

NexGen® LPS Fixed Bearing Knee

Surgical Technique

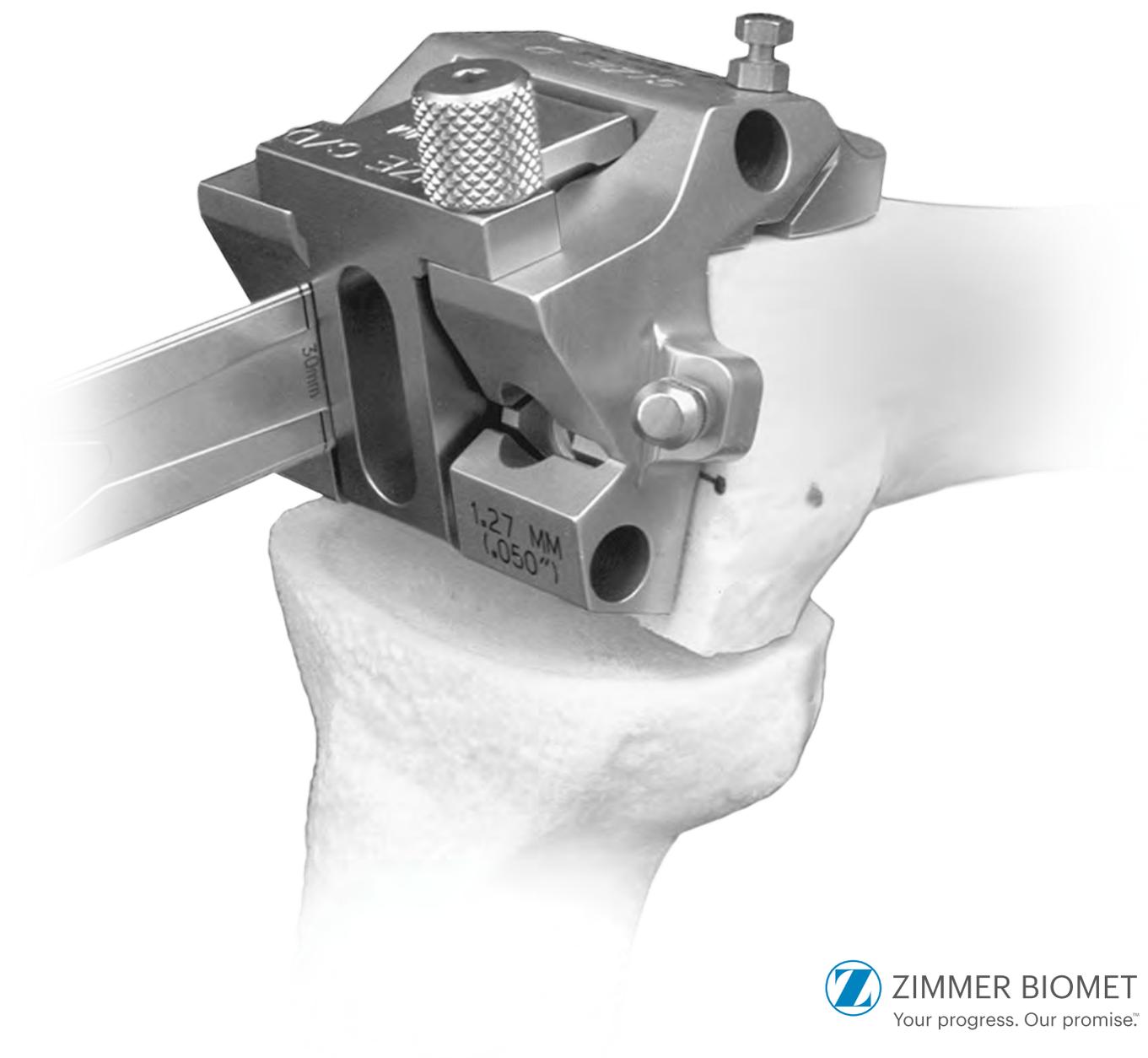


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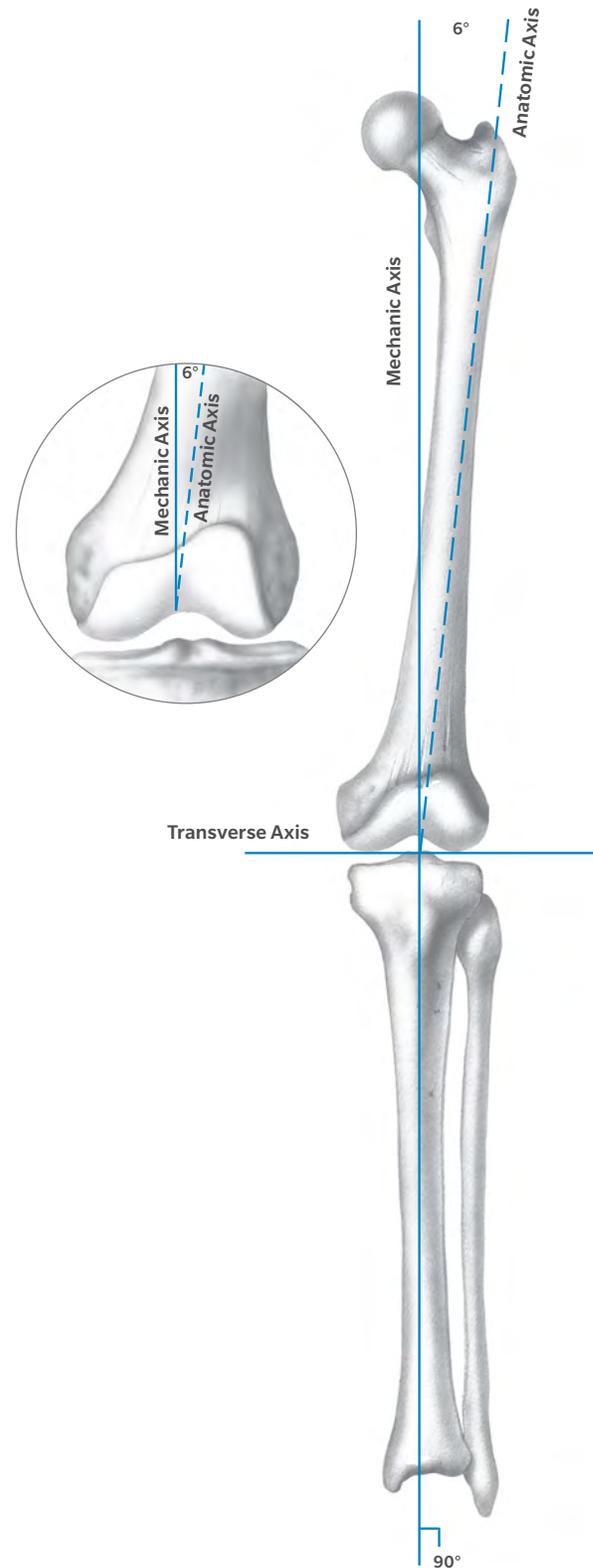
Introduction

The MICRO-MILL® Instrumentation System has been designed to provide a simple, precise and reproducible technique with a number of options that offer the surgeon more choices and greater flexibility. In resecting the femoral and tibial surfaces to accept the prosthetic components, the surgeon can choose between the Milling Technique or the 5-in-1 Saw Blade Technique. In addition, implant flexibility offers the opportunity to switch from a cruciate retaining prosthesis to a posterior stabilized prosthesis quickly and easily.

Both the milling and 5-in-1 saw blade procedures are designed to create smooth, accurate resected surfaces and precise knee alignment. The Milling Templates and the 5-in-1 Saw Guides attach to the same femoral mounting bases, providing an accurate, reproducible reference for all femoral precision cuts. This helps avoid the inaccuracies that can be associated with multiple instrument setups and referencing resected surfaces. The result is more accurate and reproducible femoral resection, leading to improved femoral fit and more precise joint alignment.

Preoperative Planning

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



Surgical Technique

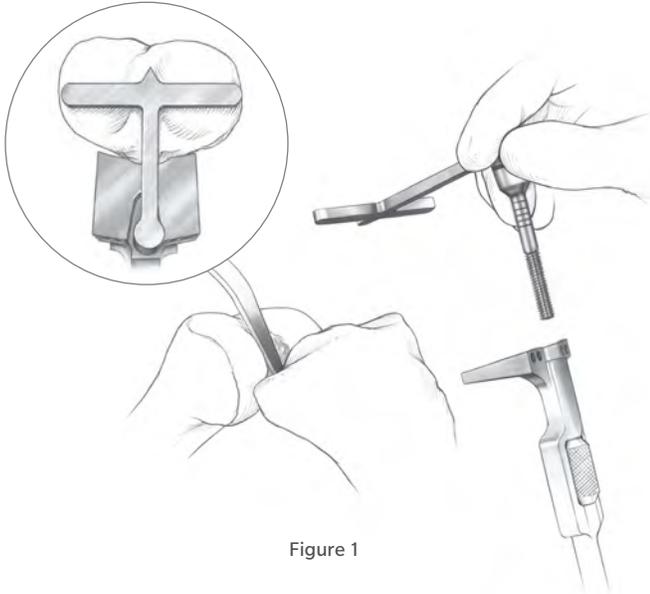


Figure 1

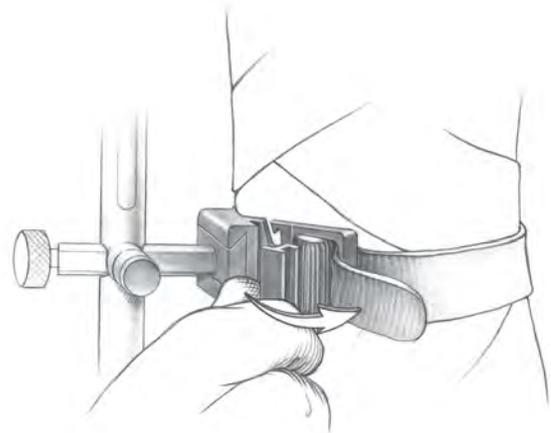


Figure 2

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. 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 alignment guide (Figure 1). Do not fully seat the reference arm. Leave 1-2 lines visible.

Center the foot of the alignment guide at the ankle and tighten the ankle strap (Figure 2). The true center of the ankle is about 5-10 mm medial to the mid-point between the medial and lateral malleoli. Position the proximal portion of the alignment guide superior to the tibial tubercle and center it mediolaterally. Use the tibial depth resection gauge in the depth resection slot on the reference guide (Figure 3) to ensure that the proximal portion is not positioned too far superiorly. This will show the maximum tibial resection when the 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 wings of the proximal tibial reference guide to ensure that proper rotation has been achieved (Figure 1 Inset).

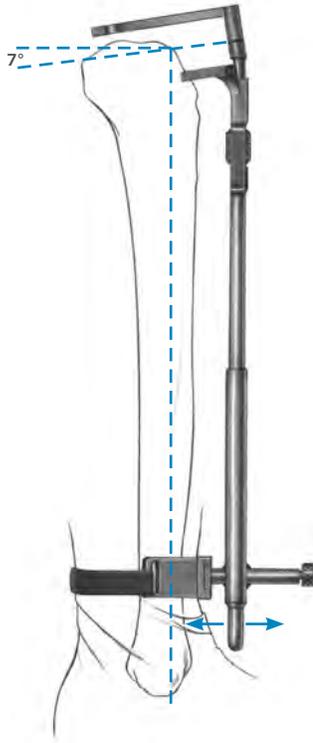


Figure 3



Figure 4

Step One: Align the Tibia (cont.)

Ensure that the alignment 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 (Figure 3). Observe the proximal tibial reference guide to check the 7° posterior slope and rotation. The 7° posterior slope represents an average of tibial slopes and patient anatomy may vary. The preferred technique is to reproduce the anatomic posterior slope. If using a stem extension, 7° posterior slope is recommended to help reduce the likelihood of impingement with the cortex. 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 and is slightly closer to the medial malleolus than the lateral malleolus (Figure 4). This will ensure that the resected surface will be 90° to the mechanical axis. Observe the proximal tibial reference guide to ensure that the resection will have the appropriate varus/valgus angle. If desired, insert a second pin after ensuring that alignment is correct.

Remove the proximal tibial reference guide.



Figure 5

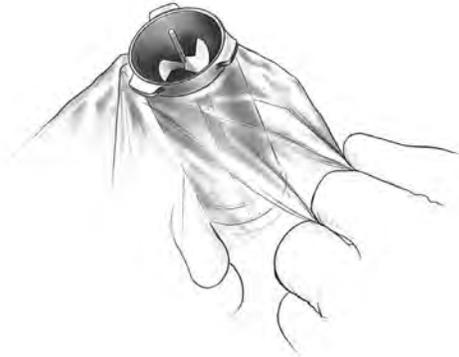


Figure 6

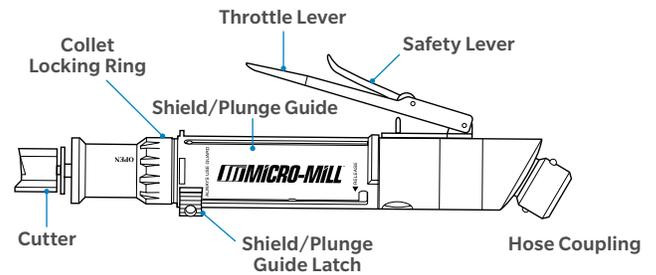


Figure 7

MICRO-MILL Hand Piece Assembly and Usage*

1. With the air hose detached, disengage the shield lock and retract the shield/plunge guide to expose the collet.
2. Turn the mill collet to the “OPEN” position.
3. Insert the cutter onto the mill until it is fully seated (Figure 5).
4. Turn the collet to the “CLOSED” position.
5. Slide the shield/plunge guide over the cutter.
6. Place the milling drape over the end of the shield/plunge guide. The hole in the center of the drape fits over the base of the safety shield (Figure 6).
7. When the drape is in place, attach the air hose to the mill.
8. Ensure that the operating pressure is set at 100 PSI plus 10 PSI for each 10 feet of hose between the mill and regulator.
9. The safety is disengaged when the surgeon places a finger under the safety lever (Figure 7).

*Please refer to the MICRO-MILL Instrumentation Instruction Manual for warnings and complete operating and cleaning instructions.



Figure 8

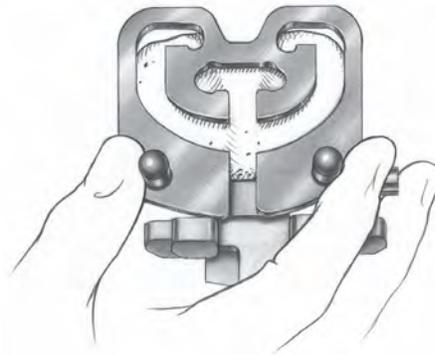


Figure 9

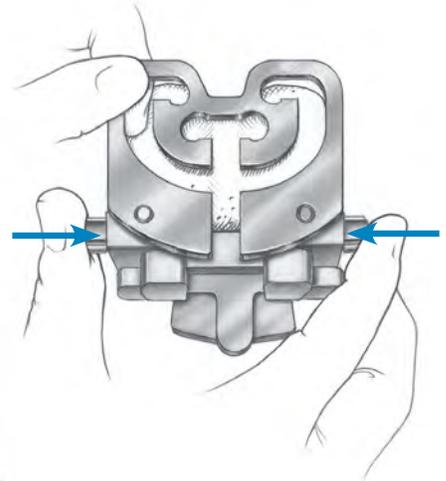


Figure 10

Step Two (Milling): Resect the Tibia

Attach the tibial milling base to the extramedullary tibial alignment guide by placing it into the guide and engaging the threads by turning the adjustment knob (Figure 8). 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 (Figure 9). **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 (Figure 10). If the template contacts the femur, flex the knee further and retract the tibia more anteriorly.

When exposure for the lateral compartment becomes tight, a small portion of the distal lateral femoral condyle can be removed to aid in placement of the template.

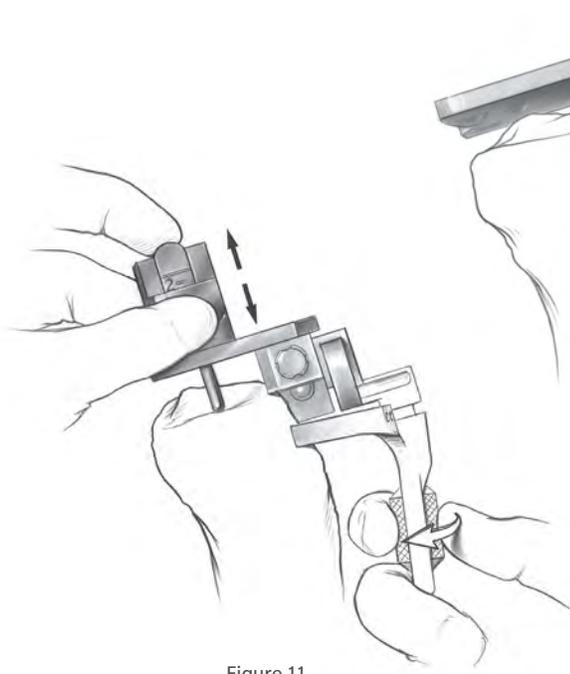


Figure 11

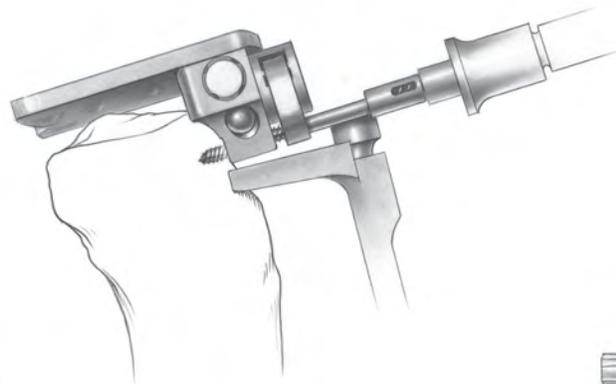


Figure 12

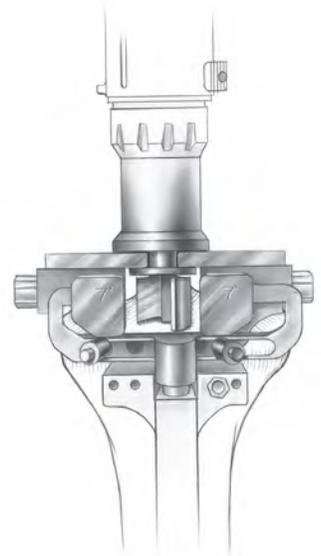


Figure 13

Step Two (Milling): Resect the Tibia (cont.)

Place the tibial milling depth resection guide onto the template. Adjust the tibial milling base to the proper level (Figure 11). Keep a finger on the plunger to ensure that the probe stays in contact with bone. The depth resection guide should read 10 mm on the intact condyle for an anatomic cut, or 2 mm 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 pin driver to pin the milling base in place with two gold tibial milling spring pins (Figure 12).

Check to ensure that all soft tissue is retracted from under the template and there is adequate clearance of the posterior femoral condyles. The patella tendon retractor is recommended to assist. Be sure that retractors are located between all soft tissues and the mill cutter.

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 (Figure 13).

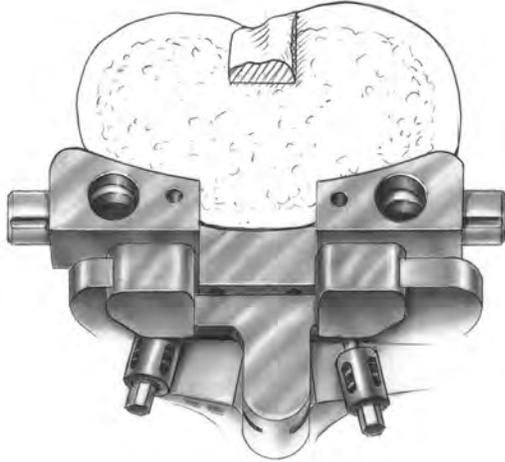


Figure 14

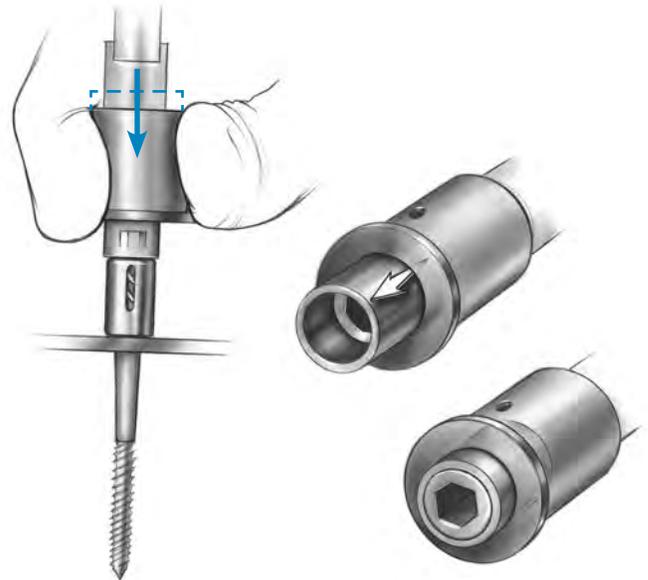


Figure 15

Step Two (Milling): Resect the Tibia (cont.)

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 (Figure 14). 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, use the female hex driver to remove the two tibial milling spring pins.

Place the female hex driver over the spring pin and apply a downward force on the driver sleeve (Figure 15). Start the drill/reamer slowly until the driver hex engages the hex head of the pin. Continue until the spring pin disengages bone.

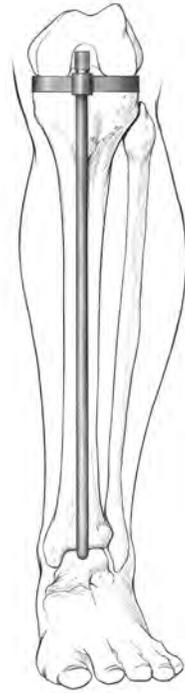


Figure 16

Step Two (Milling): Resect the Tibia (cont.)

Remove the tibial milling template, the tibial milling base, and the tibial extramedullary alignment guide. Then use a reciprocating saw to remove the island of bone at the PCL attachment.

Check the varus/valgus alignment of the tibial cut by placing a spacer/alignment guide on the resected surface of the tibia with the arm extending over the tibial tubercle. Insert the alignment rod with coupler into the hole on the arm and flex the knee so the rod hangs freely and parallel with the anatomic axis of the tibia in the A/P plane. Note the position of the distal end of the rod. It should be near the center, but slightly closer to the medial malleolus of the ankle (Figure 16).

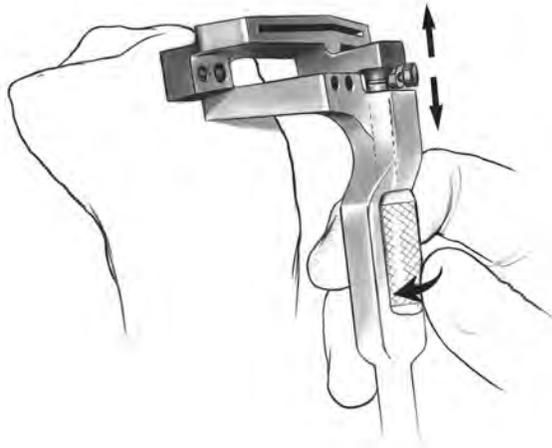


Figure 17

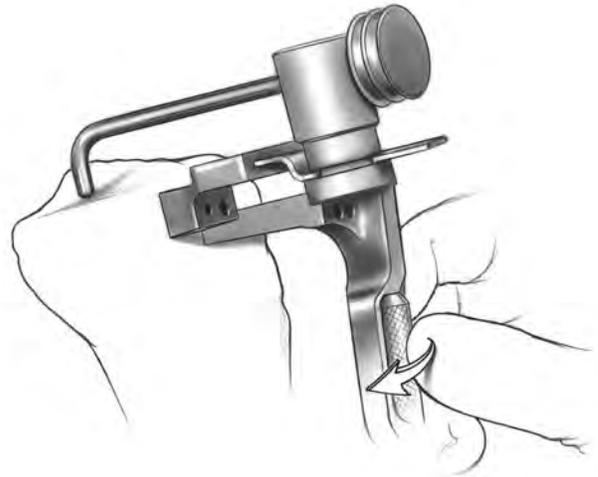


Figure 18

Step Two (Saw): Resect the Tibia

Insert the tibial cutting head into the extramedullary tibial alignment guide (Figure 17). Insert the 10 mm tab of the tibial depth resection guide into the cutting slot of the cutting guide and adjust the platform until the arm of the gauge rests on the cartilage of the good condyle (Figure 18).

ⓘ **Note:** IM tibial resection instrumentation is also available for the tibial saw blade technique.

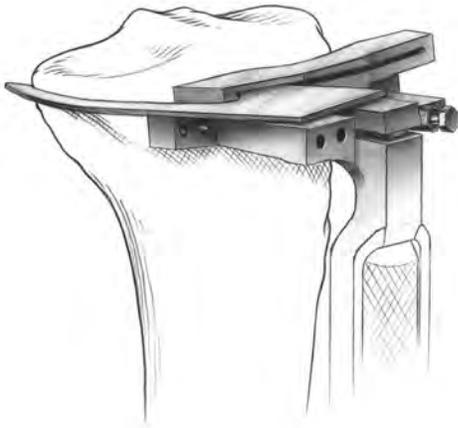


Figure 19

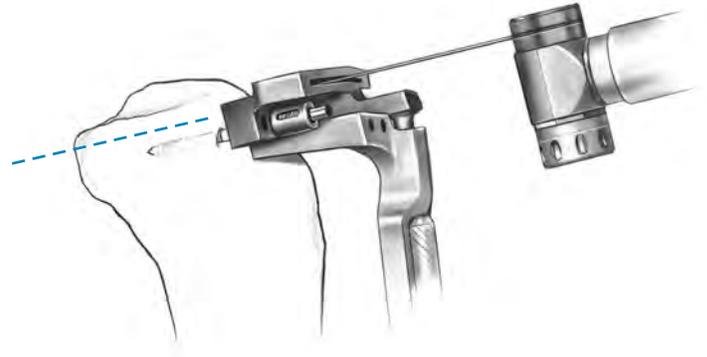


Figure 20

Step Two (Saw): Resect the Tibia (cont.)

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 (Figure 19).

Optionally, the 2 mm 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 2 mm and 10 mm 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.

Remove the depth guide and secure the cutting guide 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 (1.27 mm/.050") and an oscillating saw to cut the proximal tibia (Figure 20).

*Gold pins are for tibial milling only.

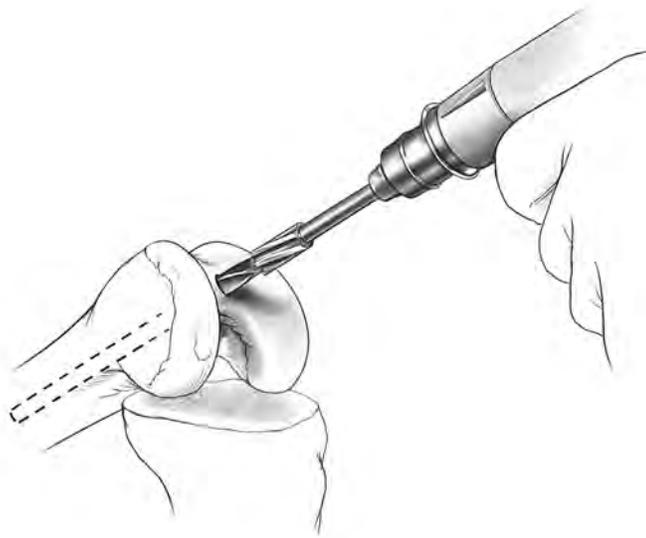


Figure 21

Step Three: Size the Femur

Drill a hole in the center of the patellar sulcus of the distal femur (Figure 21), 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 centimeter anterior to the origin of the posterior cruciate ligament. The drill is a step drill and can be used to enlarge the entrance hole on the femur to 12 mm in diameter if desired. This will help to further reduce IM pressure from placement of subsequent IM guides.

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. Flexion or extension of the guide can produce inaccurate readings. Check to ensure that the boom is not seated on a high spot, or an unusually low spot.

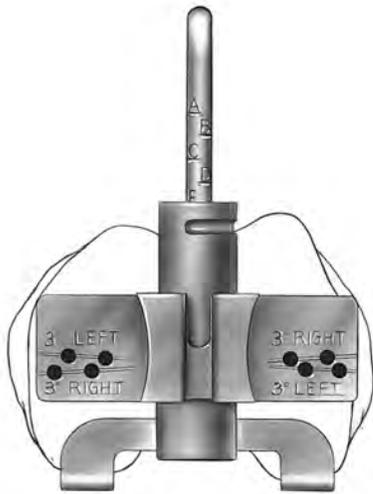


Figure 22

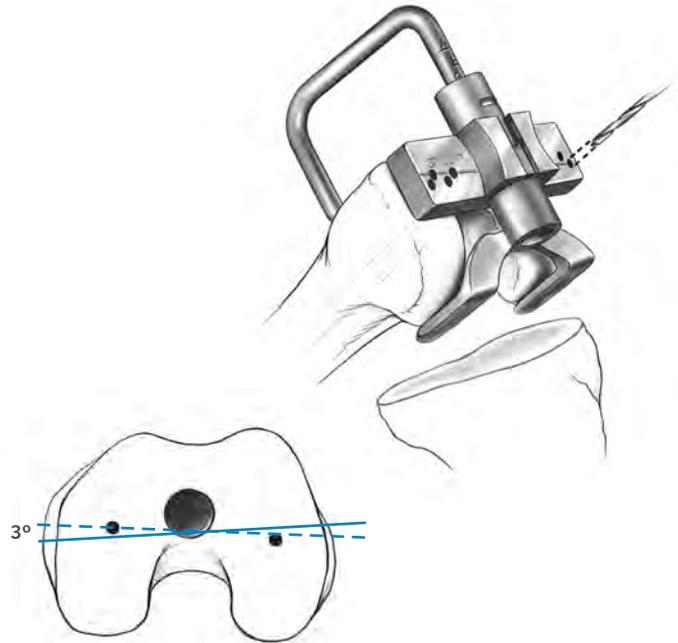


Figure 23

Step Three: Size the Femur (cont.)

Read the femoral size directly from the guide (Figure 22). If the indicator is between two sizes, consider upsizing or going to the next closest size. The option to downsize remains if the knee is too tight in flexion with the larger size. Once the size has been chosen, this size indicates the proper size of the femoral A/P positioning guide, the femoral milling template or 5-in-1 femoral cutting guide, and 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 non-deformed posterior condyles. 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 (Figure 23). These holes will be used in conjunction with the IM alignment guide to set rotation.

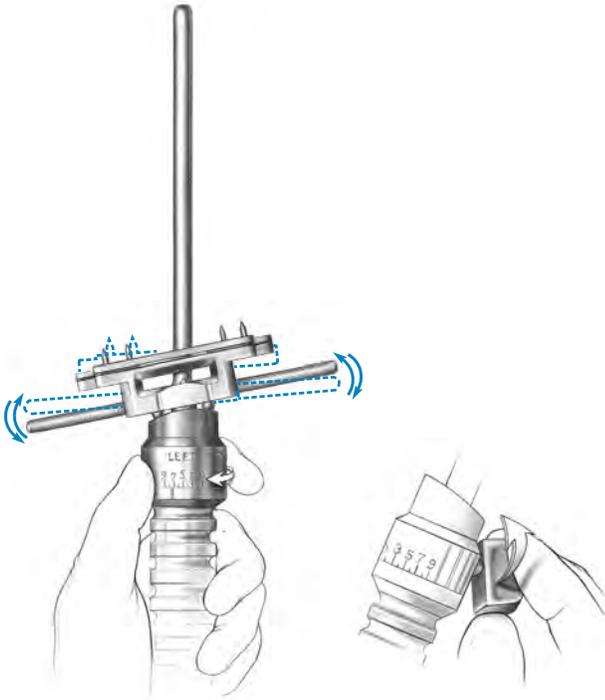


Figure 24

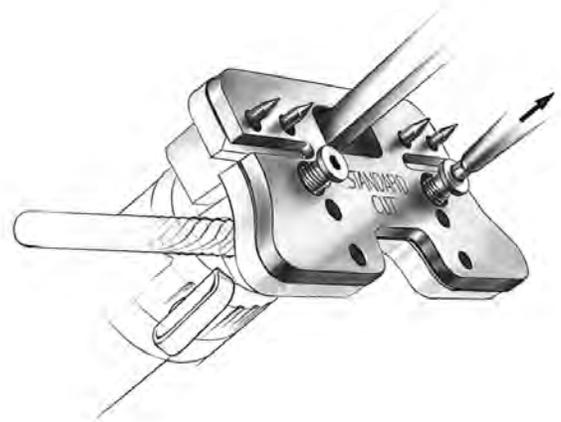


Figure 25

Step Four: Establish Femoral Alignment

In this step, the valgus angle, depth of distal femoral resection, and rotation are set.

First, set the IM 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 (Figure 24). The standard cut block must be attached to the IM 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, 3 mm of additional distal femoral bone needs to be resected, remove the standard cutting block (Figure 25).

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

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.

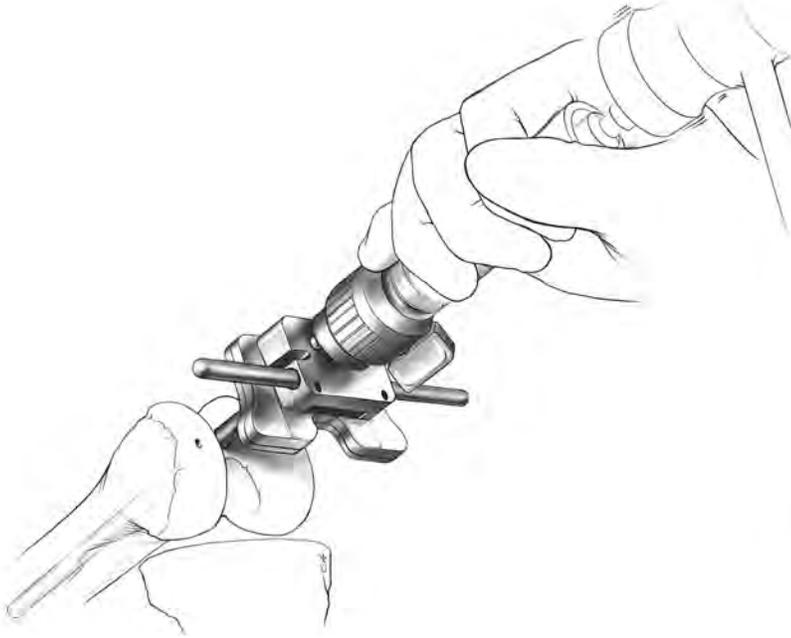


Figure 26

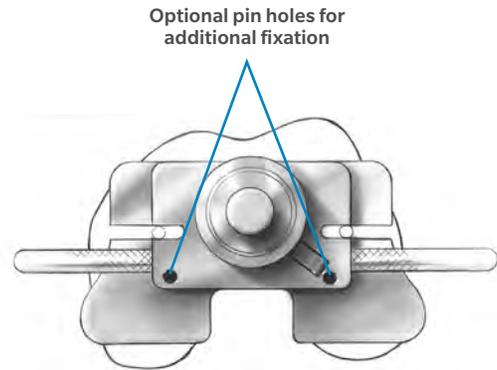


Figure 27

Step Four: Establish Femoral Alignment (cont.)

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 IM guide (Figure 26). If needed, use 1/8" pins to aid alignment with the pin going through the alignment slot on the IM guide and into the alignment holes.

Once the proper external rotation 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

The external rotation can also be set by positioning the handles of the guide relative to the epicondyles, or by using the posterior condyles and referencing the posterior aspect of the IM guide (Figure 27). A rotational alignment guide is available for easier referencing of the posterior condyles in large knees.

If the tibial resection is completed first, the external rotation can also be set by positioning the handles of the IM guide parallel to the cut surface of the tibia after balancing the collateral ligaments.

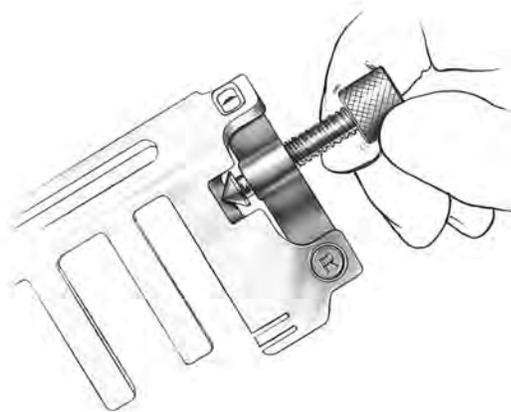


Figure 28

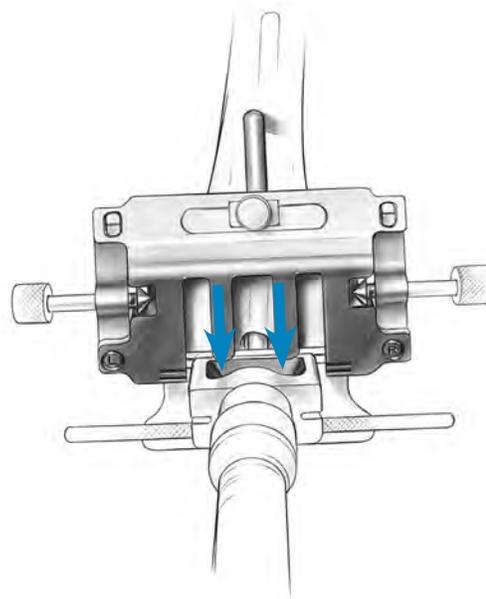


Figure 29

Step Five: Set A/P Position of the Femur

While the IM 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 positioning guide as determined in the sizing stage. Tighten the thumb screws. The bases are right/left specific with “R” and “L” indications and can only be assembled in the correct orientation (Figure 28).

Insert the A/P positioning guide with bases attached into the IM alignment guide (Figure 29) until the boom contacts the anterior femoral cortex.

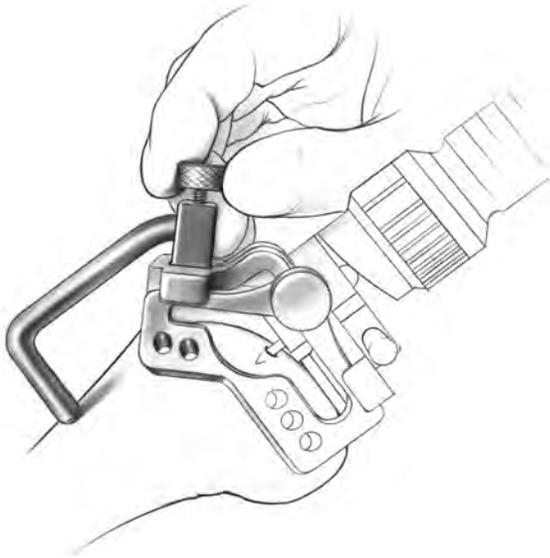


Figure 30

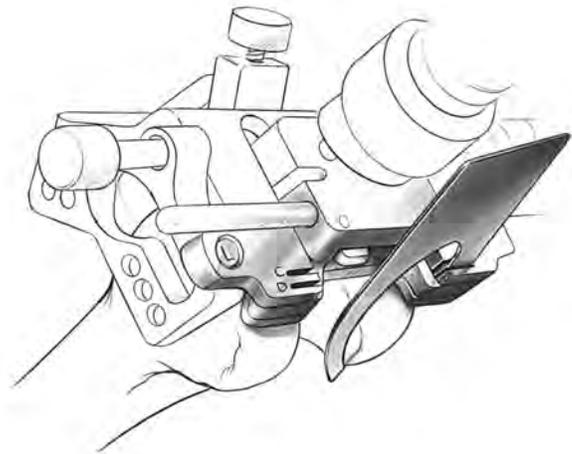


Figure 31

Step Five: Set A/P Position of the Femur (cont.)

The boom indicates where the anterior cut will exit the femur. To prevent notching of the femur, center the boom over the IM 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 thumbscrew (Figure 30).

The two slots on the posterior aspect of the A/P positioning guide correspond to the posterior femoral resection of the two femoral sizes covered by the guide. Check this resection level by placing the resection guide through the slots (Figure 31). External rotation results in removal of more bone on the medial posterior condyle.

If neither of the posterior resection levels are satisfactory, reevaluate the sizing steps.

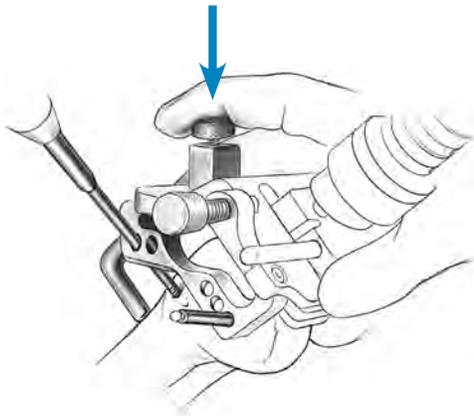


Figure 32

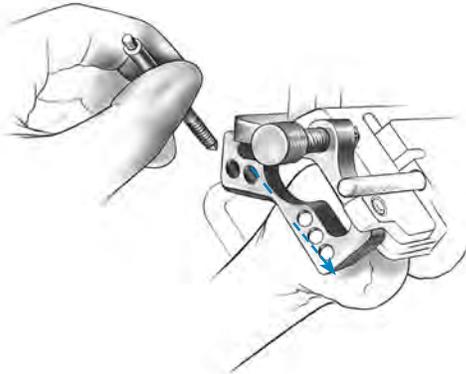


Figure 33



Figure 34

Step Six: Secure Femoral Mounting Bases

By hand, insert two femoral fixation pins into each of the two femoral mounting bases. (Do not use spring pins.) Use the holes that are farthest apart (Figure 32) and do not impinge soft tissue. Then, while holding the positioning guide boom to ensure that it is still touching the anterior femoral cortex (Figure 33), drive each pin into the bone with the female hex driver and drill reamer. The drill reamer should be set to the "Screw" position. To prevent damage 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 (Figure 34).

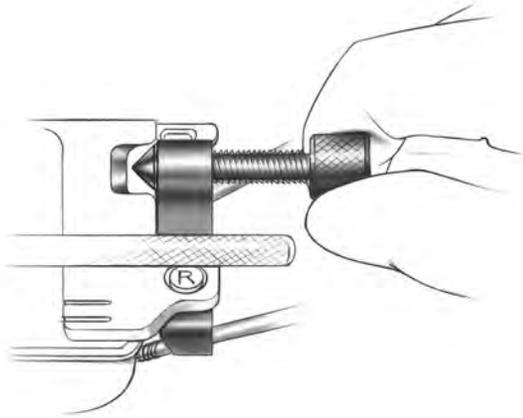


Figure 35

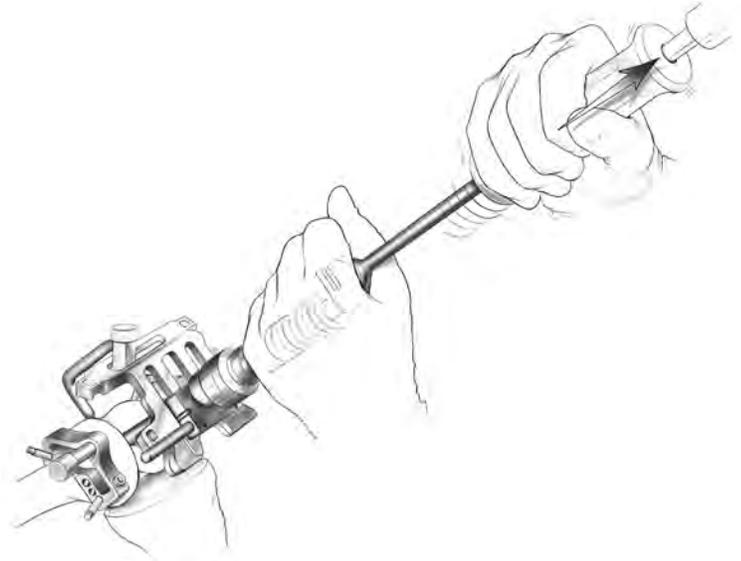


Figure 36

Step Six: Secure Femoral Mounting Bases (cont.)

Loosen the thumb screw that holds the boom of the A/P positioning guide in position and slide the boom to the medial side. Then loosen the two mounting base thumb screws to disassemble the A/P positioning guide from the mounting bases. The thumb screws must be completely free of the A/P positioning guide (Figure 35).

Remove the A/P positioning guide and IM alignment guide with the slaphammer extractor (Figure 36).

At this point, sizing and alignment are complete. All femoral precision cuts will reference off these mounting bases, preventing inaccuracies due to multiple instrument usage and referencing resected surfaces.

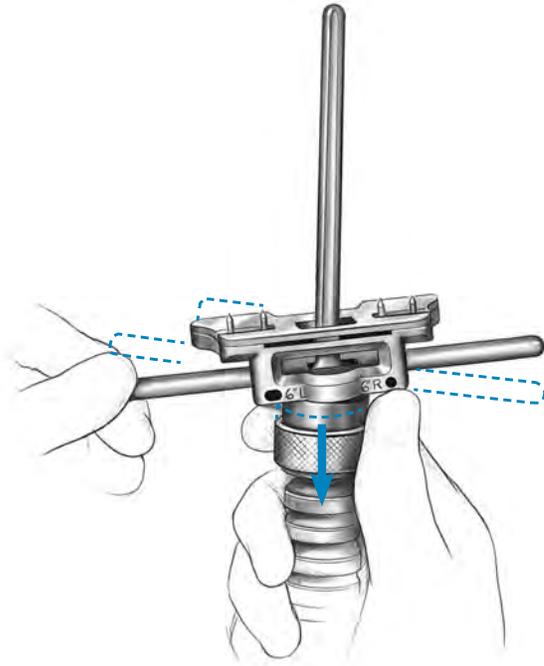


Figure 37

Step Six: Secure Femoral Mounting Bases (cont.)

Optional 4" IM 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 IM 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 (Figure 37). 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 rotated anteriorly or posteriorly. 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.

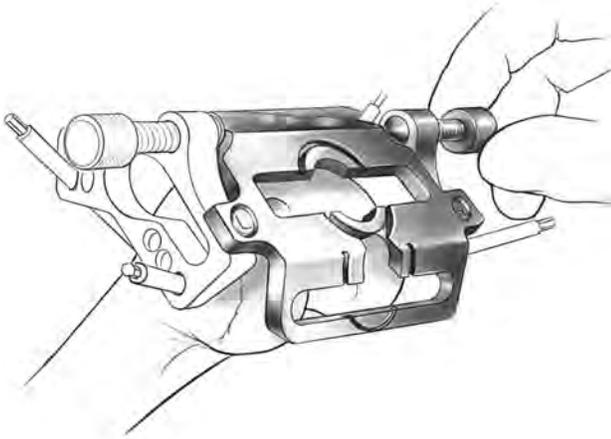


Figure 38

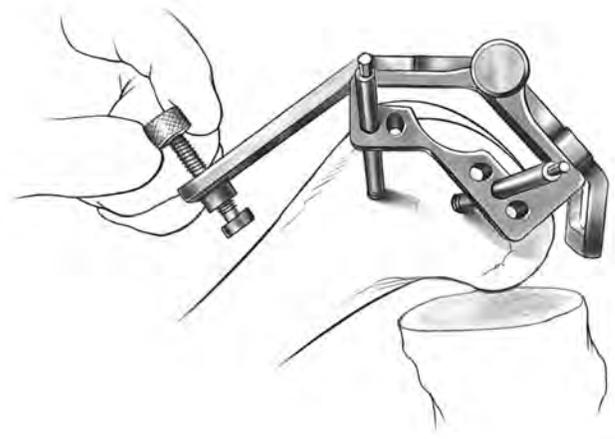


Figure 39

Step Seven: Resect the Femur

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 into position by turning the thumb screws on the two bases until they lock on the template (Figure 38). To further stabilize the template, turn the anterior screw by hand until it contacts the anterior femoral cortex (Figure 39). 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.



Figure 40

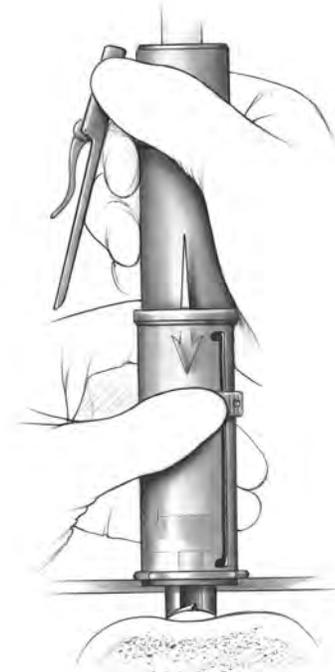


Figure 41

Step Seven: Resect the Femur (cont.)

With the shield/plunge guide over the cutter, spread the drape over the operative site and insert the mill shield/plunge guide into the anterior recessed ring on the template (Figure 40).

Disengage the shield lock and advance the cutter to the bone (Figure 41).

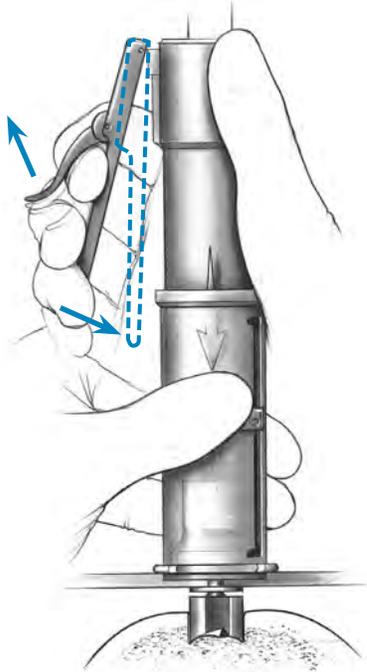


Figure 42

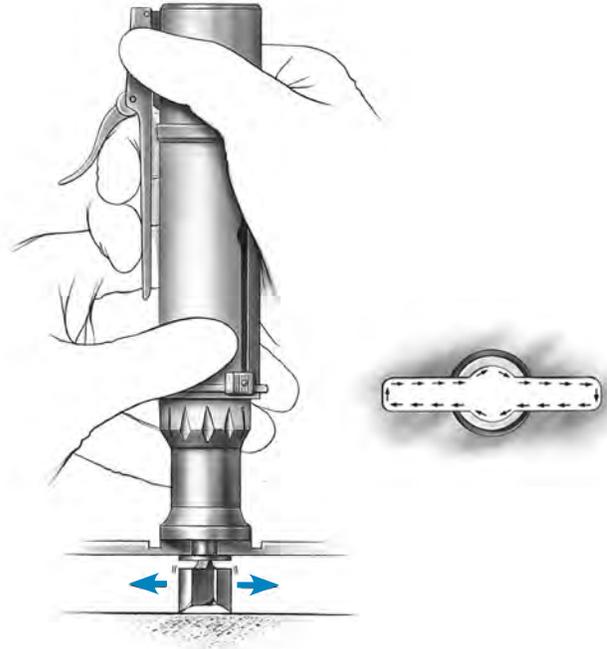


Figure 43

Step Seven: Resect the Femur (cont.)

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 (Figure 42). Keeping downward pressure on the mill, retract the shield and move the mill through the track of the template in a clockwise direction. Keep the mill against the outside edge of the track (Figure 43).

Caution: Do not force the mill. Use the lower hand to direct the mill movement. Do not hold the milling template while milling. Keep both hands on the mill, and do not allow any hands under the drape. Also, ensure that no soft tissue is below the template.

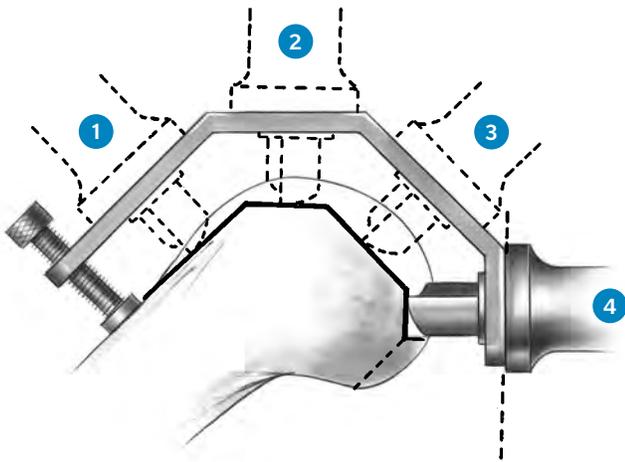


Figure 44

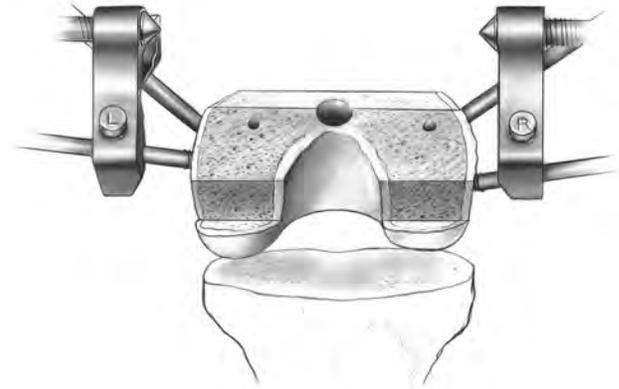


Figure 45

Step Seven: Resect the Femur (cont.)

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 template when inserting the mill into the template and when milling (Figure 44). Often, one will not need to use the shield/plunge guide. The mill can engage the template centrally without contacting the bone.

When all four sections have been milled, remove the mill and template. Check the surfaces of the milled bone (Figure 45). If milling is complete, proceed to Step Eight. If any areas are unmilled, reattach the milling template and remill the un-finished 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.

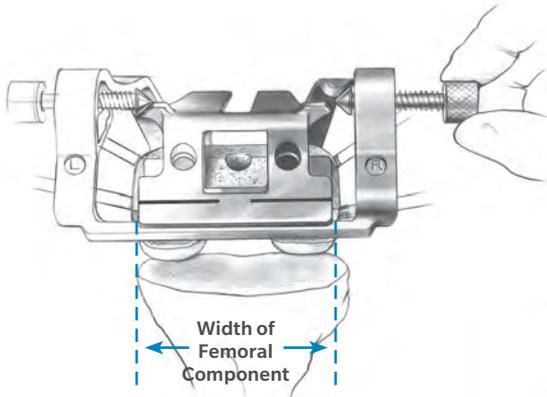


Figure 46



Figure 47



Figure 48

Step Eight (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 thumbscrews for final mediolateral adjustment and to secure the guide (Figure 46).

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 keeping the mill perpendicular to the track (Figure 47). 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 (Figure 48). Remove the mill and pull the shield back over the cutter.

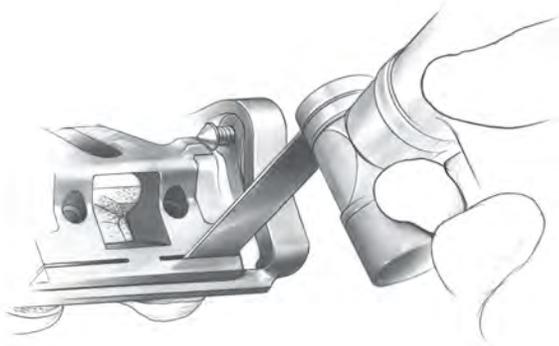


Figure 49

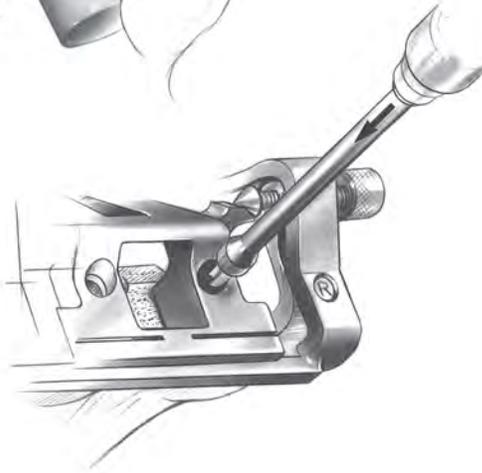


Figure 50

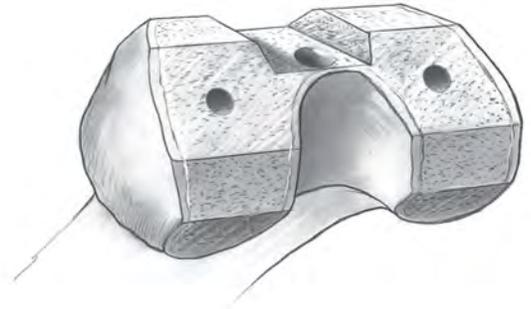


Figure 51

Step Eight (Milling): Finish the Femur (cont.)

Use the appropriate thickness (.050"/1.27 mm) blade and an oscillating saw to cut the posterior condyles (Figure 49). Ensure that the proper thickness blade is used to yield the optimum cut and implant fit. Drill the two femoral post holes (Figure 50). If using a size A or B, LPS-Flex femoral component do not drill the distal femoral post holes at this time. The holes should be drilled using the size A/B femoral peg drill and posterior recut guide. Remove the femoral finishing guide. Ensure that all cuts are complete, before removing the two mounting bases (Figure 51).

(See Spacer/Alignment Guide Technique on page 32.)

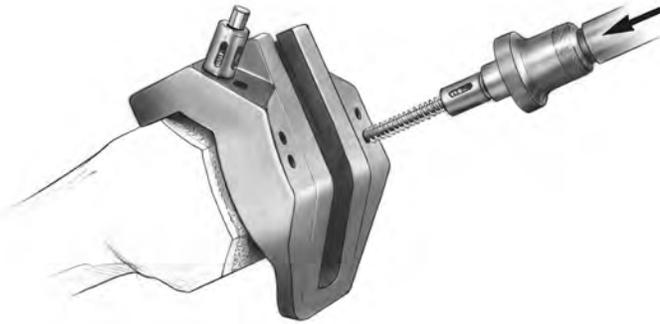


Figure 52

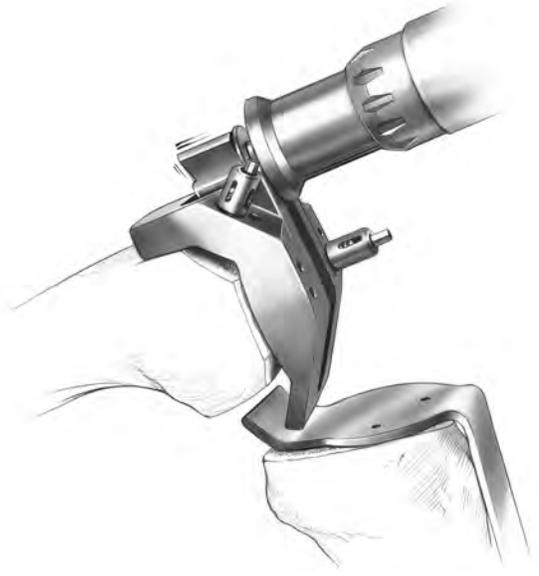


Figure 53

Step Nine (Milling): Cut the Intercondylar Notch

Place the PS notch milling guide on the cut surface of the distal femur with the anterior portion resting on the cut surface of the anterior femoral condyle and the tab on the inside anterior surface fitting in the trochlear recess. Pin the guide to the bone with two short thread spring pins (silver). Place one in the chamfer area, and one diagonally opposite in a distal hole (Figure 52).

Use the tibial/femoral retractor to protect soft tissue in the posterior aspect of the knee, and to protect the proximal surface of the tibia. This retractor also aids in distraction of the joint.

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 (Figure 53). 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 intercondylar notch. Move the mill clockwise within the track, keeping the mill pressed against the outside edge. Remove the mill and pull the shield back over the cutter.

Remove the spring pins and the PS notch milling guide.



Figure 54

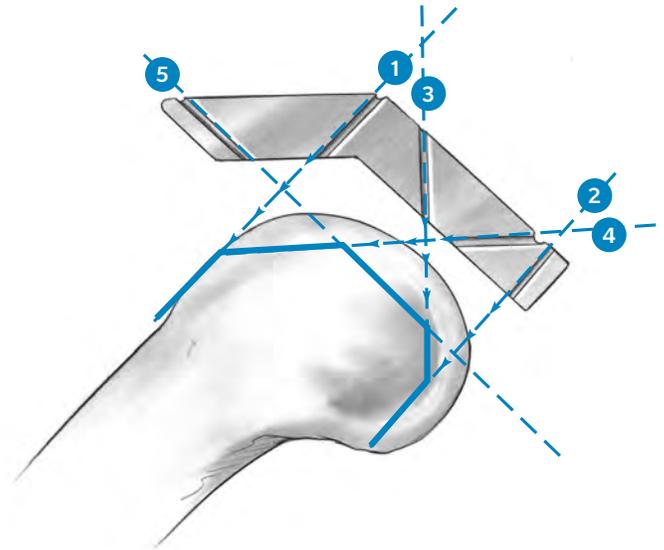


Figure 55

Step Seven (Saw Blade): Resect the Femur

Attach the proper size 5-in-1 femoral saw 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 template into position by firmly turning the thumb screws on the two bases (Figure 54). Check to be sure that there is no soft tissue in the area below the guide.

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

For the most accurate cuts, perform the femoral cuts through the slots in the order indicated on the guide (Figure 55).

- 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 (1.27 mm/.050") saw blade. When all cuts are complete, remove the 5-in-1 femoral cutting guide and the femoral mounting bases.

(See Spacer/Alignment Guide Technique on page 32.)

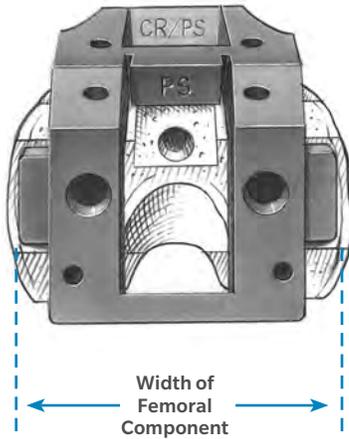


Figure 56

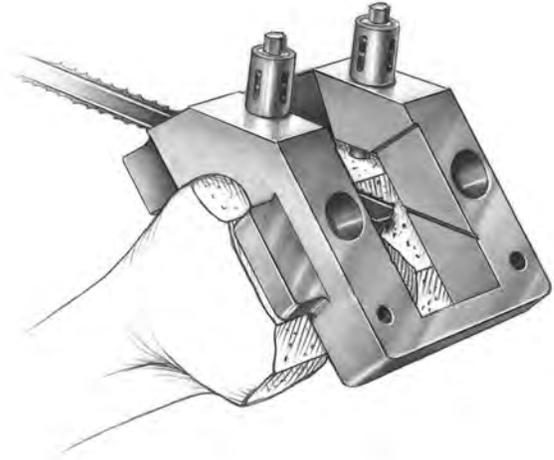


Figure 57

Step Eight (Saw Blade): Finish the Femur and Cut the Intercondylar Notch

Note: If using the LPS-Flex femoral component, the posterior recut guide can be utilized to cut the intercondylar notch and drill for the femoral post holes. If a size A or B, LPS-Flex femoral component has been chosen, the posterior recut guide and the size A/B femoral peg drill must be used because the femoral pegs have a smaller diameter.

Place the appropriate size 5-in-1 femoral finishing 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 (Figure 56). 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 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 sized 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 (Figure 57).

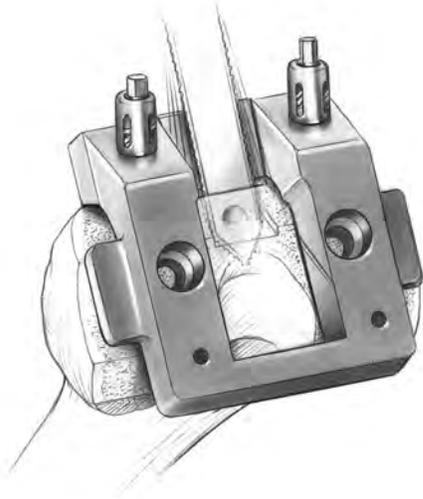


Figure 58

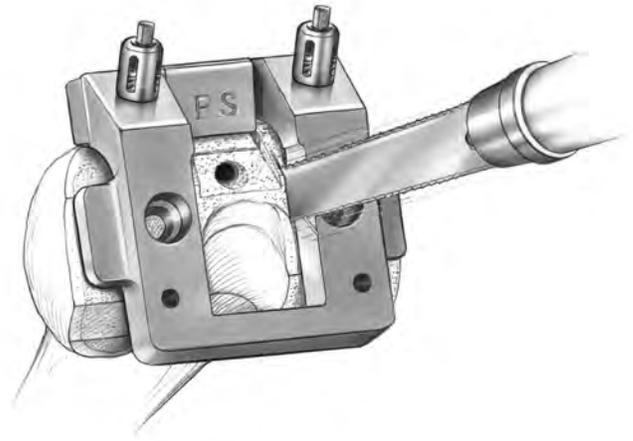


Figure 59

Step Eight (Saw Blade) (cont.)

Then use the reciprocating saw to cut the sides (Figure 58) and the base of the intercondylar notch (Figure 59).

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.

Remove the femoral finishing guide.

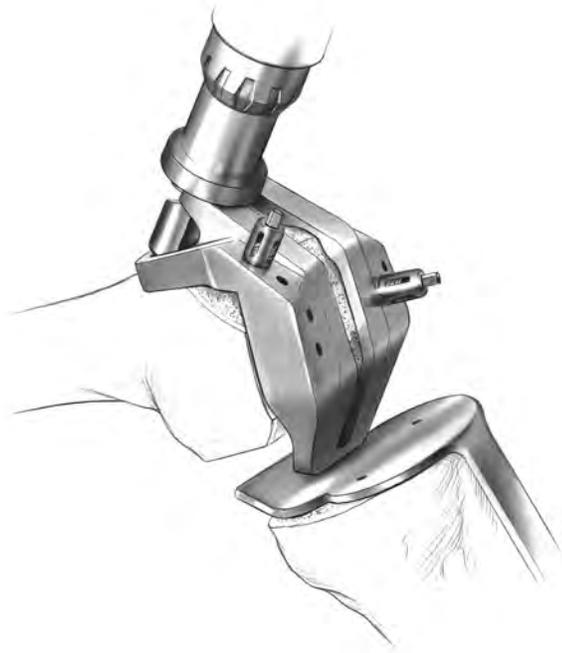


Figure 60



Figure 61

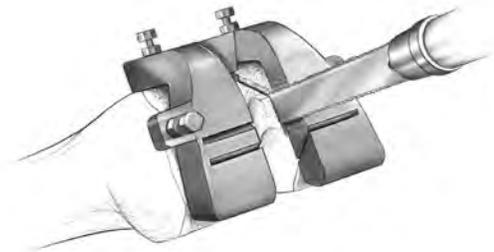


Figure 62

Step Eight (Saw Blade) (cont.)

Optional Techniques TR/PS Milling Finishing

Use the tibial/femoral retractor to protect soft tissue. Place the TR/PS milling finishing guide on the cut surface of the distal femur with the anterior portion resting on the cut surface of the anterior femoral condyle. Center the guide mediolaterally. Pin the guide to the bone and use the appropriate saw to cut the sides of the notch (Figure 60).

EPI Notch/Chamfer Guide

Place the EPI 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 medio-laterally. Pin the guide to the femur and use the appropriate saw to cut the sides of the notch (Figure 61). Then use an osteotome to remove the notch.

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 (Figure 62). Then use an osteotome to remove the notch.

Spacer/Alignment Guide Technique

Flexion/Extension Gaps

While the basic box cuts are the same for both cruciate retaining and posterior stabilized designs, there are some important differences in the technique, and it is important that those surgeons who have typically followed the cruciate retaining philosophy understand these differences. First, be aware that, when the PCL is removed, there may be a change in the symmetry of the flexion and extension gaps. Therefore, the joint balancing is different with a posterior stabilized prosthesis. In the posterior stabilized technique, the flexion and extension gaps are balanced with spacer blocks and/or tensor devices.

If the knee is tighter in extension than in flexion, recut the distal femur using the appropriate instrumentation. (See Femoral Recutting/Downsizing Technique on page 46). This will enlarge the extension space. The gaps should then be rechecked with the appropriate spacer/alignment guide to confirm equality.

If the knee is significantly looser in extension than in flexion, two options should be considered:

- 1) downsize the femoral component
(See Femoral Recutting/Downsizing Technique on page 46), or
- 2) if the femoral component cannot be downsized, then distally augment the femoral component by increasing the thickness of the cement mantle. This thicker cement mantle should be no greater than 2 mm.

ⓘ **Note:** If greater augmentation is needed, then modular augmentation should be considered. If augmentation of 5 mm or more is necessary, a stemmed component should be used.

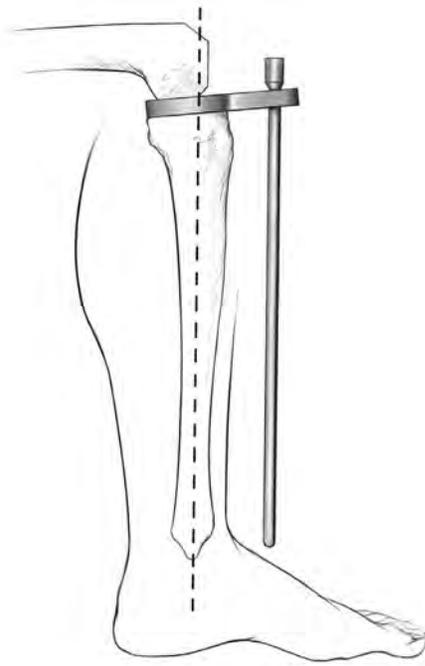


Figure 63



Figure 64

Flexion/Extension Gaps (cont.)

If the knee is tight in both flexion and extension, and will not accommodate a 10 mm spacer/alignment guide, recut the proximal tibia.

It is very important that the flexion and extension gaps are equal and balanced.

Check the thickness and alignment of the femoral cuts in both flexion and extension. With the knee flexed 90°, insert the thickest spacer/alignment guide that will easily fit between the resected surfaces of the femur and tibia. Insert progressively thicker spacer/alignment guides until the proper soft tissue tension is obtained. The resultant flexion space should be balanced and symmetrical. The tibial resection can also be checked at this point. Center the arm of the guide over the tibial tubercle and insert the alignment rod with coupler through the hole in the arm. The rod should be parallel to the anatomic axis of the tibia (Figure 63), and the distal end of the rod should be near the center of the ankle, but slightly closer to the medial malleolus.

Remove the spacer/alignment guide and extend the knee. Reinsert the spacer/alignment guide and the alignment rod with coupler. With the knee fully extended and the foot dorsiflexed, the distal end of the rod should be slightly closer to the medial malleolus. Attach the alignment rod extension to the coupler. The proximal end of the rod should be just inside the anterior superior iliac spine (Figure 64).

If the knee is too tight in flexion and extension, the proximal tibia should be recut. If the spacing is not correct in flexion and/or extension, use the appropriate NexGen Downsizing/Recutting Block to resect additional bone from the femur. (See Femoral Recutting/Downsizing Technique on page 46.)

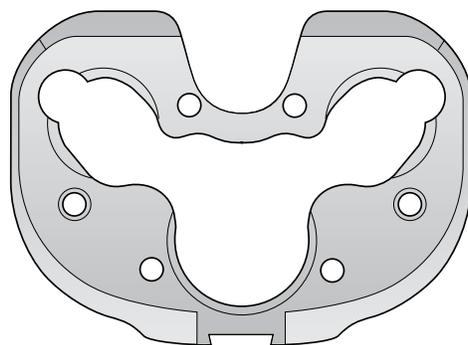


Figure 65

Step Ten: Finish the Tibia

Note: Refer to the LCCK surgical technique for successful implantation of a tibial component with a stem extension and/or augmentation.

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 stemmed tibial sizing plate provisional* that provides the desired tibial coverage (Figure 65).

*Do not use the Pegged Tibial Tray with the NexGen LPS System.



Figure 66

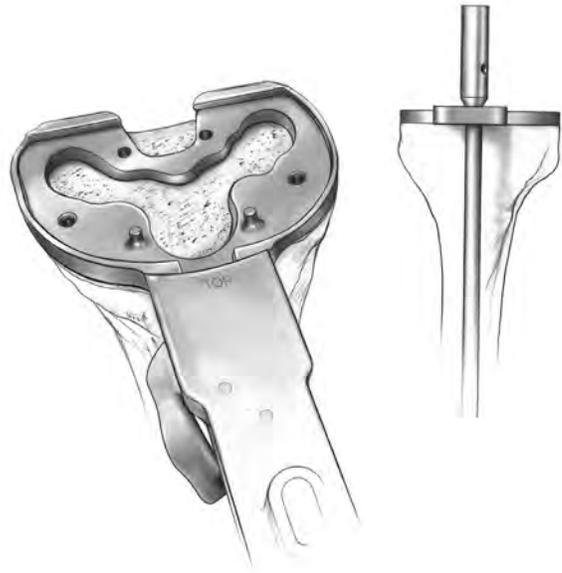


Figure 67

Stemmed Tibial Sizing Plate

Check the appropriate knee implant size matching chart for complete matching instructions.

If there is no match between the femoral provisional and sizing plate, adjust the size of the sizing plate being used to yield a match.

Attach the modular handle to the selected sizing plate by depressing the button on the handle and engaging the dovetail on the handle with the dovetail on the sizing plate. Secure by tightening the thumb screw (Figure 66).

The handle aligns with the anterior aspect of the tibia. Rotate the sizing plate so the handle points at, or slightly medial to, the midpoint of the tibial tubercle (Figure 67). The alignment rod can be used to aid in confirming proper varus/valgus alignment.

Pin the plate in place with two short head holding pins.



Figure 68



Figure 69

Position Based on Trial Range of Motion

Select the proper size of tibial sizing plate. Ensure that the plate chosen provides the desired tibial coverage. Again, a color match with the femoral provisional must occur to achieve a proper kinematic match.

Insert the proper provisional femur, tibial sizing plate and bearing. Select the color of bearing that is the same as the color match chosen for the femoral provisional and sizing plate. Ensure that 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 (Figure 68).

After this self-centering process has occurred, mark the position of the component with methylene blue or electro-cautery.

Remove the bearing trial and pin the sizing plate in place with two holding pins (Figure 69). Ensure that the sizing plate remains in the proper position when pinning.

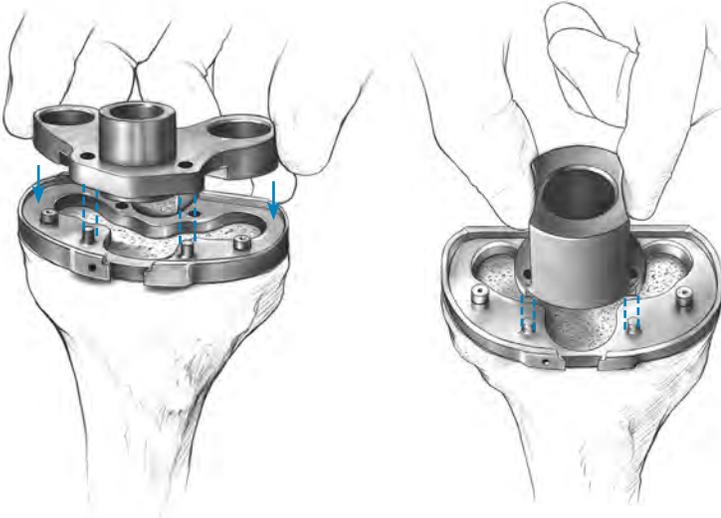


Figure 70

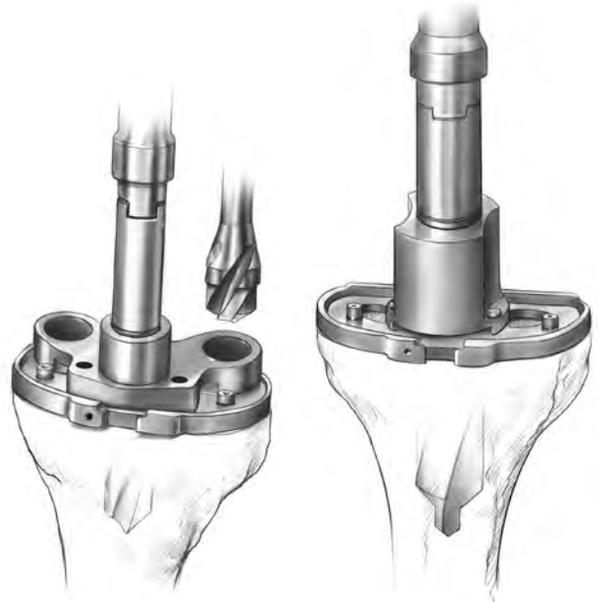


Figure 71

Tibial Plate Preparation

Once the sizing plate is pinned in position, place the appropriate size porous or cemented stem tibial drill guide on the sizing plate and drill for the stem with the porous or cemented stem tibial drill (Figure 70). Drill until the engraved line on the drill is in line with the top of the drill sleeve (Figure 71). 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 tibial drill guide and cemented stem tibial drill to allow for optimal cement fixation.

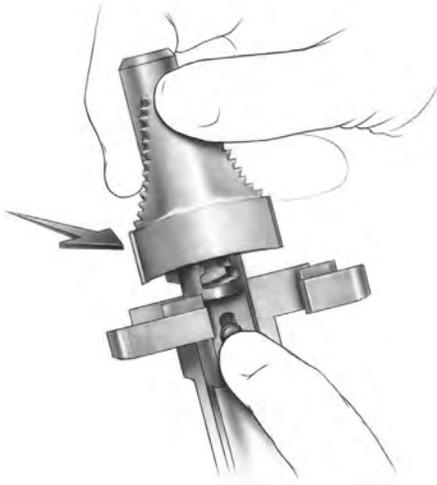


Figure 72

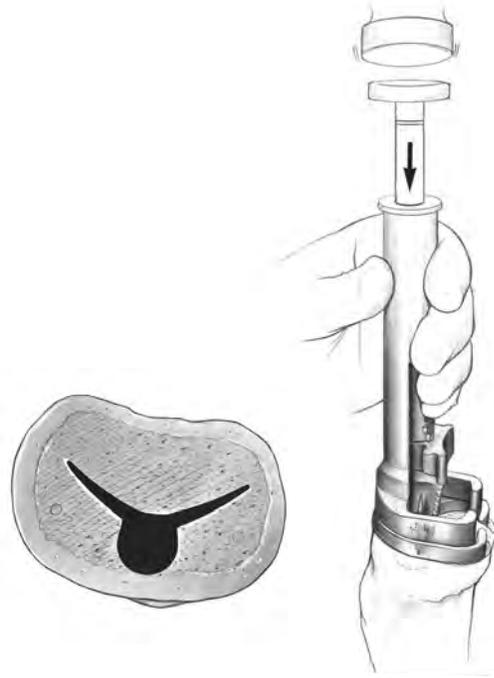


Figure 73

Tibial Plate Preparation (cont.)

Assemble the proper size tibial broach to the broach impactor (Figure 72). The broach can only be assembled from the front. Seat the impactor on the 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 over-impacted (Figure 73).

Remove the broach impactor assembly using the built-in slaphammer, then remove the sizing plate.



Figure 74



Figure 75

Tibial Plate Preparation (cont.)

Use the correct size trial tibia to ensure proper fit before implanting the final components. Assemble the impactor onto the trial tibial provisional until completely seated (Figure 74).

Impact the stemmed tibial provisional (Figure 75).

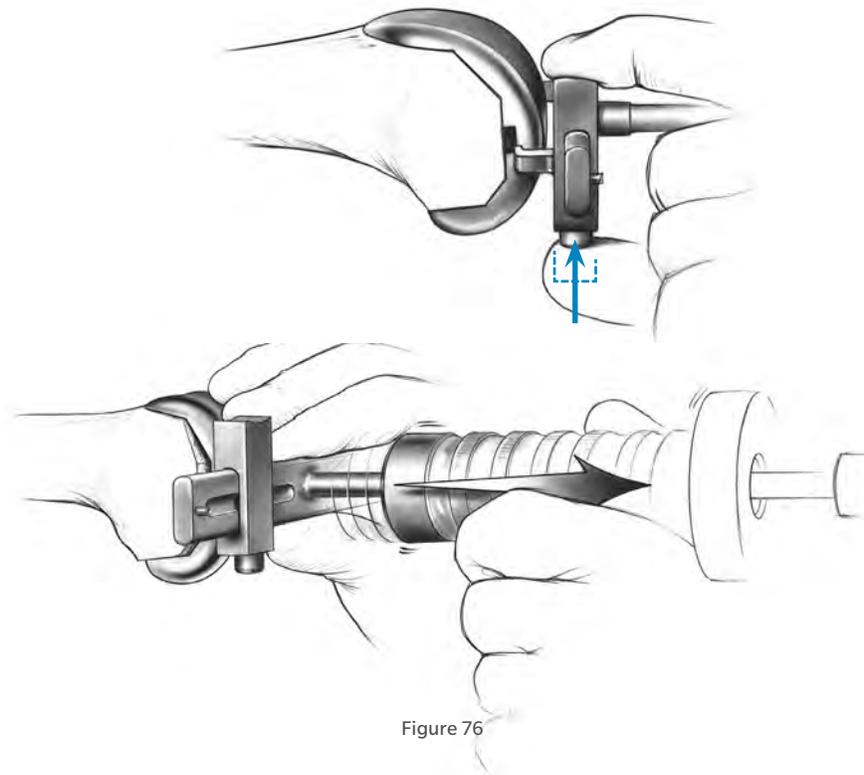


Figure 76

Tibial Plate Preparation (cont.)

Once trial reduction is complete, assemble the extractor to the femoral provisional and remove the trial. The slaphammer extractor can be used to remove the component if needed (Figure 76).

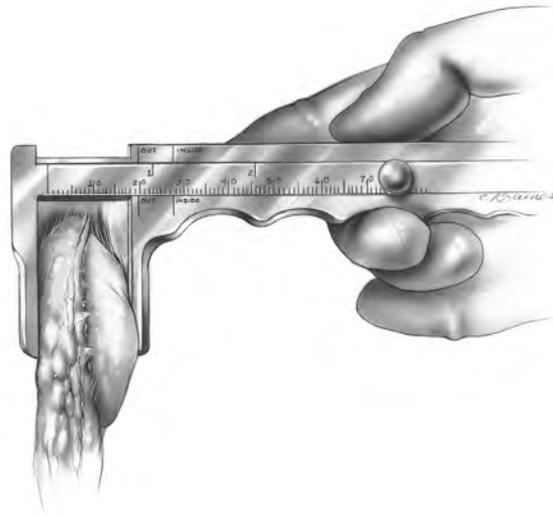


Figure 77

Step Eleven: Prepare the Patella

Sharply dissect through the pre-patellar bursa to expose the anterior surface of the patella. This will provide exposure for affixing the anterior surface into the patella clamp and assures accurate bone resection.

Remove all osteophytes and synovial insertions from around the patella. Be careful not to damage tendon insertions onto the bone. Use the caliper to measure the thickness of the patella (Figure 77). Subtract the implant thickness from the patella thickness to determine the amount of bone that should remain after resection.

Patella Thickness – Implant Thickness = Bone Remaining

All-Poly Implant Thickness*

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

Use standard size patellas with all LPS femorals

NexGen Primary Porous Patella Compatibility Chart

A B C D E F	Standard Only (32, 35, 38, 41)
G H	Standard Only (32, 38, 41)

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

* 26 mm patella is for inseting only.

** 26 mm, 29 mm, and 32 mm patellas not for use with size G and H femoral components, unless used in an inset mode.

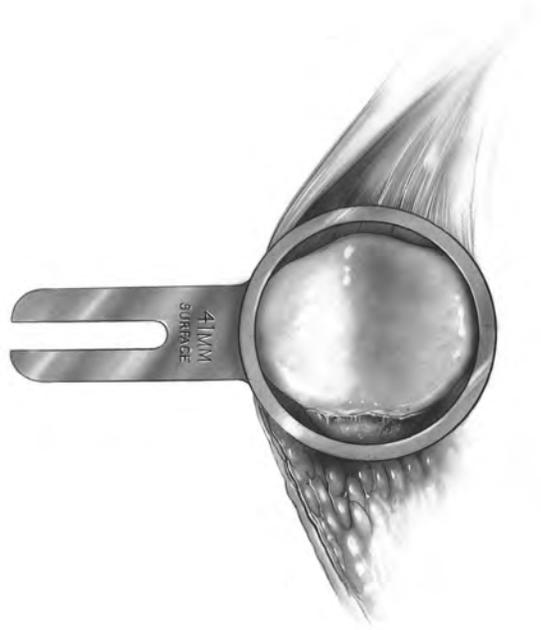


Figure 78

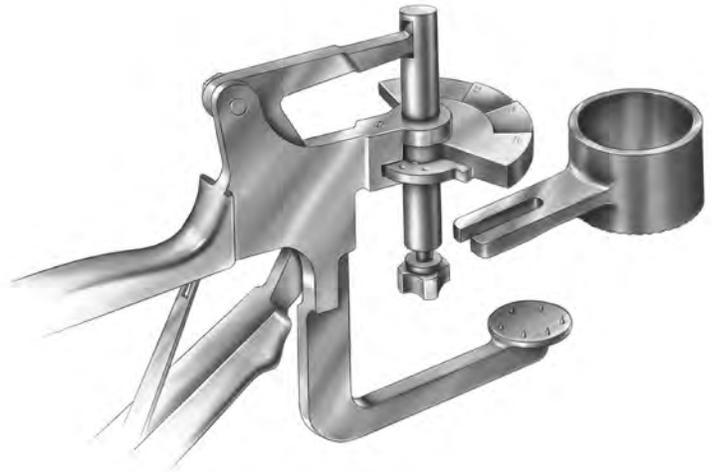


Figure 79

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 (Figure 78). If the patella is only slightly larger than the total 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 (Figure 79). Turn the locking screw until tight.

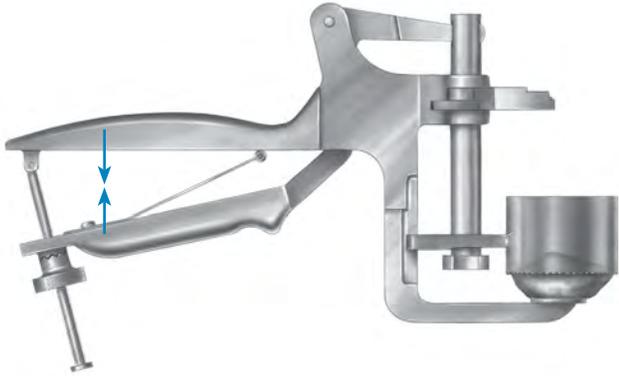


Figure 80

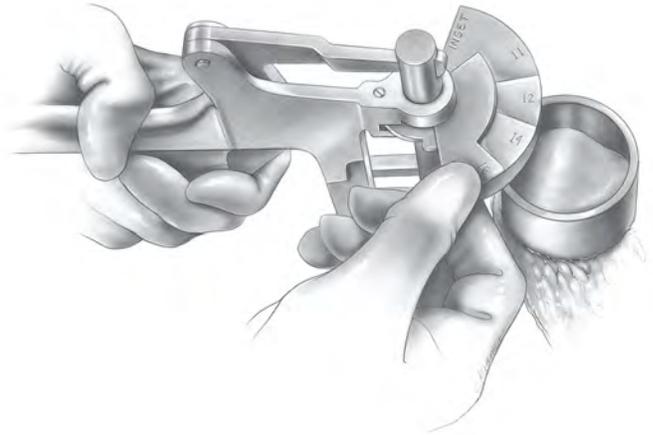


Figure 81

Patella Reamer Technique: Total Surfacing Procedure (cont.)

Apply the patella reamer clamp at a 90° angle to the longitudinal axis with the patella reamer surfacing guide encompassing the articulating surface of the patella. Squeeze the clamp until the anterior surface of the patella is fully seated against the fixation plate (Figure 80). 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 clamp wing to the proper indication for the correct amount of bone that is to remain after reaming (Figure 81).

Attach the appropriate size patella reamer blade to the appropriate size patella reamer shaft. 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.

ⓘ **Note:** Patella reamers that use the pilot drill can also be used.

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. Continue reaming with moderate pressure until the step on the reamer shaft bottoms out on the clamp wing. Remove the reamer clamp assembly.

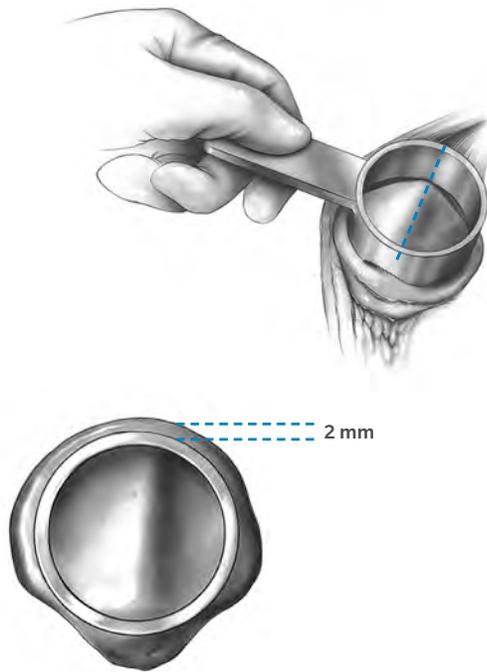


Figure 82

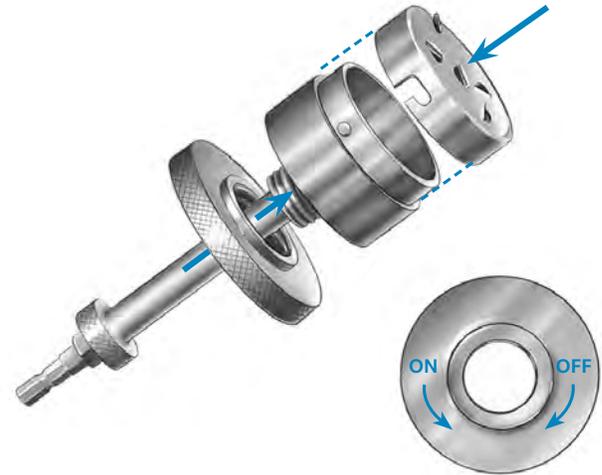


Figure 83

Insetting Procedure

Use the patella reamer insetting guides as templates to determine the appropriate size guide and reamer. Choose the guide which will allow approximately 2 mm between the superior edge of the patella and the outer diameter of the guide (Figure 82).

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 articulating 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 upon 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. Use only moderate hand pressure to tighten the blade. Do not overtighten the blade (Figure 83).

Use the patella reamer depth stops to control the amount of bone to be removed based on the thickness of the implant chosen. The depth gauge wing can be used instead of the stops to control the amount of bone remaining, rather than the amount of bone removed. The procedure is then the same as that described under total surfacing.

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. Continue reaming with moderate pressure. Remove the reamer clamp assembly.

Note: See your local Zimmer Biomet representative for a detailed surgical technique on the Zimmer Biomet Patella Reamer System.

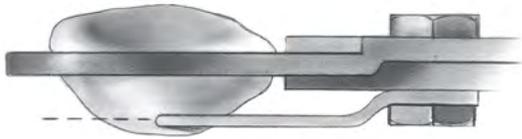


Figure 84

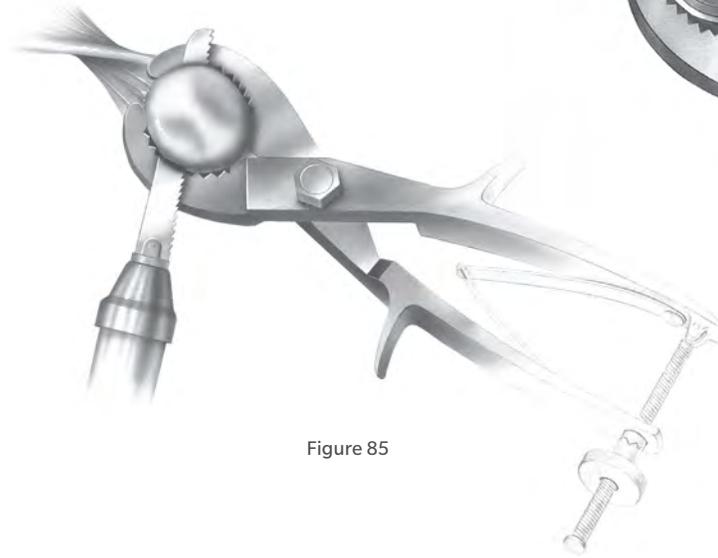


Figure 85



Figure 86

Universal Saw Guide Technique

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

The amount to be resected across the top of the saw guide jaws should be approximately the same on all sides. Check to be sure that the ten millimeter 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 ten millimeters of bone stock will remain after the cut (Figure 84).

Cut the patella flat so that a smooth surface remains (Figure 85).

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 (Figure 86).



Figure 87

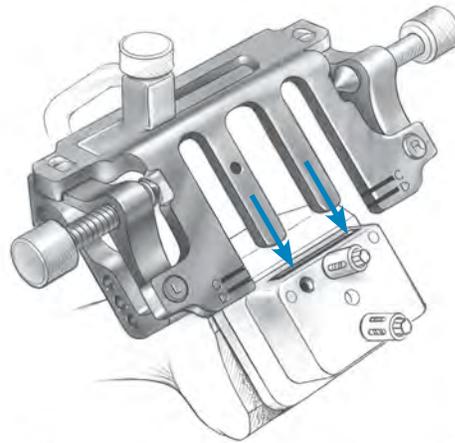


Figure 88

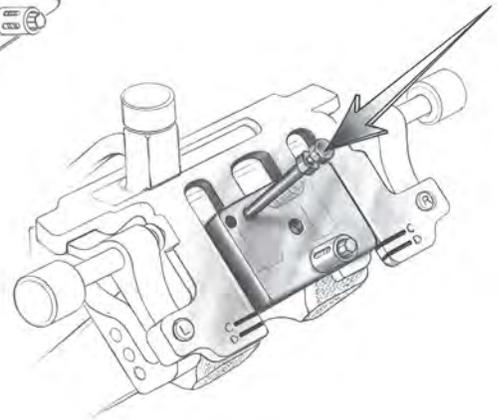


Figure 89

Step Twelve: Trial Reduction

Insert the femoral and patellar provisional components and the correct size stemmed tibial provisional. Check the appropriate knee implant size matching chart for component matching instructions. If a match is not obtainable, the incorrect tray size has been selected and another tray size and bearing family should be selected. Insert the proper height articulating surface 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 Technique

If one needs to resect more distal bone or downsize the femur to correct flexion/extension spaces, the proper recutting or downsizing block is selected and pinned to the distal femur with two silver spring pins (Figure 87). Ensure the guide is seated on the distal and anterior femur. Using the proper A/P positioning guide with mounting bases attached, insert the guide

into the block until the hole on the guide lines up with the hole on the block (Figure 88). With the two holes lined up, insert a fixation pin through the positioning hole in the block and into the hole in the A/P guide (Figure 89). (The boom on the A/P placement guide is not used when recutting the distal femur, and will not contact the femoral cortex.)

Drive two fixation pins into each of the two femoral mounting bases. Remove the fixation pin and the silver spring pins from the recutting block and remove the block and the A/P placement guide.

Attach the proper size femoral milling template onto the two femoral mounting bases. Check to ensure that there is not soft tissue in the area below the template.

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.

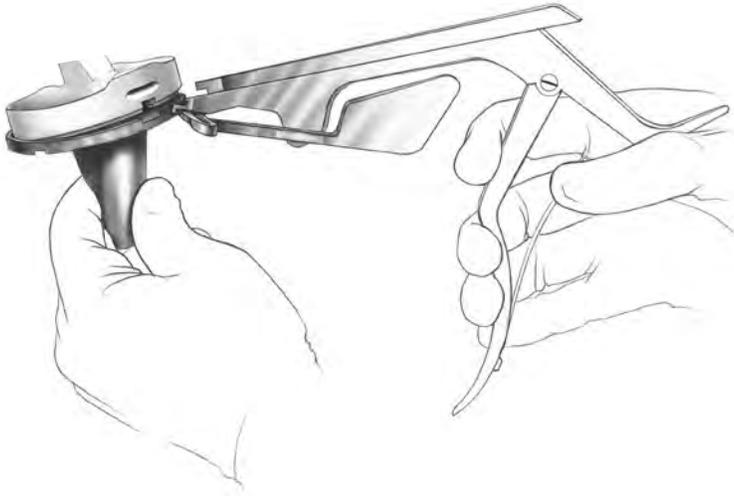


Figure 90

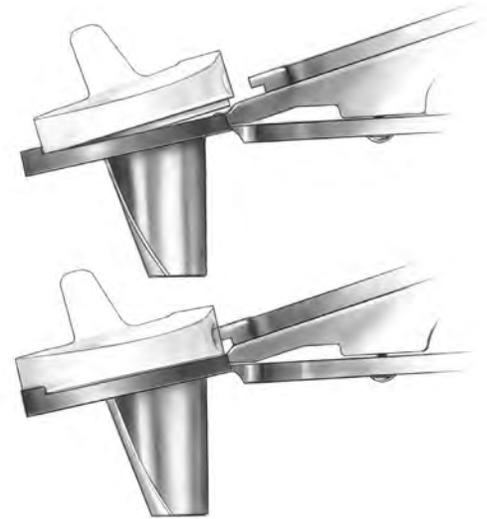


Figure 91

Femoral Recutting/Downsizing Technique (cont.)

Remill the anterior cortex, anterior chamfer, distal femur, the posterior chamfer, and the posterior condyles in the same manner as before.

Reattach the appropriate size femoral finishing guide and remill the trochlear recess.

Remove the femoral finishing guide and the femoral mounting bases, and recheck the alignment and flexion/extension gaps using the spacer/alignment guide and alignment rod.

Component Implantation

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

For cemented applications, place a layer of cement on the underside of the tibial component, around the keel, on the resected tibial surface and in the tibial IM canal. Remove excess cement. Wait for the cement to completely cure before inserting the bearing.

Bearing Insertion

The bearing inserter applies both downward and rearward forces to aid in the insertion of the bearing 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 (Figure 90). Place the bearing 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 bearing (Figure 91). Open the lever and remove the insertion tool.

Warning: Only insert a bearing once. Never reinsert the same bearing onto a tibial tray.

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1393.1-GLBL-en-REV0517



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