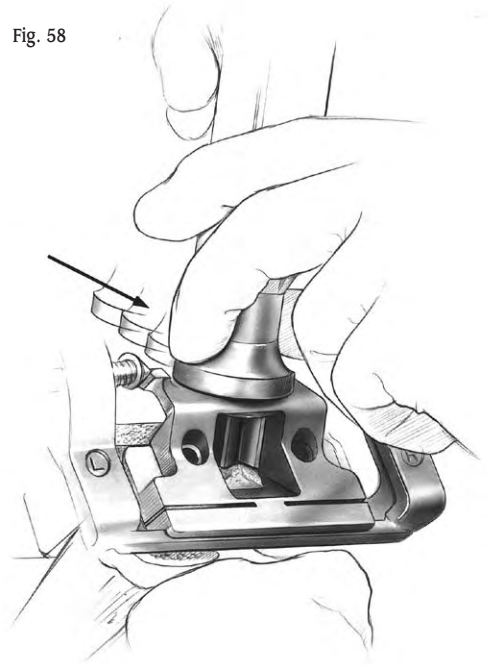


Fig. 59

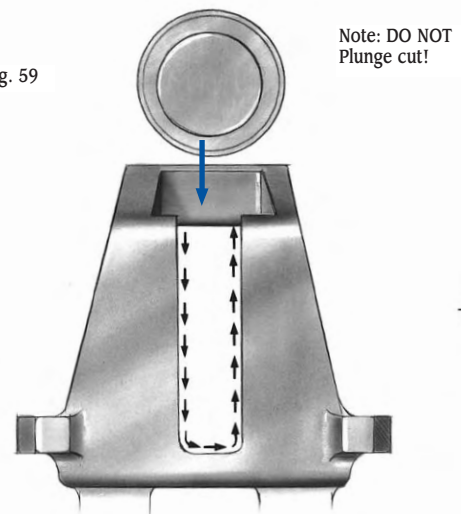
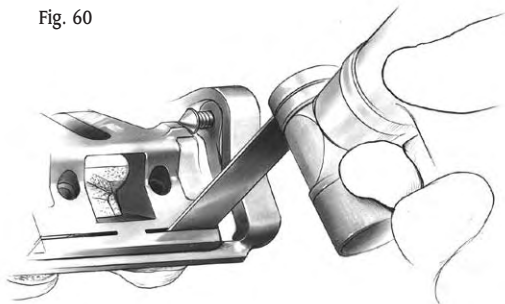


Fig. 60



Use the appropriate thickness (0.050-inch/ 1.27mm) blade and an oscillating saw to cut the posterior condyles (Fig. 60). Ensure that the proper thickness blade is used to yield the optimum cut and implant fit. Drill the two femoral post holes (Fig. 61). Remove the Femoral Finishing Guide. Ensure that all cuts are complete before removing the two Femoral Mounting Bases (Fig. 62).

Fig. 61

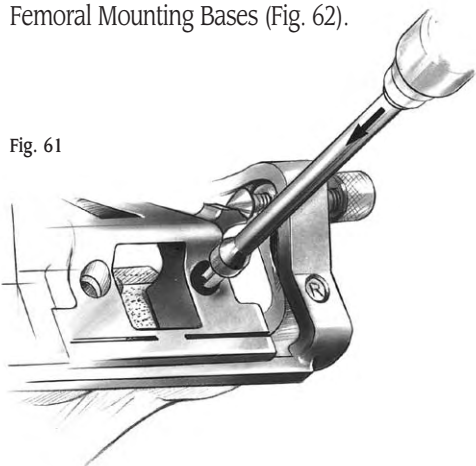
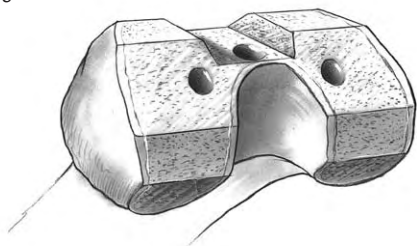


Fig. 62



STEP FIVE (5-IN-1)

FEMORAL RESECTION

Attach the proper size 5-in-1 Femoral Cutting Guide onto the two Femoral Mounting Bases. If the guide does not seat, check for and remove any osteophytes or bone that is causing interference. Lock the cutting guide into position by firmly turning the thumb screws on the two bases (Fig. 63). Check to be sure that there is no soft tissue in the area below the guide.

Note: If template is not firmly locked into position, vibration can loosen the thumb screws.

Fig. 63

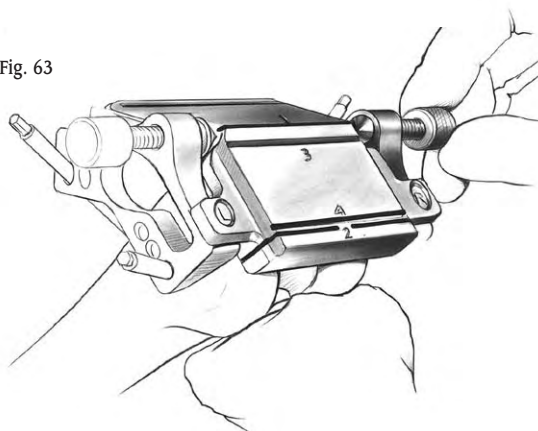
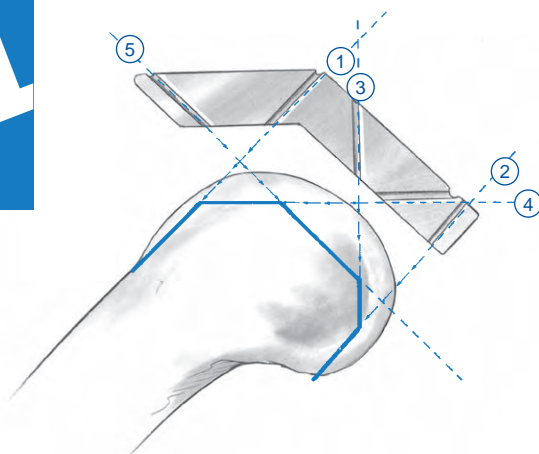




Fig. 64



For the most accurate cuts, perform the femoral cuts through the slots in the order indicated on the guide (Fig. 64).

- 1. Anterior**
- 2. Posterior**
- 3. Posterior Chamfer**
- 4. Anterior Chamfer**
- 5. Distal**

The guide can be removed at any time to check the cuts and be reattached to the bases to finish the cuts without loss of accuracy. For precision cuts, one must use the appropriate thickness (0.050-inch/ 1.27mm) saw blade. When all cuts are complete, remove the 5-in-1 Femoral Cutting Guide and the Femoral Mounting Bases.

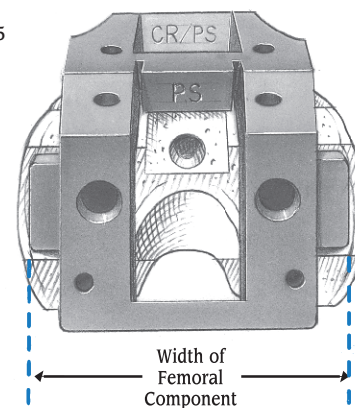
STEP SIX (5-IN-1)

FINISH THE FEMUR

Place the appropriate size 5-in-1 Finishing/ Notch Guide onto the femur. It will rest on the resected surface of the anterior and distal femur. The guide will not contact the anterior chamfer. Center the guide mediolaterally on the distal femur (Fig. 65). The width of the guide equals the distal width of the femoral component.

This will determine the position of the femoral component. Secure the guide to the femur with two Spring Pins using the Female Hex Driver and drill/reamer. The pins are designed to automatically disengage the driver when fully engaged on the guide.

Fig. 65

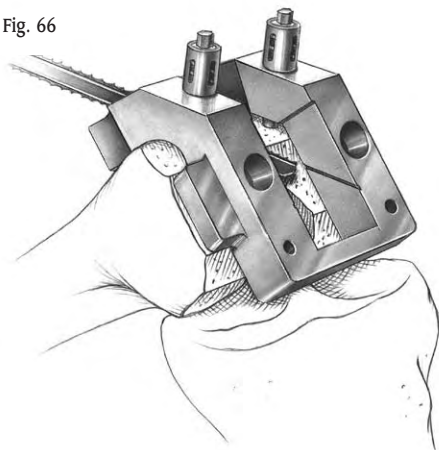


Optional Technique:

The 5-in-1 Finishing/Notch Guide can also be attached with standard 1/8-inch pins through the holes in the anterior and distal portion of the guide. Ensure that the proper size holes are selected for the Spring Pins or 1/8-inch pins.

Use a reciprocating saw to first cut the base and then the sides of the trochlear recess. The engraved lines on the inside of the guide show the depth of the trochlear recess (Fig. 66). Cut only the trochlear recess for CR Components. The cutting surface on the guide is marked "CR/PS."

Fig. 66

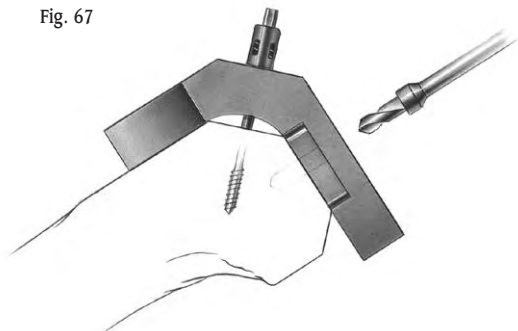


Optional Technique:

An oscillating saw with a small width blade may also be used, or a normal blade to cut the sides and a chisel or osteotome to cut the base of the recess.

Drill the two femoral post holes (Fig. 67).

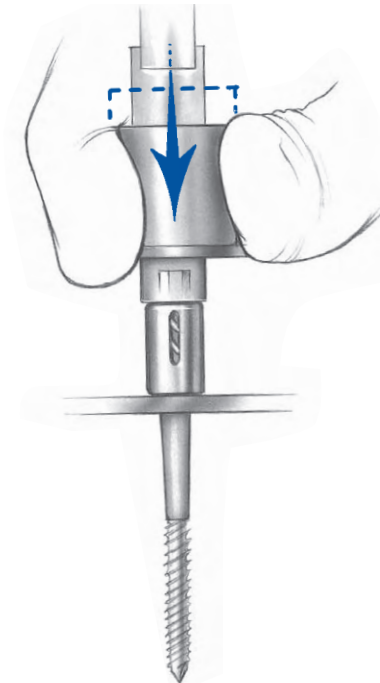
Fig. 67



Place the Female Hex Driver over the Spring Pin and apply a downward force on the driver sleeve (Fig. 68). Start the drill/reamer slowly until the driver hex engages the hex head of the pin. Continue until the Spring Pin disengages bone.

Remove the 5-in-1 Finishing/Notch Guide.

Fig. 68



FEMORAL PREPARATION

MULTI-REFERENCE 4-in-1 INSTRUMENTATION

MICRO-MILL/5-in-1 INSTRUMENTATION

CROSSOVER TECHNIQUE

TIBIAL PREPARATION

EM/IM TIBIAL RESECTOR

MICRO-MILL/5-in-1 INSTRUMENTATION

FINISH THE TIBIA

PATELLA PREPARATION

TRIAL REDUCTION/IMPLANTATION

CRA COMPONENT PREPARATION

“CROSSOVER” TECHNIQUE

(When crossing over to a posterior stabilized design)

INTRODUCTION

While the NexGen CR and LPS box cuts are the same, the techniques have some differences that are important to consider when moving from a cruciate retaining to a posterior stabilized implant. A posterior stabilized technique uses spacer blocks and/or tensor devices to balance flexion and extension gaps. Posterior-referencing instrumentation systems, such as the *Multi-Reference 4-in-1 Femoral Instrumentation System*, are designed to help balance the gaps with the initial bone cuts. Balancing the flexion and extension gaps is different between the two procedures because, when the PCL is resected, the flexion gap increases 3mm to 5mm, but the extension gap typically increases less.

Most anterior-referencing techniques recommend downsizing when the size indicated is between two sizes. Downsizing increases the flexion gap and is well-accepted when using a cruciate retaining implant because the PCL tethers the joint in flexion. However, when using a posterior stabilized implant, surgeons are advised to use the next largest size implant when the measurement is between two sizes. This will still allow them to downsize if the knee is too tight in flexion with the larger size.

The posterior slope of the tibial cut also affects the joint space in flexion. For a cruciate retaining implant, cutting a greater posterior slope on the tibia simply relieves the tightness of the knee in flexion. But for a posterior stabilized implant, a greater

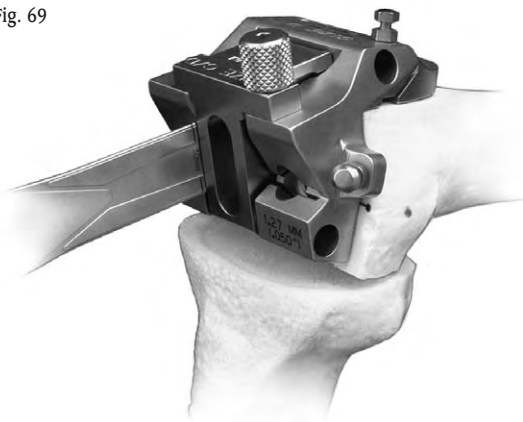
posterior slope can result in a larger flexion gap. Some surgeons who follow the posterior stabilized philosophy choose to cut a posterior slope that matches the preoperative slope of the tibia, usually in the range of 3°– 7°.

TECHNIQUE

Epicondylar Notch/Chamfer Guide

Place the Epicondylar Notch/Chamfer Guide flush with the anterior and distal surfaces of the femur. Use the previously prepared trochlear recess and/or femoral peg holes to locate the guide mediolaterally. Pin the guide to the femur and use the appropriate saw to cut the sides of the notch (Fig. 69). Then use an osteotome to remove the notch.

Fig. 69



5-in-1 Finishing/Notch Guide

Place the appropriate size 5-in-1 Finishing/Notch Guide onto the femur. It will rest on the resected surface of the anterior and distal femur. The guide will not contact the anterior chamfer. Use the previously prepared trochlear recess and/or femoral peg holes to locate the guide.

Secure the guide to the femur with two short-threaded silver Spring Pins using the Female Hex Driver and drill/reamer. The pins are designed to automatically disengage the pin driver when fully engaged on the guide.

Optional Technique:

The guide can also be attached with standard 1/8-inch pins through the holes in the anterior and distal portion of the guide. Ensure that the proper size holes are selected for the Spring Pins or 1/8-inch pins.

Use a reciprocating saw to cut the sides (Fig. 70) and the base (Fig. 71) of the intercondylar notch. The cutting surface of the guide is marked "PS."

Fig. 70

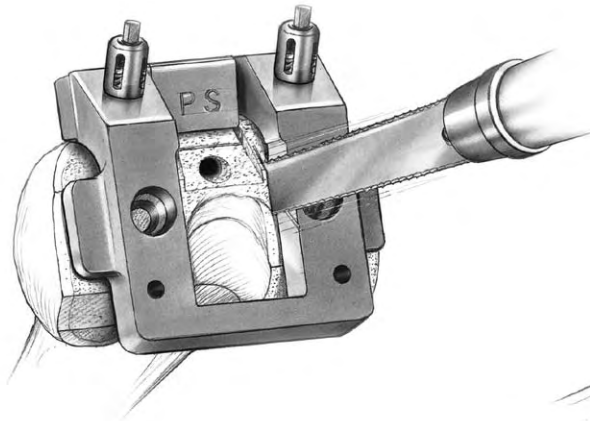
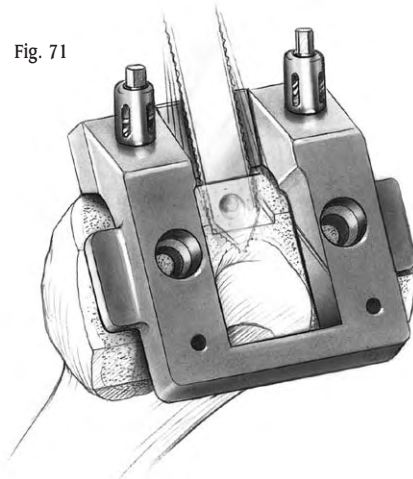


Fig. 71



Optional Technique:

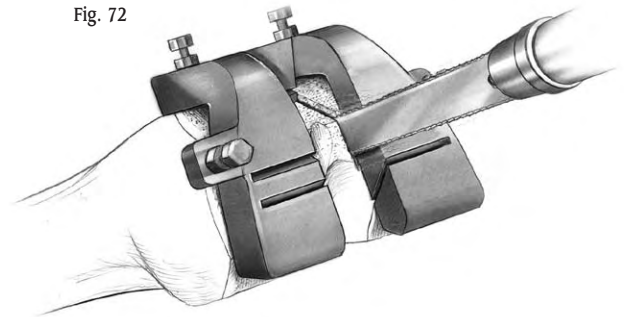
An oscillating saw with a small width blade may also be used. Or use a normal blade to cut the sides and a chisel or osteotome to cut the base of the recess.

Remove the Finishing/Notch Guide

Notch/Chamfer Guide

Place the Notch/Chamfer Guide on the cut surface of the distal femur with the anterior tab resting in the trochlear recess. Pin the guide to the bone and use a saw to cut the sides of the notch (Fig. 72). Then use an osteotome to remove the notch.

Fig. 72



FEMORAL PREPARATION

MULTI-REFERENCE 4-in-1 INSTRUMENTATION

MICRO-MILL/5-in-1 INSTRUMENTATION

CROSSOVER TECHNIQUE

TIBIAL PREPARATION

EM/IM TIBIAL RESECTOR

MICRO-MILL/5-in-1 INSTRUMENTATION

FINISH THE TIBIA

PATELLA PREPARATION

TRIAL REDUCTION/IMPLANTATION

CRA COMPONENT PREPARATION

TIBIAL PREPARATION
FOR PRIMARY
ARTHROPLASTY

EM/IM Tibial Resector

FEMORAL PREPARATION

MULTI-REFERENCE 4-in-1 INSTRUMENTATION

MICRO-MILL/5-in-1 INSTRUMENTATION

CROSSOVER TECHNIQUE

TIBIAL PREPARATION

EM/IM TIBIAL RESECTOR

MICRO-MILL/5-in-1 INSTRUMENTATION

FINISH THE TIBIA

PATELLA PREPARATION

TRIAL REDUCTION/IMPLANTATION

CRA COMPONENT PREPARATION

SPIKE ARM EXTRAMEDULLARY TECHNIQUE

STEP ONE

ASSEMBLE ALIGNMENT GUIDE

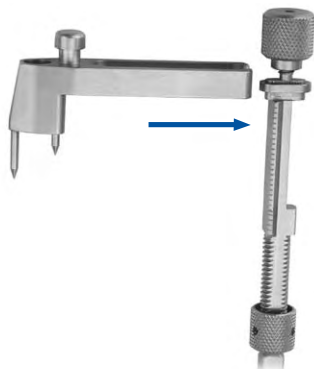
Slide the Ankle Clamp onto the dovetail at the bottom of the Distal Telescoping Rod. Turn the knob opposite the dovetail to temporarily hold the clamp in place (Fig. 73). The mediolateral position of the rod can be adjusted by loosening this knob. When the final position is determined, the knob can be fully tightened to secure it in place.

Fig. 73



Slide the Spike Arm onto the dovetail at the top of the Spike Arm Telescoping Rod and temporarily secure it by turning the knob at the top of the rod (Fig. 74).

Fig. 74



The system includes four different Cut Guides: a 7° guide and a 0° guide both in left and right configurations.

Lower the adjustment knob in the middle of the Spike Arm Telescoping Rod to the bottom of the threaded portion. Insert the Cut Guide over the threaded portion of the rod above the adjustment knob and slide it all the way up on the dovetail (Fig. 75). To hold the Cut Guide in place, advance the adjustment knob to the upper end of its range of travel. This will allow for space adjustment after the alignment guide assembly has been secured in position.

Fig. 75



Arrows are etched onto both the Spike Arm Telescoping Rod and the Distal Telescoping Rod to indicate the correct orientation during assembly (Fig. 76). Insert the Spike Arm Telescoping Rod into the Distal Telescoping Rod.

Fig. 76





STEP TWO

POSITION ALIGNMENT GUIDE

To improve exposure of the tibial surface, use the Tibial Retractor to lever the tibia anteriorly. This instrument should be carefully positioned against the posterior cortex of the tibia subperiosteally to prevent neurovascular injury. Use the Patella Retractor to retract the patella laterally. Adjust the telescoping rod to the approximate length of the tibia and turn the knob on the shaft to temporarily maintain the length. Place the spring arms of the Ankle Clamp around the ankle proximal to the malleoli (Fig. 77) and loosen the knob that provides mediolateral adjustment at the ankle.



Fig. 77

Position the Cut Guide at the proximal tibia. Loosen the knob in the middle of the telescoping rod and adjust the length of the rod until the long spike on the Spike Arm just contacts the tibial

plateau. The Cut Guide should be proximal to the tibial tubercle. Center the long spike mediolaterally on the bone surface anterior to the tibial spine. This should align the rod with the medial third of the tibial tubercle. Stabilize the Alignment Guide by tapping the Spike Arm until only the long spike engages the tibial plateau.

Do not drive the long spike in too far (Fig. 78).



Fig. 78

Adjust the slide at the foot of the rod mediolaterally so the guide is aligned with the mechanical axis of the tibia. The longitudinal axis of the rod will usually lie just medial to the midpoint of the tibial tubercle and be centered over the intercondylar eminence. The foot of the 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. When the proper mediolateral position is achieved, tighten the knob to secure the Ankle Clamp to the rod.

In the sagittal plane, align the rod so it is parallel to the anterior tibial shaft by using the slide adjustments at both the proximal and distal ends of the rod (Fig. 79). Then tighten the knobs for both adjustments. 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.

Set the final position of the extramedullary alignment guide assembly by tapping the Spike Arm until both the long and short spikes are fully impacted in the proximal tibia (Fig. 80). Then tighten the knob in the middle of the telescoping rod assembly.



Fig. 79



Fig. 80

STEP THREE

SET RESECTION LEVEL

Each tip of the Tibial Depth Resection Stylus indicates a different depth. The 2mm tip is used to check the depth from the defective tibial condyle for a minimal cut. The 10mm tip is used to check the depth from the least involved tibial condyle for an anatomic cut.

Insert the Tibial Depth Resection Stylus into the top of the Cut Guide, using the hole that corresponds to the defective tibial condyle (Fig. 81).



Fig. 81

The stylus will snap into the hole (Fig. 81a, Fig. 81b). Confirm that it is fully seated and properly oriented. The 2mm tip should rest on the tibial condyle (Fig. 82). This positions the slot of the Cut Guide to remove 2mm of bone below the tip of the stylus.

Fig. 81a



Fig. 81b



Fig. 82



Alternatively, rest the 10mm tip of the stylus on the cartilage of the least involved condyle (Fig. 83).

Fig. 83

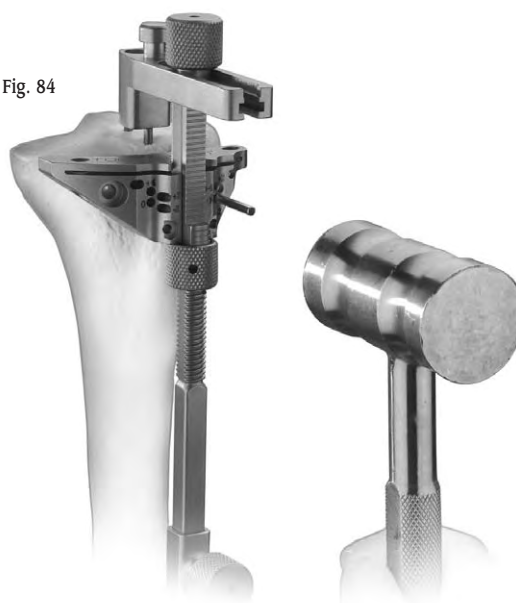


This will allow the removal of the same amount of bone that the thinnest tibial component would replace.

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.**

Adjust the Cut Guide to the desired depth by turning the adjustment knob. Then insert a 75mm Headless Holding Pin into the hole marked "0" on one side of the guide (Fig. 84).

Fig. 84





To confirm alignment, insert the Extramedullary Alignment Arch onto the Cut Guide and insert the Alignment Rod with Coupler through the arch, passing it distally toward the ankle. The distal end of the rod should point to the second toe (Fig. 85).

Fig. 85



STEP FOUR

RESECT THE PROXIMAL TIBIA

Loosen the adjustment knob below the Cut Guide until the knob is at the bottom of the threaded portion of the rod. Then loosen the knob on the telescoping rod. Use a slaphammer to disengage the spikes on the Spike Arm. Raise the telescoping rod until the dovetail disengages the Cut Guide. Then open the arms of the Ankle Clamp and remove the entire assembly, leaving the Cut Guide in place on the bone.

If desired, the Alignment Arch and Alignment Rod with Coupler can be used on the Cut Guide again to check alignment.

2mm adjustments may be made by using the sets of holes marked -2, +2, and +4. The markings on the Cut Guide indicate, in millimeters, the amount of bone resection each will yield relative to the standard tibial resection set by the Cut Guide and Tibial Depth Resection Stylus. Once the tibial resection has been determined, use the Hex-head Holding Pins or silver Spring Pins to further stabilize the guide.

Use a 0.050-inch/1.27mm oscillating saw blade through the slot on the Cut Guide to cut the proximal surface of the tibia flat (Fig. 86). Then remove the Cut Guide.

Fig. 86



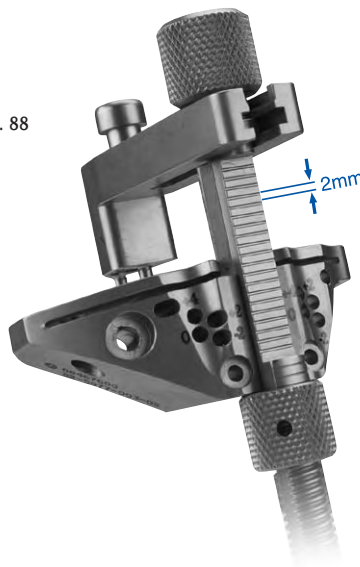
Optional Technique

If desired, the cut can be made from the top surface of the Cut Guide. The top surface of the guide is 4mm above the slot (Fig. 87), so the position of the guide must be adjusted to account for this difference. The adjustment can be made when the Cut Guide is first positioned by using the etch lines, which are in 2mm increments, at the top of the Spike Arm Telescoping Rod (Fig. 88).

Fig. 87



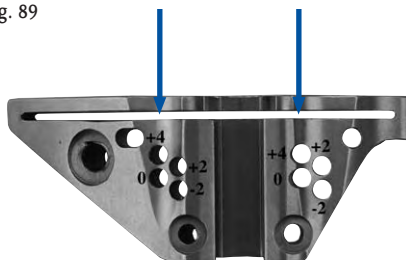
Fig. 88



Alternatively, the adjustment can be made after the alignment guide assembly is removed by lifting the Cut Guide off the headless pins, which were inserted through the holes marked "0," and reinserting the guide through the holes marked "+4" (Fig. 89).

Proceed to "Finish the Tibia" on page 81.

Fig. 89





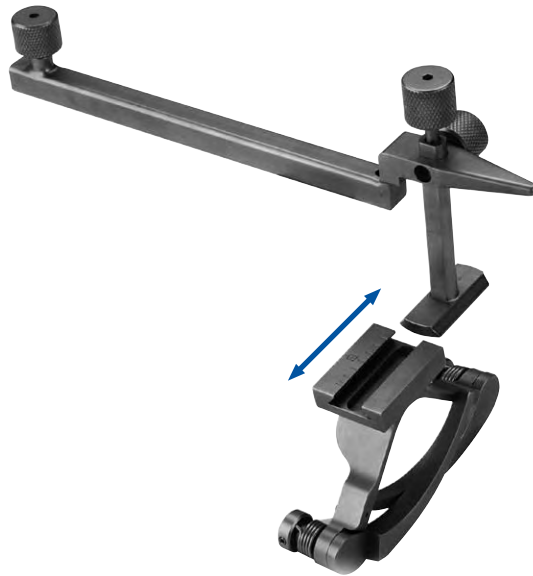
CUT GUIDE EXTRAMEDULLARY TECHNIQUE

STEP ONE

ASSEMBLE ALIGNMENT GUIDE

Slide the Ankle Clamp onto the dovetail at the bottom of the Distal Telescoping Rod. Turn the knob opposite the dovetail to temporarily hold the clamp in place (Fig. 90). The mediolateral position of the rod can be adjusted by loosening this knob. When the final position is determined, the knob can be fully tightened to secure it in place.

Fig. 90



The system includes four different Cut Guides: a 7° guide and a 0° guide, both in left and right configurations.

Place the desired Cut Guide onto the dovetail of the proximal portion of the Cut Guide Telescoping Rod. Tighten the knob to secure the position (Fig. 91).

Arrows are etched onto both the Cut Guide Telescoping Rod and the Distal Telescoping Rod to indicate the correct orientation during assembly (Fig. 92). Insert the Cut Guide Position Alignment Guide.

Fig. 91



Fig. 92



STEP TWO

POSITION ALIGNMENT GUIDE

To improve the exposure of the tibial surface, use the Tibial Retractor to lever the tibia anteriorly. This instrument should be carefully positioned against the posterior cortex of the tibia subperiosteally to prevent neurovascular injury. Use the Patella Tendon Retractor to retract the patella laterally.

Adjust the telescoping rod to the approximate length of the tibia and turn the knob on the shaft of the rod to temporarily maintain the length.

Place the spring arms of the Ankle Clamp around the ankle proximal to the malleoli (Fig. 93) and loosen the knob that provides mediolateral adjustment at the ankle.

Fig. 93



Position the Cut Guide at the proximal tibia. Loosen the knob in the middle of the telescoping rod and adjust the length of the rod until the Cut Guide is proximal to the tibial tubercle. Align the rod with the medial third of the tibial tubercle (Fig. 94) or just medial to the tubercle.

Adjust the slide at the foot of the rod mediolaterally so the guide is aligned with the mechanical axis of the tibia (Fig. 95). The longitudinal axis of the rod will usually lie just medial to the midpoint of the tibial tubercle and be centered in line with the intercondylar eminence. The foot of the 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. When the proper mediolateral position is achieved, tighten the knob to secure the Ankle Clamp to the rod. The posterior cortex of the tibia can also be used as a rotational check.

In the sagittal plane, align the rod so it is parallel to the anterior tibial shaft by using the slide adjustment at the distal end of the rod. Tighten the knob for the adjustment. 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.

Fig. 94



Fig. 95





STEP THREE

SET RESECTION LEVEL

Each tip of the Tibial Depth Resection Stylus indicates a different depth. The 2mm tip is used to guide the depth from the defective tibial condyle for a minimal cut. The 10mm tip is used to guide the depth from the least involved tibial condyle for an anatomic cut.

Insert the Tibial Depth Resection Stylus into the top of the Cut Guide, using the hole that corresponds to the defective tibial condyle (Fig. 96).



Fig. 96

The stylus will snap into the hole (Figs. 96a & 96b). Confirm that it is fully seated and properly oriented. The 2mm tip should rest on the tibial condyle (Fig. 97). This positions the slot of the Cut Guide to remove 2mm of bone below the tip of the stylus.



Fig. 96a



Fig. 96b



Fig. 97

Alternatively, rest the 10mm tip of the stylus on the cartilage of the least involved condyle (Fig. 98).

Fig. 98



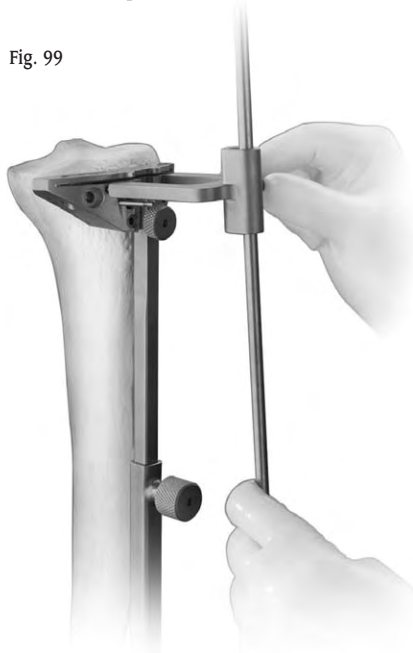
This will allow the removal of the same amount of bone that the thinnest tibial component would replace.

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.**

Adjust the Cut Guide to the desired depth by adjusting the length of the alignment guide assembly. Then retighten the telescoping rod, and insert a 75mm Headless Holding Pin into the hole marked "0" on one side of the Cut Guide.

To confirm alignment, insert the Extramedullary Alignment Arch into the Cut Guide and insert the Alignment Rod with Coupler through the arch, passing it distally toward the ankle (Fig. 99). The distal end of the rod should point to the second toe.

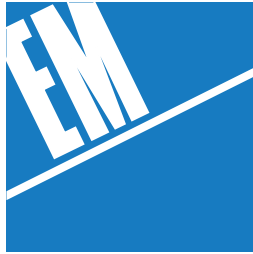
Fig. 99



Insert a second 75mm Headless Holding Pin into the other hole marked "0" (Fig. 100).

Fig. 100





STEP FOUR

RESECT THE PROXIMAL TIBIA

Loosen the knob that has secured the Cut Guide onto the Cut Guide Telescoping Rod and remove the entire assembly, leaving the Cut Guide in place on the bone.

Additional 2mm adjustments may be made by using the sets of holes marked -2, +2, and +4. The markings on the Cut Guide indicate, in millimeters, the amount of bone resection each will yield relative to the standard tibial resection set by the Cut Guide and Tibial Depth Resection Stylus. Once the tibial resection has been determined, use the Hex-head Holding Pins or silver Spring Pins to further stabilize the guide.

Use a 0.050-inch/1.27mm oscillating saw blade through the slot on the Cut Guide to cut the proximal surface of the tibia flat (Fig. 101). Then remove the Cut Guide.

Optional Technique

If desired, the cut can be made from the top surface of the Cut Guide. The top surface of the guide is 4mm above the slot (Fig. 102), so the position of the guide must be adjusted to account for this difference. The adjustment can be made after the alignment guide assembly is removed by lifting the Cut Guide off the headless pins, which were inserted through the holes marked "0," and reinserting the guide through the holes marked "+4" (Fig. 103).

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Fig. 102



Fig. 103

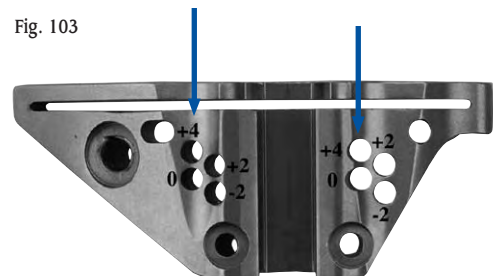


Fig. 101



CUT GUIDE INTRAMEDULLARY TECHNIQUE

To improve exposure of the tibial surface, use the Tibial Retractor to lever the tibia anteriorly. This instrument should be carefully positioned against the posterior cortex of the tibia subperiosteally to prevent neurovascular injury. Use the Patella Tendon Retractor to retract the patella laterally.

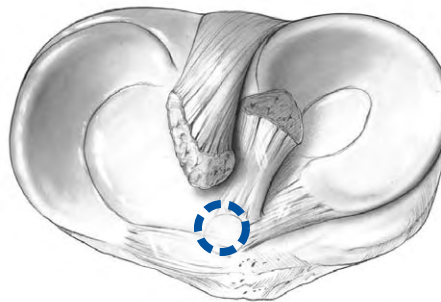
A preoperative radiograph of the tibia is necessary to make sure that the tibial shaft is straight and will accept the Tibial IM Rod. **Some tibias are bowed or have too small a canal and will not accept the rod. The acetate template used for femoral planning can be inverted and used on the tibia.**

STEP ONE

POSITION IM ALIGNMENT GUIDE

Use the Universal Handle to start a hole in the proximal tibia just anterior to the anterior cruciate ligament insertion and centered mediolaterally (Fig. 104). This may seem too far anterior; however, it is the straight proximal extension of the tibial medullary canal. If a hole is started further posteriorly, excessive posterior slope may be cut into the proximal tibia.

Fig. 104



Drill a hole using the 8mm IM Drill. Suction the canal to remove medullary contents.

Slowly insert the Tibial IM Rod (5977-44) into the canal. The flutes on the rod will aid decompression of the canal during insertion.

Attach either the 7° Revision Tibial Boom (5787-10) or the 0° Augment Tibial Boom (5125-60) to the rod (Fig. 105). **The selection of the boom will determine the posterior slope of the tibial resection.**

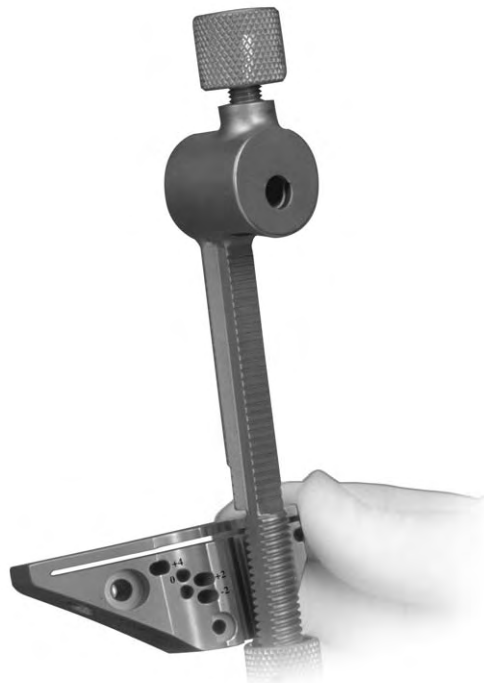
Fig. 105





Lower the adjustment knob on the IM Alignment Guide to the bottom of the threaded portion. Insert the 0° Cut Guide over the threaded portion of the alignment guide above the adjustment knob and slide it up until it just engages the dovetail (Fig. 106). This will allow for final adjustment after the alignment guide has been secured in position. To hold the Cut Guide in place, advance the adjustment knob until it contacts the underside of the guide.

Fig. 106



Only the 0° Cut Guide will fit onto the IM Alignment Guide. The 7° Cut Guide will not fit onto the IM Alignment Guide. Using the 0° Cut Guide with the 7° Revision Tibial Boom will result in a 7° cut.

Slide the barrel of the IM Alignment Guide onto the boom, making sure that the locking knob has been adjusted to allow free access (Fig. 107). Rotate the boom on the rod until the Cut Guide is properly positioned mediolaterally on the anterior tibia. Use the medial third of the tibial tubercle as a landmark. Then slightly secure the knob on the boom.

Fig. 107



To determine varus/valgus alignment, insert the Extramedullary Alignment Arch onto the Cut Guide and insert the Alignment Rod with Coupler through the arch, passing it distally toward the ankle (Fig. 108). The distal end of the rod should point to the second toe.

Fig. 108



If the surgeon would like to set the Cut Guide at a 90° angle to the Tibial IM Rod, tighten the knob at the top of the IM Alignment Guide **clockwise** in the 90° direction as etched on top of the knob (Fig. 109). Do not overtighten the knob.

If the alignment check suggests a varus/valgus adjustment, rotate the barrel of the IM Alignment Guide on the boom to align the Alignment Rod to the second toe. When the appropriate varus/valgus alignment is achieved, tighten the knob at the top of the IM Alignment Guide **counterclockwise** in the “Var-Valg” direction as etched on top of the knob (Fig. 110). This will hold the varus/valgus position of the Cut Guide. Do not overtighten the knob.

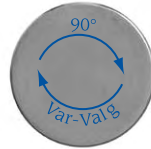
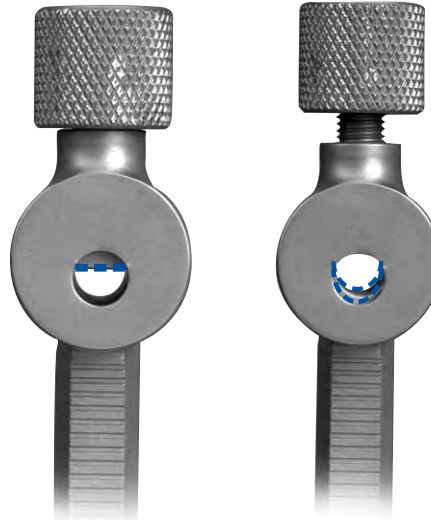


Fig. 109

Fig. 110



STEP TWO

SET RESECTION LEVEL

Each tip of the Tibial Depth Resection Stylus indicates a different depth. The 2mm tip is used to check the depth from the defective tibial condyle for a minimal cut. The 10mm tip is used to check the depth from the least involved tibial condyle for an anatomic cut.

Insert the Tibial Depth Resection Stylus into the top of the Cut Guide, using the hole that corresponds to the defective tibial condyle (Fig. 111). The stylus will snap into the hole (Figs. 111a & 111b). Confirm that it is fully seated and properly oriented. The 2mm tip should rest on the tibial condyle (Fig. 112). This positions the slot of the Cut Guide to remove 2mm of bone below the tip of the stylus.

Fig. 111



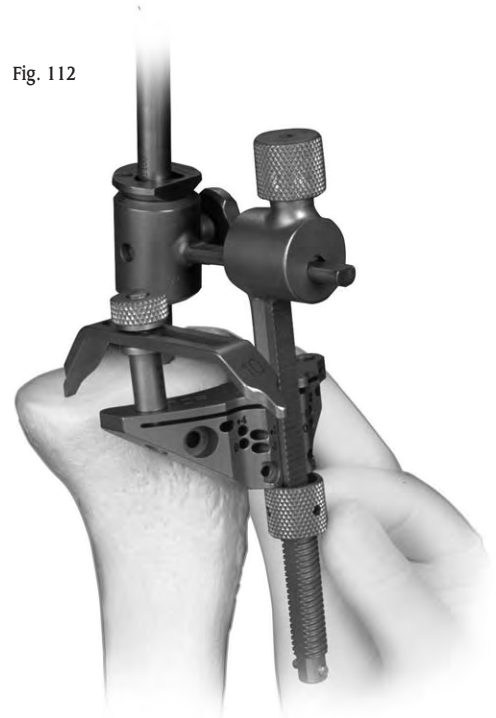
Fig. 111a



Fig. 111b



Fig. 112



Alternatively, rest the 10mm tip of the stylus on the cartilage of the least involved condyle (Fig. 113). This will allow the removal of the same amount of bone that the thinnest tibial component would replace.

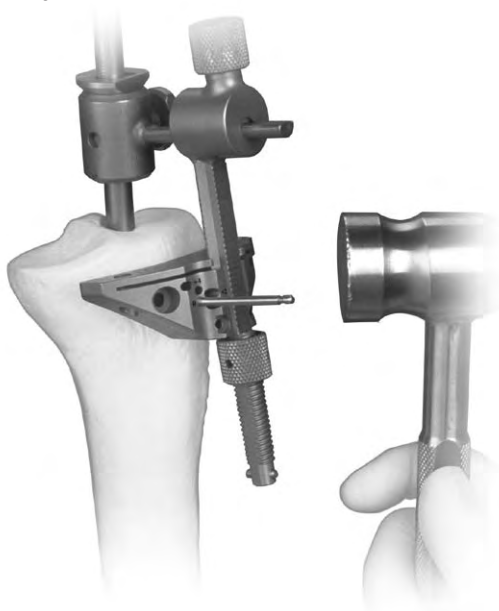
Fig. 113



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

Adjust the Cut Guide to the desired depth by turning the adjustment knob. Then insert 75mm Headless Holding Pins into the holes marked "0" (Fig. 114).

Fig. 114



STEP THREE

RESECT THE PROXIMAL TIBIA

Loosen the adjustment knob below the Cut Guide until the knob is at the bottom of the threaded portion of the rod. Loosen the varus/valgus adjustment knob on the IM Alignment Guide. Use a slaphammer to raise the IM Rod until the dovetail portion of the IM Alignment Guide disengages from the Cut Guide. Remove the alignment assembly, leaving the Cut Guide in place on the bone.

If desired, the Alignment Arch and Alignment Rod with Coupler can be used on the Cut Guide again to check alignment.

Additional 2mm adjustments may be made by using the sets of holes marked -2, +2, and +4. The markings on the Cut Guide indicate, in millimeters, the amount of bone resection each will yield relative to the standard tibial resection set by the Cut Guide and Tibial Depth Resection Stylus. Once the tibial resection has been determined, use the Hex-head Holding Pins or silver Spring Pins to further stabilize the guide.

Use a 0.050-inch/1.27mm oscillating saw blade through the slot on the Cut Guide to cut the proximal surface of the tibia flat (Fig. 115). Then remove the Cut Guide.

Fig. 115





Optional Technique

If desired, the cut can be made from the top surface of the Cut Guide. The top surface of the guide is 4mm above the slot (Fig. 116), so the position of the guide must be adjusted to account for this difference. The adjustment can be made when the Cut Guide is first positioned by using the etch lines, which are in 2mm increments, on the IM Alignment Guide (Fig. 117).

Fig. 116



Alternatively, the adjustment can be made after the IM Alignment Guide is removed by lifting the Cut Guide off the headless pins, which were inserted through the holes marked "0," and reinserting the guide through the holes marked "+4" (Fig. 118).

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Fig. 117

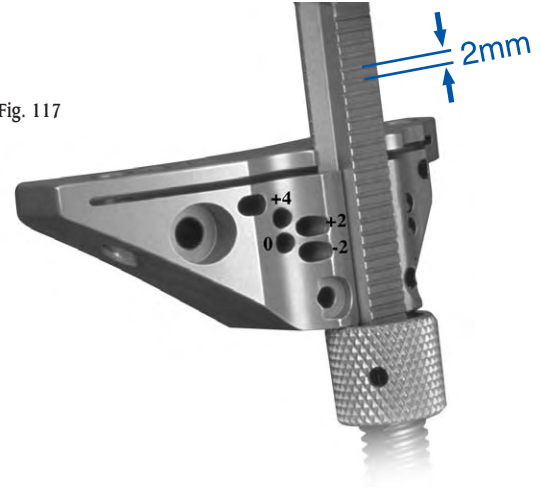
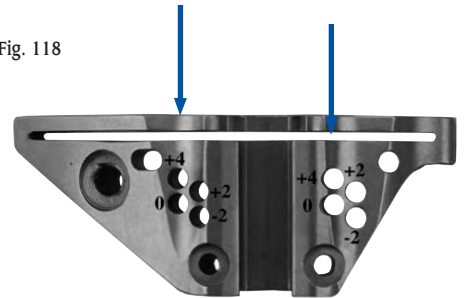


Fig. 118



SPIKE ARM INTRAMEDULLARY TECHNIQUE

To improve exposure of the tibial surface, use the Tibial Retractor to lever the tibia anteriorly. This instrument should be carefully positioned against the posterior cortex of the tibia subperiosteally to prevent neurovascular injury. Use the Patella Tendon Retractor to retract the patella laterally.

A preoperative radiograph of the tibia is necessary to make sure that the tibial shaft is straight and will accept the Tibial IM Rod. Some tibias are bowed or have too small a canal and will not accept the rod. The acetate template used for femoral planning can be inverted and used on the tibia.

STEP ONE

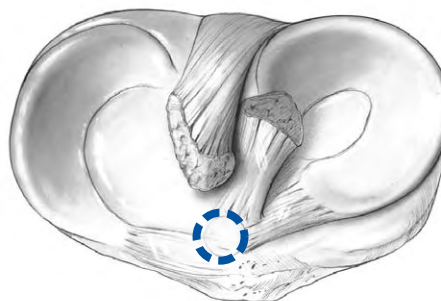
INSERT IM ROD

Use the Universal Handle to start a hole in the proximal tibia just anterior to the anterior cruciate ligament insertion and centered mediolaterally (Fig. 119). This may seem too far anterior; however, it is the straight proximal extension of the tibial medullary canal. If a hole is started further posteriorly, excessive posterior slope may be cut into the proximal tibia.

Drill a hole using the 8mm IM Drill. Suction the canal to remove medullary contents.

Slowly insert the Tibial IM Rod (5977-44) into the canal. The flutes on the rod will aid decompression of the canal during insertion.

Fig. 119



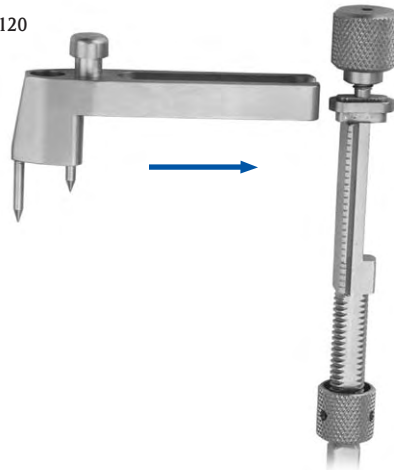
STEP TWO

POSITION CUT GUIDE

The system includes four different Cut Guides: a 7° guide and a 0° guide, both in left and right configurations.

Slide the Spike Arm onto the top of the Spike Arm Telescoping Rod and secure it temporarily by turning the knob at the top of the rod (Fig. 120).

Fig. 120



Lower the adjustment knob in the middle of the Spike Arm Telescoping Rod to the bottom of the threaded portion. Insert the Cut Guide over the threaded portion of the rod above the adjustment knob and slide it all the way up on the dovetail (Fig. 121). To hold the Cut Guide in place, advance the adjustment knob to the end of its range of travel. This will allow for final adjustment after the alignment assembly has been secured in position.

Fig. 121



Slide the Spike Arm assembly over the IM Rod (Figs. 122, 122a & 122b). Lower the assembly until the long spike engages the tibial surface. Adjust the assembly to the correct rotation. Impact the Spike Arm until both the long and short spikes are fully engaged in bone. Loosen the knob at the top of the Spike Arm Telescoping Rod, and slide the rod and Cut Guide toward the anterior tibial surface. Then tighten the knob.

Fig. 122



STEP THREE

SET RESECTION LEVEL

Each tip of the Tibial Depth Resection Stylus indicates a different depth. The 2mm tip is used to check the depth from the defective tibial condyle for a minimal cut. The 10mm tip is used to check the depth from the least involved tibial condyle for an anatomic cut.

Insert the Tibial Depth Resection Stylus into the top of the Cut Guide, using the hole that corresponds to the defective tibial condyle (Fig. 123). The stylus will snap into the hole (Figs. 123a & 123b). Confirm that it is fully seated and properly oriented.

Fig. 122a



Fig. 122b



To confirm alignment, insert the Extramedullary Alignment Arch onto the Cut Guide and insert the Alignment Rod with Coupler through the arch, passing it distally toward the ankle. The distal end of the rod should point to the second toe.

Fig. 123



Fig. 123a



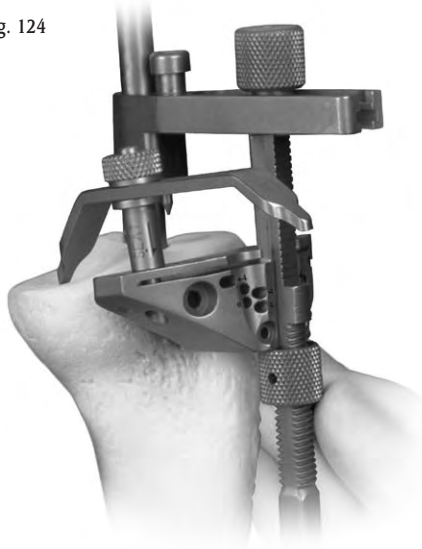
Fig. 123b





The 2mm tip should rest on the tibial condyle (Fig. 124). This positions the slot of the Cut Guide to remove 2mm of bone below the tip of the stylus.

Fig. 124



Alternatively, rest the 10mm tip of the stylus on the cartilage of the least involved condyle (Fig. 125). This will allow the removal of the same amount of bone that the thinnest tibial component would replace.

Fig. 125



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

Adjust the Cut Guide to the desired depth by turning the adjustment knob. Then insert 75mm Headless Holding Pins into the holes marked "0".

STEP FOUR

RESECT THE PROXIMAL TIBIA

Loosen the adjustment knob below the Cut Guide until the knob is at the bottom of the threaded portion of the rod. Use a slaphammer to raise the Tibial IM Rod and Spike Arm assembly until the dovetail portion of the IM Alignment Guide disengages from the Cut Guide. Remove the alignment assembly, leaving the Cut Guide in place on the bone.

If desired, the Alignment Arch and Alignment Rod with Coupler can be used on the Cut Guide again to check alignment.

Additional 2mm adjustments may be made by using the sets of holes marked -2, +2, and +4. The markings on the Cut Guide indicate, in millimeters, the amount of bone resection each will yield relative to the standard tibial resection set by the Cut Guide and Tibial Depth Resection Stylus. Once the tibial resection has been determined, use the Hex-head Holding Pins or silver Spring Pins to further stabilize the guide.

Use a 0.050-inch/1.27mm oscillating saw blade through the slot on the Cut Guide to cut the proximal surface of the tibia flat (Fig. 126). Then remove the Cut Guide.

Fig. 126





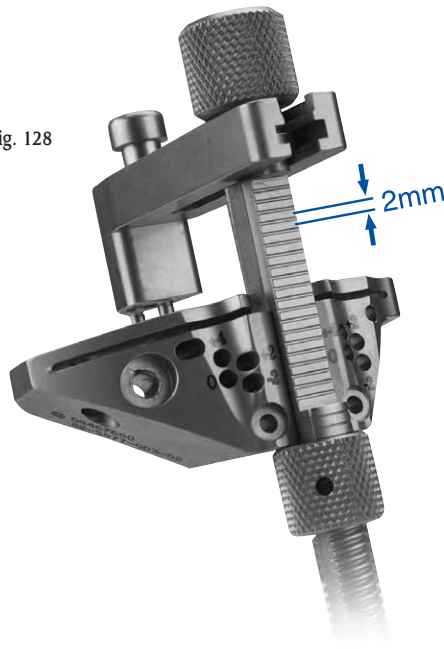
Optional Technique

If desired, the cut can be made from the top surface of the Cut Guide. The top surface of the guide is 4mm above the slot (Fig. 127), so the position of the guide must be adjusted to account for this difference. The adjustment can be made when the Cut Guide is first positioned by using the etch lines, which are in 2mm increments, on the Spike Arm Telescoping Rod (Fig. 128).

Fig. 127



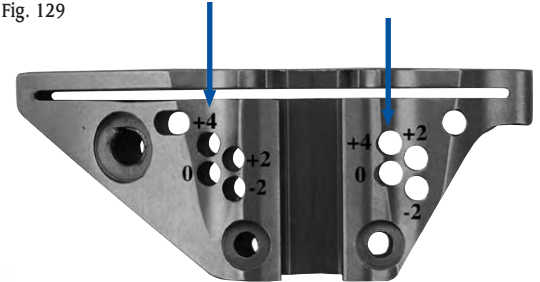
Fig. 128



Alternatively, the adjustment can be made after the alignment assembly is removed by lifting the Cut Guide off the headless pins, which were inserted through the holes marked "0," and reinserting the guide through the holes marked "+4" (Fig. 129).

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Fig. 129



FEMORAL PREPARATION

MULTI-REFERENCE 4-in-1 INSTRUMENTATION

MICRO-MILL/5-in-1 INSTRUMENTATION

CROSSOVER TECHNIQUE

TIBIAL PREPARATION

EM/IM TIBIAL RESECTOR

MICRO-MILL/5-in-1 INSTRUMENTATION

FINISH THE TIBIA

PATELLA PREPARATION

TRIAL REDUCTION/IMPLANTATION

CRA COMPONENT PREPARATION

MICRO-MILL INSTRUMENTATION

STEP ONE

ALIGN THE TIBIA

In this step, the tibial cut is aligned, ensuring proper posterior slope and rotation, and that the resection is perpendicular to the mechanical axis.

Retract the tibia anteriorly by using the Tibial Retractor (Fig. 130). Adjust the length of the Extramedullary Tibial Alignment Guide to fit the patient's tibia. Attach the Proximal Tibial Reference Guide to the proximal end of the guide (Fig. 131). Do not fully seat the reference arm, leave 1-2 lines visible.

Center the foot of the guide at the ankle and tighten the ankle strap (Fig. 132). The true center of the ankle is about 5mm-10mm medial to the midpoint between the subcutaneous palpable medial and lateral malleoli. Position the proximal portion superior to the tibial tubercle and center it mediolaterally. This will normally be the medial third of the tibial tubercle. Use the Resection Guide in the depth resection slot on the reference guide to ensure that the proximal portion is not positioned too far superiorly. This will show the maximum tibial resection when the Tibial Milling Base is inserted to the same depth as the reference guide. If there is not enough resection possible, move the alignment guide distally. Also observe the Proximal Tibial Reference Guide to help ensure that proper rotation has been achieved (Fig. 133).

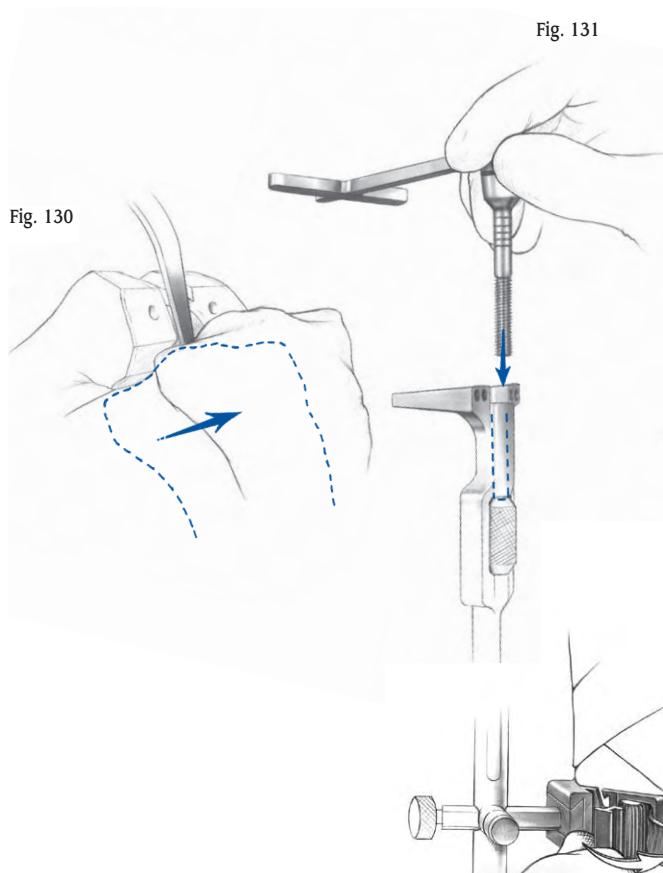


Fig. 130

Fig. 131

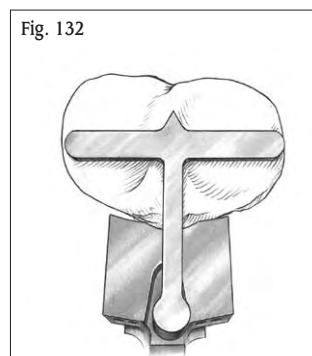


Fig. 132



Ensure that the guide is parallel to the mechanical axis in the sagittal plane. If it is not, adjust the guide in or out at the ankle until it is parallel (Fig. 133). Observe the Proximal Tibial Reference Guide to help confirm the 7° posterior slope and rotation. When the position is set, pin the guide with one pin on the lateral side. Adjust the distal ankle portion in the mediolateral plane so the guide follows the anterior tibial crest (Fig. 134).

This will ensure that the resected surface will be 90° to the mechanical axis. Observe the Proximal Tibial Reference Guide to help confirm that the resection will have the appropriate varus/valgus angle. If alignment is correct, insert a second pin.

Remove the Proximal Tibial Reference Guide.

Fig. 133

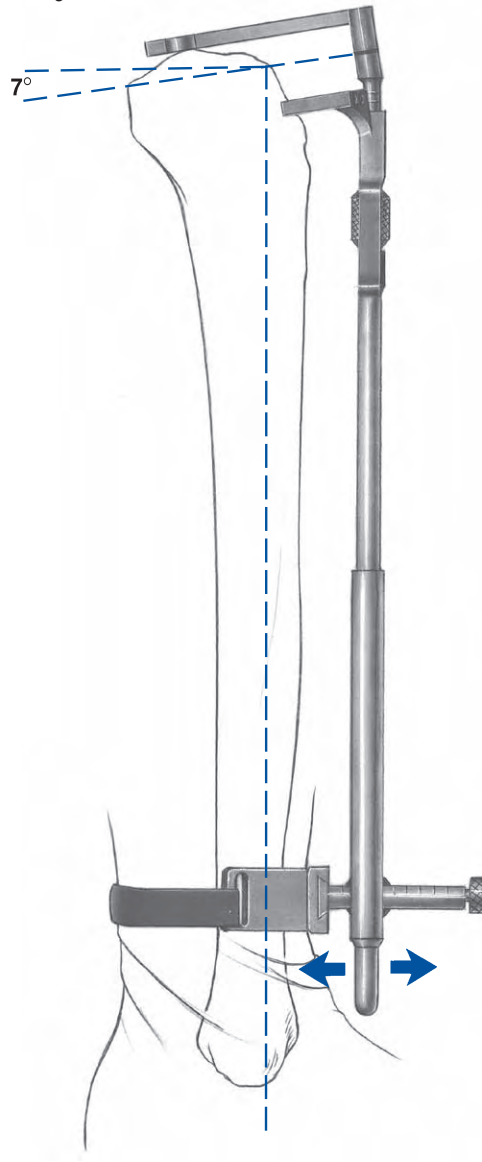
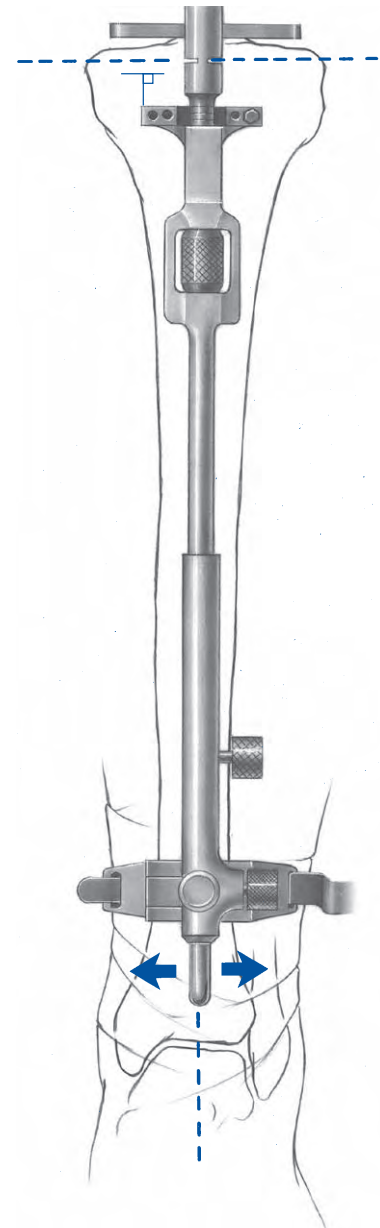


Fig. 134



STEP TWO (MILLING)

RESECT THE TIBIA

Attach the Tibial Milling Base to the Tibial Alignment Guide by placing it into the guide and engaging the threads by turning the adjustment knob (Fig. 135). Choose the appropriate Tibial Milling Template by placing them one at a time over the tibia until one provides the desired tibial coverage for bone removal (Fig. 136). **This does not dictate the final size selection for the tibial base plate.** The outer edge of the template corresponds to the cutting edge of the mill. Attach the selected template to the Tibial Milling Base by compressing the two plungers on each side of the base (Fig. 137). If the template contacts the femur, flex the knee further and retract the tibia more anteriorly. In very tight knees, it may not be possible to mill the tibia and the saw blade technique should be used.

Fig. 135

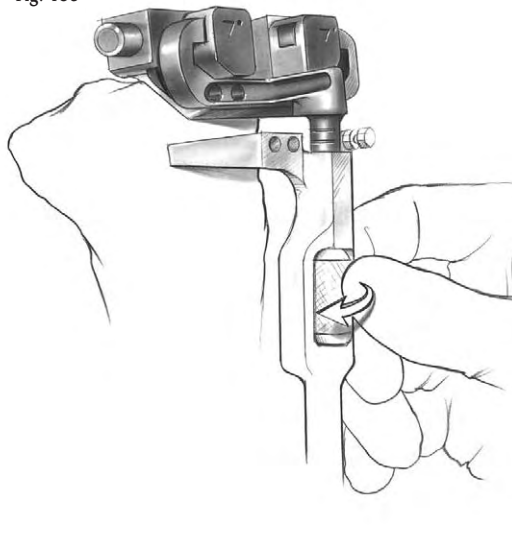


Fig. 136

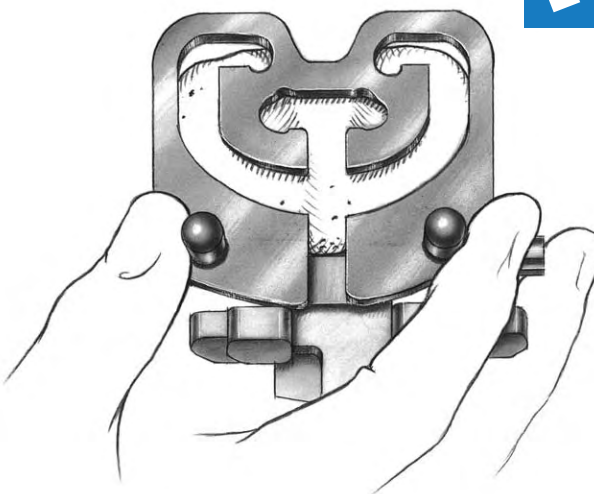
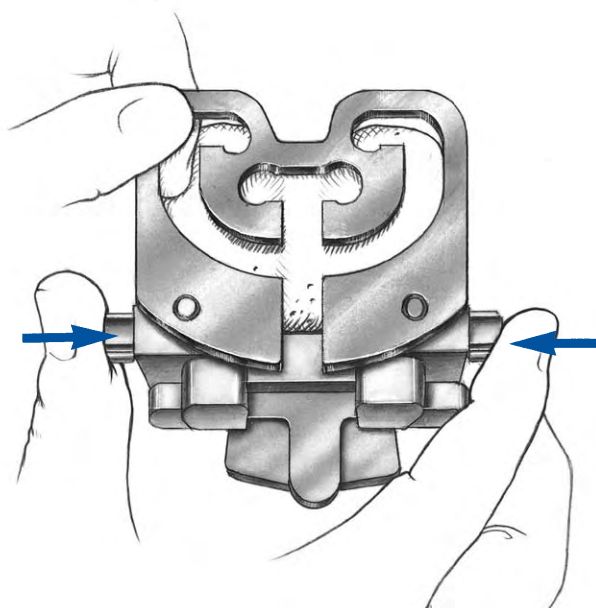


Fig. 137





Place the Tibial Milling Depth Resection Gauge onto the template. Adjust the Tibial Milling Base to the proper level (Fig. 138). Keep a finger on the plunger to ensure that the probe stays in contact with bone. The gauge should read 10mm on the intact condyle for an anatomic cut, or 2mm on the defective condyle for a minimal cut. These two points of resection will usually not coincide. **The surgeon must decide between an anatomic and minimal resection based on patient age, bone quality, and type of prosthetic implant planned.** After the depth is set, move the template mediolaterally until it is centered over the PCL attachment site. When positioned properly, use the drill/reamer to pin the Tibial Milling Base in place with two Tibial Long-threaded Spring Pins (Fig. 139).

Check to ensure that all soft tissue is retracted from under the template and that there is adequate clearance of the posterior femoral condyles. The Patella Tendon Retractor can be used to assist. With the milling drape over the assembled mill and the operative sight, retract the shield and engage the mill into the anterior opening of the template (Fig. 140).

Fig. 139

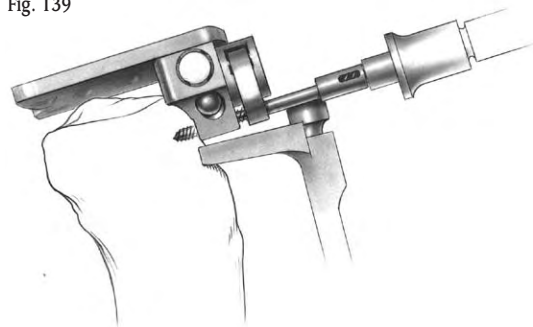


Fig. 140

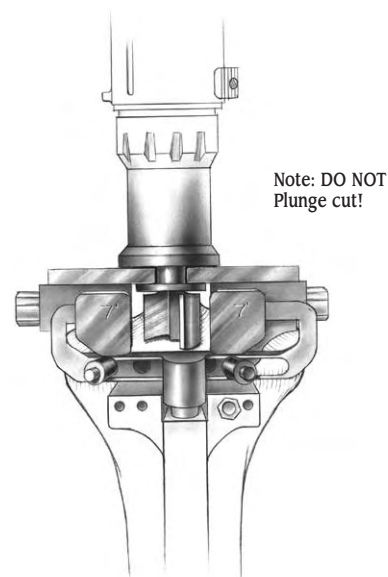
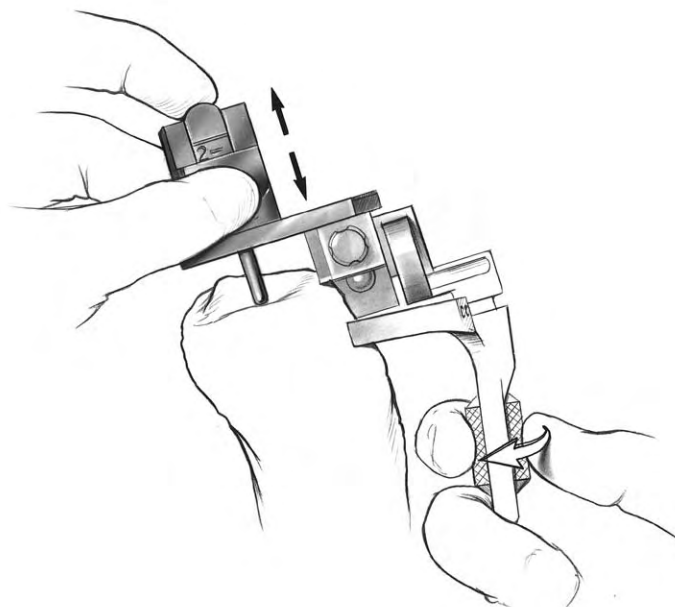


Fig. 138

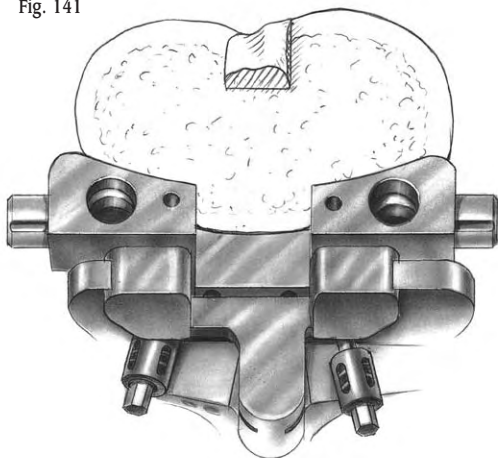


Disengage the safety and start the mill with the cutter slightly off the bone. Mill the tibia by following the tracks on the template in a clockwise direction. Keep the mill against the outside edge of the track. **Depending on the level of resection, the template may contact the tibial crest and prevent milling. If this occurs, the crest should be removed with a rongeur or oscillating saw to allow the mill to cut properly.**

When milling is complete, turn off and remove the mill. Pull the shield back over the cutter. Remove the Tibial Milling Template and check the proximal tibial surface resection (Fig. 141). If bone remains around the edges of the proximal tibia, attach the next larger template and remill. If osteophytes are present, remove them with a rongeur. When complete, remove the Tibial Milling Template and Tibial Milling Base.

Proceed to "Finish the Tibia" on page 81.

Fig. 141



STEP TWO (5-IN-1)

RESECT THE TIBIA

Insert the Tibial Cutting Head into the Tibial Alignment Guide (Fig. 142). Insert the 10mm tab of the Tibial Depth Resection Gauge into the cutting slot of the Tibial Cutting Head and adjust the platform until the arm of the gauge rests on the cartilage of the good condyle (Fig. 143).

Note: IM tibial resection instrumentation and IM tibial milling instrumentation are also available for tibial saw blade technique.

Fig. 142

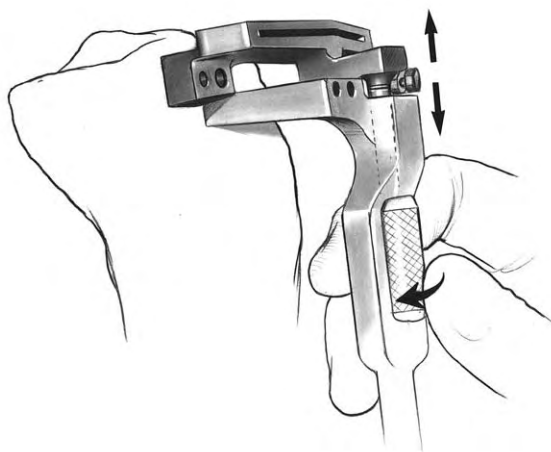
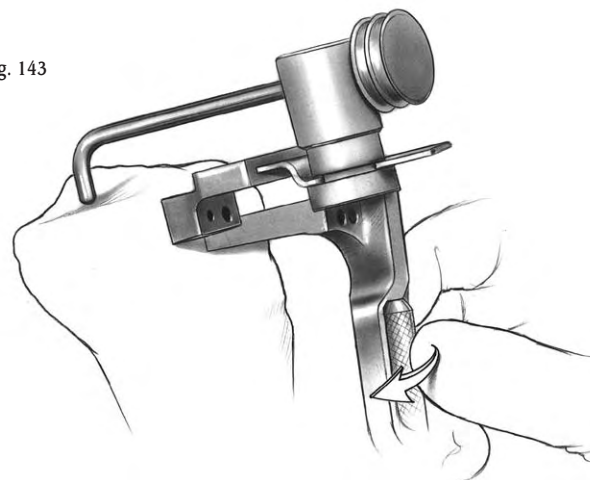


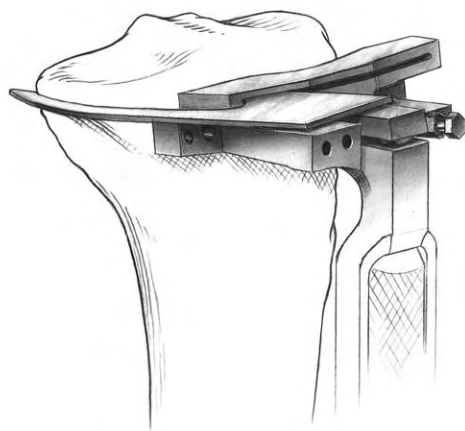
Fig. 143





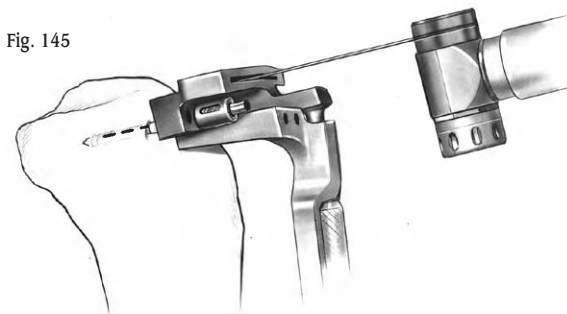
Be sure that the mark on the arm of the gauge is lined up with the mark on the base of the gauge. This will ensure that the arm is properly rotated within its base and that the proper resection depth is made. This positions the cutting slot to remove the same amount of bone that the thinnest tibial component would replace to give an anatomic fit. The Resection Guide can also be used to visualize where the cut will exit the posterior tibia (Fig. 144).

Fig. 144



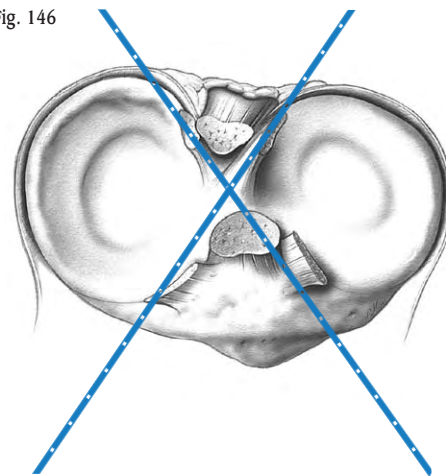
Optionally, the 2mm tab can be placed into the cutting slot. The arm of the gauge should rest on the defective condyle to be resected. This will allow the removal of two millimeters of bone below the tip of the gauge and provide a minimal resection. These 2mm and 10mm points of resection will usually not coincide. **The surgeon must decide between an anatomic and minimal resection based on patient age, bone quality, and the type of prosthetic implant planned.**

Fig. 145



Remove the depth gauge and secure the Tibial Cutting Head with two silver Spring Pins using the Female Hex Driver. Do not use gold-sleeved pins. (Two standard 1/8-inch pins can also be used to secure the guide). Use the appropriate thickness blade (0.050-inch/1.27mm) and an oscillating saw to cut the proximal tibia, taking care not to resect the cruciate island (Fig. 145). A reciprocating saw can be used to aid in resecting around the cruciate island (Fig. 146).

Fig. 146



Optional Spacer Alignment Technique:

Once the tibia and femur are resected, the Spacer/Alignment Guides can be used to check that the flexion and extension gaps are equal.

Proceed to "Finish the Tibia" on page 81.

FEMORAL PREPARATION

MULTI-REFERENCE 4-in-1 INSTRUMENTATION

MICRO-MILL/5-in-1 INSTRUMENTATION

CROSSOVER TECHNIQUE

TIBIAL PREPARATION

EM/IM TIBIAL RESECTOR

MICRO-MILL/5-in-1 INSTRUMENTATION

FINISH THE TIBIA

PATELLA PREPARATION

TRIAL REDUCTION/IMPLANTATION

CRA COMPONENT PREPARATION

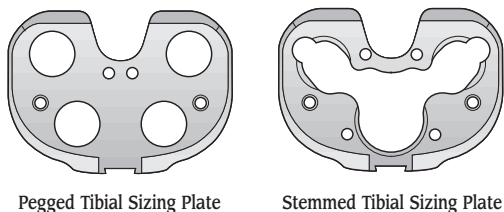
FINISH THE TIBIA

The tibia can be finished prior to trial reduction if the implant position will be chosen based on anatomic landmarks. Alternatively, the provisionals, in combination with the sizing plate, can be used to perform a trial range of motion to aid in tibial location.

Position Based on Anatomic Landmarks

Select the proper style of Tibial Sizing Plate (for either stemmed or pegged tibias) and the plate size that provides the desired tibial coverage (Fig. 147).

Fig. 147



The selected color code designation on the Tibial Sizing Plate should be compared to the color code designations on the anterior flange of the selected Femoral Provisional. At least one of the colors and size designation listed on the Femoral Provisional must match at least one color on the Tibial Sizing Plate and the articular surface to ensure that the components will be kinematically matched. The colors and sizes must match exactly. For example, Yellow A/B = Yellow A/B. The striped colors are not the same as the standard colors (Yellow A/B \neq Striped Yellow A/B) and should not be viewed as a match. If there is no match between the Femoral Provisional and Tibial Sizing Plate, adjust the size of the sizing plate being used to yield a match.

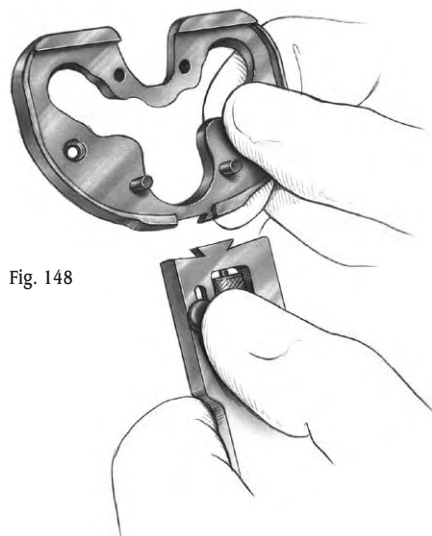


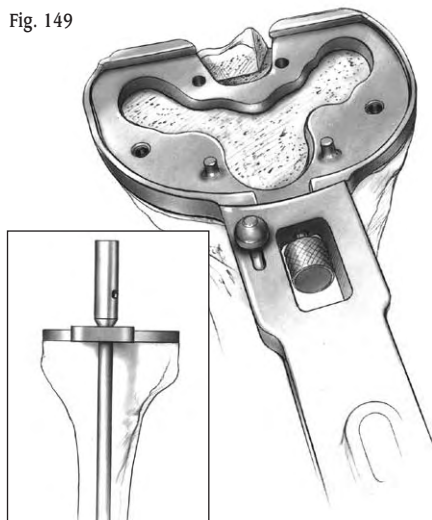
Fig. 148

Attach the Tibial Provisional/Drill Guide Holding Clamp to the selected Tibial Sizing Plate by depressing the button on the holding clamp and engaging the dovetail on the holding clamp with the dovetail on the sizing plate and secure by tightening the thumb screw. (Fig. 148).

Generally, the holding clamp aligns with the anterior aspect of the tibia. Rotate the sizing plate so the holding clamp points at, or slightly medial to, the tibial tubercle (Fig. 149). The Alignment Rod can be used to help confirm varus/valgus alignment.

Pin the sizing plate in place with two Short-head Holding Pins.

Fig. 149





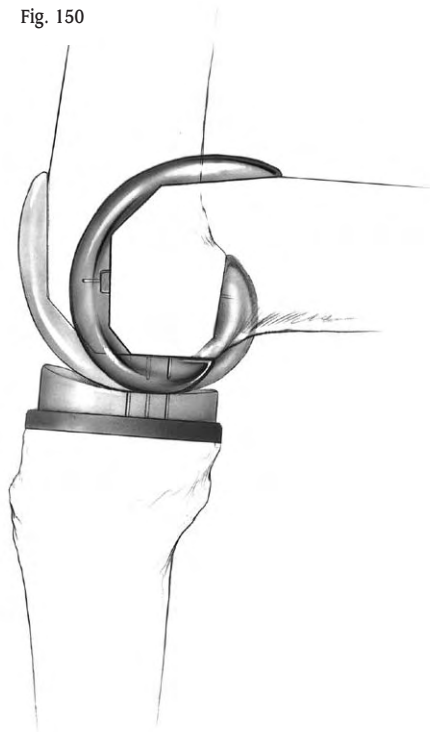
Position Based on Trial Range of Motion

If using the provisionals and performing a range of motion to determine tibial component placement, the patella preparation should be completed. Then select the proper size and style of Tibial Sizing Plate. Ensure that the plate chosen provides the desired tibial coverage. Again, a color match with the Femoral Provisional must occur for a proper kinematic match.

Insert the proper Femoral Provisional, Patellar Provisional, Tibial Sizing Plate, and Articular Surface Provisional. Select the color and letter designation of Articular Surface Provisional that is the same as the color match chosen for the Femoral Provisional and sizing plate. Ensure soft tissue balance is appropriate.

Flex and extend the knee with the provisionals in place. With proper soft tissue balancing complete, the tibial component tends to seat itself in the position where it best articulates with the femur (Fig. 150).

Fig. 150



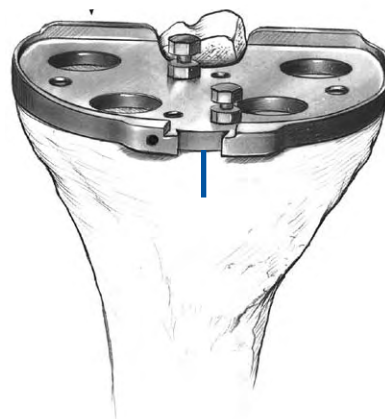
Note: During the trial reduction, observe the relative position of the Femoral Provisional on the Articular Surface Provisional by using the lines on both provisionals. The lines can be used to determine if posterior rollback is occurring, whether the PCL is functional, and if the femoral component will 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 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.

After this self-centering process has occurred, mark the position of the component with methylene blue or electrocautery (Fig. 151).

Remove the Articular Surface Provisional and pin the sizing plate in place with two Short-head Holding Pins. Ensure that the sizing plate remains in the proper position when pinning.

Fig. 151



Pegged Tibial Plate Preparation (For Use With NexGen CR/CRA Components Only)

With the Tibial Sizing Plate pinned in position, take the Tibial Peg Drill and drill the four peg holes. After drilling each hole, place a Tibial Holding Peg in each to aid in stability (Fig. 152).

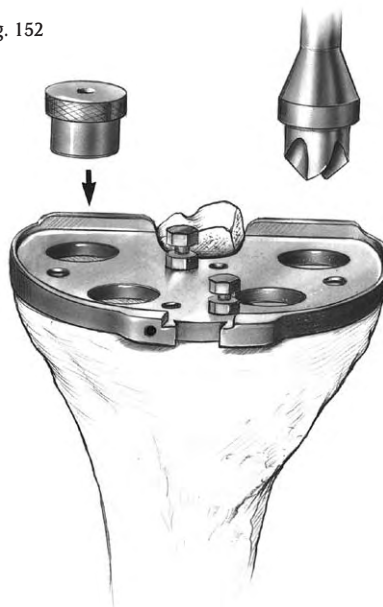
If trial reduction has been completed, remove the sizing plate and other provisionals. If it has not been completed, proceed to "Trial Reduction and Implantation" on page 99.

Stemmed Tibial Plate Preparation

Once the Tibial Sizing Plate is pinned in position, place the appropriate size Porous or Cemented Stem Drill Guide on the sizing plate and drill for the stem with the Porous or Cemented Stem Drill (Fig. 153). Drill until the engraved line on the drill is in line with the top of the drill sleeve (Fig. 154). If one is using a porous stemmed tibial plate, drill for the posterior pegs with the Tibial Peg Drill. Remove the drill and drill guide.

Note: When cementing the stemmed tibia, (precoat or porous), you must use the Cemented Stem Drill Guide and Cemented Stem Drill to allow for optimal cement fixation.

Fig. 152



Drill for Porous
Stemmed Tibias
Only.

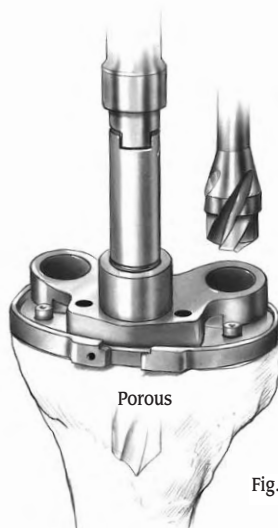


Fig. 154

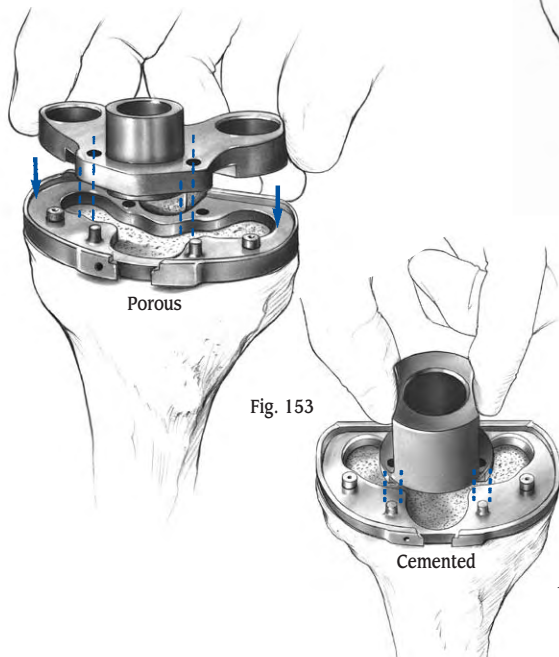
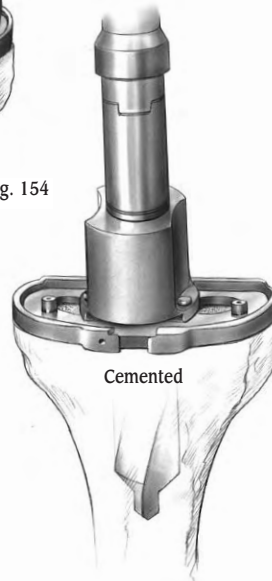


Fig. 153

Note: NexGen Knee components are indicated for use with bone cement in the United States.

CRUCIATE RETAINING



Assemble the proper size Tibial Broach to the Broach Impactor (Fig. 155). **The broach can only be assembled from the front.** Seat the impactor on the Tibial Sizing Plate and impact the broach to the proper depth indicated by the etched groove on the shaft aligning with the impactor handle. The broach has a built-in stop so it cannot be overimpacted (Fig. 156).

Fig. 155

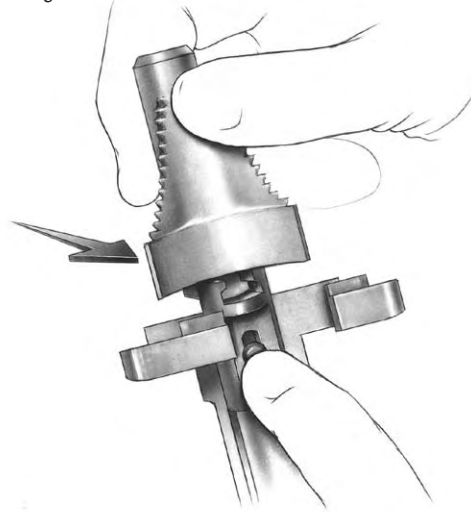
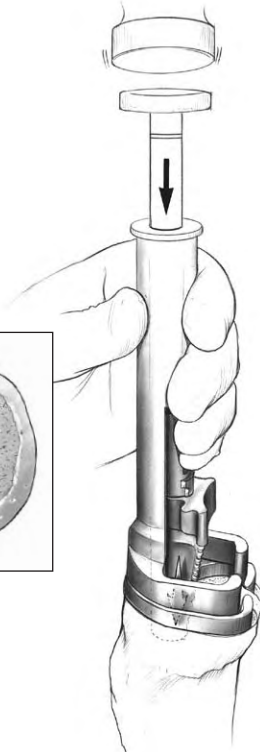
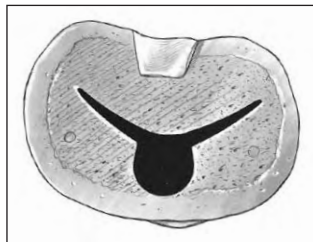


Fig. 156



Remove the broach assembly and sizing plate. Use the correct size Stemmed Tibial Provisional to ensure proper fit before implanting the final components. Assemble the impactor onto the provisional until completely seated. Impact the Stemmed Tibial Provisional (Figs. 157 & 158).

Fig. 157

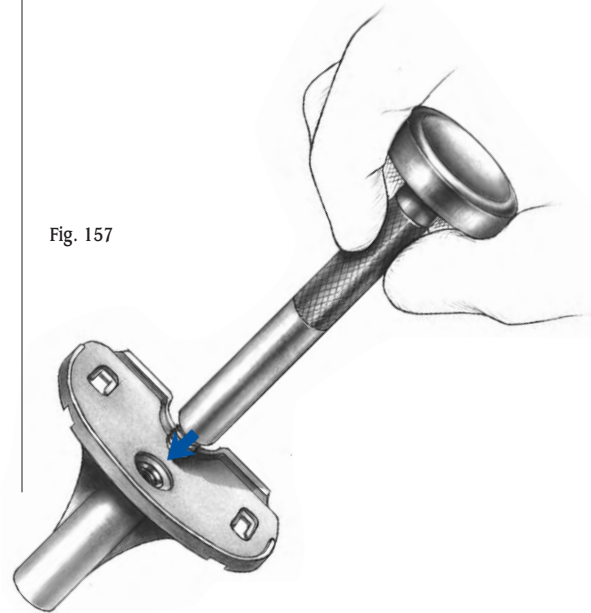
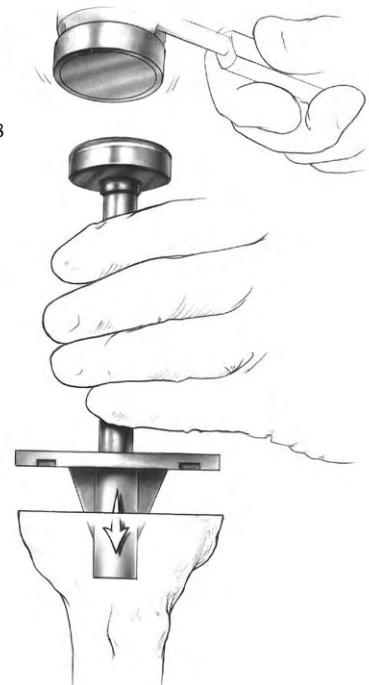


Fig. 158



Once trial reduction is complete, assemble the Femoral Extractor to the Femoral Provisional and remove the trial. The Slaphammer Extractor can be used to remove the component, if needed (Fig 159).

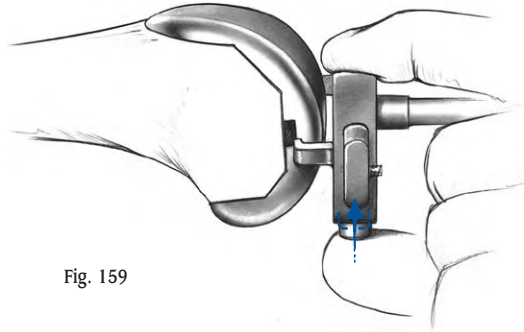
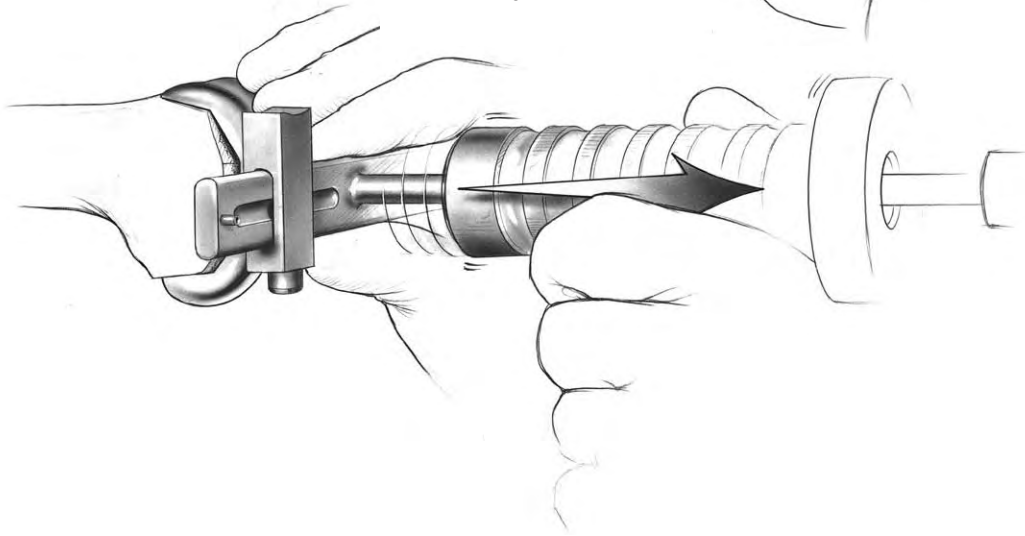


Fig. 159



FEMORAL PREPARATION

MULTI-REFERENCE 4-in-1 INSTRUMENTATION

MICRO-MILL/5-in-1 INSTRUMENTATION

CROSSOVER TECHNIQUE

TIBIAL PREPARATION

EM/IM TIBIAL RESECTOR

MICRO-MILL/5-in-1 INSTRUMENTATION

FINISH THE TIBIA

PATELLA PREPARATION

TRIAL REDUCTION/IMPLANTATION

CRA COMPONENT PREPARATION

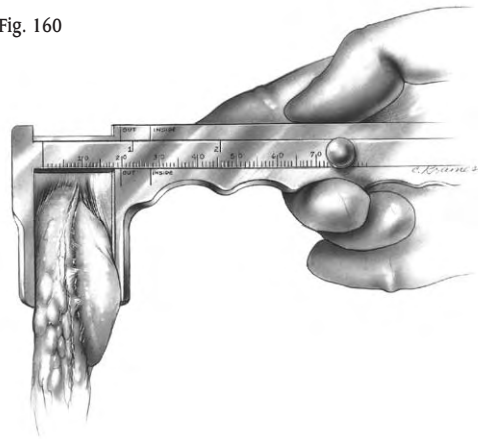
PATELLA PREPARATION

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. 160). Subtract the implant thickness from the patella thickness to determine the amount of bone that should remain after resection.

Fig. 160



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

PATELLA REAMER TECHNIQUE

TOTAL SURFACING PROCEDURE

Use the Patella 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 161). 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. Insert the appropriate size Patella Reamer Surfacing Guide into the Patella Reamer Clamp (Fig 162). Turn the locking screw until tight.

Fig. 161

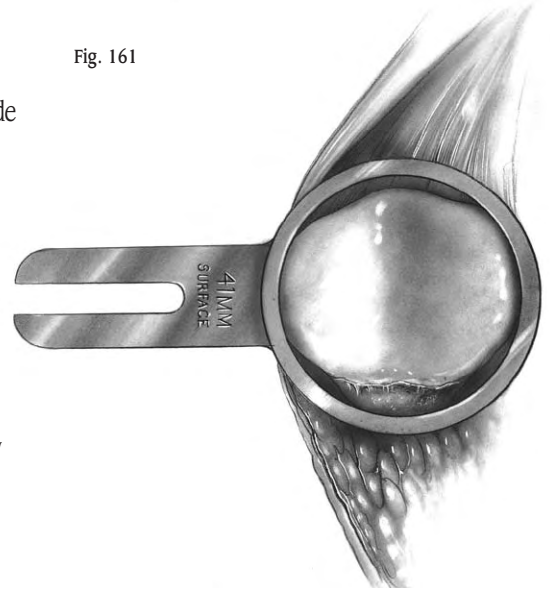
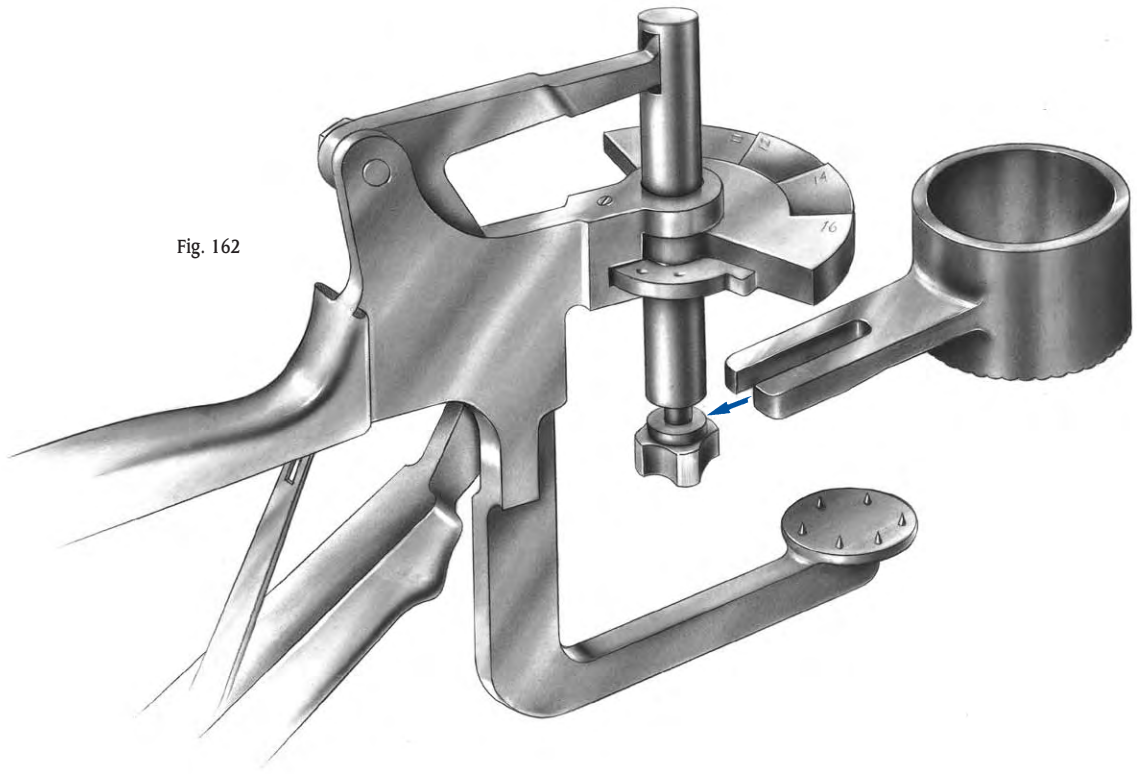


Fig. 162



PATELLA PREPARATION

Apply the Patella Reamer Clamp at a 90° angle to the longitudinal axis with the Patella 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. 163). Turn the clamp screw to hold the instrument in place. The anterior surface must fully seat upon the pins and contact the fixation plate.

Turn the depth gauge wing on the Patella Reamer Clamp to the proper indication for the correct amount of bone that is to remain after reaming (Fig. 164).

Attach the appropriate size Patella Reamer Blade to the appropriate size Patella Reamer Shaft (Fig. 165). Use only moderate hand pressure to tighten the blade.

Do not overtighten the blade. Insert the Patella Reamer Shaft into a drill/reamer. Insert the reamer assembly into the Patella 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 Patella Reamer Clamp. Remove the reamer clamp assembly. Proceed to Finish the Patella on page 93.



Fig. 163

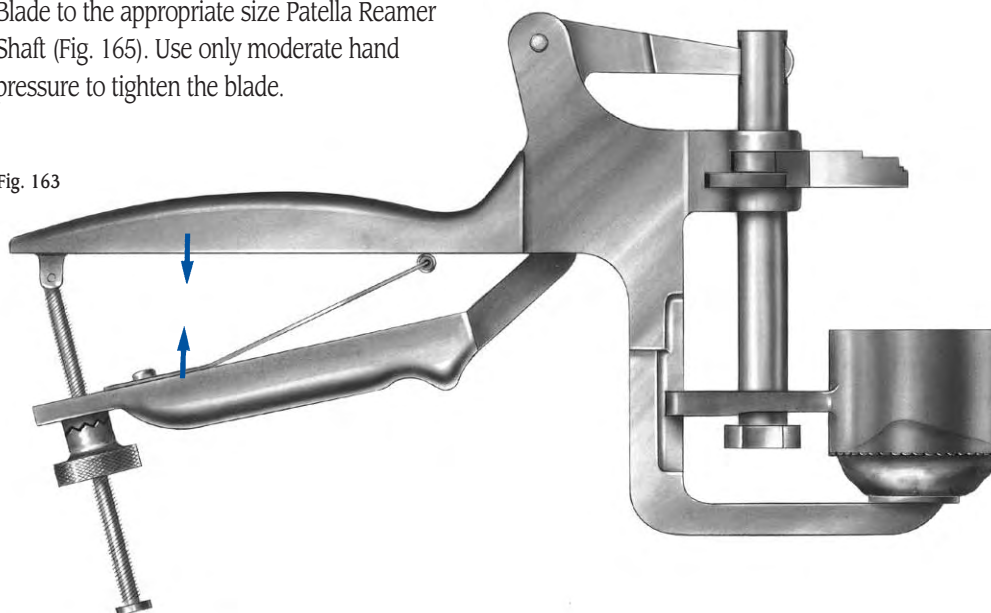


Fig. 164

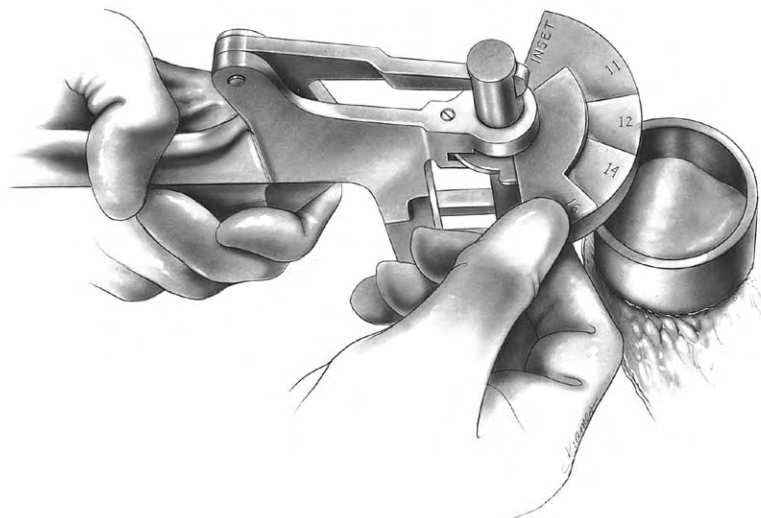
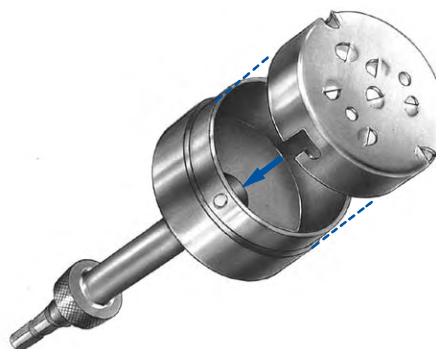


Fig. 165





Insetting Technique

Use the Patella 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. 166).

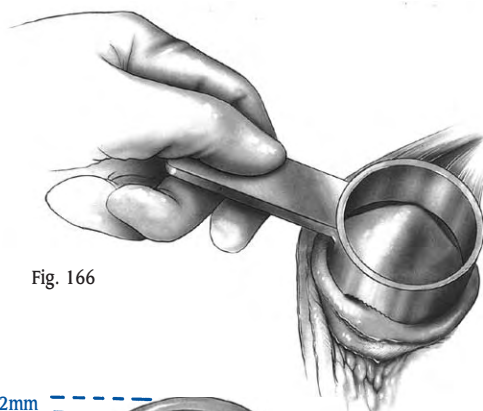
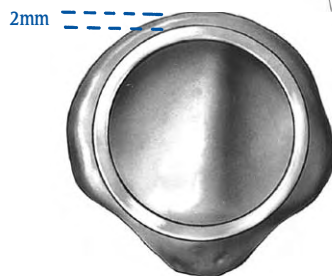


Fig. 166



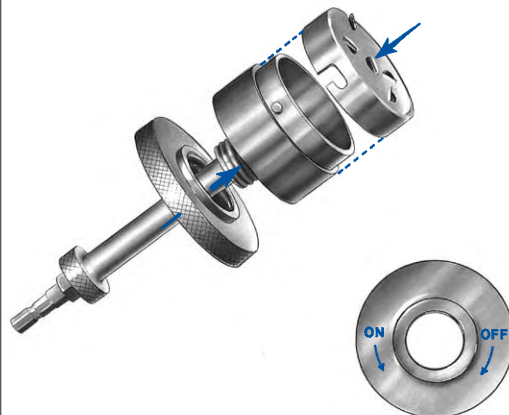
Insert the appropriate size Patella Reamer Insetting Guide into the Patella Reamer Clamp. Turn the locking screw until tight. Apply the Patella Reamer Clamp at a 90° angle to the longitudinal axis with the Patella Reamer Insetting Guide on the articular surface. Squeeze the clamp until the anterior surface 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 Patella Reamer Blade to the appropriate size Patella Reamer Shaft (Fig. 167). Use only moderate hand pressure to tighten the blade. **Do not overtighten the blade.** Insert the Patella Reamer Shaft into a drill/reamer.

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

Fig. 167



(Note: If using a Primary Porous Patella with Trabecular Metal™ Material, all implants are 10mm thick.) The depth gauge wing on the Patella Reamer Clamp can be used instead of the stops to control the amount of bone remaining, rather than the amount of bone removed.

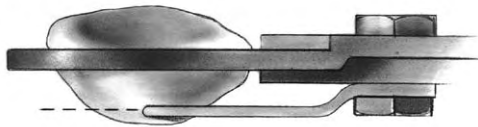
Insert the reamer assembly into the Patella Reamer Insetting Guide. Raise the reamer slightly off the bone and bring it up to full speed. Advance it slowly until the prominent high points are reamed off the bone. Continue reaming with moderate pressure. Remove the reamer clamp assembly. Proceed to Finish the Patella on page 93.

Universal Saw Guide Technique

Apply the Universal Patella 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 thumb screw 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. 168).

Fig. 168



Cut the patella flat so that a smooth surface remains (Fig. 169).

Fig. 169

FINISH THE PATELLA

For the NexGen Primary Porous Patella With Trabecular Metal Material

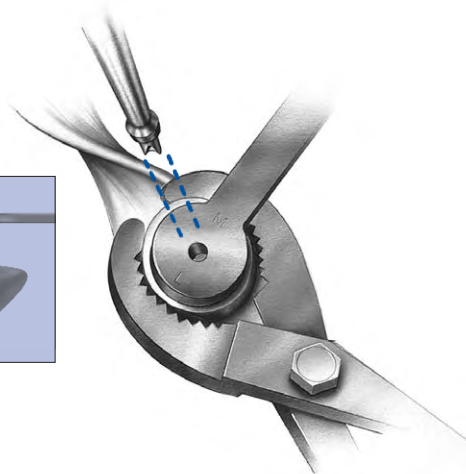
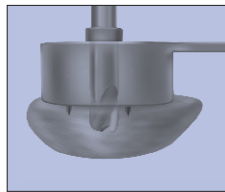
Center the appropriate Patella Drill Guide over the resected patella surface with the handle on the medial side of the patella and perpendicular to the tendon. Press the drill guide firmly in place so that the teeth fully engage and the drill guide sits flat on the bone surface (Fig. 170). Drill the peg hole making sure the drill stop collar contacts the top of the drill guide (Fig. 171).

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

Fig. 170



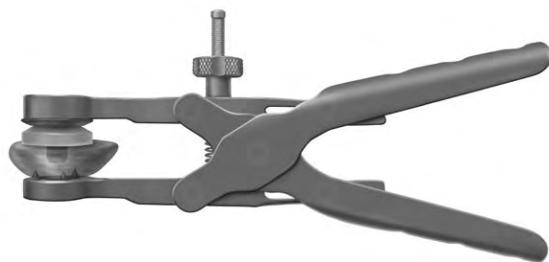
Fig. 171





Apply cement to the *Trabecular Metal Material* 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. 172). Remove excess cement.

Fig. 172



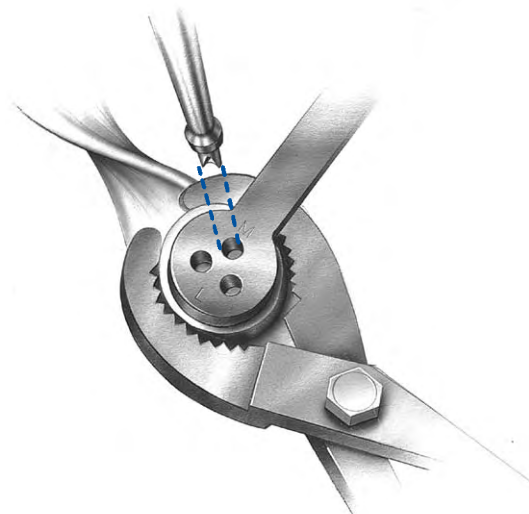
Note: If the implant post begins to engage at an angle, the implant should be removed and repositioned perpendicular to the resected surface. Insert the patella again and reclamp, applying an even distribution of pressure on the patellar surface.

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. 173).

Fig. 173



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.

FOR THE AUGMENTATION PATELLA

COMPONENT SIZE SELECTION AND BONE PREPARATION

Use a caliper to determine the thickness of the remaining patellar bone stock. The Augmentation Patella may be used if the remaining patella is less than 10mm thick and patellar resurfacing with a standard implant is not feasible.

Note: Determine position, size, tilt, and depth of the Augmentation Patella Base before reaming.

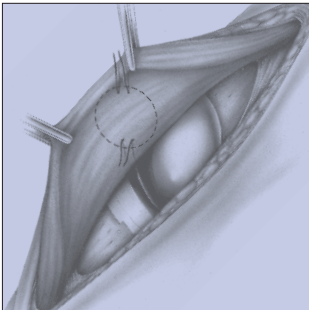
Use a spherical reamer to prepare the patellar bone bed. Select the reamer size according to the anticipated size of the implant base, as shown in this table.

AUGMENTATION PATELLA	
Reamer Diameter	Overall Thickness
Medium, 52mm	Medium, 19.5mm
Medium, 38mm	Medium, 22mm
Large, 62mm	Large, 19mm
Large, 44mm	Large, 22mm

TRIAL REDUCTION

Select the appropriate size Augmentation Patella Provisional and secure it with sutures in several places to the patellar tendon. Sutures provide stability during the trial reduction. With the joint reduced, ensure that the Augmentation Patella Provisional easily engages the trochlear groove of the femoral component at 25° of flexion. When the proper position and orientation have been established, clamp the patella and mark the component position with a skin marker or cautery (Fig. 174).

Fig. 174



SECURING THE AUGMENTATION PATELLA BASE

Apply an adequate amount of bone cement to the anterior aspect (*Trabecular Metal*-dome shape) of the Augmentation Patella Base. Then, place the device against the remaining patella bone stock and clamp until the cement is fully cured.

Suture the Augmentation Patella Base to the extensor tendon. The holes in the Augmentation Patella Base are chamfered to minimize the potential for abrasion of the sutures. Pass the sutures through the holes in the titanium ring, and tie the sutures on the posterior aspect of the Augmentation Patella Base, as shown. If necessary, use a 1/16 in. (or 1mm) drill to create holes in the native patella. Often, the patella is thin enough to permit placement of a suture without drilling.

Note: Components are indicated for use with bone cement in the United States.



Use an interrupted suture pattern. Insert a #2 nonabsorbable suture through a hole on the posterior surface of the titanium ring (Fig. 175). Bring the needle from the anterior surface back through an adjacent hole and cut the suture (Fig. 176). Repeat the procedure, passing a second suture through the same set of holes and cutting the suture. Then tie two independent knots.

Note: This can also be accomplished by doubling the suture through the eye of the needle and making one pass.

Fig. 175

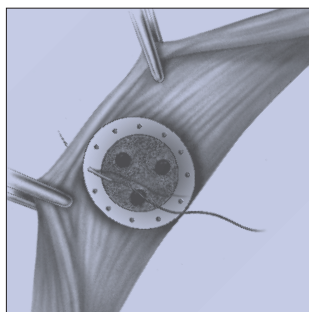


Fig. 176

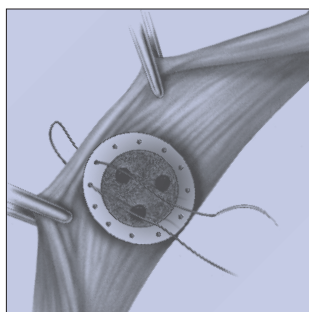
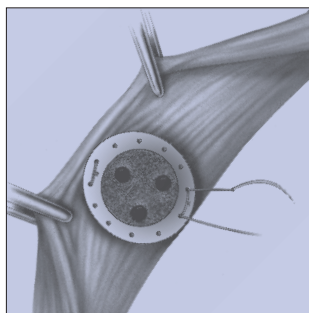


Fig. 177



Tie the knots on the posterior surface of the patella. Repeat the same steps in two holes on the side opposite the completed suture (Fig. 177). Alternating sutures on opposite sides helps ensure proper implant position and soft-tissue balance. The Augmentation Patellar Clamp can be used to hold the patella and augment while suturing.

Note: Tight sutures on the base can compromise circulation. After the tourniquet is released, check the soft tissues to be sure they return to their normal color. If not, the sutures may need to be replaced with looser knots tied around the base.

CEMENTING THE ALL-POLYETHYLENE PATELLA

At the surgeon's discretion, implant position can be confirmed with an intraoperative radiograph.

Perform an additional trial reduction using the All-Polyethylene Patellar Provisional placed onto the secure Augmentation Patella Base. Select the All-Polyethylene Patella that will completely cover the underlying base and suture ring. Apply bone cement in its doughy state to the Augmentation Patella Base and post holes, completely covering the suture ring. It is necessary to completely fill the space between the All-Polyethylene Patella and the suture ring, so the sutures are protected and the All-Polyethylene Patella is supported appropriately. Align the pegs of the All-Polyethylene Patella with the holes in the Augmentation Patella Base and assemble the two together. Use the Augmentation Patellar Clamp to clamp the patella, and remove excess cement. Allow the cement to fully cure before removing the clamp.

After the cement has hardened, observe patellar tracking through the full range of knee motion.

FEMORAL PREPARATION

MULTI-REFERENCE 4-in-1 INSTRUMENTATION

MICRO-MILL/5-in-1 INSTRUMENTATION

CROSSOVER TECHNIQUE

TIBIAL PREPARATION

EM/IM TIBIAL RESECTOR

MICRO-MILL/5-in-1 INSTRUMENTATION

FINISH THE TIBIA

PATELLA PREPARATION

TRIAL REDUCTION/IMPLANTATION

CRA COMPONENT PREPARATION

TRIAL REDUCTION AND IMPLANTATION

TRIAL REDUCTION

Insert the Femoral Provisional, Patellar Provisional, and the correct size Tibial Sizing Plate if using the four-pegged tibial component or the correct size Stemmed Tibial Provisional if using the stemmed tibial component. Remember that at least one color designation on the tibial provisional should match one of the color designations listed on the Femoral Provisional, and this color and size designation must be the same color and size of the articular surface family being used. If three of a kind is not obtainable, the incorrect tray size has been selected and another tray size and articular surface family should be selected. Insert the proper height Articular Surface Provisional and check the range of motion and ligament stability. Perform any necessary soft tissue releases. The Femoral Extractor can be used to remove the Femoral Provisional.

FEMORAL RECUTTING/DOWNSIZING

If the extension gap is less than the flexion gap, it may be necessary to resect more distal bone or downsize the femur.

For MICRO-MILL/ 5-in-1 Instrumentation

Select the proper Recutting Block and pin it to the distal femur with two silver Spring Pins (Fig. 178). Ensure that the block is seated on the distal and anterior femur. Insert the proper Femoral A/P Placement Guide, with Femoral Mounting Bases attached, into the block (Fig. 179). Place a pin through the positioning hole into the placement guide (Fig. 180). Then pin the mounting bases to the femur as previously described. Once this is complete, proceed to the femoral resection step.

Fig. 178

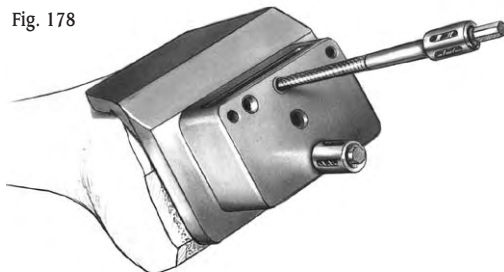


Fig. 179

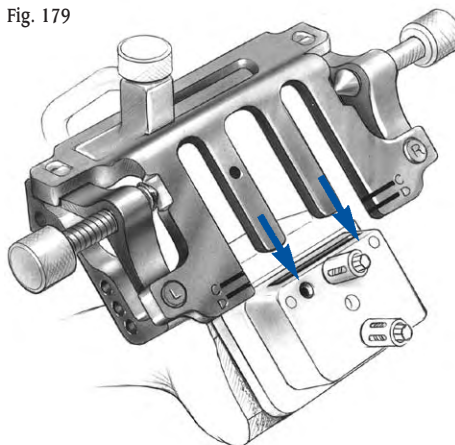
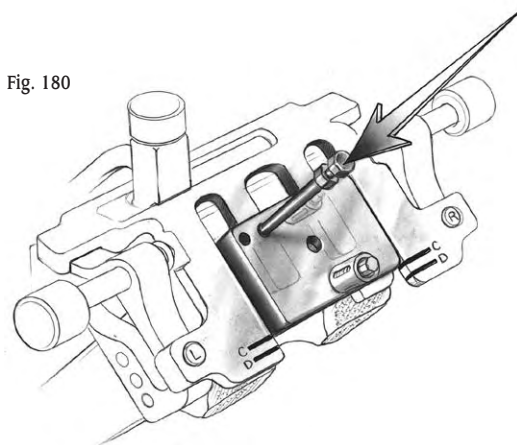


Fig. 180





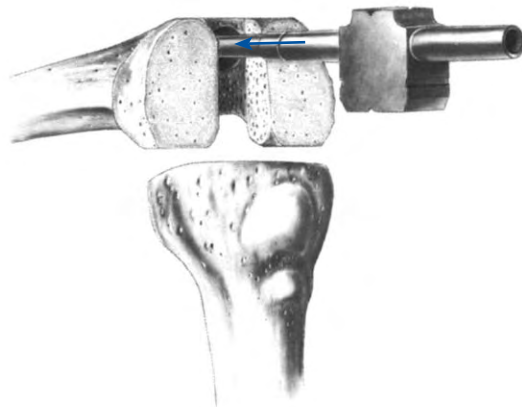
For Intramedullary, Epicondylar, or Multi-Reference 4-in-1 Femoral Instrumentation

An additional cut of 2mm, 3mm, or 5mm can be made. Determine the desired additional cut by taking the difference between the Spacer Block thicknesses in flexion and extension. If full extension cannot be achieved with the 8mm Spacer Block, estimate the amount of resection necessary using the Minus Spacer Blocks (-2mm, -3mm, and -5mm thicknesses). The additional resection indicated will bring the space up to 8mm.

Insert two pins through the appropriate depth holes in the Distal Femoral Recutting Guide. Locate the guide so that the two depth pins are flush against the cut surface of the distal femur. Insert two holding pins to secure the instrument to the femur and recut the distal femur (Fig. 181).

Remove the Distal Femoral Recutting Guide and use the appropriate Spacer Block to reassess the gaps.

Fig. 181



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 Insertion Instrument applies both downward and rearward forces to aid in the insertion of the articular surface onto the tibial tray. Push the lever on the instrument fully to either side. Place the articular surface onto the implant tray, engaging the dovetails (Fig. 182).

Steady the surface on the tray with one hand by applying downward pressure near the posterior cruciate cutout. Engage the hook on the insertion instrument with the mating slot in the front of the plate and close the lever with your index finger.

This should lock the insertion instrument to the tray. Squeeze the handles of the insertion instrument to seat the articular surface (Fig. 183). **Open the lever and remove the insertion instrument. Only insert an articular surface once. Never reinsert the same articular surface onto a tibial tray.**



Fig. 183

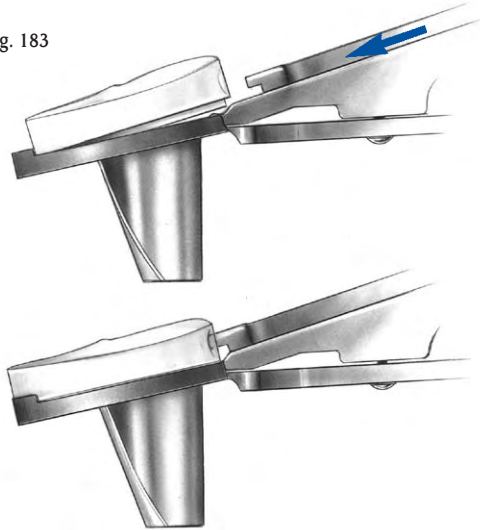
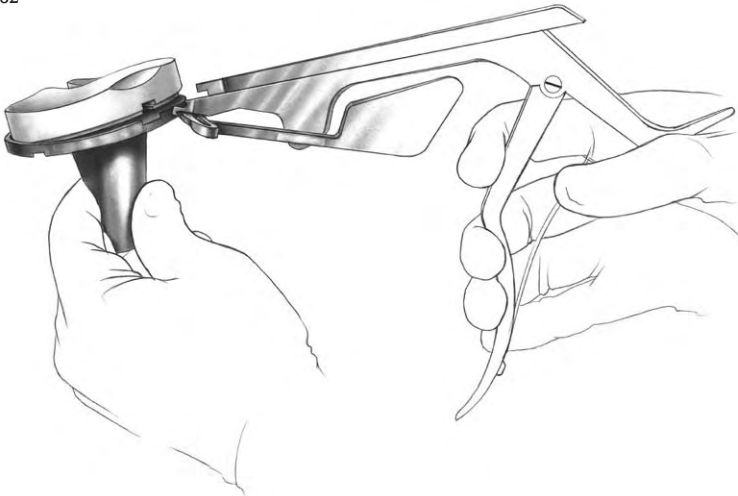


Fig. 182





FEMORAL PREPARATION

MULTI-REFERENCE 4-in-1 INSTRUMENTATION

MICRO-MILL/5-in-1 INSTRUMENTATION

CROSSOVER TECHNIQUE

TIBIAL PREPARATION

EM/IM TIBIAL RESECTOR

MICRO-MILL/5-in-1 INSTRUMENTATION

FINISH THE TIBIA

PATELLA PREPARATION

TRIAL REDUCTION/IMPLANTATION

CRA COMPONENT PREPARATION

PREPARATION FOR CRA COMPONENTS



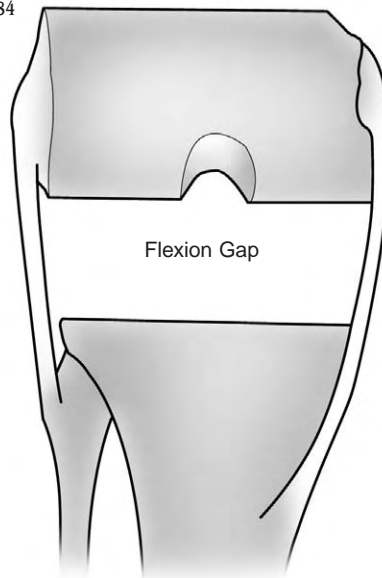


DETERMINING FEMORAL ROTATION

Inappropriate femoral component rotation may create a flexion imbalance and/or compromise patellofemoral kinematics.¹ Therefore, it is important to pay particular attention to femoral rotation.

When establishing femoral rotation, consider the condition of the medial soft tissues. If a medial release is not necessary for axial alignment, the femoral component should be externally rotated to compensate for the normal medial inclination of the tibial plateau and the flexion laxity of the lateral ligaments. This will help produce a rectangular flexion gap (Fig. 184). If a medial release is performed, a rectangular flexion gap will result from the release itself. The distal femoral anatomy can then be used to help

Fig. 184



determine the proper rotational alignment.

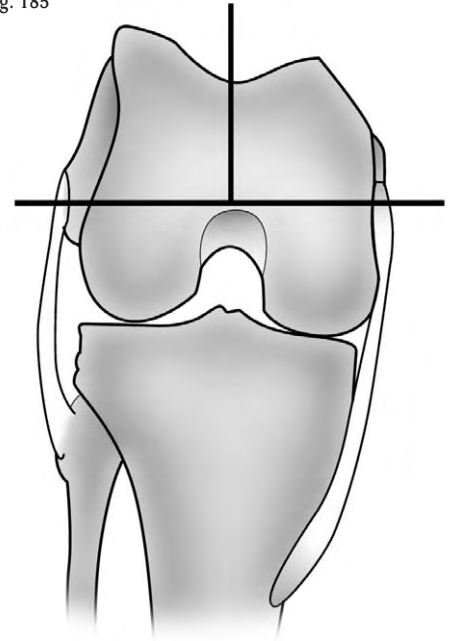
A number of methods using anatomic landmarks may be used. With some of these methods, surgeon judgement must be used as anatomic

landmarks are not always reliable because of defects or inconsistencies.

When applying judgement, it is particularly important to avoid inappropriate internal rotation.¹

One method for determining femoral component rotation is to use the A/P axis of the distal femur as defined by the deepest point of the patellar

Fig. 185



sulcus (Fig. 185). This method, however, may not be accurate in cases involving trochlear dysplasia, and in some valgus knees.¹

Another method is to use the posterior femoral condyles (Fig. 186); however, erosion of the condyles may distort the reference angle resulting from this method.¹ The tibial

¹ Insall JN. Surgery of the Knee. 3rd ed. New York, NY: Churchill Livingstone; 1996:1556.

Fig. 186

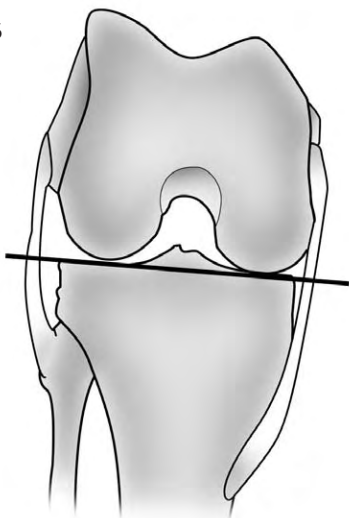
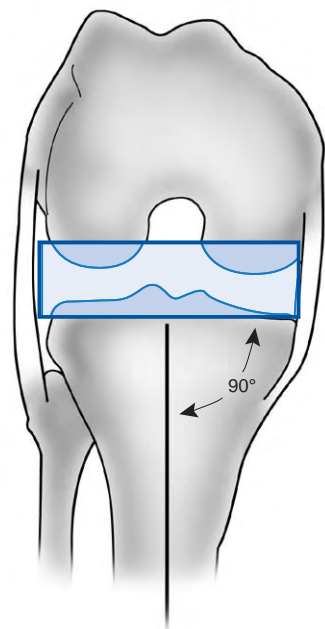


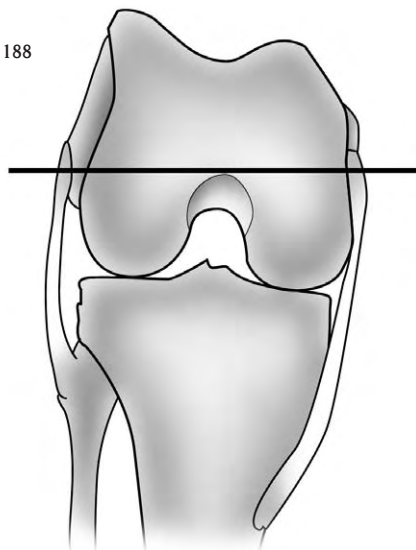
Fig. 187



shaft axis may offer an accurate reference for determining femoral rotation (Fig. 187), and help balance the flexion space.

The recommended method for establishing femoral component rotation is to use the epicondyles, the attachment points for the collateral ligaments (Fig. 188). Identifying the epicondylar axis may require additional soft tissue dissection to visualize the epicondyles. The center

Fig. 188



of the medial epicondyle is located in the sulcus between the proximal and distal origins of the deep MCL. The lateral epicondyle is the most prominent lateral point on the distal femur.

If desired, one of the other methods can then be used to confirm proper rotation. The A/P axis, for example, is approximately at right angles to the epicondylar axis although, in some patients, it has been shown to vary by up to $\pm 7^\circ$ ². Relative to the posterior condylar line, the epicondylar line is rotated externally $0^\circ - 8^\circ$ ($4^\circ \pm 4^\circ$)².



² Poilvache PL, Insall JN, Scuderi GR, Font-Rodriguez DE. Rotational landmarks and sizing of the distal femur in TKA. *Clin Orthop*. 331:35-46, 1996.



PRIMARY PROSTHESIS EXTRACTION

Remove the failed tibial and femoral components, compromising remaining bone as little as possible. Remove all cement and debride all bone surfaces down to good quality bone. Perform a synovectomy when indicated to remove cement or wear debris.

Inspect the patellar component for wear and loosening. If either is present, remove the patellar prosthesis. If the patellar component is not worn and is well fixed, decide whether the design is compatible with the *NexGen* Femoral Component. If the design is compatible, it may be more appropriate to leave the previous patellar component and avoid damage to the patellar bone. If the design is not compatible, replace the patellar component.

STEP ONE

DETERMINE TIBIAL PROSTHETIC PLATFORM

After removing the tibial component, remove cement and other debris. If necessary, drill a starting hole. Center the 8mm IM Drill mediolaterally. For primary arthroplasty, locate the hole just anterior to the insertion of the anterior cruciate ligament (Fig. 189).

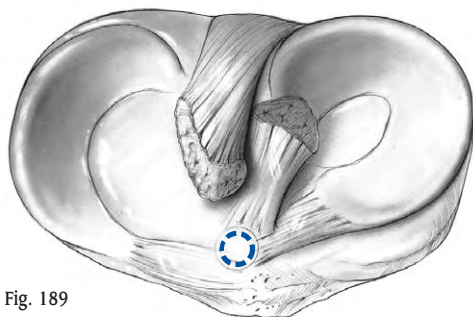


Fig. 189

For revision arthroplasty, locate it approximately 15mm from the anterior cortex. In revision, the location of the medullary canal must be determined from preoperative radiographic planning and confirmed at the time of surgery by the location of the tibial crest. The entry point for the drill should be over the midpoint of the isthmus of the tibial canal, not necessarily the midpoint of the proximal tibia. This is particularly important if an offset stem is anticipated. With the drill properly positioned, drill the hole.

Prepare the tibial canal by using progressively larger Intramedullary Reamers beginning with the 9mm diameter reamer. Ream to a depth that allows all the reamer teeth to be buried beneath the surface of the bone. Proceed up to the diameter size that contacts the cortical bone (Fig. 190).

Fig. 190



The appropriate size of the final reamer should be estimated in preoperative planning and is confirmed when cortical bone contact is made.

Note: The reamers are not end cutting but, instead, have a bullet tip lead that reduces the chance of perforating the cortex of the tibial bone. Insert the first size reamer that engages cortical bone deeper than the length of tibial stem to be used. This, in turn, will allow adequate room for the next larger diameter reamers to be inserted to the final depth without the bullet tip stopping progression of the reamer.





Be sure that the reamer remains in line with the tibial shaft based on external tibial landmarks. Retained cement and/or sclerotic bone in this area will tend to deflect passage of the reamer. If this happens, remove the cement or sclerotic bone. Leave the final Intramedullary Reamer in place, or remove the reamer and attach the Straight Stem Extension Provisional that corresponds to the last reamer size used to the Stem Provisional Adapter (Fig. 191). Insert the Stem Extension Provisional and Stem Provisional Adapter into the reamed canal.

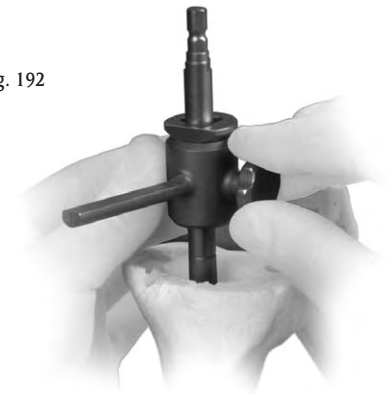
Fig. 191



Note: A shorter, possibly larger diameter stem may be desired. Preparation for this stem is accomplished after the tibia is cut by further reaming to the shorter depth with the required diameter reamers.

Attach the appropriate Tibial Boom to the reamer shaft (Fig. 192) or the Stem Extension Provisional assembly. There are two Tibial Boom options: 0° and 7° posterior slope configurations. Use the 0° Tibial Boom when an A/P Wedge Stemmed Tibial Base Plate requiring a nonsloped (0°) tibial cut is used. Use the 7° Tibial Boom on all other standard stemmed tibial base plate options within the NexGen System. Be sure to direct the boom anteriorly over the medial half of the tibial tubercle.

Fig. 192



The standard cutting slot on any of the augmented tibial cutting guides can be used for a flat cut. Slide the selected tibial cutting guide onto the Tibial Boom until it contacts the anterior tibia. Then tighten the thumb screw (Fig. 193).

Fig. 193



The rotation of the tibial cutting guide is important. Orient the cutting guide so it cuts directly from the front to the back of the tibia. Varus/valgus orientation is equally important. Check this by attaching the Extramedullary Arch to the Tibial Boom and tightening the thumb screw. Then insert the Alignment Rod through the arch (Fig. 194).

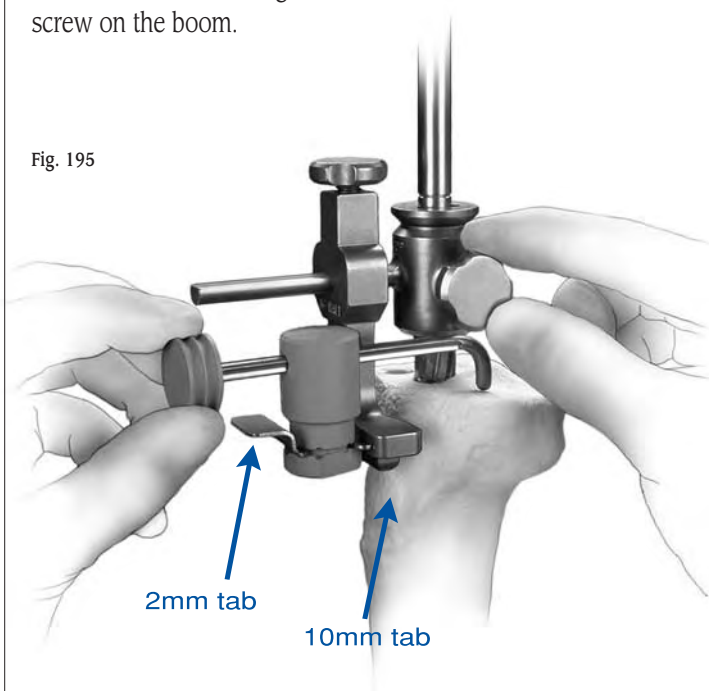
Fig. 194



Palpate the malleoli and note the midpoint. The cutting guide should be positioned so the Alignment Rod follows the anterior tibial crest and points about 7mm-10mm medial to the midpoint between the malleoli. The tibialis anterior tendon can also be used to check the varus/valgus position of the cutting guide. The distal end of the Alignment Rod should be in line with the tendon. This will help confirm that the resected surface will be 90° to the mechanical axis.

After proper rotation and varus/valgus orientation has been achieved, determine the appropriate depth of resection by taking into consideration the depth of any defects that are present. This should be a minimal resection. The purpose of this cut is to create a flat surface only. Use the Tibial Depth Resection Gauge to define where the saw cut will be made. Insert the 2mm or 10mm tab of the gauge into the cutting slot (Fig. 195) depending on which resection level has been selected. Minimal bone removal is recommended. It is not necessary to resect below all defects. Relatively small defects can be grafted and others filled with cement or augments. When the appropriate depth has been determined, tighten the thumb screw on the boom.

Fig. 195



Note: When the A/P Wedge Stemmed Tibial Base Plate has been chosen, the measurement for depth of resection should be taken as far posterior on the tibia as possible. This should be performed to help reestablish the joint line because the posterior slope is built into the implant and not cut into the bone.





Pin the tibial cutting guide to the tibia securely with two Headless Holding Pins. Use an oscillating saw with a 0.050-inch/1.27mm blade to cut through the slots (Fig. 196). Initiate the resection with the reamer or Stem Extension Provisional assembly in place. Be sure that the tibial cutting guide is securely attached to the reamer or Stem Extension Provisional assembly during the initial cutting process. This adds further stability to the cutter.

After cutting the medial and lateral plateaus, remove the Tibial Boom and reamer or provisional assembly leaving the tibial cutting guide in place, then finish the cut.

Remove the tibial cutting guide.

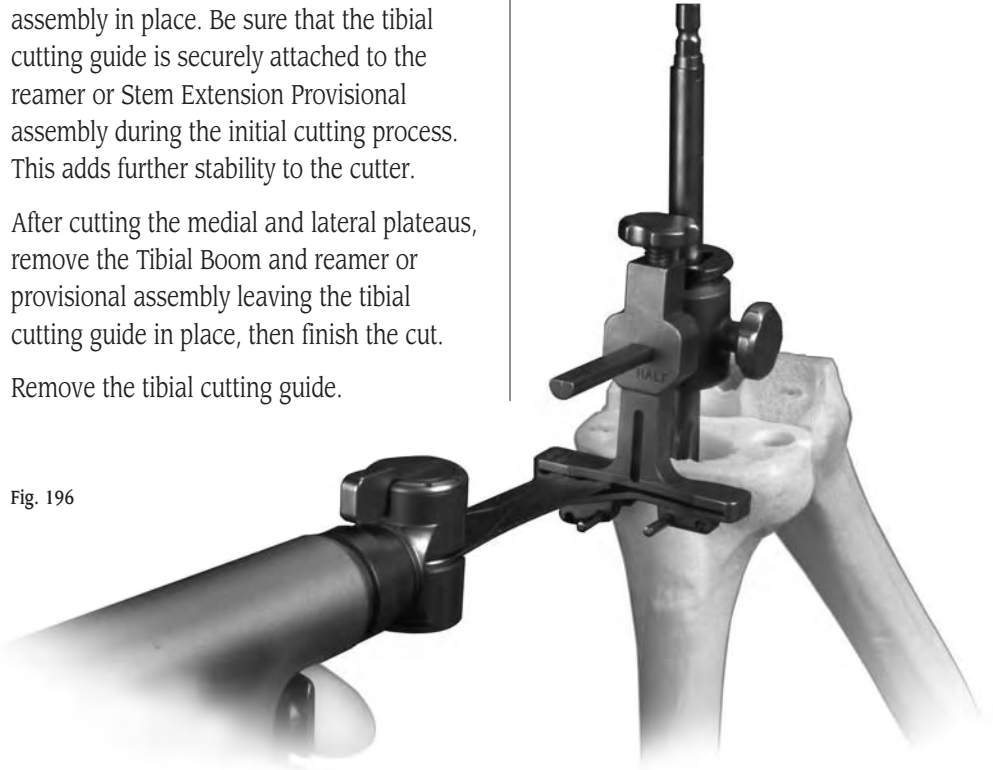


Fig. 196

STEP TWO

FINISH THE TIBIA

Select the Stemmed Tibial Sizing Plate that provides the desired tibial coverage by placing various size plates onto the resected tibial surface. Be sure to select the appropriate style sizing plate (standard, fluted, or A/P wedge) which corresponds to the boom selected in the previous step. Attach the Tibial Provisional/ Drill Guide Holding Clamp to the selected sizing plate (Fig. 197). Then use the Alignment Rod to aid in confirming varus/valgus alignment.

Fig. 197



Note: The color code designation on the Stemmed Tibial Sizing Plate should be compared to the color code designations on the anterior flange of the selected Femoral Provisional. At least one of the colors and size designation listed on the Femoral Provisional must match at least one color on the sizing plate and the articular surface to ensure that the components, will be kinematically matched.

The colors and size must match exactly. For example, Yellow A/B = Yellow A/B. The striped colors are not the same as the standard colors (Yellow A/B ≠ Striped Yellow A/B) and should not be viewed as a match. If there is no match between the Femoral Provisional and sizing plate, adjust the size of the Femoral Provisional or the sizing plate being used to yield a match.

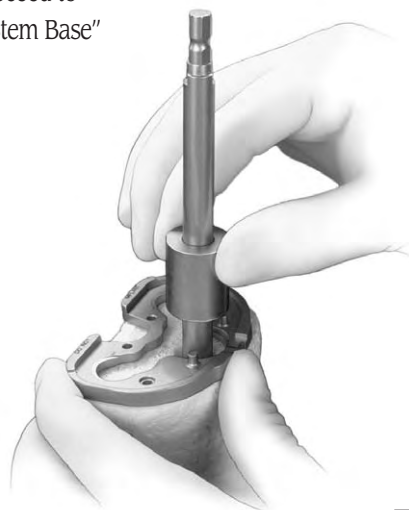
Reinsert the last Intramedullary Reamer or the Stem Extension Provisional assembly. Place the sizing plate over the reamer shaft or Stem Extension Provisional assembly and onto the prepared bone. Slide the Straight Bushing over the reamer shaft or Stem Provisional Adapter until it seats into the circular step of the sizing plate (Fig. 198). This will properly position the sizing plate relative to the tibial stem location. If the bushing will not seat in the sizing plate, check to be sure that the reamer or provisional assembly is fully inserted into the canal. Also confirm that the correct style of Tibial Sizing Plate is being used (standard, fluted, or A/P wedge).

If the Straight Bushing allows for optimal sizing plate positioning, pin the plate with two Short-head Holding Pins. Remove the bushing, and the reamer or Stem Extension Provisional assembly, leaving the sizing plate.

Note: The sizing plate must be removed prior to the reamer or Stem Extension Provisional assembly if their diameter exceeds 19mm. Mark the position of the sizing plate using the pin holes or mark with methylene blue prior to removal.

If the position of the sizing plate is not optimal, continue with the following "Offset Stem" procedure. If the position is satisfactory, and tibial augmentation is necessary, proceed to the "Tibial Augmentation" procedure. If the position is satisfactory, and tibial augmentation is not necessary, proceed to "Drilling the Stem Base" on page 115.

Fig. 198





OFFSET STEM

The NexGen Offset Stem Extension allows the stem on the tibial base plate to be positioned 4.5mm away from the center of the canal in any direction, a full 360°. This allows the position of the tibial plate to be changed relative to the stem extension and canal in order to optimize coverage of the proximal tibia. If the position of the sizing plate is not optimal, remove the Straight Bushing and slide the Offset Bushing over the reamer shaft or Stem Provisional Adapter until it seats into the circular step of the sizing plate. This will allow the plate to be shifted 4.5mm in any direction. When optimal coverage is achieved, note the position of the etched marks on the bushing relative to the etched mark on the center of the anterior portion of the sizing plate (Fig. 199). Pin the sizing plate with two Short-head Holding Pins. If a tibial augment will be used, do not pin the plate on the side that requires the augment.



Fig. 199

If tibial augmentation is not necessary, remove the bushing and the reamer or Stem Extension Provisional assembly, leaving only the sizing plate.

Note: The sizing plate must be removed prior to the reamer or Stem Extension Provisional assembly if their diameter exceeds 14mm. Mark the position of the sizing plate using the pin holes or mark with methylene blue prior to removal.

If tibial augmentation is necessary, continue with the “Tibial Augmentation” procedure. If tibial augmentation is not necessary, proceed to “Drilling the Stem Base” on page 115.

TIBIAL AUGMENTATION

If tibial augmentation is necessary, slide the appropriate Tibial Offset Boom (0° or 7°) over the reamer shaft or Stem Provisional Adapter, and the Straight or Offset Bushing (Fig. 200). The two holes on the bottom of the boom will fit over the two pegs on the top of the sizing plate. Tighten the thumb screw on the boom. Attach the appropriate tibial cutting guide, sliding it along the boom until it contacts bone. Then tighten the thumb screw.



Fig. 200

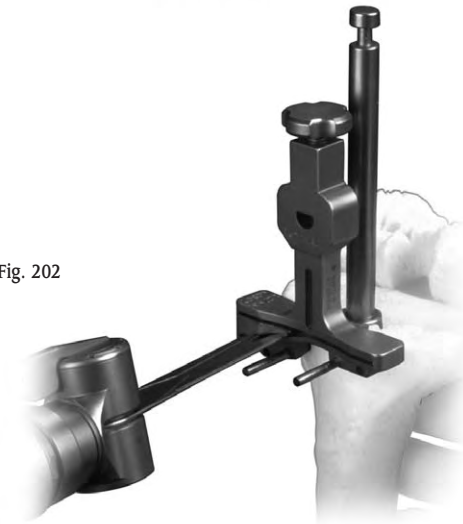
Pin the tibial cutting guide to the bone with Headless Holding Pins (Fig. 201). Then use an oscillating saw to begin the augmentation cut. Remove the cutting guide, boom, bushing, sizing plate, and reamer or Stem Extension Provisional assembly.

Reinsert the cutting guide over the Headless Holding Pins. If desired, insert Hex-head Holding Pins to increase the stability of the cutting guide. Then finish the cut (Fig. 202).

Fig. 201



Fig. 202



Remove the tibial cutting guide and holding pins from the bone and attach the appropriate provisional augments to the sizing plate. Pin the sizing plate to the bone with two Short-head Holding Pins. Ensure that the sizing plate remains in the proper position when pinning. Note that one of these pins can be inserted through the provisional augment.

DRILLING THE STEM BASE

Place the appropriate tibial drill guide (porous, cemented, or fluted) onto the sizing plate (Fig. 204) and drill for the tibial stem base with the corresponding stem drill. Drill until the engraved line on the drill is in line with the top of the drill guide (Fig. 205).

Fig. 203



Fig. 204



Note: NexGen Knee components are indicated for use with bone cement in the United States.



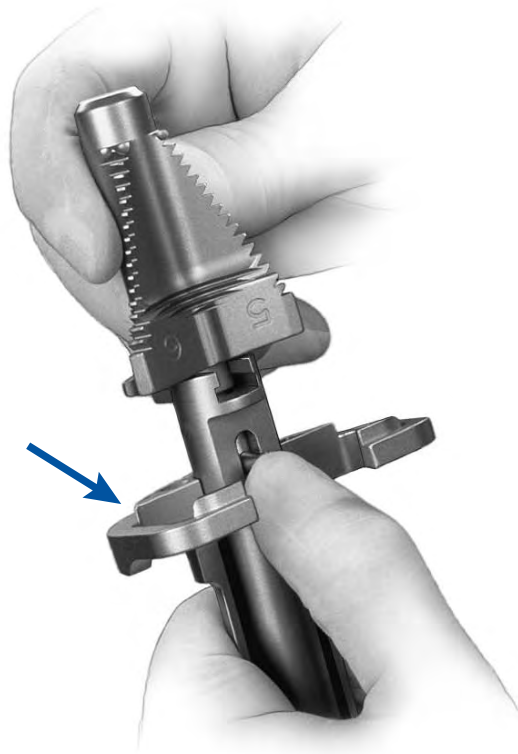
CRUCIATE RETAINING AUGMENTABLE



Attach the proper size and style Tibial Broach to the Broach Impactor. The broach can be attached only from the front (Fig. 205).

Note: Guide arrows are etched on the broach and impactor for additional guidance.

Fig. 205



Seat the impactor over the location pegs on the sizing plate, and impact the broach to the depth indicated by the etched groove on the shaft aligning with the impactor handle (Fig. 206). The broach has a built-in stop so it cannot be overimpacted.

Fig. 206



Remove the Broach Impactor assembly and sizing plate.

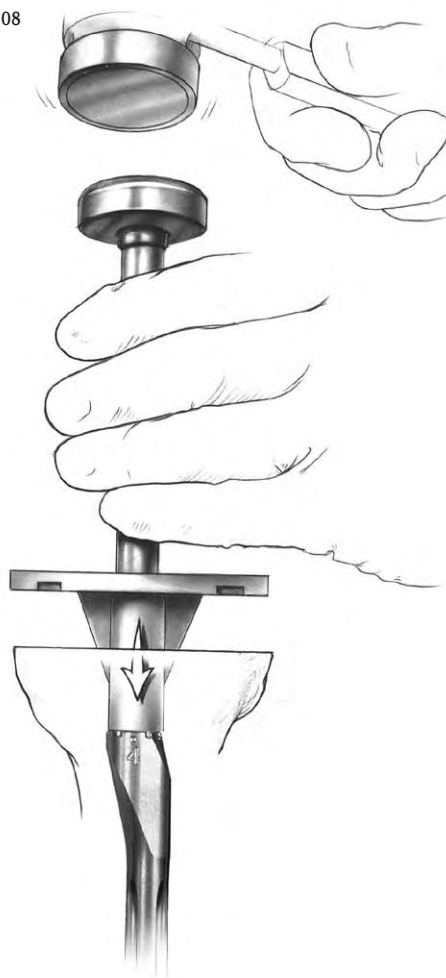
Assemble the appropriate Stemmed Tibial Provisional, Stem Extension Provisional, and Tibial Augment Provisional for which the bone has been prepared. For a straight stem, use the Hex-head Screwdriver to fully tighten the Stem Extension Provisional. For an offset stem, line up the appropriate mark on the Offset Stem Extension Provisional with the etch mark on the Stemmed Tibial Provisional (Fig. 207). This mark should correspond to the mark noted earlier on the Offset Bushing (See Fig. 199, page 114). Attach the Stem Extension Provisional, but do not fully tighten the screw if an offset stem will be used.

Fig. 207



Insert the final trial prosthesis assembly into the tibia. For the offset stem, allow the Offset Stem Extension Provisional to rotate to attain an optimal position. Be sure that the provisional plate is properly positioned rotationally. Component malrotation on the cut surface of the bone can cause a misfit. Impact the Stemmed Tibial Provisional with the Tibial Provisional Impactor (Fig. 208). Check to see that the trial prosthesis fits the cut surfaces with appropriate apposition to bone. If any undesired gaps are present, remove the trial component and adjust the bone cuts until a good intimate fit is obtained. Fully tighten the hex screw on the Offset Stem Extension Provisional.

Fig. 208





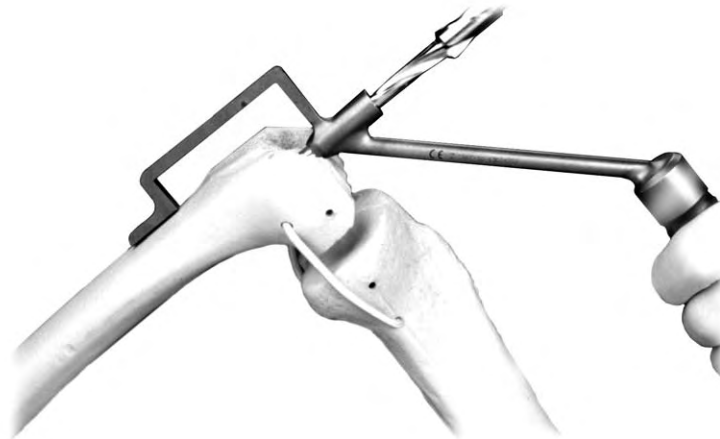
STEP THREE

PREPARE THE FEMORAL CANAL

The optional IM Hole Locator may be used to find an appropriate entry point for the femoral canal. Place the outrigger of the IM Hole Locator on the anterior cortex of the distal femur. The outrigger should lie flat on the cortex and parallel to the anatomic axis of the femur. Position the drill guide portion of the hole locator in the center of the patellar sulcus.

This hole location is a starting location for reaming; it is an approximate location for the stem relative to the anterior cortex. With the guide in this position, use the 8mm drill to make a hole in the medullary canal of the femur (Fig. 209). When drilling this hole, be sure to be parallel to the shaft of the femur in both the A/P and lateral projections. After the initial hole is made, remove the IM Hole Locator and use the step drill to enlarge the entrance hole.

Fig. 209



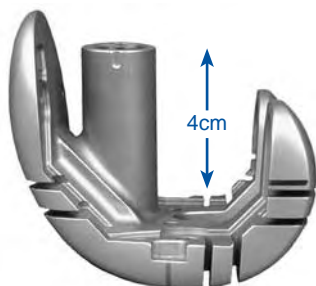
Beginning with the 9mm Intramedullary Reamer, progressively ream the femoral canal (Fig. 210).

Fig. 210



Care should be taken so that the reamer is passed in line with the center of the femoral shaft both in the A/P and M/L planes. Avoid eccentric reaming of the femoral shaft. The appropriate diameter of the final reamer should be estimated in preoperative planning, and is confirmed when cortical bone contact is made. Note the diameter of the last reamer used. To accommodate the stem base of the CRA Femoral Component, the surgeon must ream 18mm in diameter to the depth of the stem base, which is 4cm in length (Fig. 211).

Fig. 211

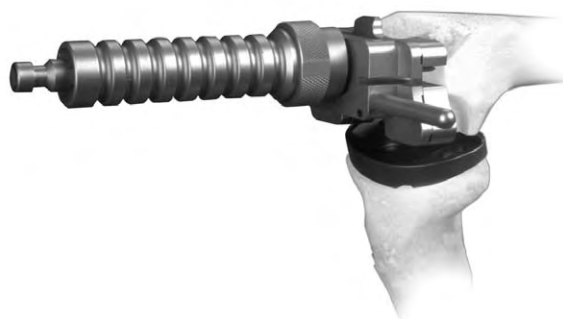


If cortical bone contact is made before an 18mm-diameter reamer is used, continue reaming to 18mm to accommodate the CRA Femoral Provisional/Cutting Guide stem base. Alternatively, the 18mm Femoral Stem Drill can be used to complete the canal preparation necessary to accommodate the stem base.

*Note: If desired, the femoral stem base instruments can be used to drill for the stem base (See **STEP FIVE**—"Establish Femoral Rotation and Position" on page 124).*

To ensure a 6° valgus angle, attach the Standard Revision Cut Block to the Revision IM Guide. Then attach a Straight Stem Extension Provisional, which corresponds to the last diameter reamer used, to the guide. Be sure that the Revision IM Guide is set for "Left" or "Right" depending on the side of the surgery. Insert the Revision IM Guide into the femoral canal (Fig. 212).

Fig. 212



If the Revision IM Guide sits flush on the cut distal femur, 6° of valgus alignment exists between the orientation of the medullary canal and the distal cut. Proceed to **STEP FOUR**—"Evaluate Femoral Size" on page 122. If not, recutting the distal femur is necessary.





Resecting the Distal Femur

Attach the Standard Revision Cut Block to the Revision IM Guide. Set the revision IM Guide to either "R" or "L". Then attach the Straight Stem Extension Provisional to the guide. Insert the Stem Extension Provisional and IM guide into the femoral canal. Impact the guide onto the distal femur (Fig. 213).

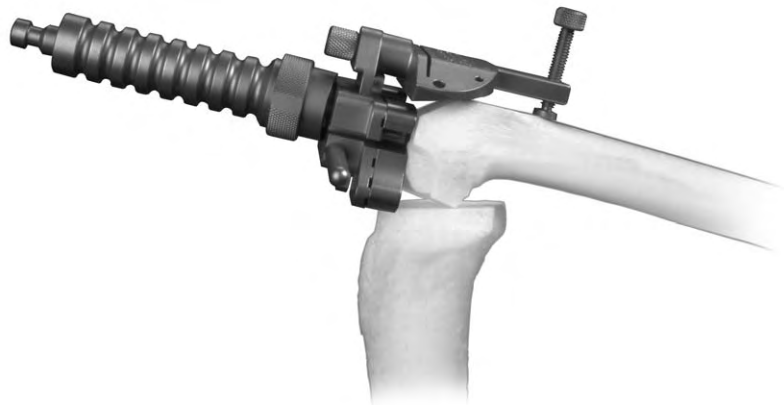
Note: After impaction check to ensure that the guide has remained on the correct "Right" or "Left" designation. Because the stem location of the CRA Femoral Component is oriented in 6° of valgus, the IM guide is designed to yield a 6° valgus cut.

Attach the Distal Femoral Cutting Guide to the Distal Placement Guide. Turn the thumb screw on the cutting guide all the way to the left. Attach the cutting guide/placement guide assembly onto the Revision IM Guide. Turn the thumb screw until it contacts the anterior femur (Fig. 214). This will help stabilize the cutting guide. Once it has contacted bone, do not turn the screw further. Secure the Distal Femoral Cutting Guide by inserting two Headless Holding Pins through the holes marked "0" on the top of the guide. Use the Femoral Extractor to remove the Revision IM Guide and the Stem Extension Provisional.

Fig. 213



Fig. 214



Use a 0.050-inch/1.27mm oscillating saw blade to make a minimal resection of the distal femur through the slot on the cutting guide (Fig. 215). 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 Revision IM Guide and the selected cut block. Remove the Distal Femoral Cutting Guide. Then proceed to **STEP FOUR**—“Evaluate Femoral Size”.



Fig. 215





STEP FOUR

EVALUATE FEMORAL SIZE

There are several ways to estimate the appropriate femoral size. The following techniques should be used in conjunction with templating as discussed in “Preoperative Planning,” to determine an approximate femoral size. The final size will ultimately be selected during **STEP SIX**–“Establish Flexion Gap and Stability” on page 129.

Femoral Sizing Templates

Reinsert the final Intramedullary Reamer, or attach the Stem Extension Provisional that corresponds to the last reamer size used to the Stem Provisional Adapter. Insert the Stem Extension Provisional assembly or reamer into the femoral canal. Center the etched line of the various sizes of Femoral Sizing Templates on the shaft of the reamer or adapter until the appropriate size is found (Fig. 216).

Fig. 216



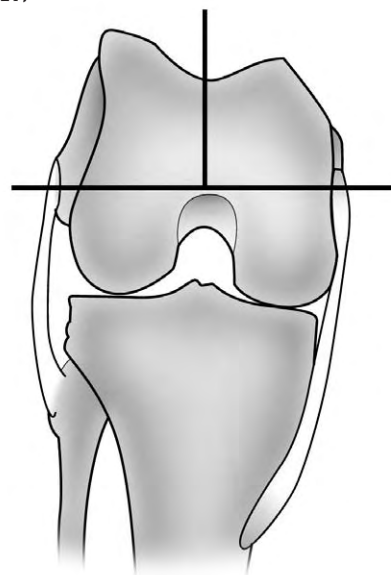
Previous Prosthesis

Measure the size of the revised previous prosthesis with the Femoral Sizing Templates.

Epicondylar Width

The epicondylar width of the femur also aids in selecting the appropriate femoral size. Measure the width of the epicondyles (Fig. 217) and use the following chart to assist in defining the appropriate size.

Fig. 217



NexGen FEMORAL COMPONENT SIZE RELATED TO THE TRANSEPICONDYLAR WIDTH

Transepicondylar Width (mm)	Female Size	Male Size
75	C	-
80	D	C
85	E	D
90	F	E
95	G	F
100	H*	G
105	-	H*

*CRA not available in Size H.

CRUCIATE RETAINING AUGMENTABLE

The femoral component must be chosen to stabilize the arthroplasty with the knee in flexion, without regard to the available distal femoral bone. Selecting the femoral component to fit the existing bone may undersize the femoral component and can create a large flexion gap which may be unequal to the extension gap or, if balanced, may lead to undesirable proximal displacement of the joint line.

Note: After estimating the femoral size, one can assemble that size of CRA Femoral Provisional/Cutting Guide with the Stem Extension Provisional that corresponds with the depth of reaming and the diameter of the last reamer used. Seat the femoral assembly on the existing bone. If the components will not seat, use a rongeur to carefully remove any anterior or posterior bone that is preventing insertion. Take care not to overresect at this point.





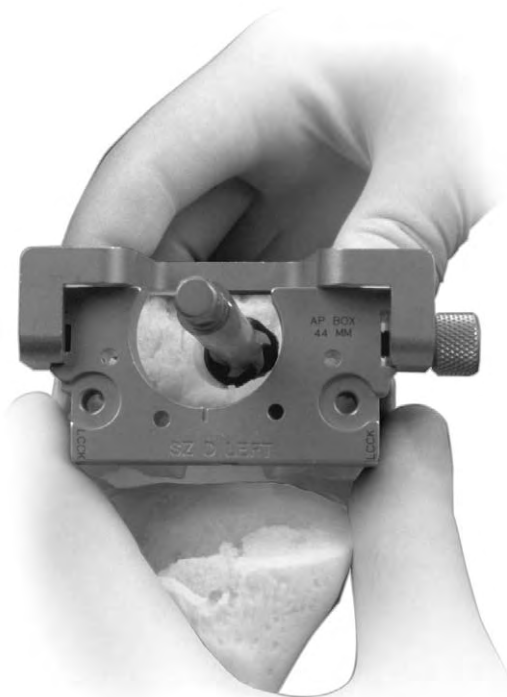
STEP FIVE

ESTABLISH FEMORAL ROTATION AND POSITION

Establish Femoral Rotation

Attach the Femoral Base Guide Flange to the Femoral Stem Base/Cutting Block that corresponds to the femoral component size chosen. Be sure that the proper “Right” or “Left” indication is facing toward you on the cutting block. Tighten the thumb screw to secure the flange to the cutting block. Slide the block and flange over the reamer or Stem Provisional Adapter. The cutting block should be flush against the distal femur and the flange should rest on the anterior femoral cortex (Fig. 218).

Fig. 218



Slide the 9mm-10mm Femoral Guide Bushing over the reamer shaft or Stem Provisional Adapter until it seats into the circular step of the Femoral Stem Base/Cutting Block (Fig. 219).

Fig. 219



A collar inside the cutting block serves as a stop to indicate when the bushing is fully seated. The straight bushings are keyed so they can only fit into the guide one way.

CRUCIATE RETAINING AUGMENTABLE

Attach the Revision Rotational Alignment Guide to the posterior edge of the Femoral Stem Base/Cutting Block by inserting the pegs on the alignment guide into the holes on the face of the cutting block. To achieve the proper external rotation of the Femoral Stem Base/Cutting Block, and the prosthesis, the handles of the alignment guide should be in line with the epicondylar axis (Fig. 220). If the Femoral Base Guide Flange prevents the appropriate rotational adjustment, remove the flange. Then align the handles with the transepicondylar axis (Fig. 221).



Fig. 220

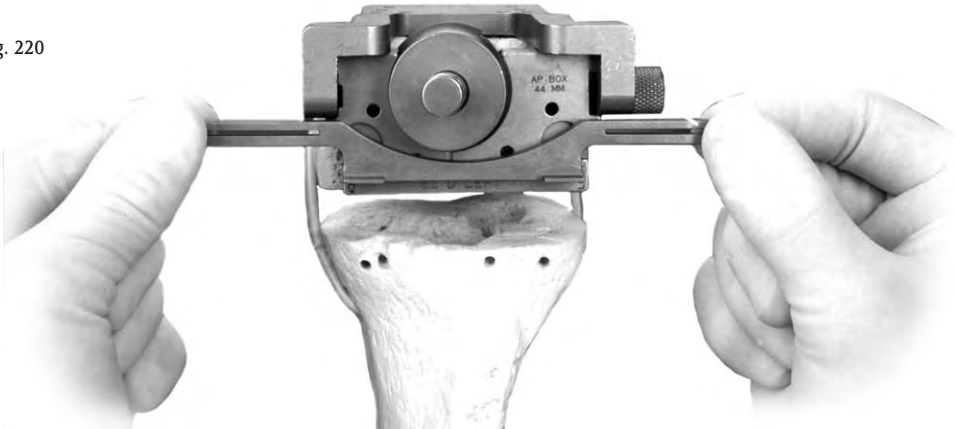
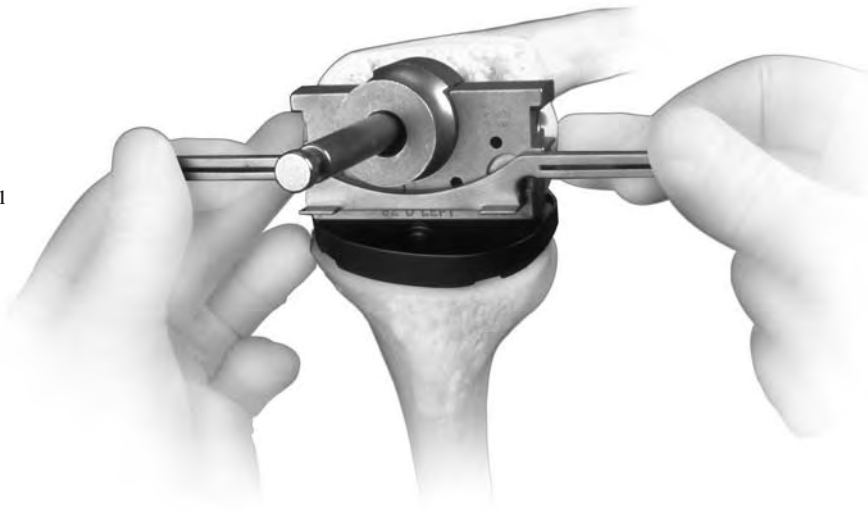


Fig. 221



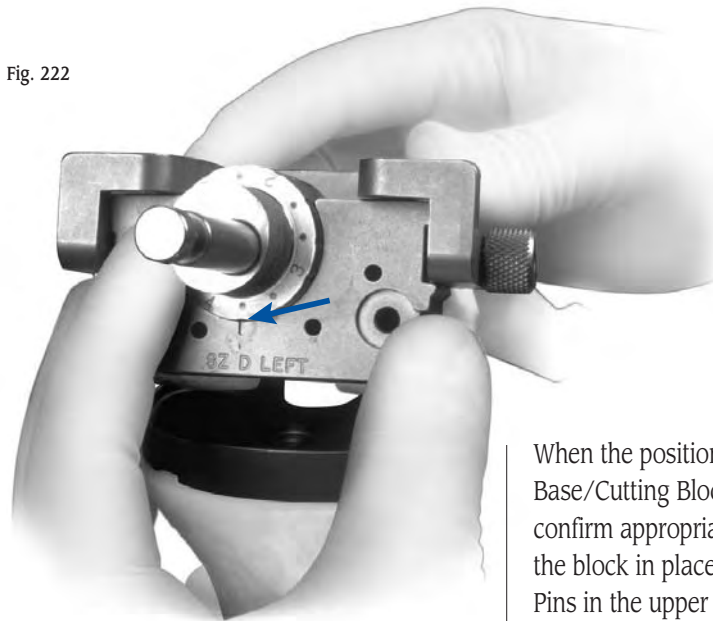


Determine Component Placement

It is important to optimize the A/P and M/L position of the Femoral Stem Base/Cutting Block on the distal femur. If it appears that the prosthesis will not be properly positioned on the distal femur, an offset stem should be used. To prepare for the offset stem, use the Femoral Offset Bushing in place of the 9mm-10mm Femoral Guide Bushing. Insert the Femoral Offset Bushing with the numbers facing out. This bushing does not have a step that locks it into a keyed rotational orientation on the Femoral Stem Base/Cutting Block. Rotate the bushing within the block until an optimal position is determined.

The Femoral Offset Bushing allows the guide and, therefore, the prosthesis, to be shifted 4.5mm from the center of the canal in any direction. If the Femoral Base Guide Flange prevents appropriate placement, remove the flange. The necessity for anterior bone resection will result, but be careful not to notch the anterior cortex. Note the orientation of the Femoral Offset Bushing by observing the numbers and marks on the bushing relative to the etched line on the posterior face of the Femoral Stem Base/Cutting Block (Fig. 222). This reference will be needed later in the procedure.

Fig. 222



When the position of the Femoral Stem Base/Cutting Block has been established, confirm appropriate external rotation and pin the block in place with two Headless Holding Pins in the upper two holes. Remove the 9mm-10mm Femoral Guide Bushing or Femoral Offset Bushing. Remove the Intramedullary Reamer or, the Stem Extension Provisional assembly with the Femoral Extractor. Attach the extractor at the slot indicated for the Femoral Finishing Guide.

CRUCIATE RETAINING AUGMENTABLE

Insert the 16mm-18mm Femoral Guide Bushing into the cutting block.

Attach the Femoral Stem Drill to a drill/reamer and drill through the bushing. Drill to the second engraved line for a *NexGen* Femoral Component. The depth is indicated on the drill bit (Fig. 223).

Remove the Femoral Base Guide Flange by loosening the thumb screw if it has not already been removed.

Fig. 223



Anterior and posterior clean-up cuts may be necessary due to optimal femoral guide rotation and placement from previous steps. For the posterior cut, the Posterior Saw Guide Attachment can be assembled to the hole on the posterior edge of the cutting block. The instrument is marked to indicate the side that must face the bone. Be sure the thumb screw is fully tightened. Use an oscillating saw to cut the anterior and posterior condyles (Figs. 224, 225, or 226).

Remove the Femoral Stem Base/Cutting Block leaving the headless pins in place.

Fig. 224



Fig. 225



Fig. 226





When using a straight stem, insert the appropriate size Straight Stem Extension Provisional into the appropriate size CRA Femoral Provisional/Cutting Guide.

When using an offset stem, fully thread the Offset Stem Locknut onto the appropriate size Offset Stem Extension Provisional. Then back thread the locknut until it engages only the first thread. Thread the offset provisional onto the appropriate size Femoral Provisional/Cutting Guide (Fig. 227). Rotate the Offset Stem Extension Provisional to the position noted earlier on the Offset Bushing (See Fig. 223, page 127). The posterior mark on the stem base of the femoral provisional must be lined up with the appropriate mark on the Offset Stem Extension Provisional. Use the Offset Stem Wrench to tighten the locknut against the cutting guide stem.

Fig. 227



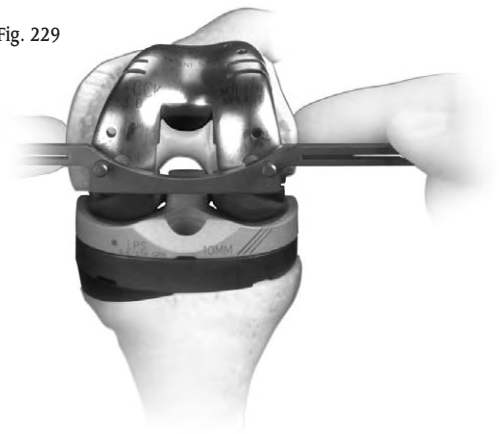
With the knee in flexion, insert the provisional/cutting guide assembly onto the distal femur. The cutting guide will fit over the headless pins (Fig. 229). Seat the femoral assembly on the existing bone. If the components will not seat, use a rongeur to carefully remove any anterior or posterior bone that is preventing insertion. Be careful not to overresect at this point.

Fig. 228



Insert the tabs of the Revision Rotational Alignment Guide into the posterior augment resection slots of the Femoral Provisional (Fig. 229). The handles of the alignment guide should line up with the epicondylar axis. The guide may also be used to reference the tibial plateau to confirm a symmetrical gap in flexion.

Fig. 229



If additional adjustments to the amount of external rotation are necessary, return to the beginning of this section.

STEP SIX

ESTABLISH FLEXION GAP AND STABILITY

Determine the ability of the selected CRA Femoral Provisional/Cutting Guide to fill the flexion gap and create stability in flexion.

Make an early assessment of the need for posterior augmentation through the posterior augment cutting slots in the cutting guide. If a gap larger than 10mm exists, consider choosing the next smaller femoral component.

Note: The Posterior Augment Provisionals may be inserted into the Femoral Provisional to provide added stability in flexion.

Begin by inserting the thinnest Articular Surface Provisional (either Regular Constraint or Anterior Constrained options) of the color indicated on the tibial plate and CRA Femoral Provisionals. Evaluate the stability in flexion (Fig. 230).

If the thinnest articular surface cannot be inserted, one of two solutions should be explored. First, the Femoral Provisional can be downsized. Each femoral component size is 4mm different in the A/P dimension. The selection of the next smallest component will result in an additional 4mm in flexion space. If this does not allow the thinnest Articular Surface Provisional to be inserted, then the tibial plateau will have to be lowered. Use the 2mm Tibial Recutter to obtain an additional 2mm in both flexion and extension spaces. If the tibia has additional bone resected then it will be necessary to follow this by repeating **STEP TWO**—“Finish the Tibia” on page 113.

Insert progressively thicker Articular Surface Provisionals until adequate stability is obtained. If the knee is still loose in flexion after trialing the thickest articular surface, consider one of the following options: Augment the tibial component, adding 5mm or 10mm blocks to the medial and lateral sides, or select the next larger femoral component. There may be minor asymmetry between the medial and lateral sides. This asymmetry will be addressed in **STEP SEVEN**—“Establish Extension Gap and Stability”.



Fig. 230



STEP SEVEN

ESTABLISH EXTENSION GAP AND STABILITY

After achieving appropriate stability in flexion, leave the final Articular Surface Provisional in place and bring the knee to full extension. Assess the overall limb alignment. Bring the CRA Femoral Provisional/Cutting Guide out to meet the tibial Articular Surface Provisional and create stability in extension.

Note: The Distal and Posterior Augment Provisionals may be used as spacers to create added stability in extension and flexion (Fig. 231).

Fig. 231



Joint Line

Assess the joint line. The true joint line in the average knee, in full extension, can be approximated by referencing several landmarks. These landmarks include: one finger breadth distal to the inferior pole of the patella; one finger breadth above the fibular head; 12mm -16mm distal to the femoral PCL attachment; and 30mm distal to the epicondyles.

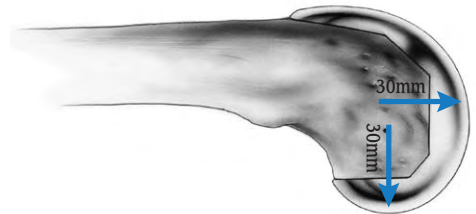
If desired, use the Patella Joint Line Gauge to assess the position of the patella. With the tabs of the gauge positioned in the two slots on the anterior flange of the CRA Femoral Provisional/Cutting Guide, the inferior pole of the Patellar Provisional or unresurfaced patella should fall between the two “Normal” marks on the gauge (Fig. 232).

Fig. 232



The epicondyles also provide a starting point for distal positioning of the femoral component. The distal joint line averages 30mm from the epicondyles (Fig. 233). This is very similar to the average distance to the posterior joint line and this distance may be used to check femoral component size.

Fig. 233



Avoid hyperextension. If hyperextension exists, move the femoral trial more distally. Evaluate the resultant space between the femoral component and distal femur. If the gap exceeds the maximum augment available, 10mm, then evaluate the next smaller femoral component size. This will allow the use of a thicker articular surface and will necessitate a return to **STEP SIX**–“Establish Flexion Gap and Stability, to reassess the flexion gap”.

If full extension is not possible, either move the femoral trial more proximally or use a thinner tibial Articular Surface Provisional. Another option is to perform a posterior capsule release. If a thinner tibial articular surface is used, it may be necessary to use the next larger femoral size and return to **STEP SIX**–“Establish Flexion Gap and Stability”.

Balance Soft Tissues

While the knee is in extension, perform necessary ligament releases to achieve symmetric and adequate tension. In rare cases, ligament advances may be appropriate. Ligament releases should be performed in a manner which is conceptually similar to that in primary arthroplasty. Selectively release the ligaments on the concave or contracted side of the knee until symmetric ligament balance or tension is observed on the medial and lateral sides of the knee with the limb in neutral mechanical alignment. In revision surgery, however, the specific ligamentous structures which may be identified in the primary total knee are likely to be scarred fibrous tissue sleeves that are more difficult to identify and/or release. In general, they are more amenable to treatment as medial or lateral sleeves of undifferentiated ligamentous tissue.

If the knee is well balanced in extension but has significant imbalance in flexion, there may be a rotational problem with the femoral component. Internal or excessive external rotation of this component may cause substantial lateral or medial laxity in flexion. If so, evaluate the rotational alignment of the femoral component by returning to **STEP FIVE**–“Establish Femoral Rotation and Position” on page 124.

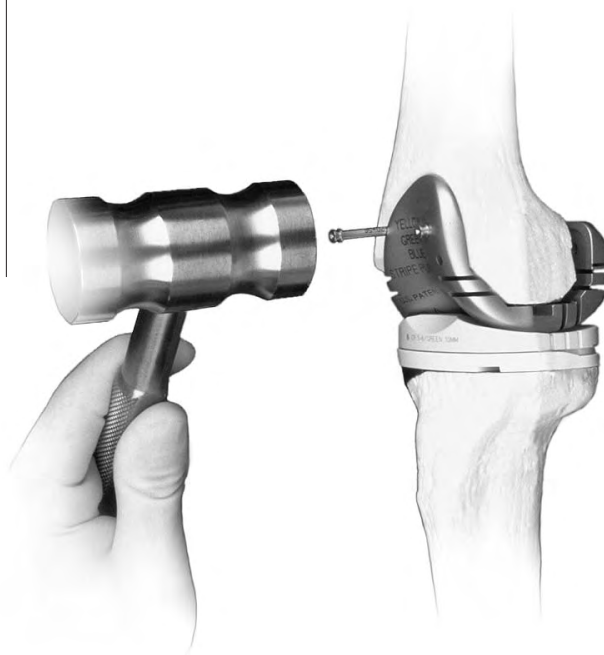
If the femoral component rotation is appropriate, the joint line has been reestablished, and the Articular Surface Provisional height is appropriate, the knee should be stable in both flexion and extension. If it is not stable, there is a mismatch between the extension and flexion gaps. Understanding how the size and position of the components affect the flexion and extension gaps is essential to problem solving in total knee arthroplasty.

When the extension gap has been balanced with the previously determined flexion gap, and the limb alignment and joint line have been judged to be accurate, pin the CRA Femoral Provisional/Cutting Guide anteriorly using the Short-head Holding Pins (Fig. 234).

Perform a trial range of motion and confirm that the soft tissue tension, balance, and joint line are appropriate.



Fig. 234





STEP EIGHT

MAKE FEMORAL AUGMENT CUTS

Insert the Posterior Femoral Retractor to protect the posterior capsule, and tibial bone or provisional. Make any necessary posterior or distal augment cuts through the cutting slots in the CRA Femoral Provisional/Cutting Guide (Figs. 235 & 236). Use a 0.050-inch/1.27mm thick reciprocating saw blade. A 0.050-inch/1.27mm thick oscillating blade may also be used. Begin the cuts with the cutting guide in place, then remove the guide, the Short-head Holding Pins, and the Headless Holding Pins to complete the cuts. Once the augment cuts have been made, remove the retractor.

Note: It may be necessary to remove the CRA Femoral Provisional/Cutting Guide to complete any distal augment cuts. When removing the Femoral Augment Provisionals from any instrument, use the ball-nose screwdriver to push the peg of the augment from the opposite side.

Fig. 235



Fig. 236

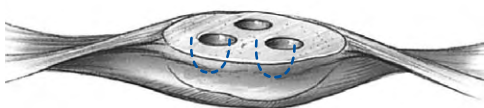


STEP NINE

PREPARE THE PATELLA

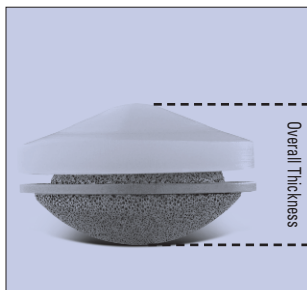
It is not always necessary to revise the patellar component. A well-fixed component from the same system should be left. A reasonably compatible, well-fixed, all-polyethylene component should also be left. If the component is loose or found to be incompatible, determine if there is enough bone remaining to implant a new patellar component. Sufficient bone must remain to ensure that the pegs from the new prosthesis do not protrude through the anterior surface (Fig. 237).

Fig. 237



The NexGen All-Polyethylene Patellar Component requires a minimum of 11mm of remaining bone to allow for the implant pegs. If inadequate bone remains, trim the surface and either leave the residual bone or consider use of a patellar component that has been designed to compensate for defects in the patella (Fig. 238).

Fig. 238

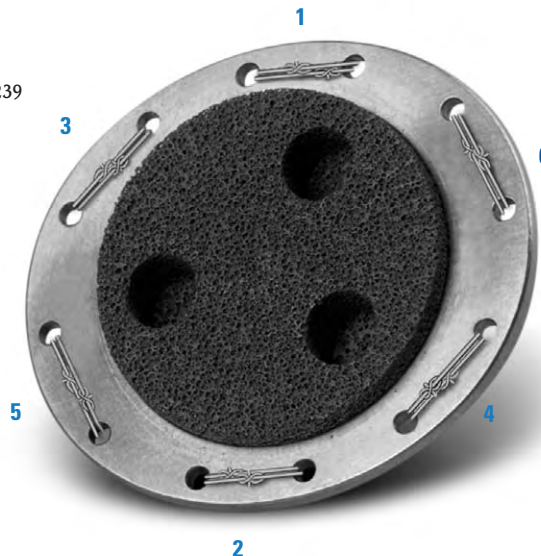


The NexGen Augmentation Patella provides the additional option of suturing the patella base to the extensor tendon to provide adjunctive fixation (Fig. 239) (See NexGen Augmentation Patella Surgical Technique on page 95).

If the decision is made to replace the primary patellar component with a NexGen Patellar Component, prepare the patellar peg holes by centering the appropriate Patellar Drill Guide over the patella. It may be necessary to rotate the guide to avoid the peg holes from the previous patellar component. Holding the guide firmly in place, drill the three peg holes using the Patellar/Femoral Drill Bit.



Fig. 239





STEP TEN

PERFORM TRIAL REDUCTION

Attach the appropriate Posterior Augment Provisionals, then the Distal Augment Provisionals to the CRA Femoral Provisional/ Cutting Guide (Fig. 240). The augment provisionals simply snap into place. If necessary utilize any appropriate anterior augment.

Fig. 240



Assemble the Stem Extension Provisional to the CRA Femoral Provisional/ Cutting Guide. (Fig. 241).

Fig. 241



Insert the femoral provisional assembly onto the bone to check for proper fit.

Insert the correct size and style of Stemmed Tibial Provisional with the selected Tibial Augment Provisional and Stem Extension

Provisional. Attach the proper height and style of Articular Surface Provisional onto the tibial provisional.

Remember that at least one color designation on the tibial provisional must match one of the color designations listed on the femoral provisional, and this color and femoral size should be the same color and size of the articular surface family being used. If a three-of-a-kind color match is not obtainable, the incorrect tibial size has been selected and another tray size and articular surface family should be selected.

Check the range of motion and ligament stability (Figs. 242 & 243).

Fig. 242



Fig. 243



CRUCIATE RETAINING AUGMENTABLE

Note: During the trial reduction, observe the relative position of the CRA Femoral Provisional/Cutting Guide on the 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 CRA Femoral Provisional/Cutting Guide should sit near the anterior or center lines on the 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.

Perform any necessary soft tissue releases. Then, remove all provisionals.





STEP ELEVEN

COMPONENT IMPLANTATION

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

FEMORAL COMPONENT PREPARATION

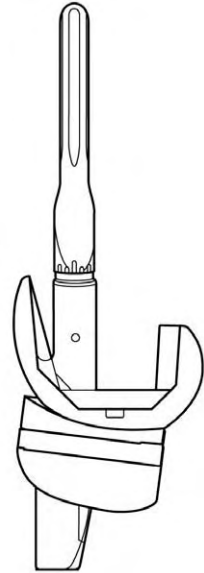
Stem Extension

The locking mechanism between the femoral implant and the stem extension implant is a combination of a Morse-type taper and two set screws. Remove the stem extension locking screw from the stem extension and discard. The stem extension screw is not used with the femoral component.

Check to ensure that the set screws have not migrated into the femoral stem base taper prior to inserting the stem extension. Insert the stem extension into the base of the femoral component. When using the Offset Stem Extension, use the stem location referenced earlier and line up that stem location number with the etched line on the posterior stem base housing (Fig. 244). The stem extension should be “snug” in the femoral component base. If toggle exists, back out one or both of the set screws one half turn. When a “snug” fit is achieved, wrap the femoral component in a cloth and place it on a surgical cart. While protecting the stem extension, strike it solidly one time with a two-pound mallet.

Note: Hitting the stem more than once may loosen the taper connection.

Fig. 244



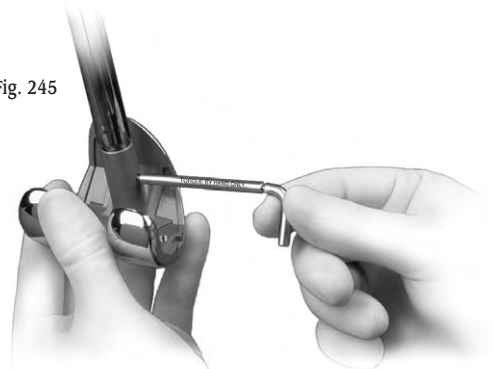
After seating the Morse-type taper, tighten the two set screws located in the base of the femoral component. Use the Femoral Set Screw Hex Driver and apply moderate torque to tighten each of the two set screws (Fig. 245).

Note: The Femoral Set Screw Hex Driver is designed to limit the amount of torque which can be applied to the set screws.

Torque by hand only.

It is recommended that a stem extension always be used with a CRA Femoral Component. If, in the surgeon's opinion, a stem is not needed, then the set screws should be removed before implanting the femoral component.

Fig. 245



AUGMENTS

The locking mechanism between the femoral implant and the femoral augment implant is a single fixation screw (except the anterior augment which is cemented only). The fixation screw is packaged with the augment.

A special ball-nose style Femoral Augment Screwdriver was designed to attach the posterior lateral augment because the anterior flange prevents straight alignment of the screwdriver. The same screwdriver can be used on all the other femoral augments as well, although the standard Hex-head Screwdriver may be preferred for attaching the distal femoral augments.

Augments may also be cemented in place and are precoated for enhanced cement fixation. If augments are to be cemented, apply cement between the augment and femoral component, around the sides of each augment, and to the rails of the femoral component. Use the Femoral Augment Holding Clamp Head with the Augment Assembly Clamp to achieve intimate contact between the augment and the femoral component until the cement is cured.

When using multiple augments, the order in which they are positioned is important. The distal femoral augments must be positioned first, followed by the posterior femoral augments, and then the anterior femoral augment.

Note: Posterior-only and distal-only augments are not to be used in combination with other distal or posterior augments.

TIBIAL COMPONENT PREPARATION

Tibial augments are designed to be secured to the tibial plate with screws or bone cement. Screws provide automatic alignment on the tibial tray and immediate attachment of the augment. As with the stem extensions, the augment screws are packaged with the augment. If cement is used to attach the augment, use the Augment Assembly Clamp to stabilize the augment while the cement is curing. All augments are PMMA precoated to enhance fixation to the bone cement.

There are two techniques for inserting the tibial articular surface onto the tibial plate. The recommended method is to assemble and tighten the articular surface, tibial plate, and stem extension on the back table. The alternative method is to insert the articular surface intraoperatively, after the tibial plate has been cemented.





ARTICULAR SURFACE INSERTION

The Articular Surface Insertion Instrument applies both downward and posterior forces to help seat the articular surface onto the tibial tray. Push the lever on the inserter fully to either side. Engage the hook on the insertion tool with the mating slot in the front of the plate and close the lever with your index finger. This should lock the insertion tool to the tray (Fig. 246).

Place the articular surface onto the implant tray, engaging the dovetails. Steady the surface on the tray with one hand by applying downward pressure near the posterior cruciate cutout. Squeeze the handles of the insertion tool to seat the articular surface (Fig. 247). Open the lever and remove the insertion tool. **Insert an articular surface only once. Never reinsert the same articular surface onto a tibial tray. Insertion and removal of an articular surface will deform the polyethylene.**

Fig. 246

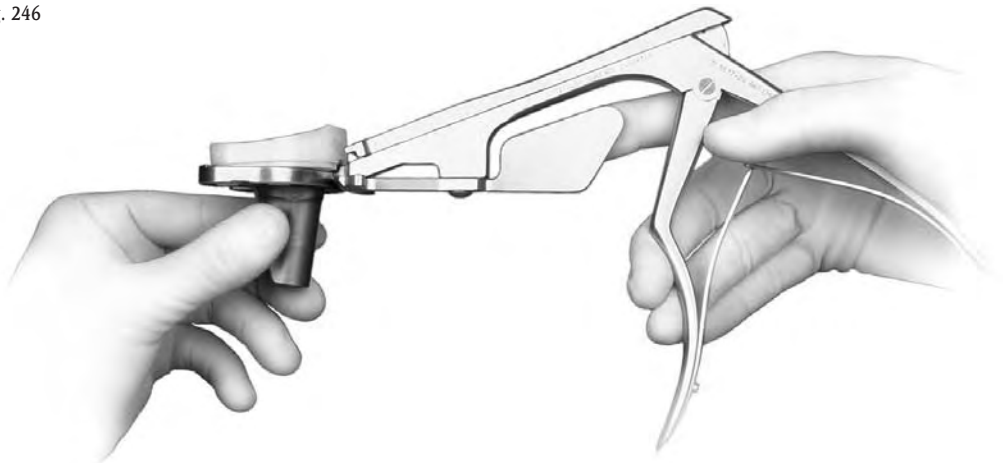
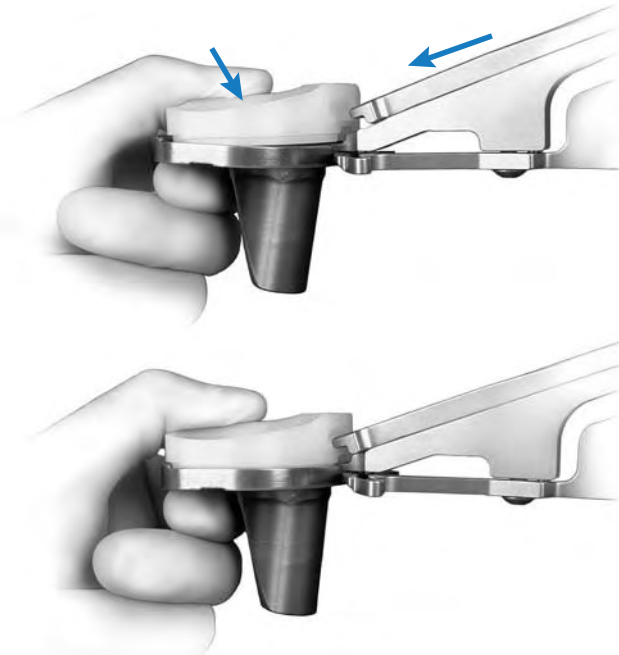


Fig. 247



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

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