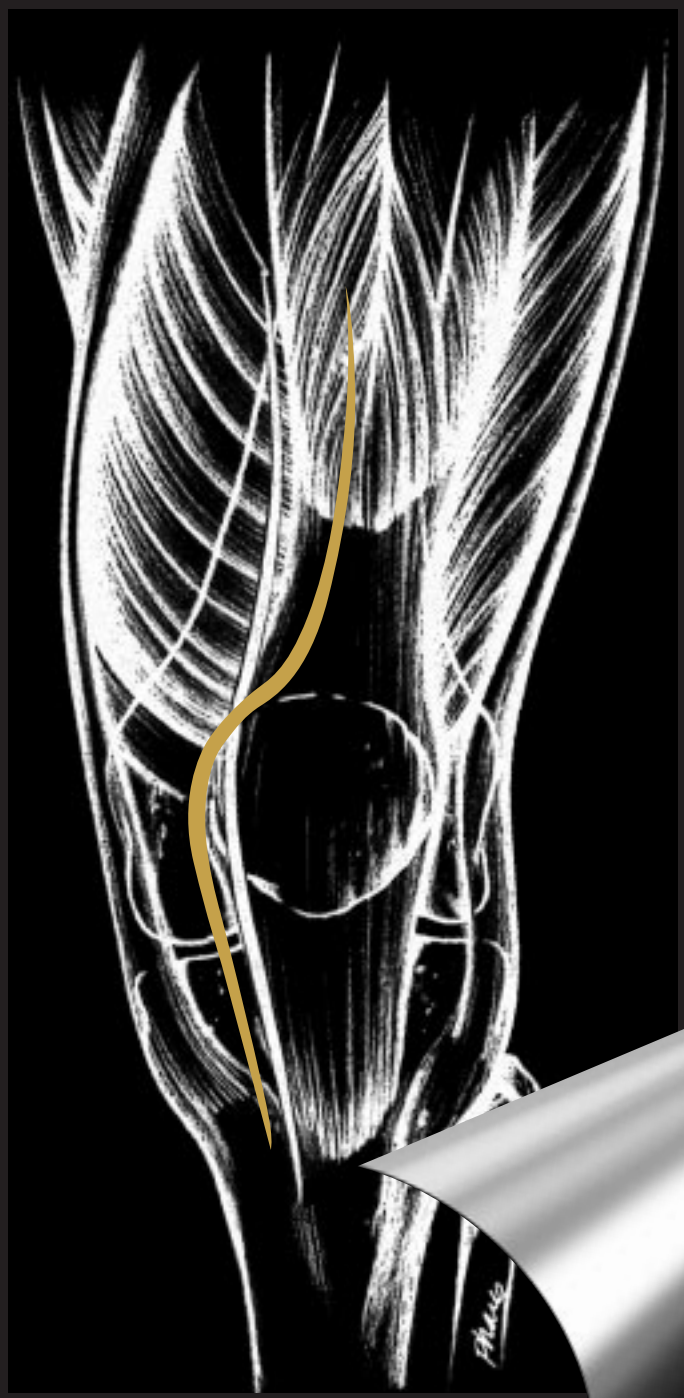
Monogram®
KNEE INSTRUMENTS



Monogram® IM Revision Instrument Surgical Technique with Offsetting Instruments

Duracon® Total Stabilizer

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OSTEONICS

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MONOGRAM® IM REVISION INSTRUMENT

Surgical Technique with Offsetting Instruments

Duracon® Total Stabilizer Revision Knee System using Monogram® IM Revision Instrument Surgical Technique with Offsetting Instruments*

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*US Patent Nos. 4,550,448; 4,646,729; 4,653,488; 4,668,290; 4,714,468; 4,787,383; 4,825,857; 4,834,756; 4,944,756; 5,035,700; 5,192,324; 5,441,537; 5,542,947; and US Design Patent Nos. 273,894-95; 274,090-95; 274,161-62. Other Patents Pending.

INTRODUCTION

The Monogram® IM Revision Instruments are designed for use with the Total Stabilizer implant. This instrument system provides stability and accuracy in both simple and complex revision scenarios.

By referencing and maintaining fixation in the intramedullary canal, Monogram® IM Revision Instruments provide a stable construct for reliable positioning, which ultimately leads to more accurate bone preparation and implant placement. In addition to these benefits, all of the required femoral bone preparations – including the stabilizer box – can be accomplished in one step. This minimizes the potential for inaccuracies that can occur with the removal and reattachment of multiple blocks and instruments.

The offsetting instruments allow the femoral and tibial implants to be shifted relative to the canal of the femur or tibia. On the femur this freedom allows for optimum positioning of the intercondylar mechanism and avoids inappropriate removal of important intercondylar femoral bone. This freedom also allows the tibial baseplate to be shifted around the tibial canal to provide the optimal implant coverage for the resected tibia. In addition, the instruments allow for the placement of the offset in a controlled, reproducible manner.

The following pages present highlights of the surgical technique for the Total Stabilizer Components using the Monogram® IM Referencing and Offsetting Instrumentation.

Component Removal

When removing the components to be revised, great care must be taken to preserve as much of the remaining bone stock as possible and to avoid the risk of fracture of the residual bone. Through the use of small flexible osteotomes, saws, and high-speed burring instruments, bone preservation can usually be achieved.

Femoral Canal Preparation

1. If a canal opening is not already present, one must be made using the 5/16" intercondylar stepped drill. The *estimated* entry point should be 5mm to 10mm anterior to the insertion of the posterior cruciate ligament and in line with the sulcus of the patient's original trochlear groove in the medial/lateral plane. This placement will allow a long alignment rod to traverse the femur maximally so that the final stem extender will be well centered in the canal.

2. If the canal is already enlarged due to the removal of a stemmed component or if a stem is going to be used in the revision situation, the canal must be reamed in order to accommodate the new implant. Start reaming with a reamer 2mm to 3mm smaller than the diameter of the stem that was removed or the templated measurement of the canal. The reamers were designed to be self centering. Thus the tapered tip of the reamer follows the path of the previous smaller reamer. Ream progressively until cortical contact is achieved. If the canal had not been previously prepared for a stemmed component, start with an 8mm reamer and ream progressively until cortical contact is achieved.

It is strongly recommended that IM Canal reaming be performed manually to avoid bone perforation and/or fracture. Manual reaming should allow for tactile feedback and allow the surgeon to achieve proper fill of the canal without over-reaming. In selected cases, if uncertainty exists, interoperative check X-rays may be considered. However these are not routinely necessary.

FEMORAL CANAL PREPARATION (CONTINUED)

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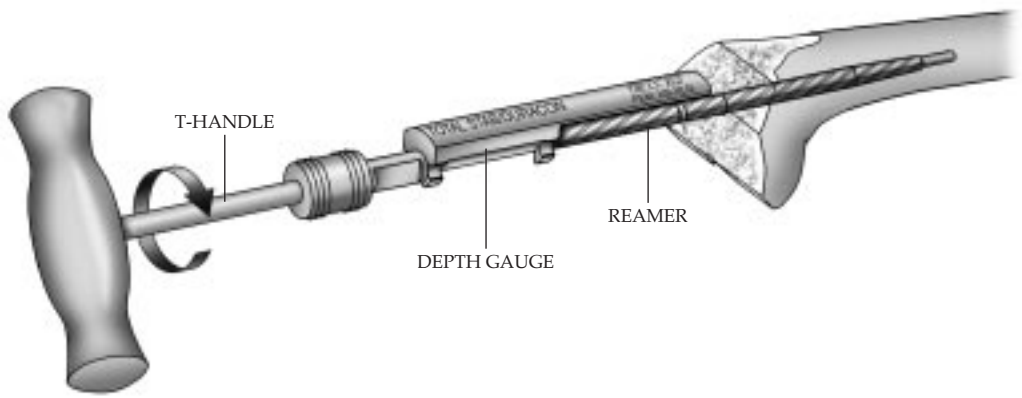

When using Stem Extenders, proper reamer depth is achieved by attaching the appropriate depth gauge to the shaft of the reamer and by advancing the reamer into the canal. Reaming proceeds until the tip of the depth gauge reaches the level of the most prominent bony aspect of the distal femur (**Figure 1**). Depth gauges for both femoral *and* tibial preparation are available in three basic configurations: "boss," 80mm stem, and 155mm stem. "Boss" refers to the depth required to seat the internally threaded "boss" properly on either the femoral component or tibial baseplate. 80mm and 155mm refer to the depth required to seat the "boss" plus the length of the Stem Extender to be used (Implant Stem Extenders are available in 80mm and 155mm lengths for both the femur and tibia).

In addition, a set of depth gauges for use with 80mm and 155mm offset stems is also available. These depth gauges will account for the additional length of the offset adaptor when reaming.

Figure 2 gives an example of depth gauge marking, and how it relates to preparation of the canal for an implant with a straight stem.

IMPORTANT: In situations where Press-fit Stem diameters of 17mm or less, or no stem at all, are being used, it is necessary to ream the medullary canal of the distal femur with a 17mm reamer to at least 40mm. This reaming provides the necessary clearance to fully seat the cutting guide tower and the "boss" portion of a stemmed femoral component. One should attach the "boss" depth gauge to the 17mm IM reamer, and ream until the gauge reaches the level of the most prominent bony aspect of the distal femur.

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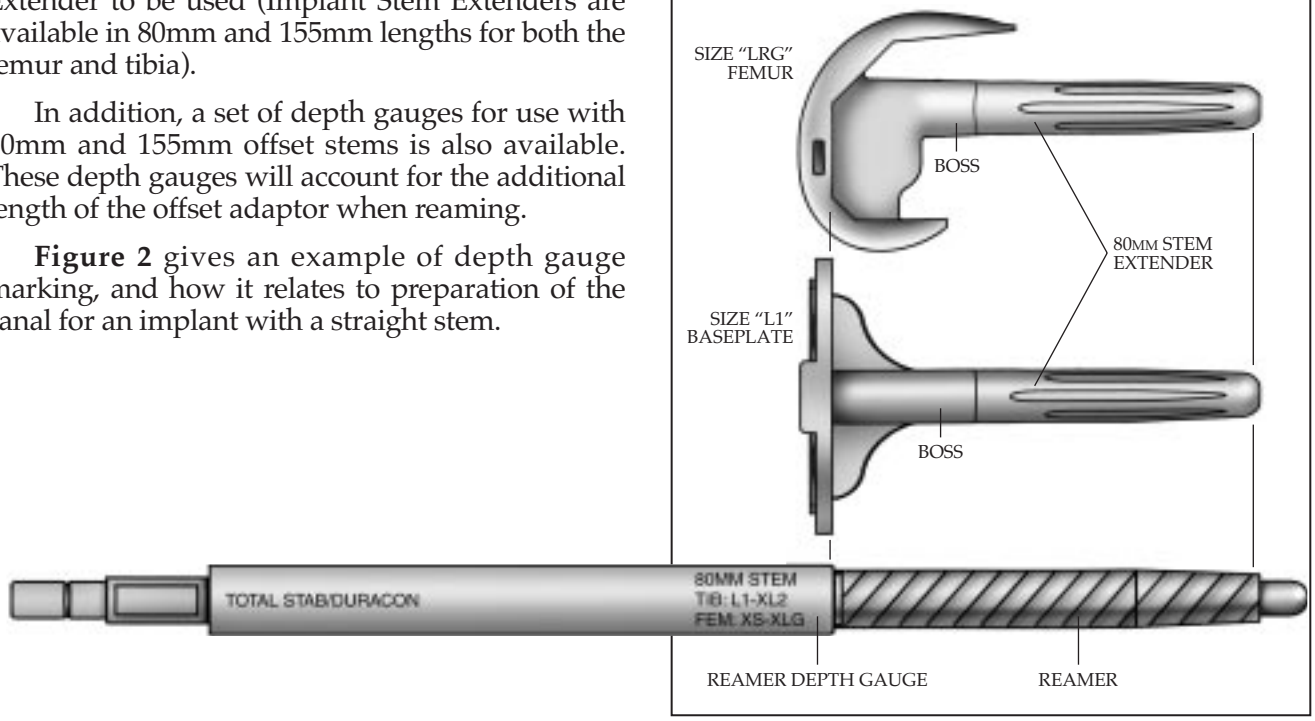
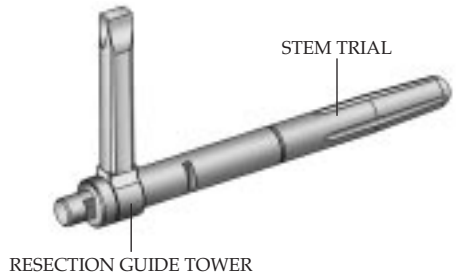


DISTAL FEMORAL RESECTION

3▼



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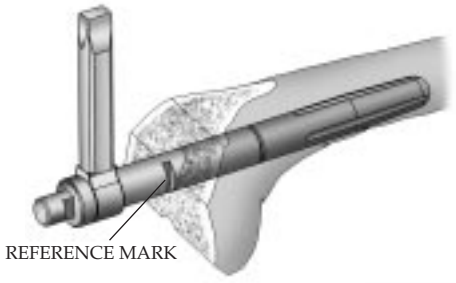
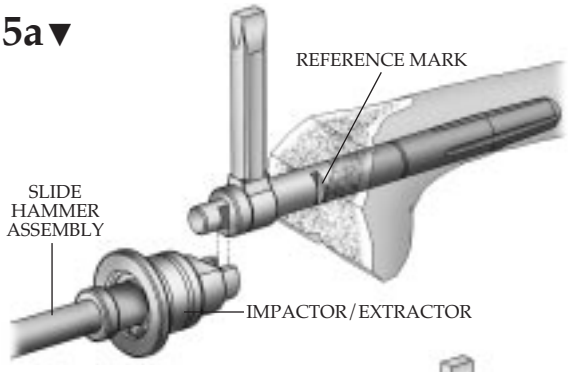


Based on the diameter and reaming depth of the last IM reamer used, the appropriate stem trial is chosen and attached to the cutting block resection guide tower (**Figure 3**).

The trial stem is inserted into the canal until the reference mark on the resection guide tower is in line with the most prominent bony aspect of the distal femur. This position will allow a 2mm distal femoral cleanup cut to be made (**Figure 4**).

The impactor/extractor in combination with the slide hammer assembly can be used to carefully introduce the instrument into the canal (**Figure 5a**). An optional method is to use the hex impactor/extractor with the T-handle to introduce the instrument by gently rotating the assembly while applying axial force (**Figure 5b**). In situations where the canal opening is enlarged and does not provide adequate support or a good reference point to seat the resection guide tower, a small or medium sized femoral collar (each available in "Right" and "Left" versions) can be attached to the tower to assist in setting the final position and rotation of the instrument (**Figure 5c**).

5a▼



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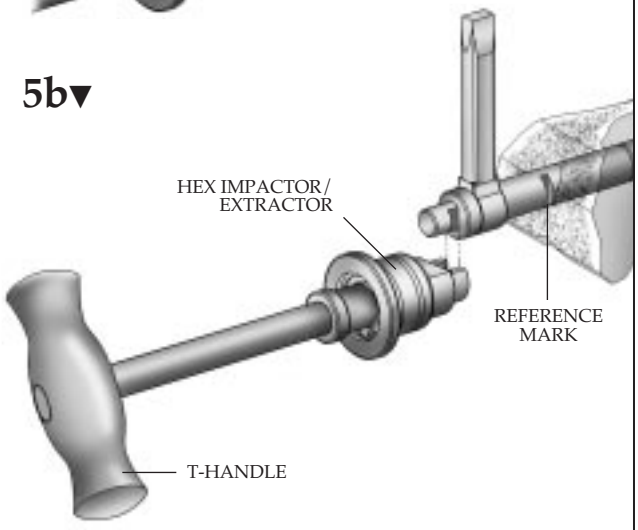

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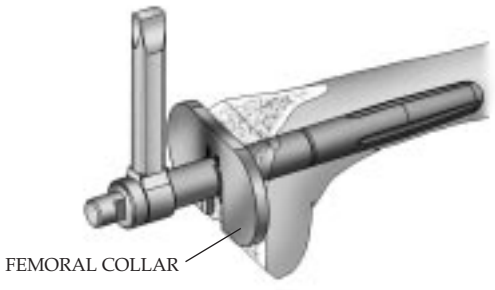

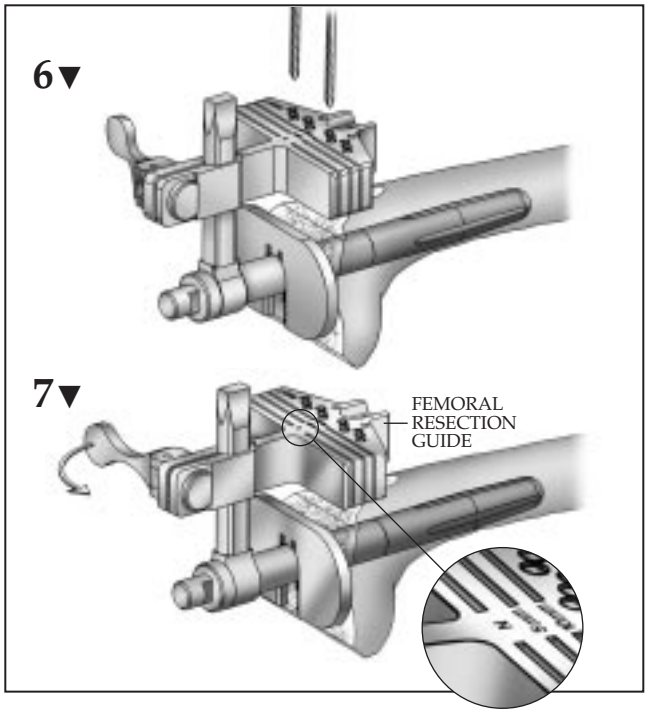

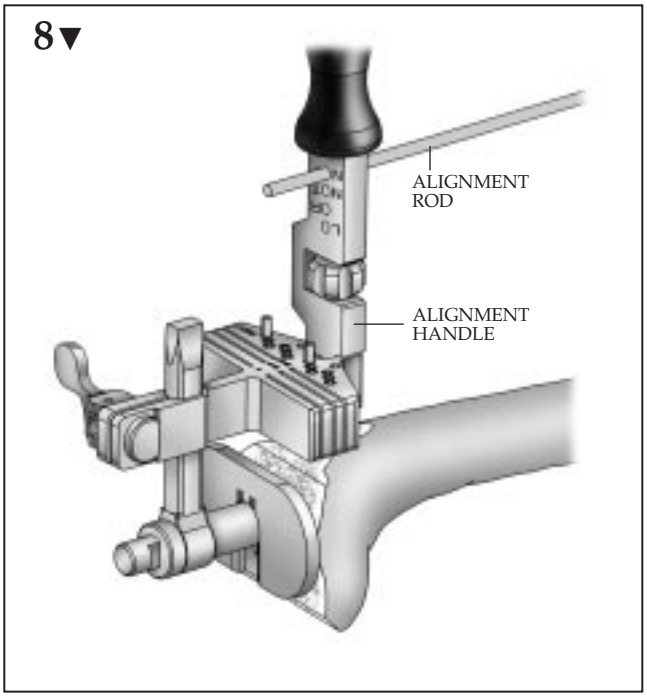

Once proper depth and rotational alignment have been achieved, the femoral resection guide is attached to the tower and secured by using the cam-lock mechanism. The appropriate left or right notation on the guide should be facing away from the bone corresponding to the knee being operated on. A valgus angle of 6°, which is equal to the stem angle of the implant, has been built into the cutting block. The block is pinned into place with two 1/8" drill bits, and the 2mm cleanup cut performed using the slot marked "N" for neutral. **The trial stem and resection guide tower are intended to remain in position during cutting to aid in block stability and cutting accuracy** (**Figure 6**). If Distal Femoral Augments are required, the appropriate 5mm or 10mm cut(s) is made through the appropriately marked slot(s) (**Figure 7**).

NOTE: *A narrow (19mm) sawblade is recommended for use with all IM Revision Resection Guides.*

If the level of the transverse cut is too far distal (too little bone resection), cutting depth can be adjusted two ways. The preferred method is to gently tap the resection tower (in the absence of the 1/8" drill pins) into the canal to facilitate a deeper cleanup cut. If this step is insufficient, the level of the resection can be adjusted by using the -2mm or -4mm drill holes of the distal femoral cutting block. This is done by first removing the jig from the pins and alignment tower. The alignment tower is then removed from the IM canal, and the cutting jig is reattached to the pins in either the -2mm or -4mm position. A pin may be inserted obliquely into the "X" drill hole to provide additional stability and to prevent vibration of the jig, off the pins, during cutting.

NOTE: Keep in mind that initially the jig and pins were placed in a position that provided a 2mm cleanup cut. If the cutting block is repositioned to the -2mm position, this will actually provide a 4mm cleanup cut. If the cutting block is repositioned to the -4mm position, this will provide a 6mm cleanup cut.

After making the cleanup cut, the reamed depth of the canal must be increased by the amount of the completed cleanup cut. This is accomplished by reaming with the previously used reamer and depth gauge to the new resection level. This additional reaming will allow the jig, and ultimately the final implant, to seat properly on the femur.

NOTE: Do not overtighten the cam-lock locking mechanism on the resection guide. Tighten only until resistance is felt, as overtightening could damage the instrument. **This mechanism should be lubricated after each cleaning cycle**.

In situations where an external alignment check is desired, a modular alignment handle is secured to the face of the cutting block by tightening the locking knob. By dropping a long alignment rod into the hole marked "NF" ("neutral femur"), alignment can be assessed (**Figure 8**).

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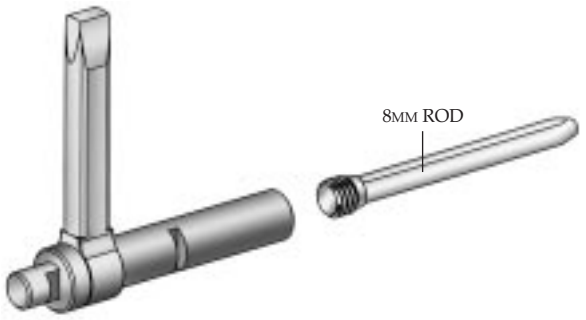

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Options

In situations where a Stem Extender will not be used, one of the two following options can be employed to make the distal femoral cleanup cut:

NOTE: When total stabilized components are felt to be indicated, a surgeon is invited to give strong consideration to the use of at least medium length femoral and tibial IM stems. The reasoning in such cases is to provide additional resistance to periprosthetic fractures.

OPTION 1

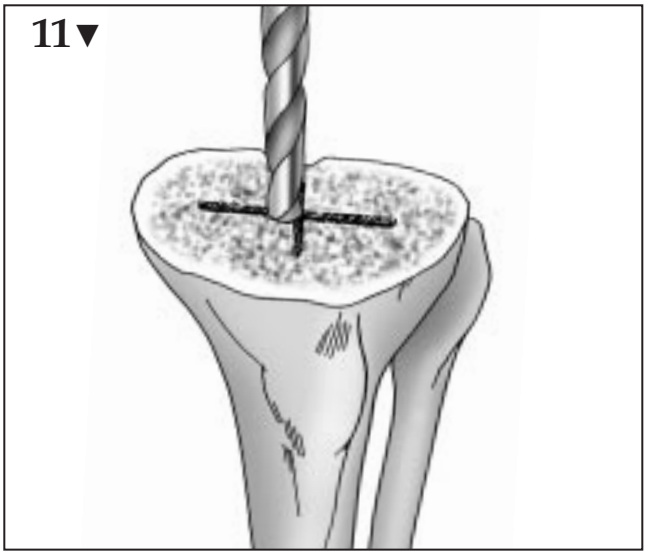
An 8mm x 255mm IM rod can be attached to the cutting block tower to provide an intramedullary reference. In situations where the femur is extremely bowed or an obstruction of the IM canal is present, a 155mm IM rod is available (**Figure 9**). When using the 8mm IM rod, the distal portion of the femur must first be reamed to 17mm to allow proper seating of the guide tower and to provide clearance for the "boss" portion of the stemmed femoral component. This is done by attaching the "boss" depth gauge to the 17mm reamer; ream the canal until the gauge reaches the level of the most prominent bony aspect of the distal femur (**Figure 10**).

OPTION 2

The Monogram® primary distal femoral alignment guide, distal cutting block, and 5/16" "T" rod can be used to make the distal femoral cleanup cut. For further details, refer to *Duracon® Total Knee System Using Monogram® Knee Instruments Surgical Technique (Cat. No. 6640-1-126-0)*.

Tibial Canal Preparation and Proximal Tibial Resection

11▼



In the rare case where a canal opening is not already present, one must be made by using the 5/16" intercondylar stepped drill. In general, the location of the intramedullary canal is one-third the distance from the anterior projection of the tibia to the posterior cortex. In the medial/lateral plane, the canal will normally be located on the medial aspect of the patient's original tibial eminence, or just medial to the tibial tubercle. A/P and lateral radiographs should be reviewed in order to assess the approximate position of any tibial stem. Care should be taken to drill the hole as parallel as possible to the coronal plane of the tibia (**Figure 11**).

If the canal is already enlarged due to the removal of a stemmed component, or a stem is going to be used in the revision situation, the canal must be reamed in order to accommodate the new implant. Start reaming with a reamer 2mm to 3mm smaller than the diameter of the stem that was removed or the templated measurement of the canal. The reamers were designed to be self centering. Thus the tapered tip of the reamer follows the path of the previous smaller reamer. Ream progressively until cortical contact is achieved. If the canal has not been previously prepared, start with an 8mm reamer and ream progressively until cortical contact is achieved.

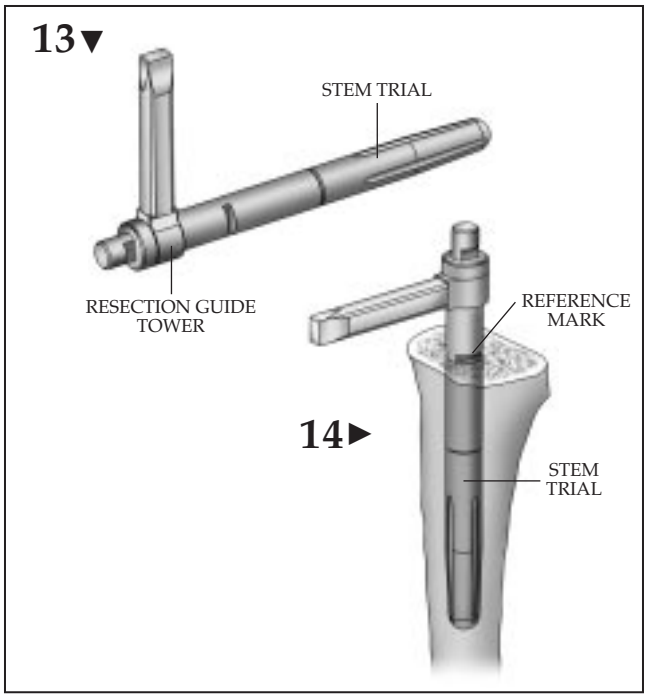
It is strongly recommended that IM Canal reaming be performed manually to avoid bone perforation and/or fracture. Manual reaming should allow for tactile feedback and allow the surgeon to achieve proper fill of the canal without over-reaming. In selected cases, if uncertainty exists, interoperative check X-rays may be considered. However these are not routinely necessary.

12▼

When using Stem Extenders, proper reamer depth is achieved by attaching the appropriate depth gauge to the shaft of the reamer and by advancing the reamer into the canal. Reaming proceeds until the tip of the depth gauge reaches the level of the most prominent bony aspect of the proximal tibia (**Figure 12**). Depth gauges for tibial preparation are available in three lengths: "boss," 80mm, and 155mm. "Boss" refers to the depth required to properly seat the internally threaded "boss" on the tibial baseplate. 80mm and 155mm refer to the depth required to properly seat the "boss" plus the length of the Stem Extender to be used. In addition, a set of depth gauges for use with 80mm and 155mm offset stems is also available. These depth gauges will account for the additional length of the offset adaptor when reaming.

NOTE: *On Universal Baseplates, the length of the "boss" varies slightly depending on the size of the implant. In order to ream to the correct depth, the proper depth gauge must be chosen. An initial baseplate sizing assessment can be made using the tibial sizing templates and/or by referencing the size of the explanted component.* **Figure 2** *(page 4) gives an example of depth gauge marking and how it relates to a given combination of implants.*

IMPORTANT: In situations where a Press-fit Stem of 15mm or less will be used, or when no stem will be used at all, it is necessary to ream the medullary canal with a 15mm reamer by using the "boss" depth stop. This reaming provides the

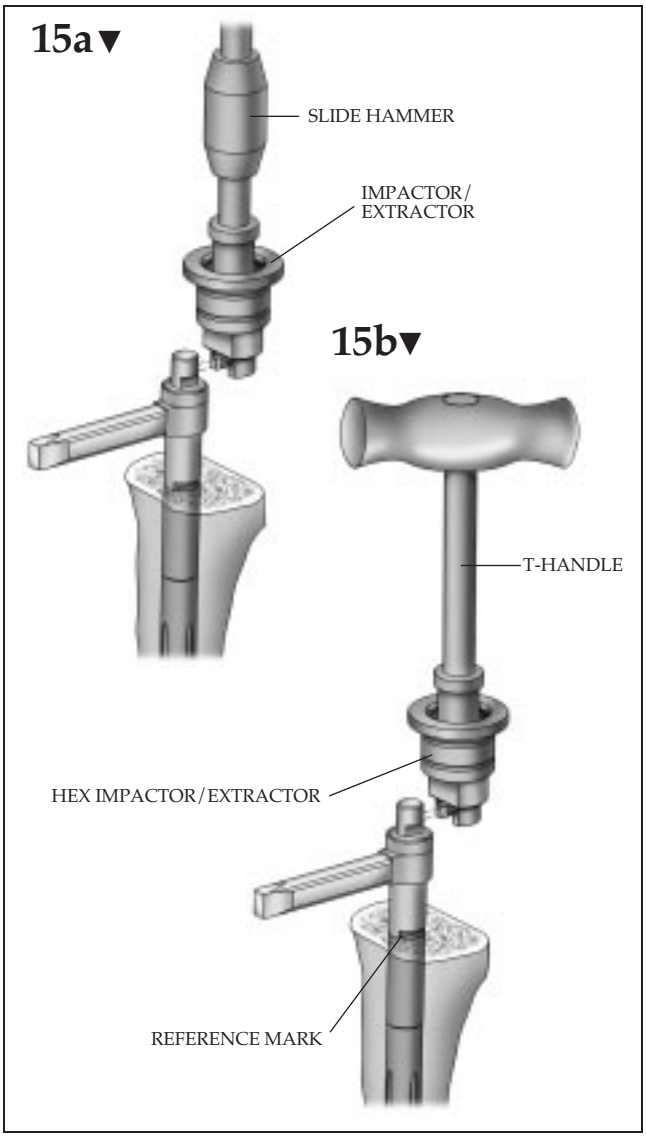


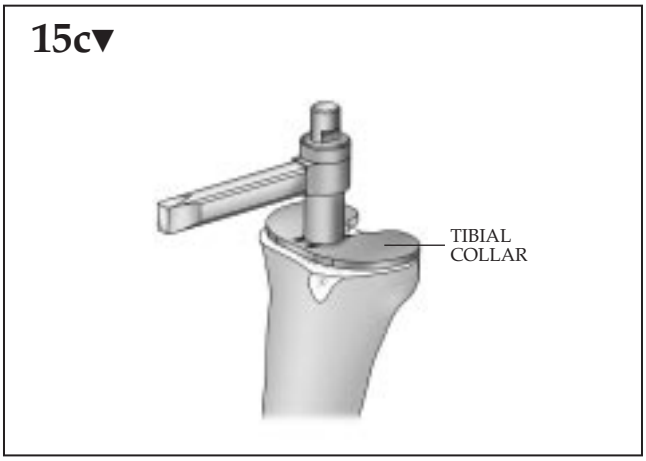
necessary clearance to fully seat the cutting guide tower and the stemmed portion of the tibial baseplate. This is done by reaming to the "boss" marking of the 15mm IM reamer.

Based on the diameter and reaming depth of the last IM reamer used, the appropriate stem trial is chosen and attached to the resection guide tower (**Figure 13**).

The trial stem is inserted into the canal until the reference mark on the resection guide tower is in line with the most prominent bony aspect of the proximal tibia. This position will allow a 2mm proximal tibial cleanup cut (**Figure 14**).

The impactor/extractor in combination with the slide hammer assembly can be used to carefully introduce the instrument into the canal (**Figure 15a**). An optional method is to use the hex impactor/extractor with the T-handle to introduce the instrument by gently rotating the assembly while applying axial force (**Figure 15b**). In situations where the canal opening is enlarged and does not provide adequate support or a good reference point to seat the resection guide tower, a small, medium, or large tibial collar can be attached to the tower to assist in setting the final position and rotation of the instrument (**Figure 15c**).





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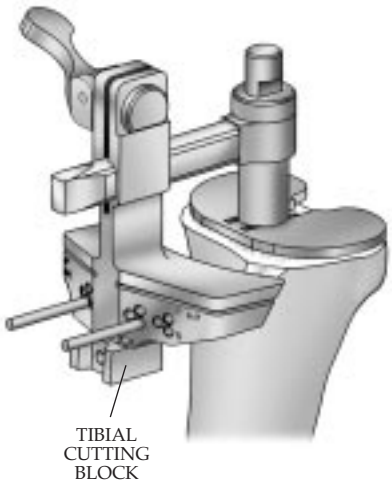

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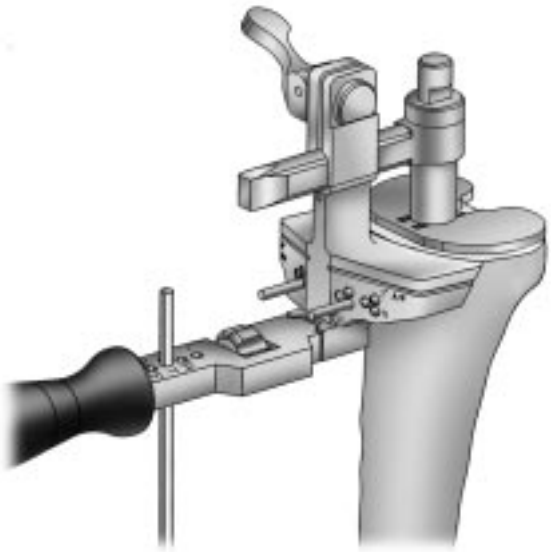

Once proper depth and rotational alignment have been achieved, the appropriate right or left tibial cutting block is chosen, slid onto the resection tower to make contact with the tibia, and secured using the cam-lock locking mechanism. Tibial component rotation is a complex issue. The tibia will be guided to some rotational position, at least in full extension, as the soft tissue sleeve is distracted. There is an array of bony landmarks, some of which may not be present in revision cases, which one may reference. As a first approximation, or primary reference, we are suggesting an axis from the posterior mid-point of the tibia, i.e. the location of the PCL insertion, to the junction of the medial and anterior one third of the tibial tubercle. The block is then pinned into place with two 1/8" drill bits, using the neutral drill holes. A 2mm cleanup cut can now be made. *The trial stem and resection guide tower are designed to remain in position during the cleanup cut to aid in block stability and cutting accuracy.* Three degrees of posterior slope have been built into the cutting block to accommodate the Universal Baseplate (**Figure 16**).

If the level of the transverse cut is too far proximal (too little bone resection), the cleanup cut depth can be adjusted in two ways. The preferred method is to gently tap the resection tower (in the absence of the 1/8" drill bits) into the canal to facilitate a deeper cleanup cut. If this step is insufficient, the level of the resection can be adjusted by using the -2mm or -4mm drill holes of the proximal tibial cutting block. This is done by first removing the jig from the pins and alignment tower. The alignment tower is then removed from the IM canal, and the cutting jig is reattached to the pins in the -2mm or -4mm position. A pin may be inserted obliquely into the "X" drill hole to provide additional stability and to prevent vibration of the jig off the pins during cutting.

After making the cleanup cut, the depth of the reamed canal must be increased by the amount of the completed cleanup cut. This is accomplished by reaming with the previously used reamer and depth gauge to the new resection level. This additional reaming will allow the jig, and ultimately the final implant, to seat properly on the tibia.

NOTE: Do not overtighten the cam-lock locking mechanism on the resection guide. Tighten only until resistance is felt, as overtightening could damage the instrument. *To ensure proper function, this mechanism should be lubricated after each cleaning cycle.*

In situations where an external alignment check is desired, a modular alignment handle is secured to the face of the cutting block by tightening the locking knob. By dropping a long alignment rod into the hole marked "NT" ("neutral tibia"), external alignment can be assessed (**Figure 17**).

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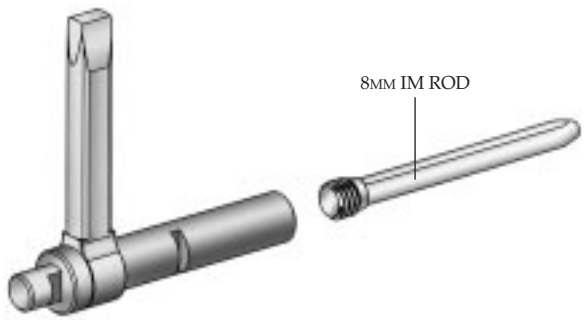

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Options

In situations where a Stem Extender will not be used, one of the two following options can be employed to make the proximal tibial cleanup cut:

NOTE: When total stabilized components are felt to be indicated, a surgeon is invited to give strong consideration to the use of at least medium length femoral and tibial IM stems. The reasoning in such cases is to provide additional resistance to periprosthetic fractures.

OPTION 1

An 8mm x 255mm IM rod can be attached to the cutting block tower to provide an intramedullary reference. In situations where the tibia is extremely bowed or an obstruction of the IM canal is present, it is possible to use a 155mm rod (**Figure 18**).

When using this option, the proximal portion of the tibia must first be reamed to 15mm to allow proper seating of the guide tower and to provide clearance for the "boss" portion of the baseplate (**Figure 19**). This is done by attaching the "boss" depth gauge to the 15mm reamer; ream the canal until the gauge contacts the most prominent bony aspect of the proximal tibia.

OPTION 2

The Monogram® primary external or IM referencing proximal tibial resection guide can be used to make the cleanup cut. For further details refer to *Duracon® Total Knee System Using Monogram® Knee Instruments Surgical Technique (Cat. No. 6640-1-126-0)*.

FLEXION AND EXTENSION GAP ASSESSMENT

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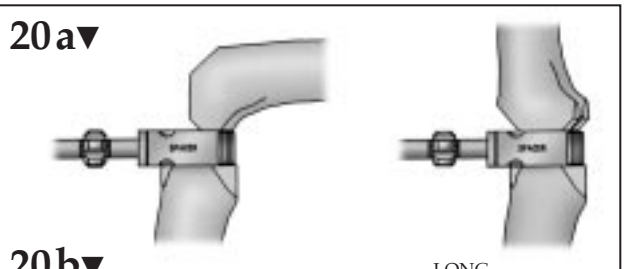

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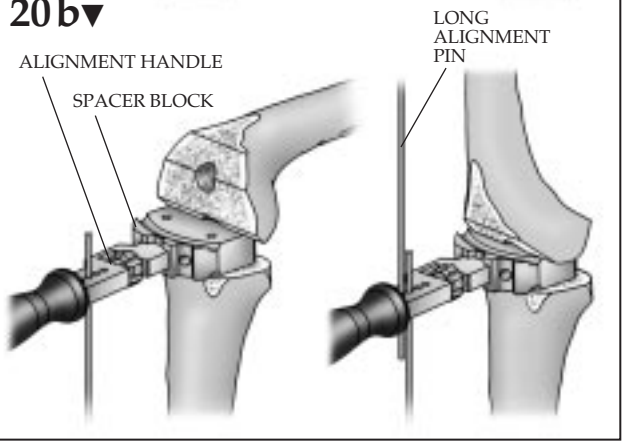

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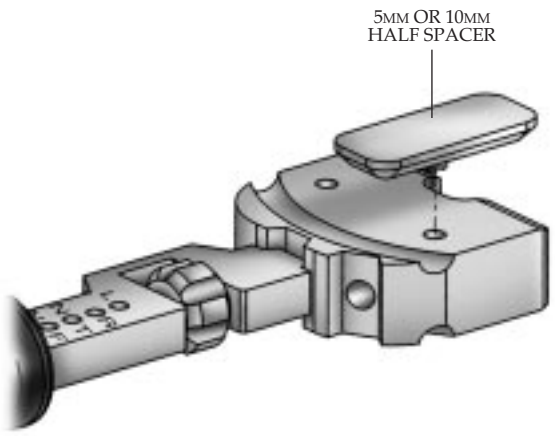


Once the distal femoral and proximal tibial cleanup cuts have been completed, the balance and alignment of the flexion and extension gaps can be evaluated through the use of spacer blocks. Spacer blocks are available in multiple thicknesses that correspond to the combined thickness of the tibial baseplate, polyethylene insert, and the femoral condyles (**Figure 20a**).

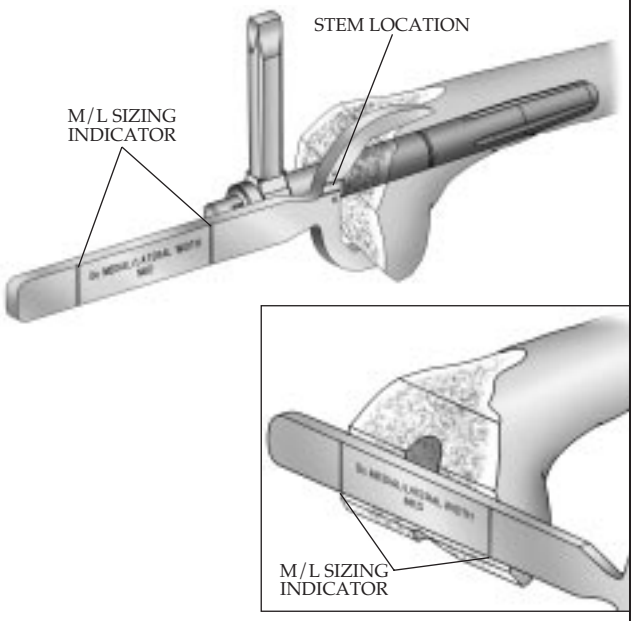
The blocks are available in the following thicknesses: 19mm, 21mm, 23mm, 26mm, 29mm, 32mm, 35mm, 38mm, and 41mm. The nominal dimension of the spacer block that properly fills the joint space in flexion and extension can be used to derive an estimated insert thickness that will be reconfirmed at trial reduction. To arrive at the insert thickness, take the spacer block thickness and subtract 10mm. For example, if a 32mm spacer block is used, the best trial insert to start with at trial reduction will be 22mm.

To perform an external check of overall limb alignment, the modular alignment handle can be attached to the spacer block and used with long alignment pins inserted in the two holes marked "NT" and "NF" ("neutral tibia" and "neutral femur") (**Figure 20b**).

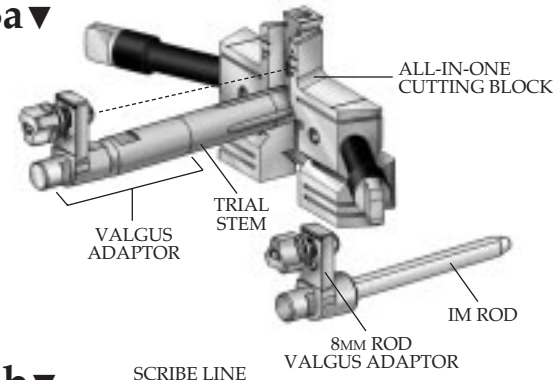
5mm and 10mm modular "half spacers" are available and can be attached to the spacer blocks (**Figure 21**). These are particularly useful for evaluating the effect of various combinations of distal and posterior femoral augments on joint line restoration and flexion/extension balance. If bone has already been resected to accommodate distal femoral augments, the half spacers can be used to compensate in order to carry out proper soft tissue evaluation.

FEMORAL SIZING AND RESECTION

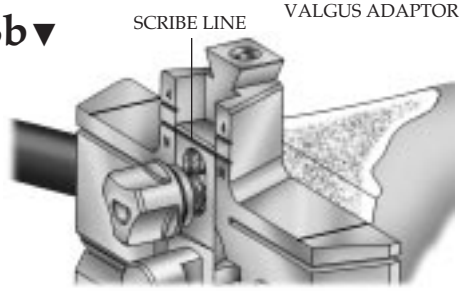
22▼



23a▼



23b▼



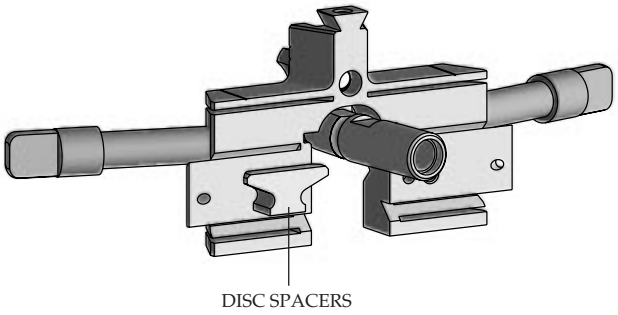
Femoral sizing can be accomplished three ways: a) referencing the revised component by measuring the A/P and M/L dimensions and choosing a similarly sized Total Stabilizer component; b) preoperative templating; or c) using the femoral sizing template (**Figure 22**). To use the femoral sizing template, leave the resection guide tower and trial stem in the femur and position the sizing template so that the etched line marked "N" for neutral stem is coincident with the centerline of the guide tower and the canal. If an anterior gap is present, reposition the sizing template so that the engraved line marked "4mm" is coincident with the centerline of the guide tower and reassess the fit of the template in this "4mm offset stem" position. Check the Medial-Lateral fit by using the engraved lines on the handle of the template (**Figure 22 inset**). Repeat this process with a different size template if necessary to determine the best size femoral component and whether a 4mm offset stem is required.

Only the 4mm offset adaptor is intended for use with the Total Stabilizer femoral component. If it seems that a larger offset might be needed, assess the fit of the next larger size femoral component. The change in stem position between sizes will help reduce the overall needed offset and prevent the component from being positioned too far posteriorly.

Following the sizing process, the correct All-in-One cutting block is chosen. The appropriate left or right valgus adaptor is attached to the correct diameter and length stem trial or an 8mm IM rod. The valgus adaptor with stem is then attached to the cutting block and tightened in place at the appropriate position on the cutting block (**Figure 23a**). The scribe line on the valgus adaptor should be positioned in line with the "N" line of the cutting block if no offset is to be used. If the four-millimeter offset is to be used the valgus adaptor should be locked in position at the "4" line. After assembly, the instrument is inserted into the femoral canal and seated against the distal femur (**Figure 23b**).

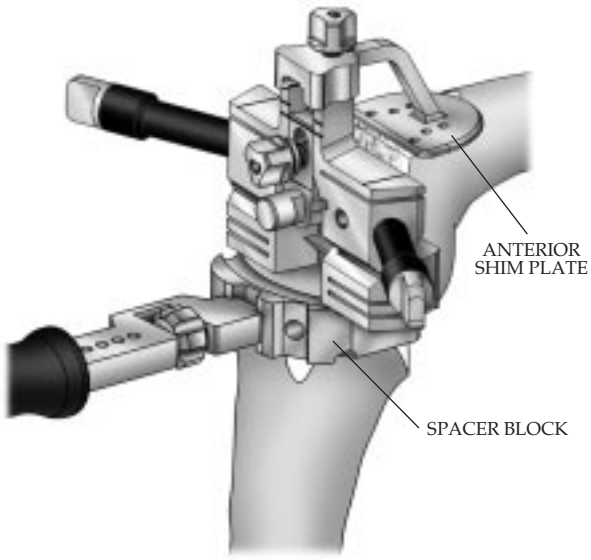
NOTE: The stem plug wrench can be used to aid in securely tightening the valgus adaptor locking knob.

24▼



If a 5mm or 10mm Distal Femoral Augment is to be used, the corresponding spacer disc must be attached to the back of the All-In-One cutting block to insure the stability of the instrument (**Figure 24**).

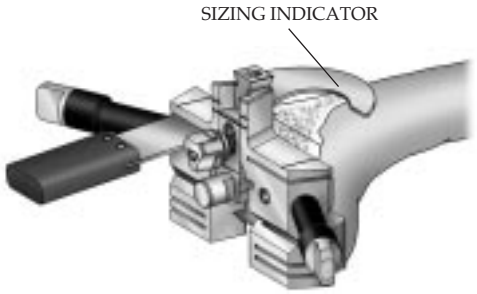
25▼



The rotational position of the femoral cutting guide can be set using any of the following methods: a) visually paralleling the cutting guide handles with the transepicondylar axis; b) visually paralleling the posterior surface of the cutting guide with the posterior condyles; c) using a spacer block between the All-in-One cutting guide and the resected proximal tibial surface to ensure a parallel flexion gap; or d) using the anterior shim plate to reference the original anterior resection plane (**Figure 25**).

NOTE: Femoral component rotation is a complex issue in both primary and revision total knee arthroplasty. We favor strong consideration of the use of the epicondylar axis as the primary rotational reference. One can check the existing anterior and posterior residual femoral surfaces to see if they are approximately parallel to the epicondylar axis. If so, working from those surfaces will be relatively easy and relatively reliable. Paralleling the femoral All-in-One guide to the cut tibial surface using a spacer block can be done. However, care needs to be taken to make certain that the femoral bone itself has not distracted or fallen into an inappropriate rotational position.

26▼



Confirmation of the cutting block size can now be achieved by placing the sizing indicator through the anterior cutting surface of the block and referencing the anterior femoral cortex (**Figure 26**).

Once proper size and positioning have been confirmed, the cutting block is pinned to the bone to provide additional stability.

All bone cuts are then made through this block:

a) Anterior and Posterior

b) Anterior and Posterior Chamfers

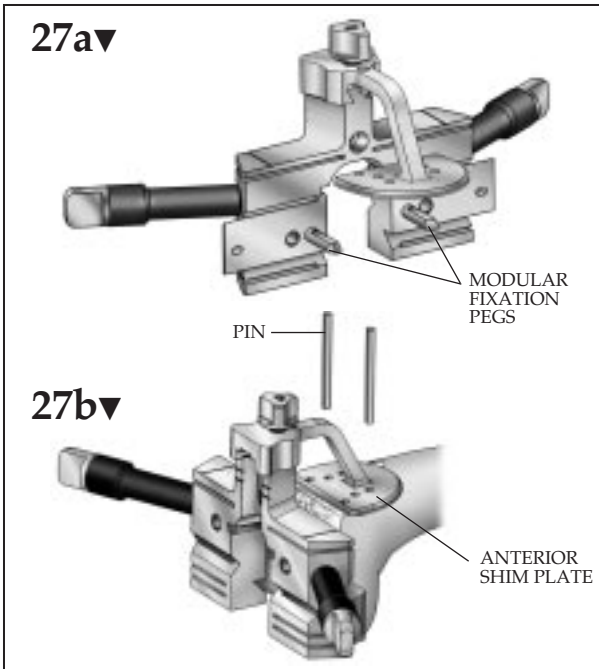
c) Posterior Augments (if required)

d) Intercondylar Box Preparation

For additional cutting jig stability, after making the anterior bone cut, the anterior referencing plate can be attached to the femoral cutting jig and pinned in place. This will provide added stability during the chamfer and posterior cuts.

NOTE: *The anterior bone cut cannot be made with the anterior shim plate in place.*

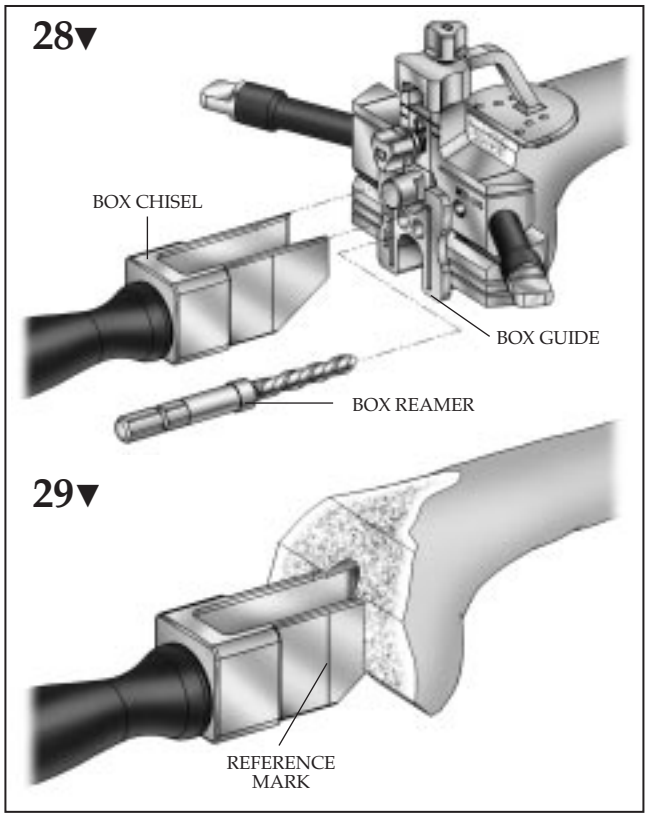
27a▼

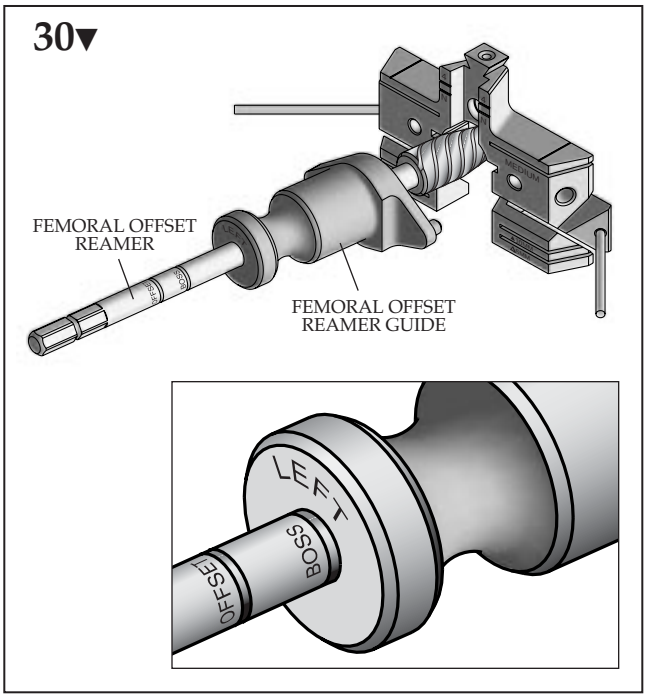


OPTION - Anterior Referencing

If IM referencing is not used, the anterior referencing plate can be attached to the cutting block and can aid in the positioning of the jig. Modular fixation pegs can be screwed into the back of the cutting block to allow fixation to the bone (**Figure 27a**). Additional 1/8″ oblique fixation holes can be used to provide additional stability (**Figure 27b**).

STABILIZER BOX PREPARATION





To prepare for the stabilizer box, the appropriate-size stabilizer box guide is placed into the All-in-One cutting block. The size of the box guide must correspond to the size of the cutting block being used. Two holes are reamed through the box guide to aid in bone removal in the intercondylar region of the distal femur. Next, a 1/2" osteotome or narrow saw blade is used to make the initial cuts using the inside walls of the slots as a guide. The box chisel is then inserted into the slots and carefully impacted until it bottoms out on the box guide (**Figure 28**).

NOTE: To avoid bone fracture, a sawblade or osteotome should be used to make initial bone cuts before impacting the bone chisel.

Warning! One must recall the position of the popiteal structures and take care that they are either far enough away or otherwise protected by retractors and or sponges. More casual drilling, sawing or osteotome use, especially with the other instruments obscuring the direct view can be hazardous.

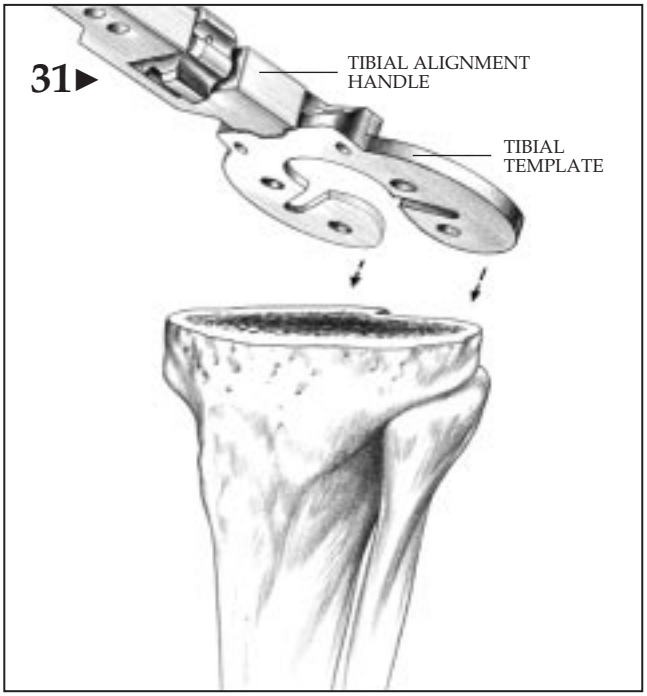
Remove the chisel and box guide. Any bone remaining in the box area is removed with small osteotomes or a rongeur, or by reinserting the box chisel until the reference mark is flush with the bone (**Figure 29**).

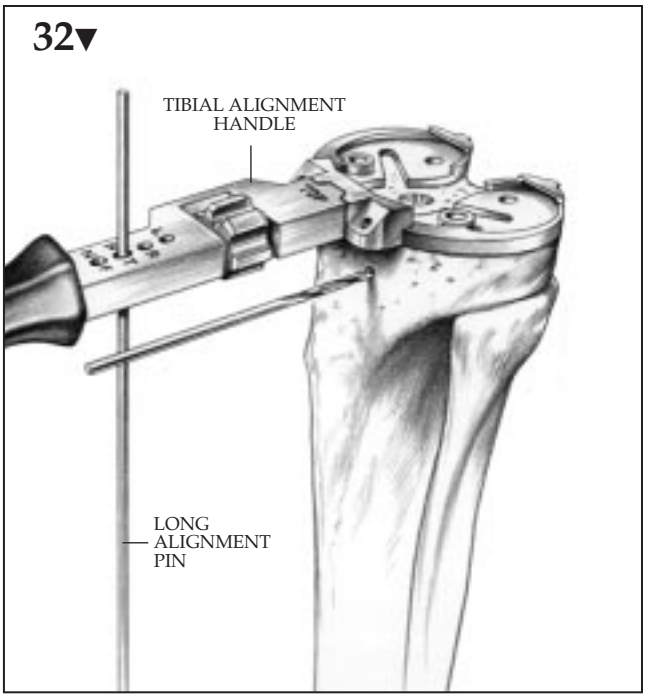
Boss and Adaptor Preparation

To prepare for the femoral implant boss, assemble the femoral offset reamer and the appropriate right or left reamer guide (**Figure 30**). Place the reamer bushing on the femoral cutting block and insert the reamer to appropriate depth marking on the reamer shaft. When no offset is to be used the reamer is inserted until the "boss" line is level with the top of the reamer guide. If an offset is to be used, insert the reamer to the "offset" line (**Figure 30 inset**).

NOTE: *The femoral offset reamer and reamer guide must always be used to prepare for the boss and offset adaptor when an offset stem is used. The femoral offset reamer and reamer guide should also be used in those cases when a straight stem with a diameter of less then seventeen millimeters is used. This will prepare the distal femur to accept the seventeen-millimeter*

FINAL TIBIAL PREPARATION





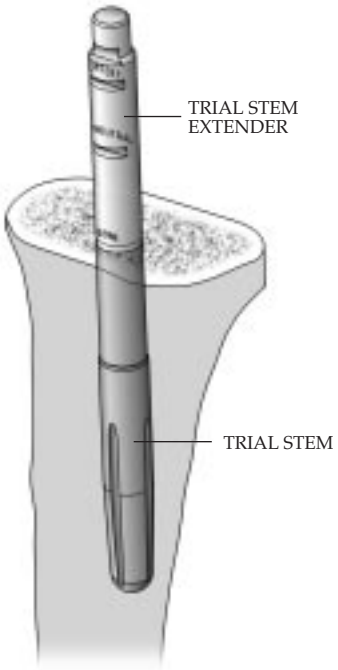
The Total Stabilizer Tibial Inserts are designed to lock into the Universal Baseplate. In addition to accepting Stem Extenders and offsets, the Universal Baseplate also accepts a variety of flat, angled, and full wedges.

To prepare the tibia for the Universal Baseplate, first select the appropriate size tibial template, and lock it onto the tibial alignment handle (**Figure 31**).

Verifying Alignment

The alignment handle helps to assess rotational, varus/valgus, and flexion/extension alignment (**Figure 32**). The previously set tibial rotational alignment can be recalled from the position of one or both of the tibial resection guide drill bits. Possibly more useful would again be an assessment of the PCL – tibial tubercle axis. A line from the original center of the posterior mid-point of the tibia, i.e. the insertion region of the PCL, projected to the junction between the medial and anterior one third of the tibial tubercle serves as an excellent first reference for tibial component rotational alignment (**Figure 33**). Varus/valgus and flexion/extension alignment are verified with a long alignment pin.

33▼

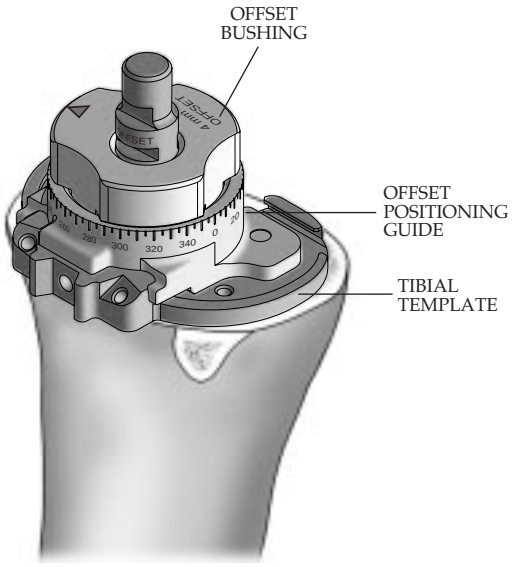


Positioning the Universal Baseplate

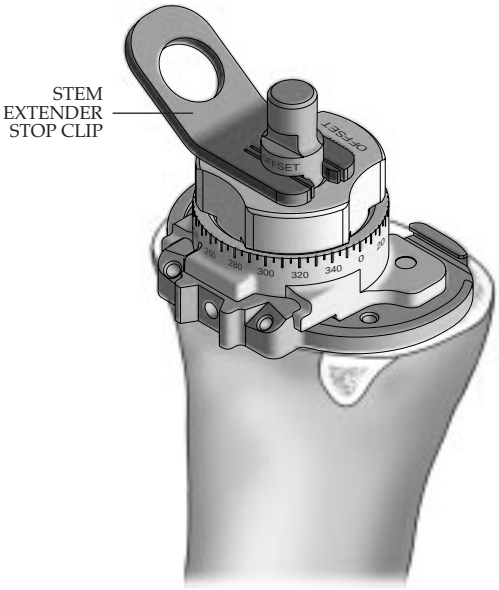
Attach the appropriate length and diameter stem to the trial stem extender. Insert the assembly into the canal until the reference mark labeled "bone", is aligned with the resection level of the proximal tibia (**Figure 33**). Select the tibial template that provides the desired coverage of the proximal tibia and assemble it to the offset positioning guide by aligning the holes of the template with the pegs on the underside of the positioning guide.

Visually assess the position of the trial stem extender and the center of the tibia. If it appears that an offset will be needed select the appropriate four, six, or eight-millimeter bushing that will maximize proximal tibial coverage and place it into the offset positioning guide. Slide the template, positioning guide construct over the trial stem extender and lower it to the bone (**Figure 34a**). If the stem construct is unstable within the canal the trial stem extender stop clip can be placed on the stem at this time to prevent migration of the stem down the canal (**Figure 34b**).

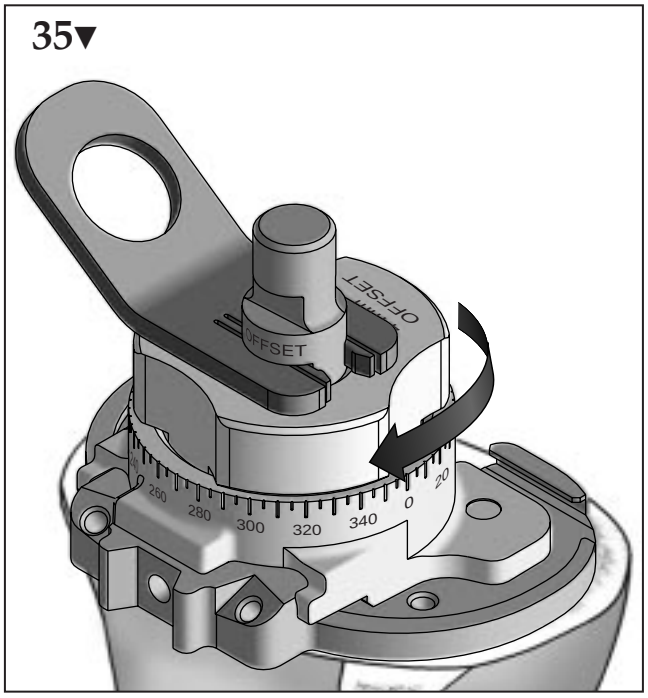
34a▼



34b▼

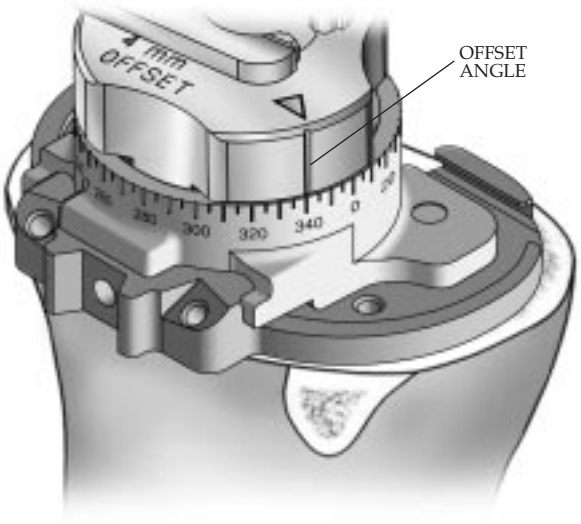


35▾



Rotate the bushing around the stem (**Figure 35**). This will move the tibial template relative to the stem in order to determine the best proximal tibial bone coverage. If a different offset is to be evaluated, remove the stop clip and bushing. Slide the new bushing over the trial stem extender and place the stop clip back in place. Assess the positions provided by the new bushing.

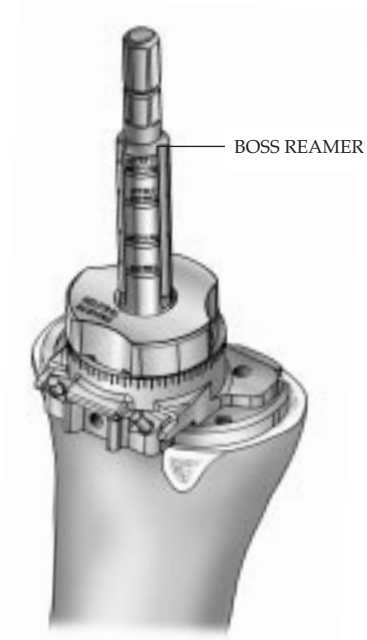
36▾



When the template has been properly positioned, pin it into place using headed nails or 1/8″ drill pins. Determine the degree of offset applied by reading the calibrated scale that is engraved on the instrument and the mark that is engraved on the bushing (**Figure 36**).

Mark this number down for reference when assembling the trials and implants.

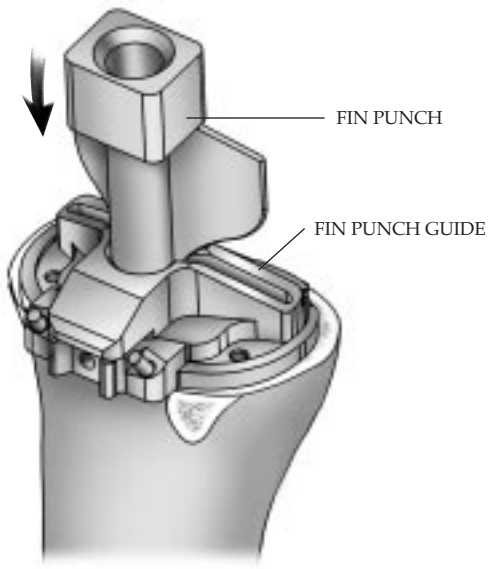
37▼



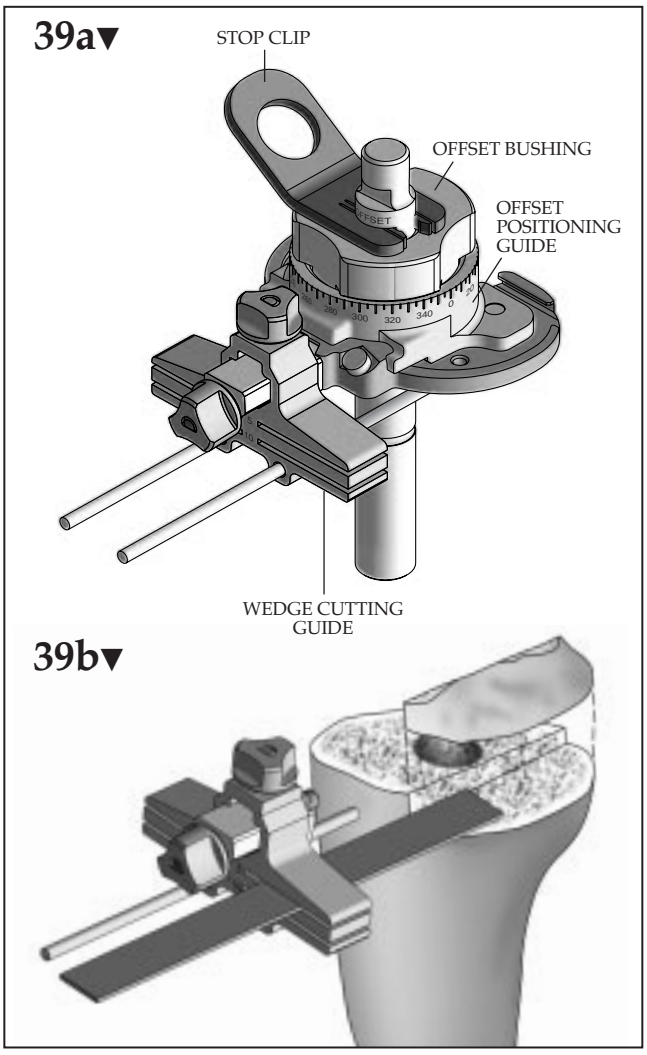
Remove the offset bushing and the stem extender construct. Leave the template and the offset positioning guide in place. Place the neutral reamer bushing into the offset positioning guide. Ream with the boss reamer through the bone to the desired depth (**Figure 37**).

NOTE: *The tibial boss reamer and reamer bushing must always be used to prepare for the boss and offset adaptor when an offset stem is used. The tibial boss reamer and reamer bushing should be used in those cases when a straight stem with a diameter of less then fifteen millimeters and no offset is used. This will prepare the proximal tibia to accept the fifteen-millimeter diameter boss of the tibial component.*

38▼



Remove the offset positioning guide and place the appropriate size fin punch guide on the tibia. Fit the punch into the cutout on the guide. Keeping the punch perpendicular to the resected surface, slowly impact the punch to allow for expansion of the bone (**Figure 38**). Remove the punch by using the small sliding hammer assembly. Use of the plug pusher is not required except in cases where a stem is not being used and the canal has not been reamed.



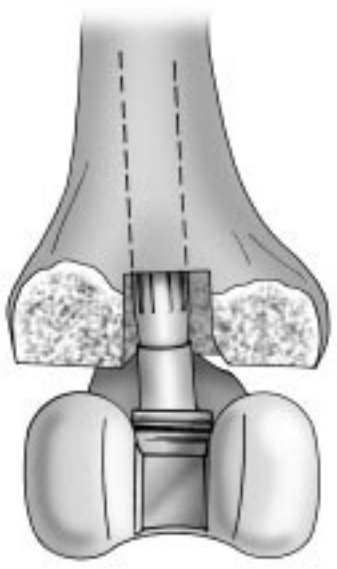
Tibial Bone Wedge Preparation (Optional)

Prior to punching for the tibial baseplate, assess the need for tibial augmentation. Based on the nature of the deformity, attach the appropriate wedge cutting guide to the tibial template and secure by tightening the locking knob. Drill pins through the holes located on the wedge cutting guide (**Figure 39a**). Complete the baseplate preparation by punching and preparing for the offset stem if necessary. Remove the tibial template and complete the wedge cut through the appropriate slot (**Figure 39b**). For the flat, half wedge a sagittal cut may be performed using an oscillating saw or an osteotome.

To prepare the tibial canal for a Cemented Stem Extender, choose the proper size cemented stem reamer and introduce the bullet tip into the canal. Carefully ream the canal until sufficient bone has been removed to seat the baseplate and stem extender chosen. Be certain to check clearance by inserting trials into the reamed cavity.

TRIAL REDUCTION

40▼



Femoral Component

The trial femoral component is assembled with required augments and stems, corresponding to the completed femoral bone preparation. The options include:

- Medial and/or Lateral Distal Spacers
- Medial and/or Lateral Posterior Spacers
- Intramedullary Stem Extenders in Press-fit and Cemented styles, in various lengths, diameters, and offsets

NOTE: To provide clearance for the stabilizer box housing during insertion, it may be necessary to relieve the medial edge of the box wall cutout by approximately 2mm. This relief can be done with a freehand saw cut or by using a rongeur or osteotome (**Figure 40**).

Tibial Component

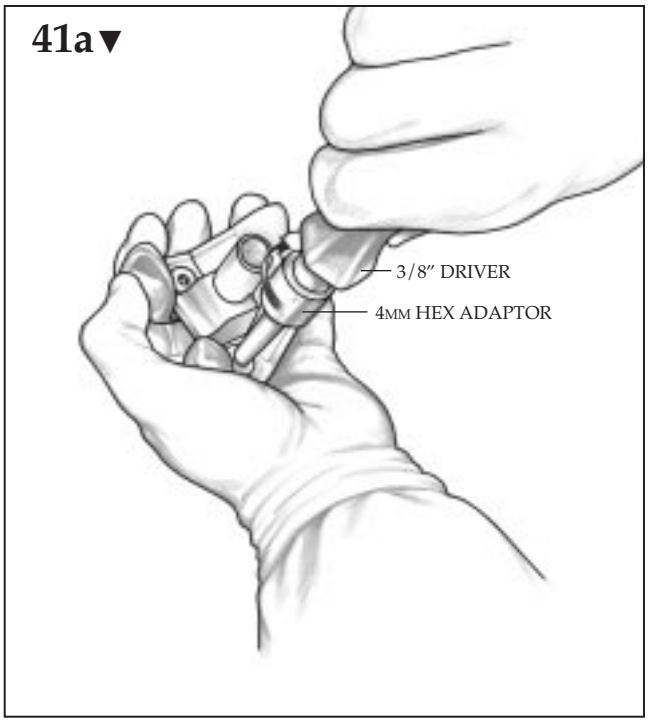
Assemble the trial tibial component corresponding to the tibial preparation. The implant options are:

- Half Flat Medial/Lateral Wedges
- Half Angled Medial/Lateral Wedges
- Full Flat Wedges
- Full Angled Wedges
- Intramedullary Stem Extenders in Press-fit and Cemented styles, in various lengths, diameters, and offsets

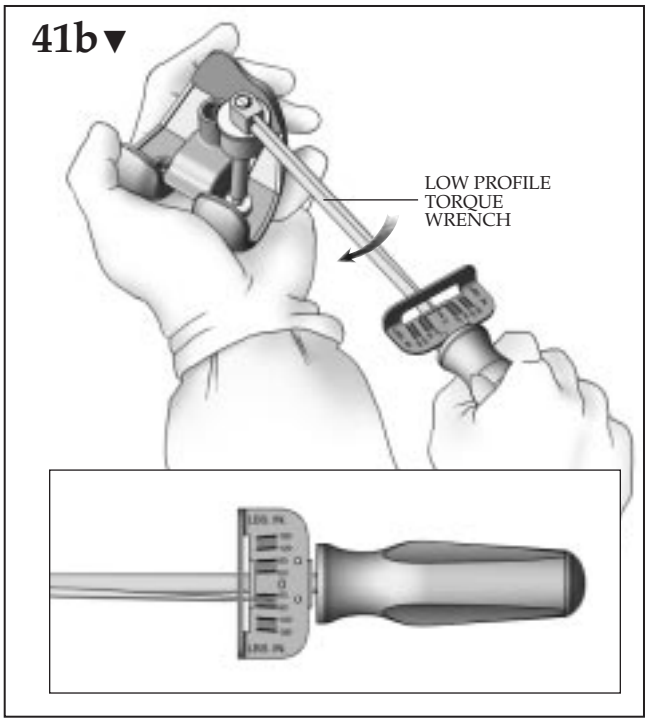
A trial reduction should be performed to confirm the proper flexion, extension, and rotation of the joint have been achieved.

COMPONENT ASSEMBLY

41a▼



41b▼

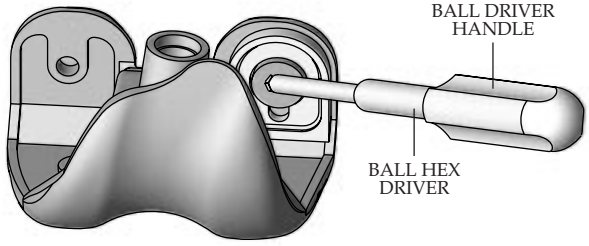


With a trial reduction completed and the appropriate size components selected, the final implants are assembled on or over a sterile instrument table.

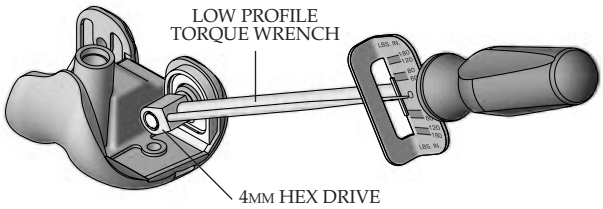
Femoral Distal Spacer Assembly

The 4mm hex adaptor is attached to the 3/8″ driver to insert the distal locking screws through the spacers into the femoral component (**Figure 41a**). After the locking screw has been inserted by hand, the 4mm hex adaptor is then attached to the torque wrench and *the screw must be tightened to a final locking torque of 60in-lb minimum to 80 in-lb maximum* (**Figure 41b**).

42a▼



42b▼

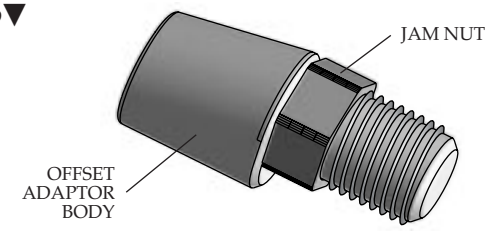


Femoral Posterior Spacer Assembly

Attach the 4mm ball driver hex fitting to the ball driver handle. Use the driver to insert the locking screw through the posterior spacer and into the femoral component (**Figure 42a**). After the locking screw has been inserted by hand, the posterior 4mm driver is attached to the torque wrench and *the screw is tightened to a final locking torque of 60 in-lb minimum to 80 in-lb maximum* (**Figure 42b**).

NOTE: *The 5mm locking screw is used to lock BOTH the five and ten millimeter full and half posterior spacers.*

43▼



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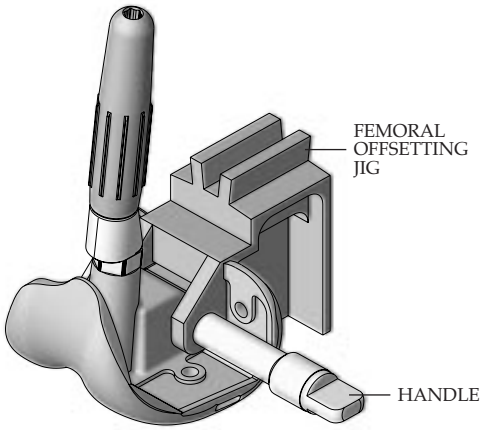


Femoral Offset Stem Assembly

STEP 1

Holding the femoral component securely in hand, the torque wrench with stem plug wrench is placed over the end cap. Loosen the cap by holding the component securely and turning the torque wrench counterclockwise.

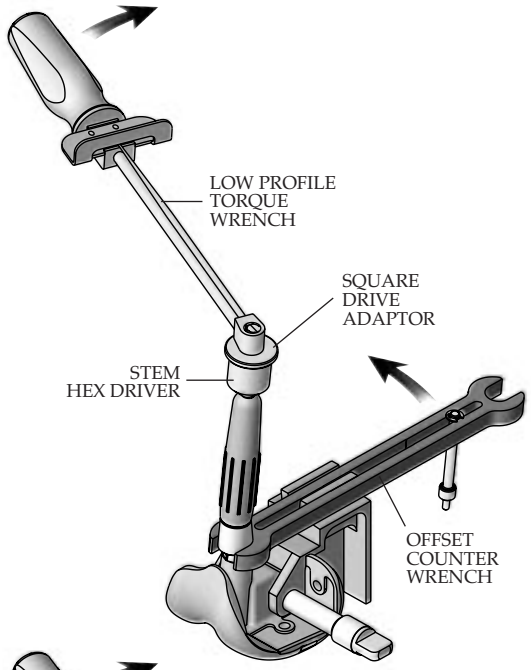
STEP 2

Turn the jam nut up the threaded stud until it contacts the offset adaptor body (**Figure 43**). Screw the offset adaptor into the boss of the femoral implant until it is seated against the femoral implant boss. Tighten the stem extender into the adaptor by hand as far as possible.

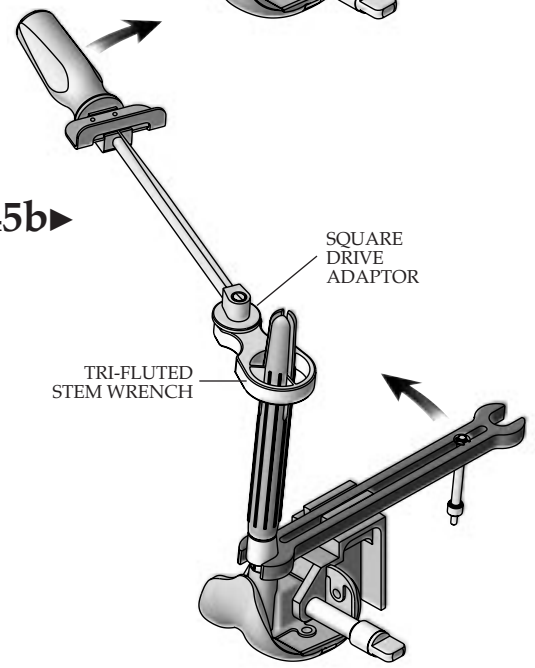
STEP 3

Attach the femoral offset locking jig onto the femoral component. Lock it in place by tightening the black handle. Turn the offset adaptor counterclockwise until the stem is anterior to the boss of the femoral component (**Figure 44**). **DO NOT EXCEED ONE FULL TURN**.

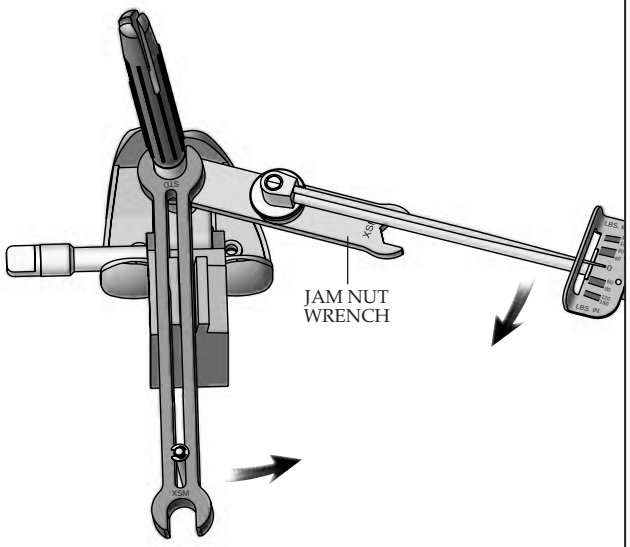
45a▼



45b▶



46▼



STEP 4

Attach the counter wrench to the appropriate left or right positioning rail on the offset locking jig and engage the offset adaptor body. Using the appropriate stem wrench and torque wrench, *tighten the stem extender to the adaptor body to a torque value of 120 in-lb minimum to 180 in-lb maximum* (**Figures 45a and 45b**).

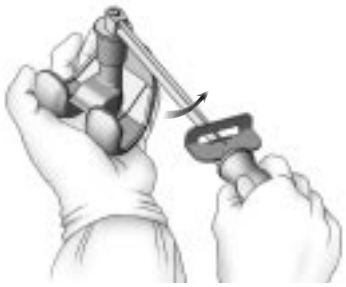
STEP 5

Attach the jam nut wrench to the torque wrench. Engage the jam nut with the torque wrench while holding the counter wrench. *Tighten to 120 in-lb minimum to 180 in-lb maximum* (**Figure 46**).

NOTE: *Orient the square drive adaptor, tri-fluted stem wrench and jam nut wrench with the long axis of the torque wrench.*

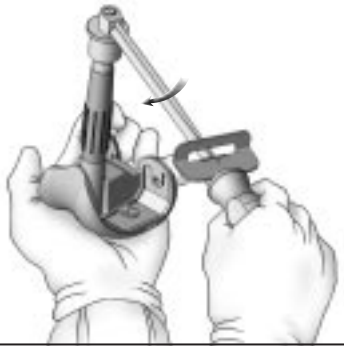
47▼

STEP#1
Remove End Cap



STEP#2
Assemble Stem Extender to Component

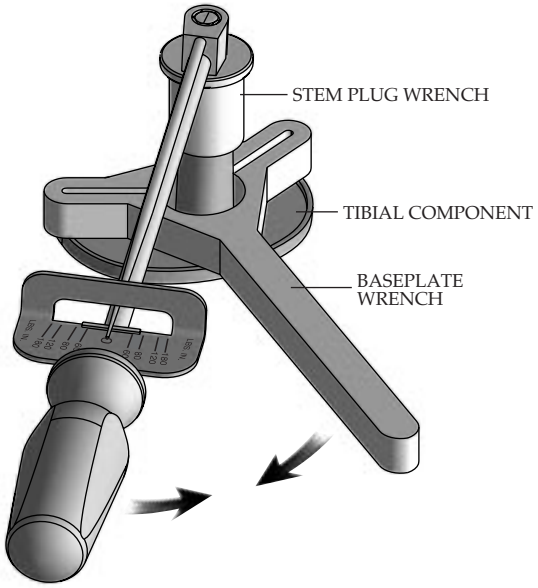
STEP#3
Lock Stem Extender to Component



If a straight stem is used, remove the cap as stated in Step 1. Tighten the stem extender into the femoral component by hand as far as possible. Attach the appropriate stem wrench to the torque wrench. Holding the femoral component in your hand, engage the stem and *tighten the stem to 60 in-lb minimum to 80 in-lb maximum* (**Figure 47**).

NOTE: If no stem extender is used *the end cap of the femoral component must be tightened to a 60 in-lb minimum to 80 in-lb maximum by using the stem plug wrench and tightening in a clockwise direction.*

48▼



Tibial Offset Stem Assembly

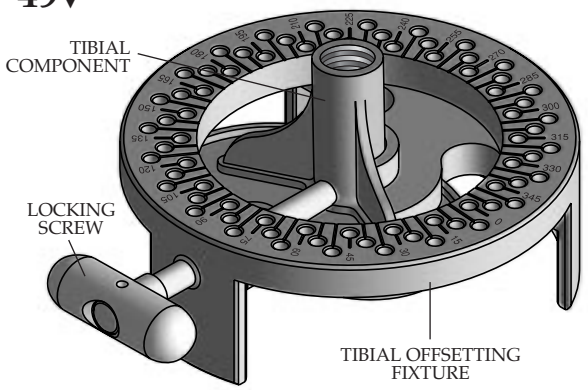
STEP 1

Slip the baseplate counter wrench over the implant and flush against the surface. Attach the stem plug wrench to that torque wrench and place it over the end cap. Loosen the cap by holding the component and baseplate counter wrench securely and turning the torque wrench counter-clockwise (**Figure 48**).

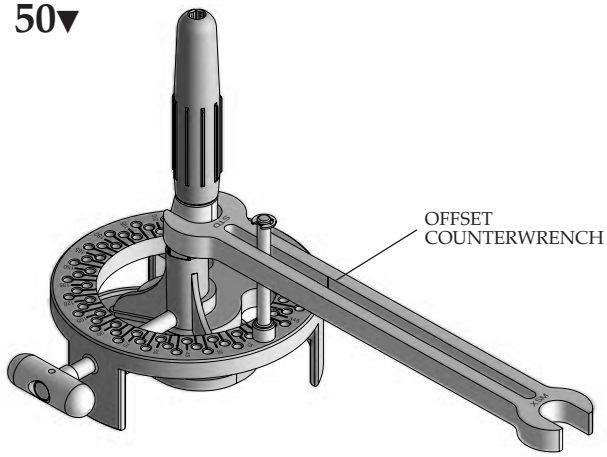
STEP 2

Assemble the tibial baseplate into the tibial-offset fixture. Lock it in place by turning the knob until the locking screw sits firmly against the boss portion of the tibial stem. Do not overtighten (**Figure 49**).

49▼



50▼



STEP 3

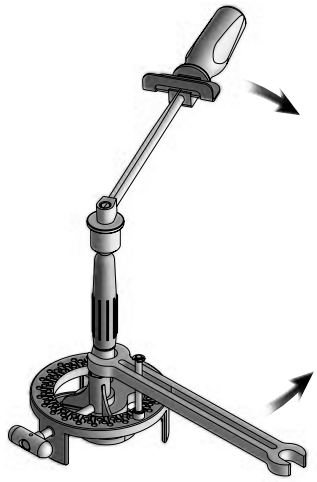
Turn the jam nut up the threaded stud until it contacts the offset adaptor body. Screw the offset adaptor into the boss of the tibial implant until it is fully seated. Tighten the stem extender into the adaptor by hand as far as possible.

STEP 4

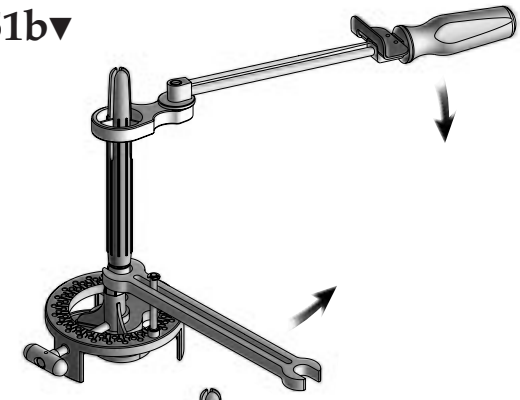
Engage the adaptor with the offset counter wrench. Rotate the counter wrench and adaptor counter-clockwise until the pin of the counter wrench can be dropped into the degree of offset determined by the offset positioning guide and offset bushing. **DO NOT EXCEED ONE FULL TURN** (**Figure 50**).

NOTE: *Line up the line markings on the offset adaptor and the offset counterwrench to ensure that the wrench is engaged on the proper side.*

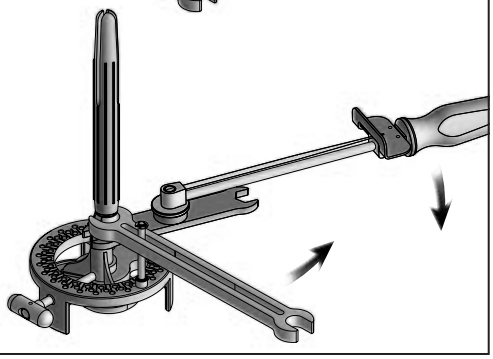
51a▼



51b▼



52▼



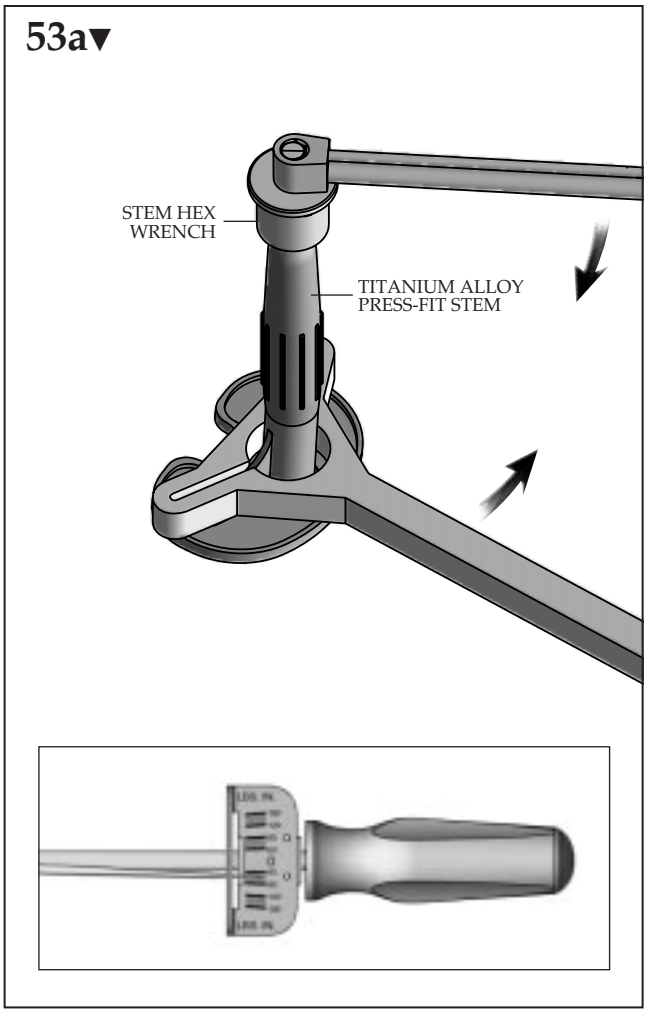
STEP 5

Using the appropriate stem wrench and torque wrench*, tighten the stem extender to the adaptor body to a torque value of 120 in-lb minimum to 180 in-lb maximum* (**Figures 51a and 51b**).

STEP 6

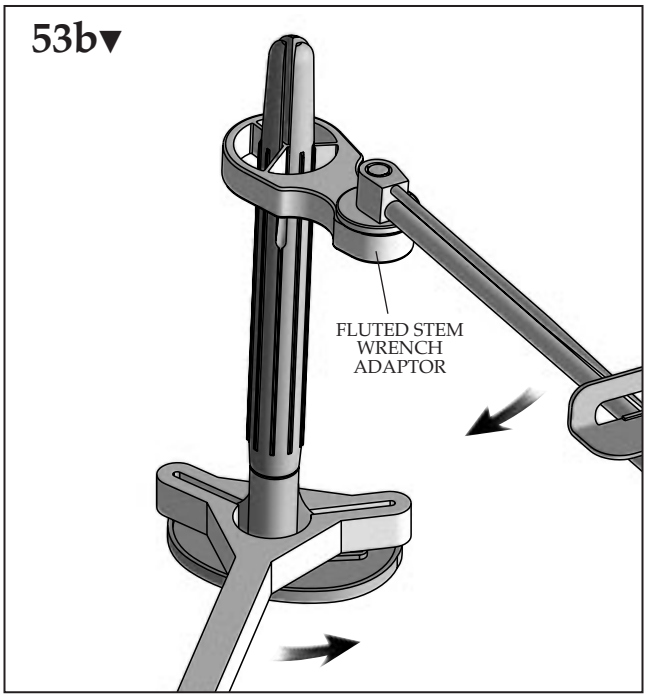
Attach the jam nut wrench to the torque wrench. Engage the jam nut with the torque wrench while holding the counter wrench and *tighten the jam nut to 120 in-lb minimum to 180 in-lb maximum* (**Figure 52**).

53a▾



If a straight stem is used, remove the cap as stated previously. Tighten the stem extender into the tibial component by hand as far as possible. Attach the appropriate stem wrench to the torque wrench. Place the baseplate wrench on the tibial component. Holding the tibial component in your hand, engage the stem with the stem wrench and *tighten to 60 in-lb minimum to 80 in-lb maximum* (**Figures 53a and 53b**).

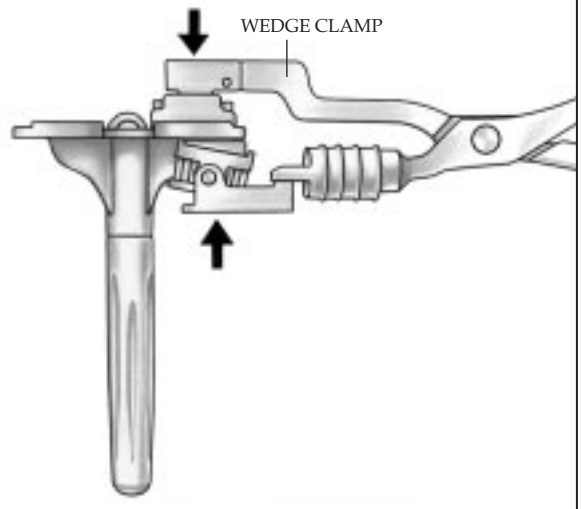
53b▾



NOTE: If no stem extender is used *the end cap of the tibial component must be tightened to a 60 in-lb minimum to 80 in-lb maximum by using the stem plug wrench and tightening in a clockwise direction*.

54▾

55▾



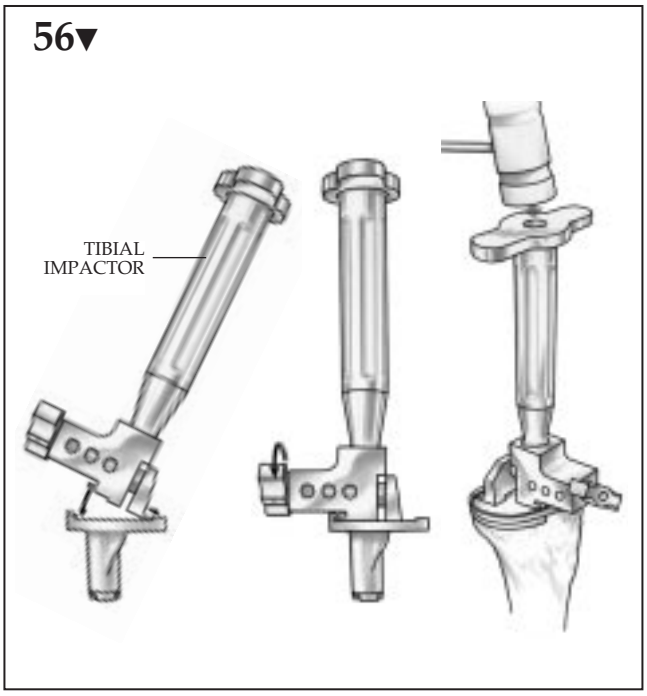
Bone Wedges

The trial wedges are color-coded by size to match the appropriate implant package. Choose the implant package that matches the color of the trial wedge and verify sizing on the package label.

The Bone Wedge is assembled, as follows: with the underside of the baseplate facing up and the posterior cutout of the baseplate facing toward the surgeon, choose the tibial Bone Wedge that corresponds to the correct size and the desired side of the baseplate. See **Figure 54** for the "Left/Right" naming convention for tibial wedges.

Cement is placed onto the surface of the baseplate and the undersurface of the Wedge. The lip on the Wedge is placed into the rim of the baseplate, and the wedge clamp is attached to the assembly, ensuring proper wedge-to-baseplate bonding (**Figure 55**). The clamp is left in place until the cement has fully hardened.

56▼



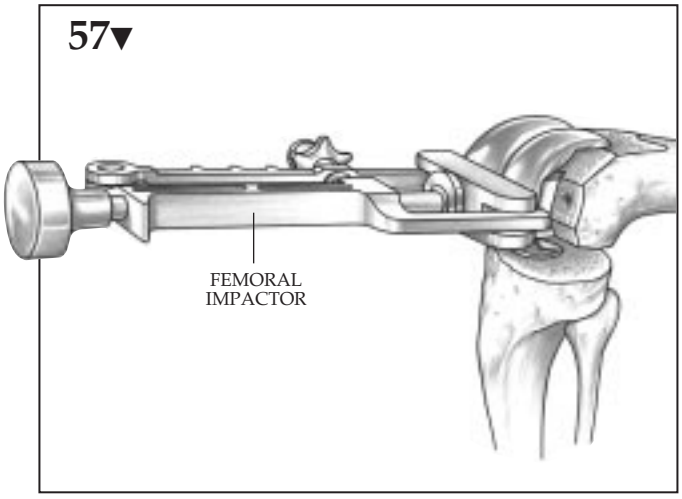
Implantation of the Universal Baseplate

Lock the "feet" of the tibial impactor under the posterior lip of the component.

Turn the wing nut clockwise to secure the anterior lock.

Use the driver to impact the component. Ensure that the *under*surface of the component always remains parallel to the cut surface of the tibia during insertion (**Figure 56**).

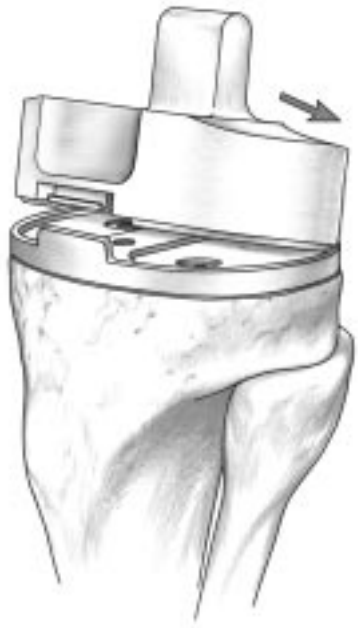
57▼



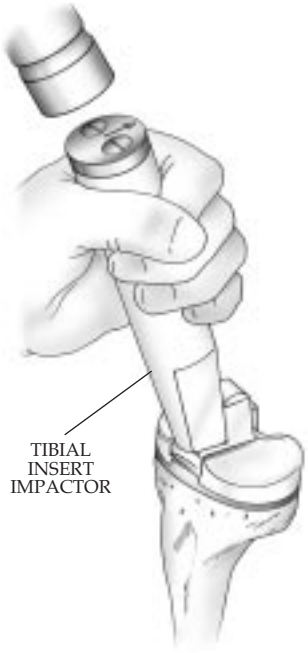
Femoral Component

The femoral impactor guides the femoral component and helps ensure proper placement (**Figure 57**).

58▼



59▼

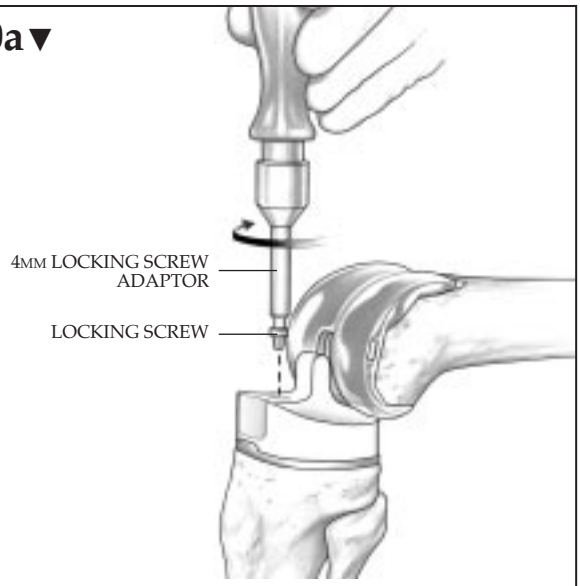


Assembly of the Plastic Insert

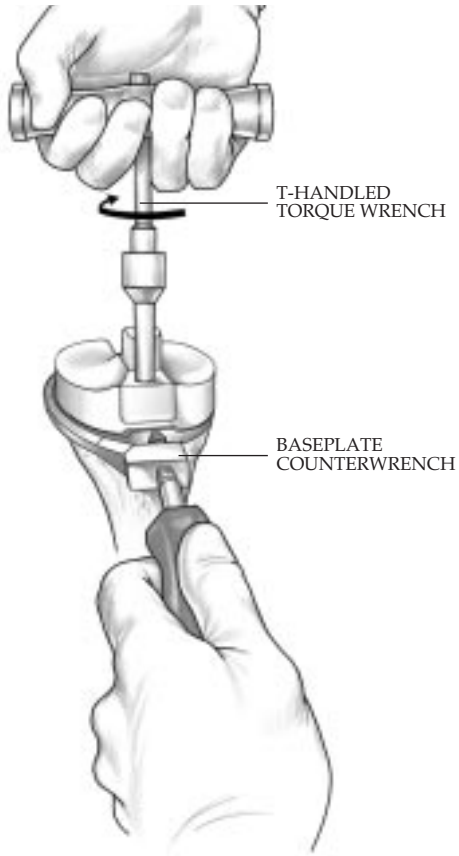
NOTE: *Once assembled onto the baseplate, the Insert cannot be removed and reassembled. One-time use only! To properly assemble the Tibial Insert to the baseplate, the insert* **must** *be slid fully posterior into the two posterior pockets of the baseplate* **before** *attempting to snap down the anterior portion of the Insert (Figure 58).*

When the Insert is slid fully posterior, snap down the anterior locking tab by applying thumb pressure, or by light impaction with the tibial insert impactor (**Figure 59**). Make certain that pressure is applied in a distal-posterior direction. Once properly assembled to the baseplate, the Insert should not be removed and reseated.

60a▼



60b▼



The locking screw packaged with the Total Stabilizer insert *must be tightened to 60in-lb minimum to 80in-lb maximum of torque* **by using the T-handled torque wrench after the Insert has been snapped into the baseplate. DO** *NOT* **TIGHTEN ONLY BY HAND. The final tightening torque should not be applied until the bone cement has fully hardened.**

Insert and hand tighten the screw using the adaptor handle and the 4mm locking screw adaptor (**Figure 60a**). Using the T-handled torque wrench (**Figure 60b**), torque is applied in a *clock*wise direction until a definitive drop in resistance is felt signifying the pre-set torque level has been reached (between 60in-lb and 80in-lb).

IMPORTANT: *Screws are not interchangeable between the Duracon® Posterior Stabilizer style tibial inserts (6642-4-series and 6642-7-series) and Total Stabilizer style tibial inserts (6642-5-series).*

Screws for the Small inserts can only be used with the Small size inserts of the same style. Screws for the Med/Large/XLarge inserts can only be used with Med/Large/XLarge inserts of the same style.

Patellar Preparation

Refer to the *Patellar Preparation Using Monogram® Knee Instruments Surgical Technique (Cat No. 6640-1-125-0)*.

Closing

The joint is copiously irrigated and closed in routine fashion over one or two wound suction drains.

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