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COMPLETE™

KNEE
REVISION

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LCS® Complete™ Revision Knee Surgery

Introduction

In total knee arthroplasty, failure may result from many causes, including wear, aseptic loosening, infection, osteolysis, ligamentous instability, arthrofibrosis, and patellofemoral complications.

In approaching revision procedures, the surgeon must address such considerations as the planning of an incision in a previously operated site, the condition of soft tissue, the extensor mechanism mobilization, the primary prosthesis extraction and the attendant bone stock conservation.

Among the goals of successful revision arthroplasty are the restoration of anatomical alignment and functional stability, fixation of the revision implants and accurate reestablishment of the joint line. The LCS Complete Revision system offers a comprehensive array of implants and instruments to address the issues of contemporary revision knee arthroplasty. Using the intramedullary canal as a fixed reference point the instrumentation allows the surgeon to assess ligamentous stability, bone loss and the joint line.

The LCS Complete Revision implants provide options to help address these issues including modular stem extensions for press-fit and cemented adjunctive fixation, multiple bolt-on augments, femoral sleeve options for metaphyseal fixation and constrained bearings to compensate for ligament instability. The rotating platform insert also provides maximum congruency and rotational freedom while providing excellent patellofemoral kinematics.

Preoperative Planning

Revision total knee arthroplasty begins with a thorough clinical and roentgenographic evaluation. Physical evaluation includes a soft tissue examination; taking into account previous skin incisions, range of motion, motor strength, the condition of all neurovascular structures, ligamentous stability and the extensor mechanism integrity.

Obtain biplaner radiographic views, as well as tangential views of the patella and full length standing bilateral extremity views for an alignment and bone stock assessment, the joint line documentation and the evaluation of the present implant fixation. Stress views are helpful in evaluating ligamentous instability. Employ templates to establish replacement implant size and the alignment of bone cuts, to indicate augmentation of skeletal deficits and to confirm the anatomic joint line.

INITIAL INCISION

When possible, follow the scar from the primary procedure (Figure 1). Where parallel incisions are present, the more lateral is usually preferred, as the blood supply to the extensor surface is medially dominant. Where a transverse patellectomy scar is present, the incision should transect it at 90 degrees. Where there are multiple incision scars or substantial cutaneous damage (burn cases, skin grafting, etc.), one may wish to consult a plastic surgeon prior to surgery, to design the incision, determine the efficacy of preoperative soft tissue expansion and plan for appropriate soft tissue coverage at closure.

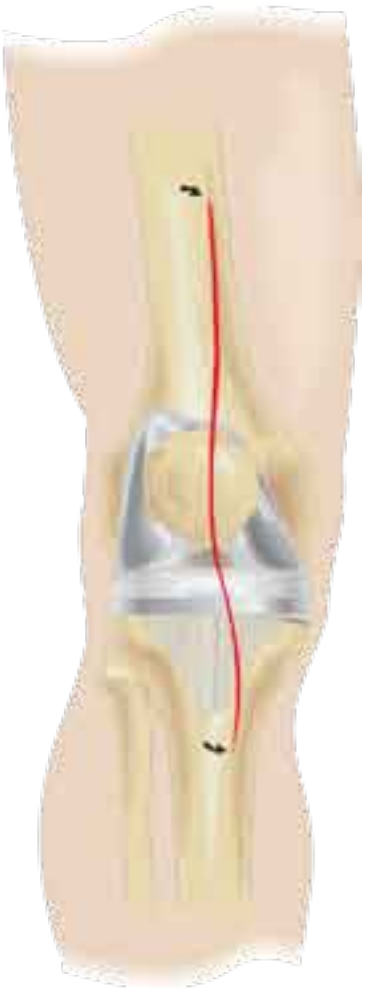


Figure 1

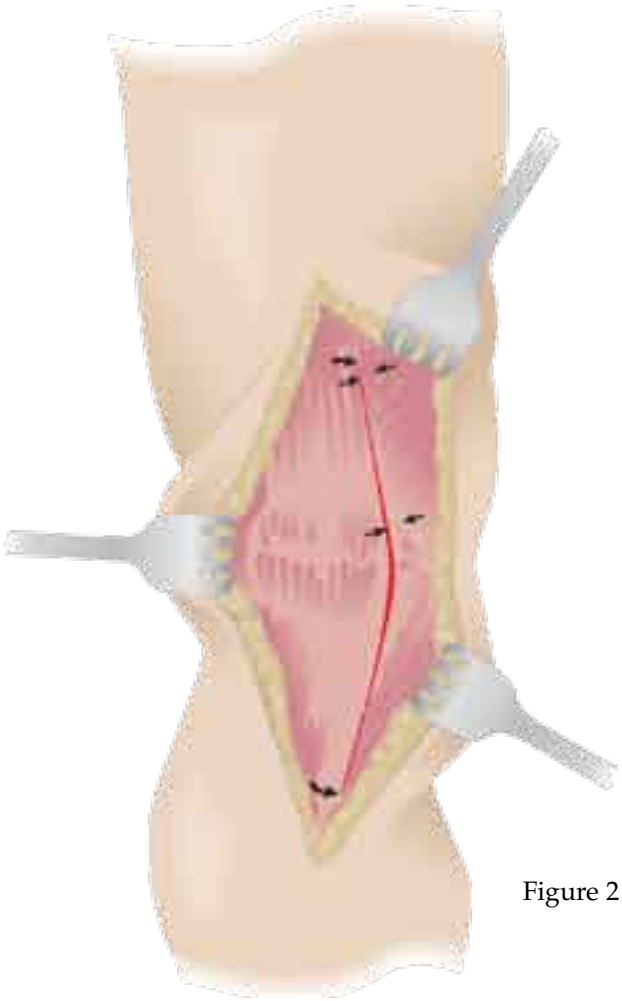


Figure 2

CAPSULAR INCISION

The fascial incision extends from the rectus femoris proximal margin to the distal margin of the tibial tubercle following the patella's medial border, maintaining a 3-4 mm cuff for reapproximation of the vastus medialis aponeurosis at closure (Figure 2). Where mobilization of the extensor mechanism and patella is problematic, extend the skin and capsular incisions proximally.

Occasionally an early retinacular release is indicated to assist with patellar eversion. Where eversion difficulties persist, a quadriceps snip, a proximal inverted quadriceps incision (modified V-Y) or a tibial-tubercle osteotomy may be indicated. Perform appropriate ligamentous release based upon preoperative and intraoperative evaluation. Release fibrous adhesions to reestablish the suprapatellar pouch and medial and lateral gutters (Figure 3).

In many revision cases, the posterior cruciate ligament will be absent or non-functional; when this is the situation, excise any residual portion.

Exercise care when everting the patella. Frequently, subluxing the patella laterally is adequate. Doing so will help avoid patella tendon aversion.

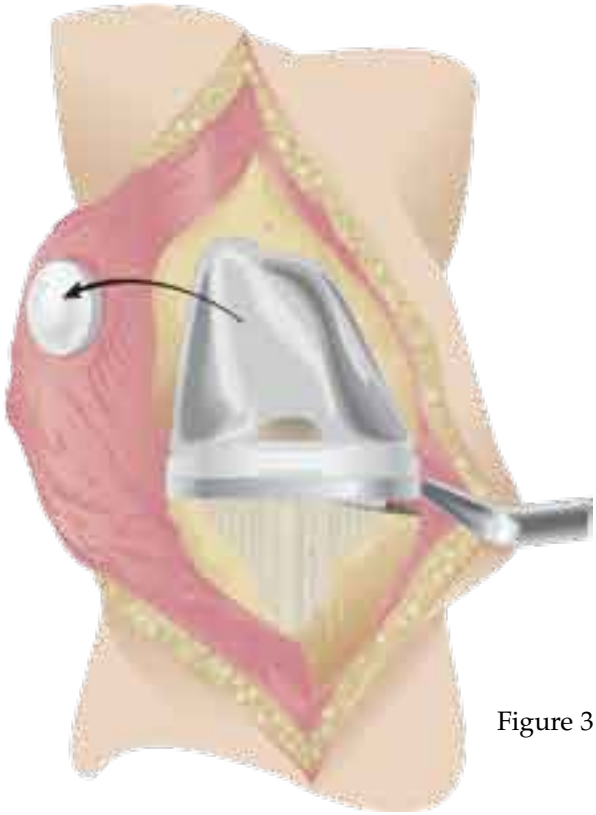


Figure 3

Implant Extraction from the Primary Procedure

Take care to preserve as much bone as possible. To this end, assemble a selection of tools, including thin osteotomes, an oscillating saw, a Gigli saw, a high-speed burr and various extraction devices, but many cases will require only the thin osteotome.

Carefully disrupt the bone/cement or bone/prosthesis interface before attempting extraction (Figure 4). Disengage the implanted components and extract as gently as possible, in such manner as to avoid fracture and unnecessary sacrifice of bone stock.

Where the entire prosthesis is to be replaced, it is advantageous to remove the femoral component first, as this will enhance access to the proximal tibia. Clear all residual methyl methacrylate with hand (chisels) or power tools.

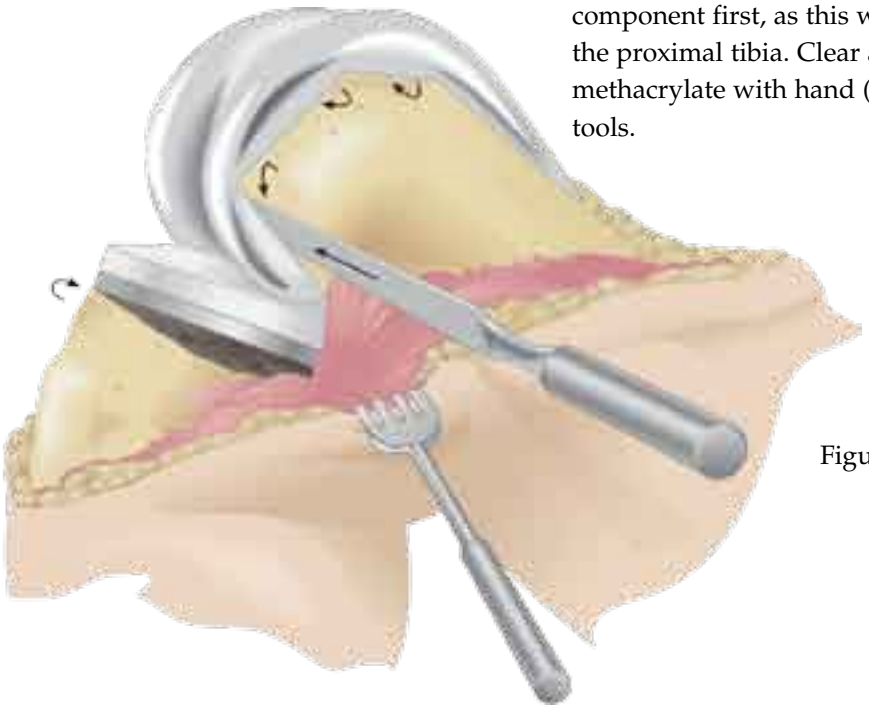


Figure 4

RECOMMENDED SURGICAL PRIORITY

1. Tibial medullary canal preparation
2. Proximal tibial resection
3. Tibial deficit augmentation
4. Femoral medullary canal preparation
5. Establishment of femoral rotation
6. A/P resections
7. Distal femoral resection
8. Anteroposterior (A/P), notch and chamfer resection
9. Establishment of tibial rotation
10. Final tibial preparation
11. Patellar preparation
12. Implantation of the components

The surgeon should assess two anatomic conditions to facilitate revision arthroplasty: the joint line level and the disparity in the flexion and the extension gaps.

JOINT LINE EVALUATION

In an average knee in full extension, the true joint line can be approximated in reference to several landmarks (Figure 5).

A It lies 12-16 mm distal to the femoral PCL attachment.

B It lies approximately 3 cm distal to the medial epicondyle and 2.5 cm distal to the lateral epicondyle.

C It lies distal to the inferior patella pole (approximately one finger width).

D Level with the old meniscal scar, if available.

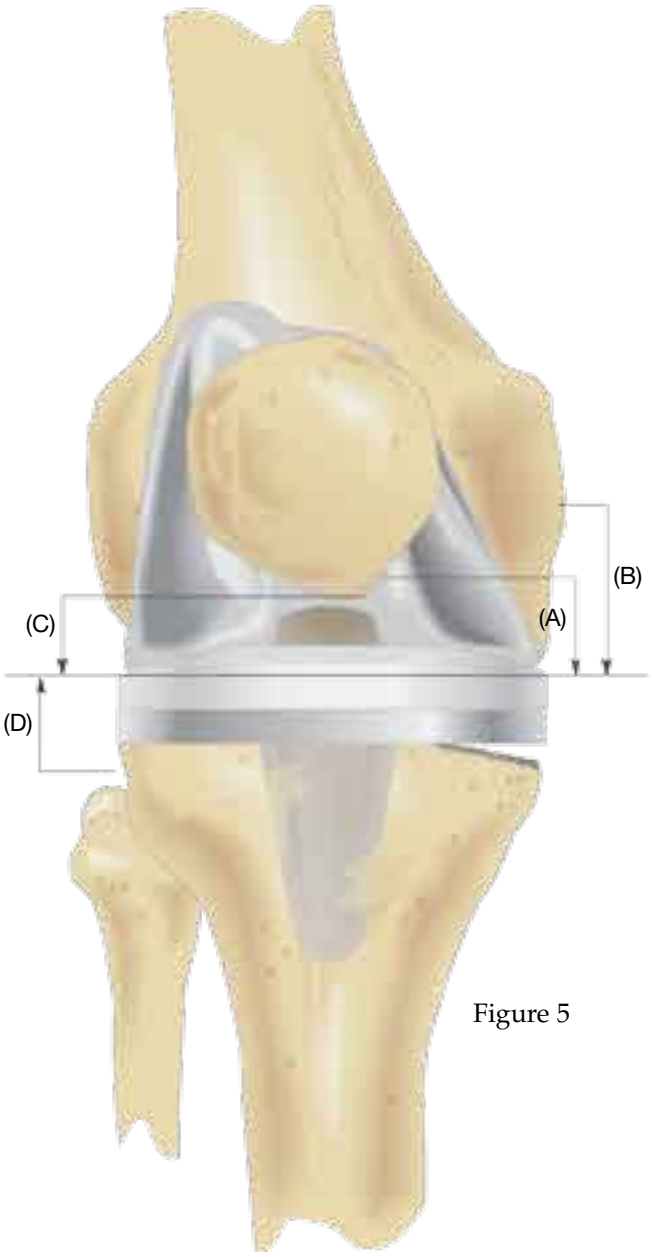


Figure 5

Additional preoperative joint line assessment tools include:

1. Review of original preoperative TKA radiograph
2. Review of the contralateral knee radiograph if non-implanted

Joint Space Assessment

Evaluate the joint space with spacer blocks to determine the flexion/extension gap relationship and the symmetry of both the flexion and extension gaps and to indicate if prosthetic augmentation is needed to ensure postoperative equivalence.

Initially insert spacer blocks into the flexion gap. In flexion, these blocks should be snug (as the flexion gap seems to loosen as the case proceeds). When applied snugly (and assuming competent ligaments), the gap will be distracted adequately to expose posterior condylar deficiency (Figure 7). Make an approximation of the deficiency. If the deficiency is small (< 5 mm) then only a 5 mm augment may be added to the more intact side and this may limit the femoral size. If the deficiency is large (> 10 mm), the size of the femoral component is limited to the A/P diameter of the more intact condyle, or one size smaller. This may mandate some elevation of the joint line. If insertion of a snug spacer block crushes some posterior condylar bone, there is no consequence as this bone is of poor quality and is best removed anyway. The size of the flexion gap, minus any possible augmentation of the more intact condyle is the anticipated thickness of the polyethylene insert. Note that the largest thickness of polyethylene is 25 mm.

Then insert spacer blocks in a like manner into the extension gap. If it is distracted in a snug manner (perhaps aided by slight axial distraction on the foot) any distal condylar deficiency will be exposed (Figure 6). The size of this deficiency is not the size of the distal augment, but only represents the difference between the possible distal femoral augments. As the distal femoral augments extend to 15 mm, distal femoral augmentation will rarely affect the size of the femoral implant. The size of the extension gap, again minus any possible augmentation, is an approximation of the extension gap.

The sizes of the flexion and extension gap should now be seriously considered. Review the possible augmentation of the flexion gap and give consideration to lessening the thickness of this gap (flexion). Having an understanding of the possible combination of posterior augments will greatly influence the femoral implant size that will eventually be chosen.

Size the tibia and establish the approximate joint line first. Select the preliminary femoral component size by evaluating the explanted component, X-ray templating, femoral sizing templates, femoral sizing caliper, the LCS Completion™ distal femoral sizer, or size against the cutting guide. Then adjust the size to accommodate the following:

Where the flexion gap is greater than the extension gap

To decrease the flexion gap without affecting the extension gap, apply a larger femoral component. This is particularly important where an IM stem extension is indicated, as the stem extension will determine the anteroposterior positioning of the component and the consequent flexion gap.

When choosing a larger LCS Complete Revision femoral component where the joint line is elevated in flexion, the preferred correction is posterior femoral augmentation.

The alternative—additional distal femoral resection and the use of a thicker tibial insert to tighten the flexion gap—is not recommended, as considerable bone stock has been sacrificed in the primary procedure and it is important that additional distal femur resection be avoided. The possible exception is where the joint line is not elevated and minimal distal resection will increase the extension gap toward equivalency with the flexion gap.

Where the extension gap is greater than the flexion gap

To decrease the extension gap without affecting the flexion gap, augment the distal femur. It is important to note that this will lower the joint line, which is usually desirable as it is generally found to be elevated in revision cases. This will lessen the incidence of postoperative patellar infera (Figures 6 and 7).

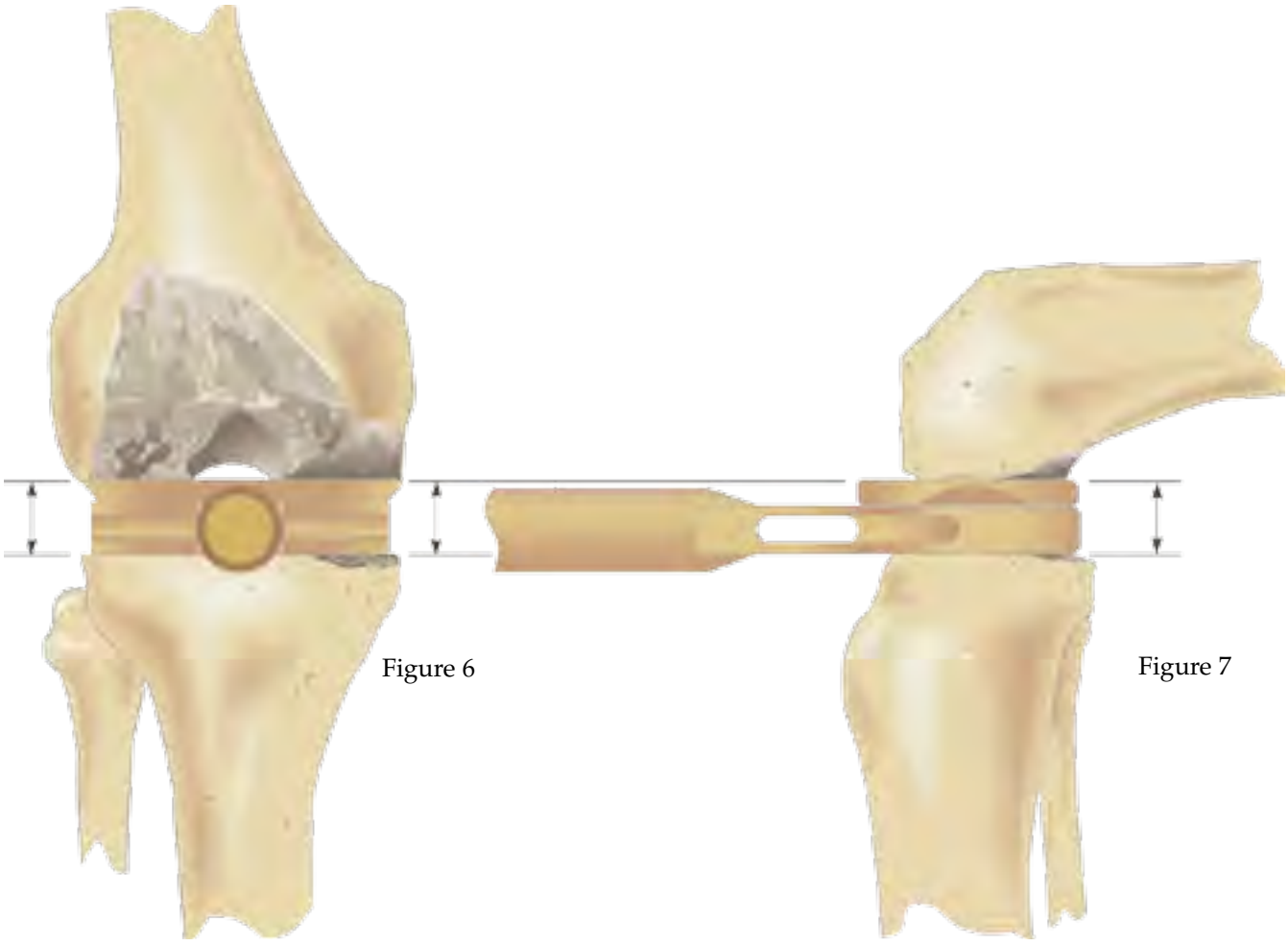


Figure 6

Figure 7

Initial Preparation of the Tibia

The Tibial Alignment System

When preoperative evaluation and X-rays indicate that fluted stem extensions, metaphyseal sleeves or wedges are required, it is recommended that the proximal tibia be prepared with reference to the position of the IM rod.

Where a cemented tibial stem extension is indicated, see Appendix I.

Place the knee in maximal flexion with the patella laterally retracted and the tibia distracted anteriorly and stabilized. Release fibrosis around the tibial border or excise as required to ensure complete visualization of its periphery.

Approximate the location of the medullary canal with reference to preoperative anterior/posterior (A/P) and lateral X-rays and to the medial third of the tibial tubercle.

Introduce a $^{5}/_{16}$ in. (9 mm) drill into the canal to a depth of 2 to 4 cm. Avoid cortical contact (Figures 8 and 9).

Figure 8

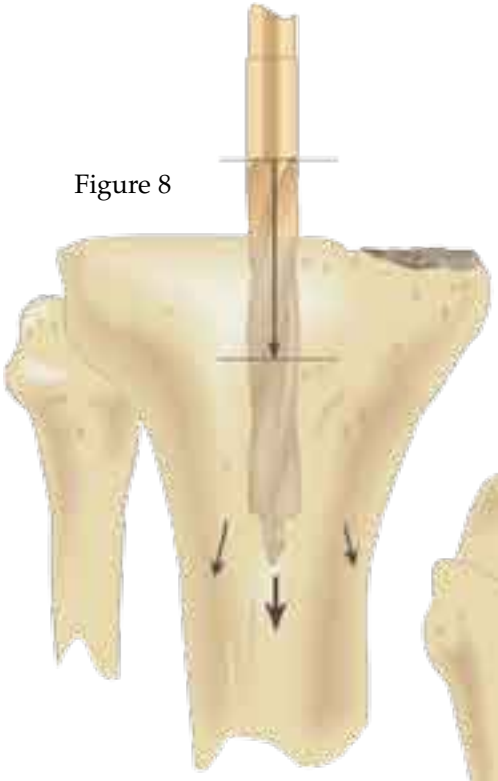
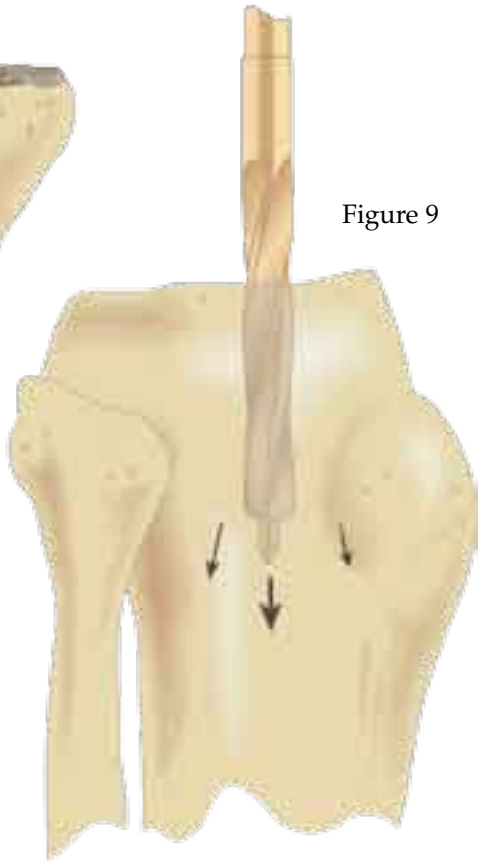


Figure 9



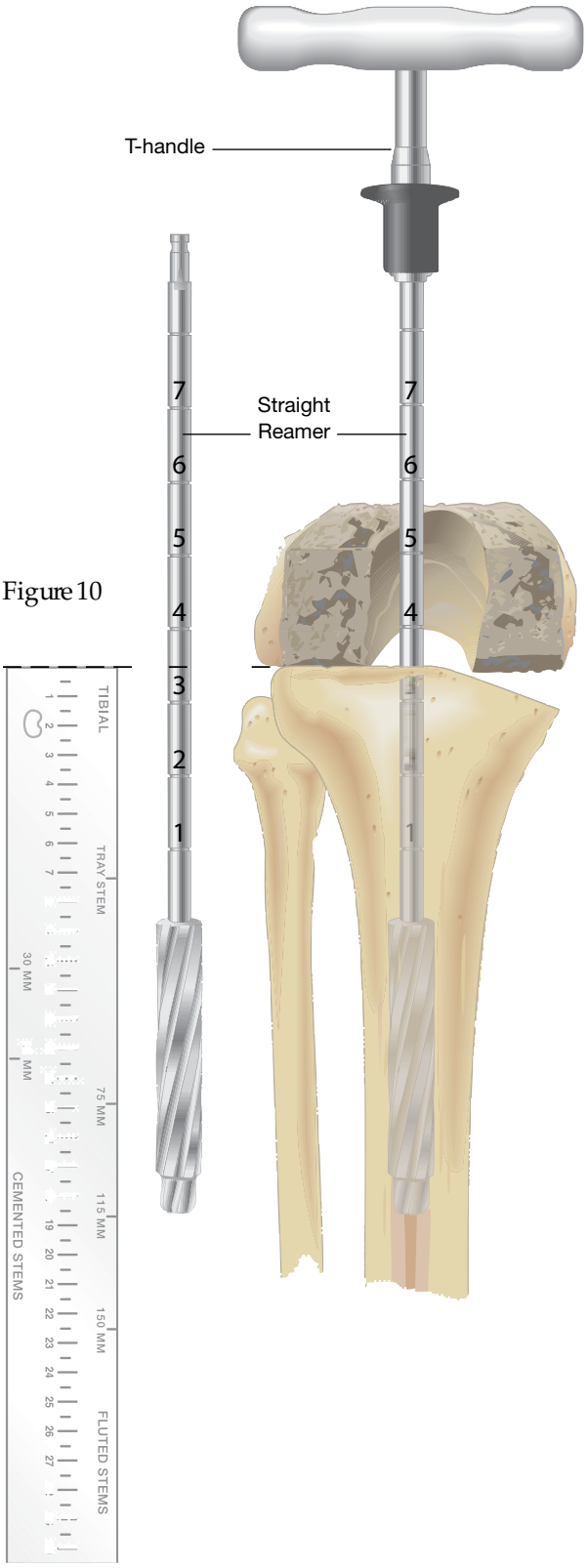


Figure 10

Reaming the Medullary Canal

Assemble the straight reamer to the T-handle. If power reaming, it will be necessary to attach the modified Hudson adaptor to the straight reamer. The shaft of the reamer contains markings in 25.4 mm (1 in.) increments. Each marking is numbered to use as a reference when reaming to the appropriate depth. Fluted tibial, uncemented stem lengths are available in 75, 115 and 150 mm. Determine the length and diameter of the prosthetic stem extension with templates (Cat. No. 2178-30-100) applied to preoperative X-rays.

Utilizing the reamer depth scale and the markings on the straight reamer, ream to the predetermined depth so the pre-selected marking on the reamer is positioned at the desired tibial resection level. Sequentially open the canal with progressively larger reamers until firm endosteal engagement is established (Figure 10).

Note: *Simple cortical contact should not be construed as engagement.*

The fixed relationship of the reamer to the cortices ensures the secure fit of the appropriate reamer and, subsequently, the corresponding fluted stem. It is equally important to not overream osteopenic bone.

While reaming the proximal tibia, pay close attention to the reamer to assure that it is somewhat centrally located to the exposed proximal tibial surface. Eccentric reaming can occur, which could lead to under sizing of the tibial component.

The size of the final reamer indicates the diameter of the implant stem. The fluted tibial stems are available in even sizes (10 through 24 mm). Perform final reaming with an even-sized reamer.

Refer to Appendix I for 30 and 60 mm cemented tibial stem preparation.

Preparation of the Metaphyseal Bone – Tapered Reamer

For Diaphyseal Engaging Stem and Metaphyseal Filling Sleeve

Attach the appropriately sized stem trial to the end of the reamer.

Note: *Assembly of the stem trial may be aided by the pre-attachment of the T-handle.*

Taper ream to the planned proximal tibial resection level (Figure 11).

Note: *Use the "cemented" taper reamer when requiring a cement mantle or when utilizing a sleeve (See Figure 63 in Appendix I). Use the press-fit tapered reamer when line-to-line fit is desired and a sleeve will not be utilized (Figure 11).*

Note: *To avoid stem trial disengagement, do not reverse ream.*

At this point, intraoperatively determine if a metaphyseal sleeve will be used.

Note: *Metaphyseal sleeves are ideal to provide filling of Engh type II or III defects in revision TKA. The steps also provide progressive loading of the bone with porous coating, which enhances fixation.*

If a metaphyseal sleeve is selected, see page 11 in order to broach the metaphyseal bone.

If a metaphyseal sleeve will not be used, see page 10 to prepare for the proximal tibial resection.

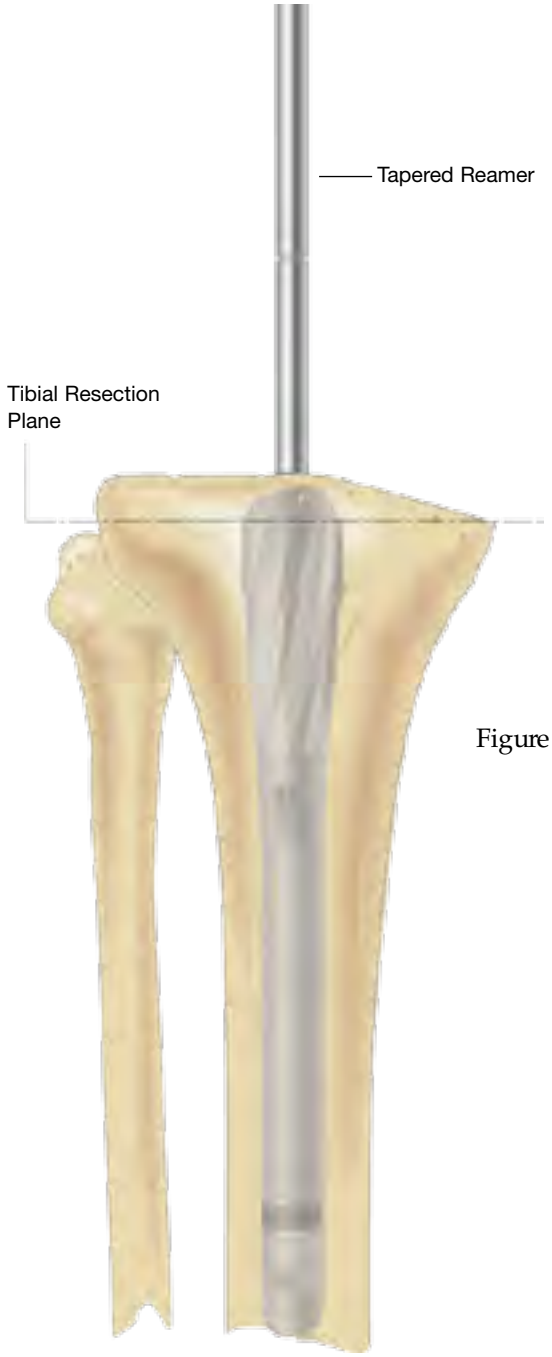


Figure 11

Proximal Tibial Resection – Tapered Reamer

Attach the 2 degree tibial cutting block to the I.M. tibial referencing device. Attach the I.M. tibial referencing device to the shaft of the tapered reamer. Position the I.M. tibial referencing device with the pre-attached 2 degree cutting block onto the shaft and allow it to descend to the proximal tibial surface. Since considerable bone stock may have been sacrificed in the primary total knee arthroplasty (TKA), minimize the amount resected: no more than 1-2 mm from the most prominent condyle, managing residual defects of the contralateral condyle with either prosthetic augment or bone graft.

Resection is based on tibial deficiency and the level of the joint line. Compensate deficiencies with sleeves, wedges and/or bone grafts. Advance the cutting block to the anterior tibial cortex and lock into position by tightening the knurled knob on the outrigger. Preliminary rotational alignment is based on the medial third of the tibial tubercle. Secure the alignment device to the reamer shaft with the lateral setscrew. (Figure 12)

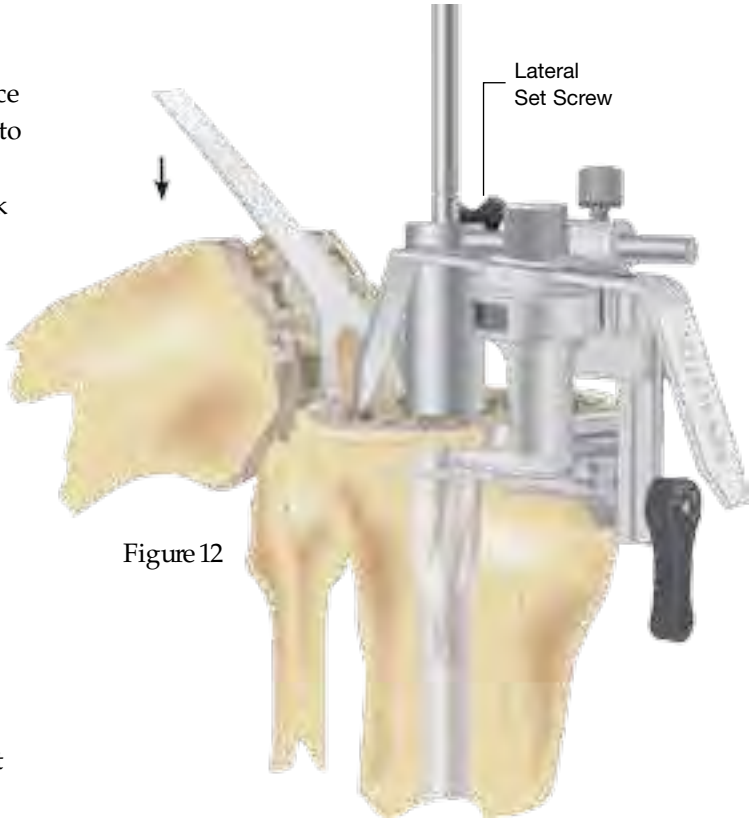


Figure 12

Pin the tibial cutting block so a minimal resection is made from the proximal tibia. Utilize the stylus when necessary. (Figure 12)

Note: If a metaphyseal sleeve is to be used, tibial resection using the 2 degree tibial cutting device is unnecessary as the tibial resection will be performed using the tibial sleeve broach. (see page 11, Figure 15)

Note: There is a slotted and non-slotted end to the stylus. The difference between the two is 5 mm.

Remove the I.M. device while leaving the 2 degree cutting block in place. Remove the tapered reamer and resect the proximal tibia. (Figure 13) (Maximum saw blade thickness 1.5 mm)

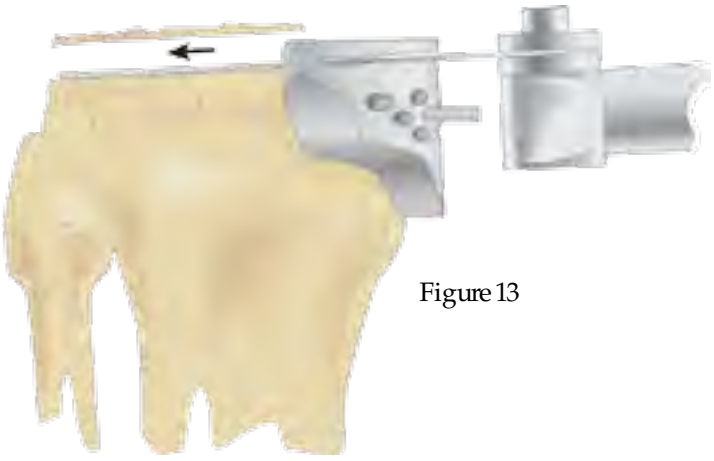


Figure 13

Note: At this point determine whether a step wedge is necessary on either the medial or lateral side to augment a defect, or both sides in order to restore the joint line. If a wedge is necessary on one side, it is recommended that the step wedge be prepared after rotational position of both the femoral and tibial components have been determined. For step wedge preparation see Appendix II.

OPTIONAL FOR SLEEVE UTILIZATION ONLY

Note: The M.B.T. revision tibial tray will accept either a tibial metaphyseal sleeve or a tibial step wedge if using sleeve sizes 37, 45, 53 and 61 mm, but not both. Only the 29 mm sleeve is indicated for use with a tibial step wedge.

Attach the M.B.T. Revision Broach handle to the smallest broach (29 mm) and then attach the appropriately sized stem trial. The broaches are asymmetrical.

Position the "ANT" engraving on the broach anteriorly.

Insert the broach into, then out of, the tibia until the top surface of the broach is at the desired proximal tibial resection level. When broaching the proximal metaphysis, take care to assure the appropriate rotation of the broach. Check for rotational stability. If the broach is unstable or the defect is unfilled, repeat with consecutively larger broaches until the desired fit is achieved. (Figure 14) Remove the broach handle, leaving the last broach in place. Any defects remaining can be filled with allograft or autologous bone placed in intimate contact with the sleeve.

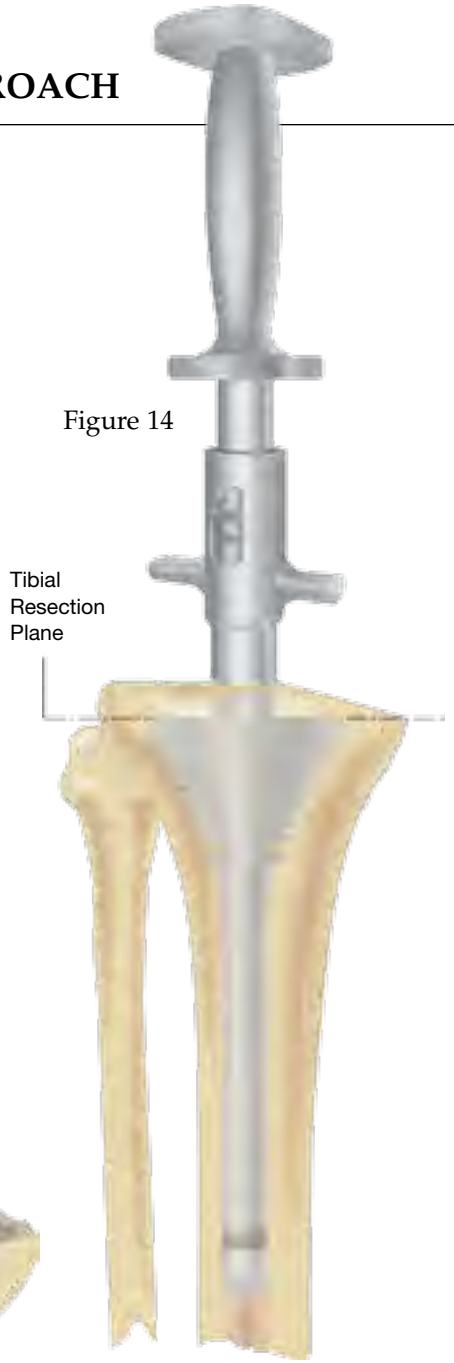


Figure 14

When utilizing a sleeve, resect the tibia off the top of the broach. (Figure 15)

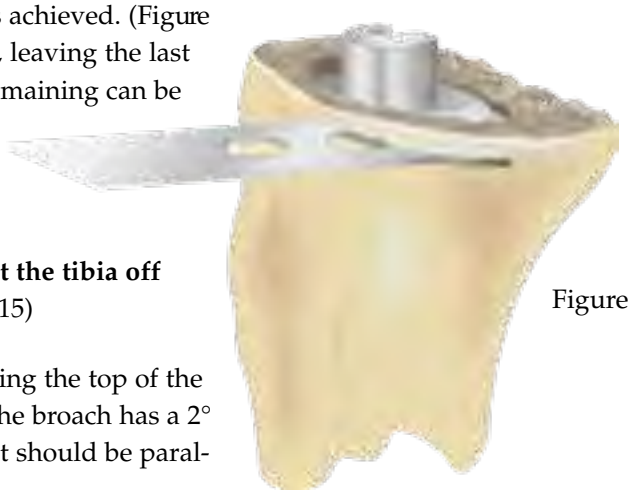


Figure 15

Resect the proximal tibia utilizing the top of the broach as a guide. The top of the broach has a 2° slope built in. The proximal cut should be parallel to the top of the broach.

Slide the tibial view plate which best covers the proximal tibial over the broach post. Note the view plate size, as it will dictate the size of the tibial base plate that will be used. The tibial view plate is transparent to help visualize tibial coverage. (Figure 16) The template matches the implant to aid in orienting the tibial sleeve to the tibial base during assembly.

Figure 16

Final Preparation of the Tibia

Place the knee in full extension and determine appropriate rotation of the tibial tray. (Figure 17)

Mark the appropriate rotation with electrocautery on the anterior tibial cortex at the center and sides of the alignment handle.

Position the tibial tray trial with stem extension, and sleeve trial if applicable (sleeve trial allows 20 degrees of rotation) into the prepared tibial canal. Assess proximal tibial coverage and rotation of tibial component. Impact the appropriate keel punch (utilize the cemented keel punch if a cement mantle is desired or the press-fit keel punch if line-to-line contact is desired). (Figure 18) The base plate should be positioned to provide the best coverage of the tibial condylar surface.

Disconnect the universal handle, leaving the keel punch in place for trial reduction. (Figure 19)

For tibial sleeve implant assembly, see page 13.

Figure 17

Figure 18

Figure 19

Assembling the Prosthesis

Tibial Sleeve Assembly

Note: It is imperative to assemble the sleeve prior to stem attachment.
Note: Sleeves and step wedges can only be used together if using a 29 mm sleeve.

Remove trial component in one piece (use as guide for assembly of implants).

Place the M.B.T. revision tray on a firm, stable, padded surface. Set the tibial sleeve in an orientation that matches the prepared canal. Matching the orientation of the tray/sleeve trial is helpful in determining appropriate rotation of the final tibial tray/sleeve implant. (Figure 20) The sleeve can rotate 20 degrees internally or externally.

Using the sleeve impactor and a mallet, impact the sleeve onto the M.B.T. revision tray. Deliver two to three strikes to engage the two components. (Figure 21)

Figure 20

Figure 21

Wedge Assembly

Note: To aid wedge assembly, attach wedge prior to stem attachment.

Assemble the designated wedge to the tray and secure using the appropriate screw. Carefully tighten with the large T-handle torque driver until an audible click is discerned, ensuring a full and permanent interlock. (Figure 22)

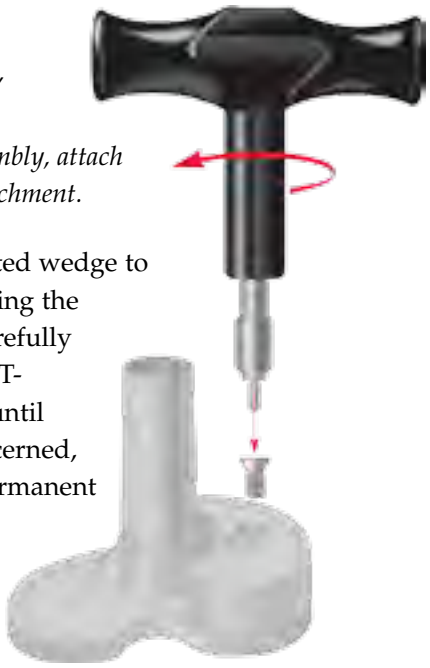


Figure 22

Stem Component Assembly

Attach the tibial stem extension to the prosthetic tray using the *two* appropriate wrenches to ensure full engagement. (Figure 23)

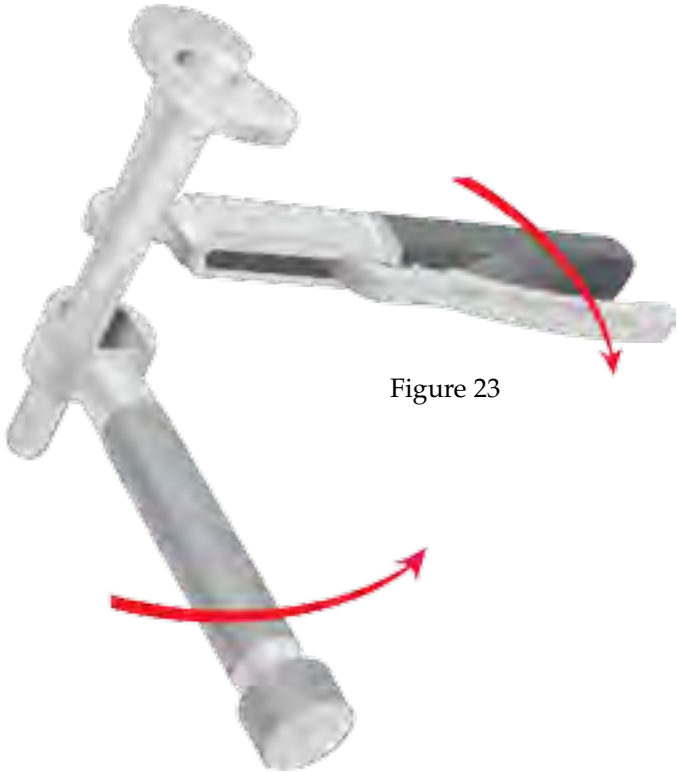


Figure 23

Good cementing technique is integral to a successful cemented prosthesis. In general, a continuous cement mantle with good cement interdigitation is necessary for success. To assure that good cement interdigitation occurs, prepare the sclerotic bone (options include drilling holes and sawing grooves), and cleanse the bone to be cemented by pulsatile lavage.

There are two *primary* cement mixing and application techniques: bowl mixing with digital application and cartridge mixing with syringe application. Vacuum mixing of cement has been shown to reduce porosity in the mixed cement, which has been shown to increase the fatigue life of the cement.[1]

Bowl mixing and applying cement digitally
To provide vacuum mixing options for surgeons who prefer bowl mixing and applying cement digitally, use the SmartMix™ Bowl to mix DePuy's medium viscosity (more liquid) cement, SmartSet® MV (Figure 24). For surgeons who prefer high viscosity (more doughy) cements, use DePuy's SmartSet HV and high viscosity cement mixed in the SmartMix Bowl.

Figure 24

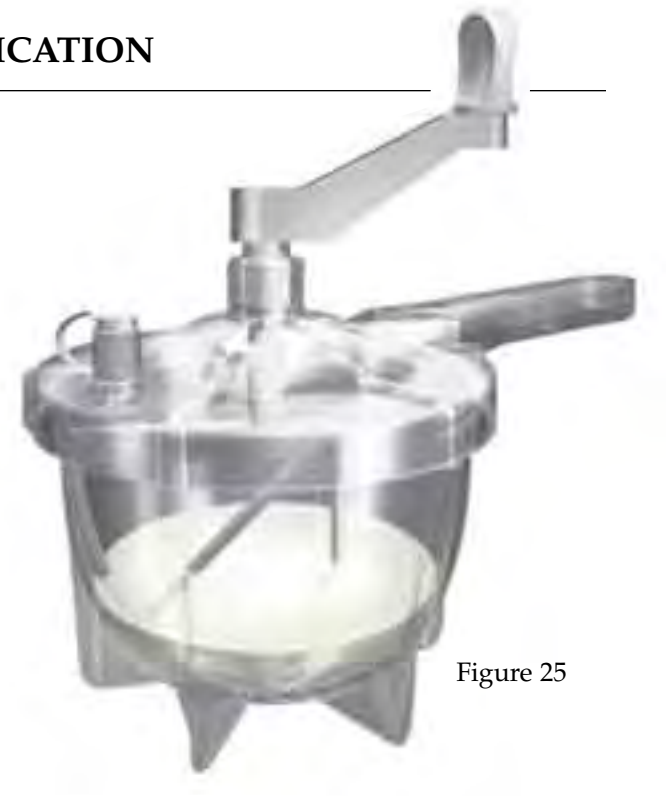


Figure 25

Cartridge mixing and applying cement by syringe
To provide vacuum mixing options for surgeons who prefer cartridge mixing and applying the cement by syringe, the SmartMix Tower cartridge can be used to mix DePuy's medium viscosity (more liquid) cements, SmartSet MV (Figure 25). For surgeons who prefer high viscosity (more doughy) cements, use the Cemvac™ cartridge to mix DePuy's SmartSet HV high viscosity cement.

Whether applying the cement digitally or by syringe/cartridge, apply the cement early in the doughy phase, when it can more easily penetrate into the cancellous bone. Pressurizing the cement promotes deeper interdigitation into the cancellous bone, which can be done digitally and/or when the implant is pressed into place.

Cemented Tray Implantation
Avoid contamination by blood of the prepared cement during application as this may cause laminations in the cement that can significantly reduce cement strength. Apply cement to the proximal tibial surface as well as the prepared central stem. It may also be applied to the underface and keel of the tibial tray. Carefully insert the M.B.T. Revision Tray into the proximal tibia avoiding malrotation (Figure 26). Attention is required to ensure the implant keel aligns with the prepared bone. Assemble the universal handle onto the tray impactor. When the tray is fully inserted, impact the top of the universal handle with several mallet blows to seat the implant fully (Figure 27). Remove excess cement with a small angled curette.

At this point, the surgeon may elect to assemble the M.B.T. Revision trial plateau post and the tibial insert trial onto the seated M.B.T. Revision Tray and the trial femoral component onto the prepared femur (Figure 28).

Note: Use of this technique will require preparation of a second cement batch if the femoral component is to be cemented.

Place the knee in 20 to 30 degrees of flexion and apply axial compression to maintain equal pressure at the bone-to-tibial implant interface until the cement has set. Return the knee to full flexion for careful excision of any remaining extruded cement.

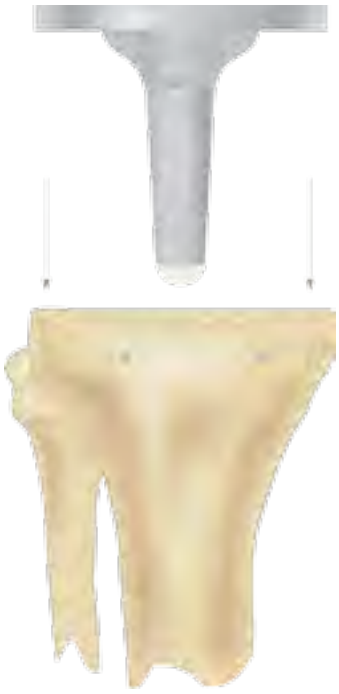


Figure 26

Figure 27

Figure 28

Select a femoral sizing template. The inside of each template corresponds to the inside geometry of the selected size of the femoral component. The outside of the template corresponds to the outside surface of the femoral component. When sizing, it is important to keep the anterior flange of the femoral component in the same plane as the anterior cortex. With the knee in flexion, place the femoral template against the lateral condyle to visually determine which implant adequately restores the joint line (Figure 29). Evaluate what augmentation might be necessary. This will define the best A/P component fit and should be the primary sizing method.

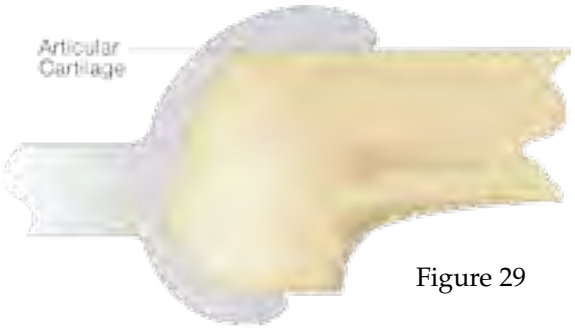


Figure 29

The M/L width of the femur can be measured at its maximal width with the knee flexed and can be used as a secondary reference for sizing (Figure 30).

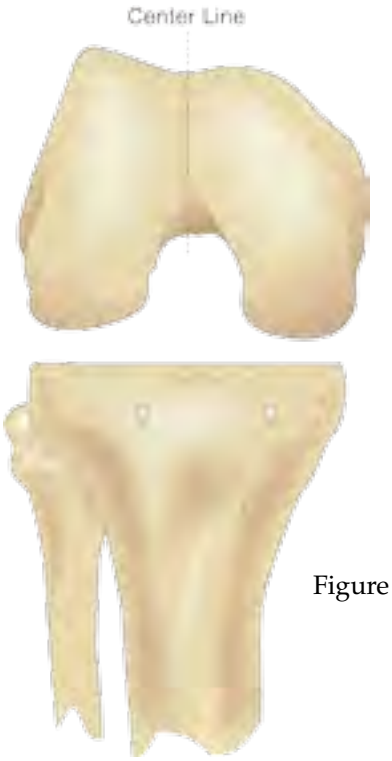


Figure 30

PREPARATION OF THE FEMUR

INTRAMEDULLARY FEMORAL ALIGNMENT SYSTEM

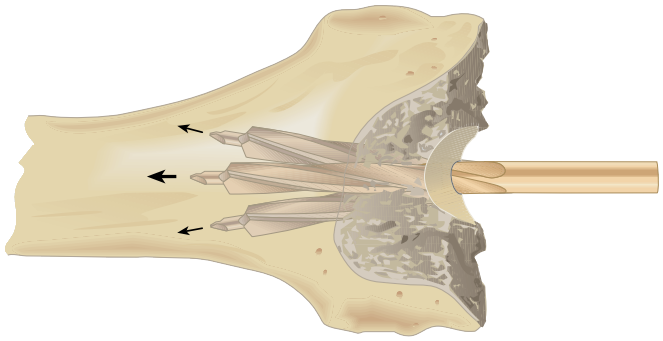
Rationale

This technique was designed to govern the placement of the femoral component with reference to the fixed position of an intramedullary reamer and existing anatomic landmarks. The length and diameter of the femoral stem extension is determined with X-ray templates and assessment of bone stock.

The femoral trochlea's midline is identified 3 mm anterior to the anterolateral margin of the posterior cruciate ligament attachment (Figure 31).

Figure 31

Enter the medullary canal with a 9 mm drill to a depth of 3-5 cm. Take care that the drill avoids the cortices. It is helpful to palpate the distal femoral shaft as the drill is advanced (Figure 32).



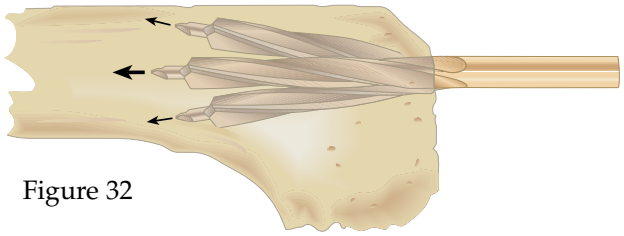


Figure 32

Reaming the Medullary Canal

Assemble the straight reamer to the T-handle. If power reaming, it will be necessary to attach the modified Hudson adaptor to the straight reamer (Figure 33). The shaft of the reamer contains markings in 25.4 mm (1 in.) increments (Figure 34). Use the Reamer Depth Chart (Figure 34a) to determine reamer depth for each combination of components. Each marking is numbered to use as a reference when reaming to the appropriate depth. Fluted tibial, uncemented stem lengths are available in 75, 115 and 150 mm. Determine the length and diameter of the prosthetic stem extension with templates (Cat. No. 2178-30-100) applied to preoperative X-rays.

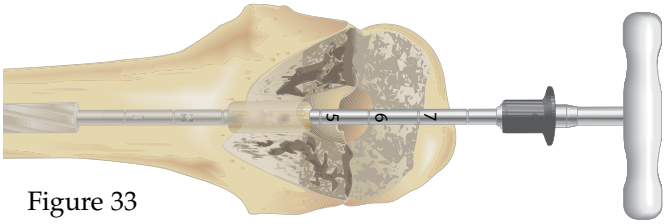


Figure 33

Figure 34

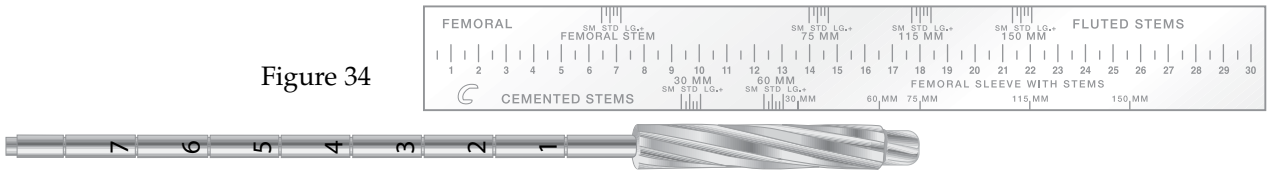


Figure 34a

Reamer Depth Chart		Sleeves: No Sleeve	20 mm 31 mm 34 mm	40 mm 46 mm
Cemented Stems	30 mm	1	2	2
	60 mm	2	3	4
	90 mm	4	5	6
	120 mm	4	6	6
	150 mm	6	7	7
Universal Slotted Stems	75 mm	3	4	4
	115 mm	4	5	6
	150 mm	6	7	7

Smooth, non-fluted cemented modular tibial stems are available in 30 and 60 mm lengths. Cemented femoral tapered stems are available in 13 mm diameter and 90, 120 and 150 mm lengths. A 15 mm diameter cemented tapered stem is available in the 90 mm length. The fluted (press-fit) femoral stem lengths available are 75, 115 and 150 mm in 2 mm increments 10-24 mm. The medullary canal is sequentially opened in 1 mm diameter increments with reamers of progressively greater size until firm endosteal engagement is established.

Take care to ream the canal in line with the femoral axis to avoid putting the implant in flexion (Figures 35a and 35b).

If reaming to cortical bone and it is determined that the fluted stem will be less than 16 mm in diameter, it will be necessary to attach the stem reamer to the threaded shaft and ream for the fixed stem on the femoral component.

Do not reverse ream.

Where a P.F.C.® Sigma™ cemented stem extension is indicated, make the final reaming with a 15 mm reamer to accommodate the 13 mm diameter stem extension and the fixed stem on the femoral component.

As fluted rods are available in even sizes (10 mm through 24 mm), perform final reaming accordingly with an even-sized reamer.

If using stem-only, proceed to A/P section. If using femoral metaphyseal sleeve, see Appendix IV.

Figure 35a

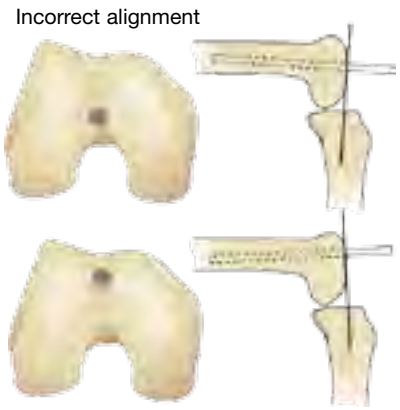


Figure 35b

Anterior/Posterior Resection

Use of Threaded Shaft Assembly

Attach the appropriate stem trial to the proximal end of the complete revision femoral collar that corresponds to the diameter of the stem that will be used. Attach the completion revision femoral threaded shaft to the distal end of the femoral collar. Slide the block on to the threaded shaft, through the appropriate bushing. Position and seat it flush against the femur (Figure 36).

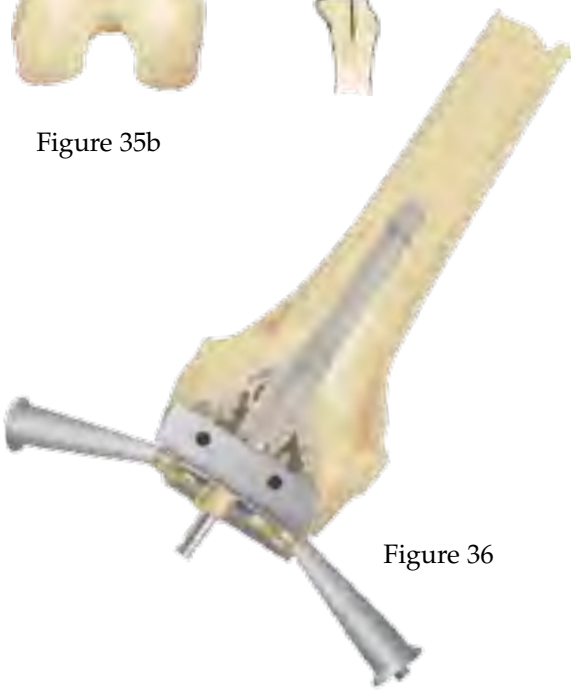


Figure 36

The appropriate 8 or 9 mm bushing, positioned for right or left knee, is assembled to the revision A/P cutting block. The bushing aligns the block at a 5 degree femoral valgus angle. The gold 8 mm bushing is used in most cases when cutting off the reamer. Use the silver 9 mm bushing only if utilizing the LCS completion IM drill.

Alternatively, insert the IM rod and sleeve guide corresponding to the final ream size over the reamer and into the distal femur to help stabilize the reamer.

Slide the block on to the reamer through the appropriate bushing position and seat it flush against the femur.

Femoral Rotation

Rotational Alignment of The A/P and Chamfer Cutting Devices

Assemble the appropriate trial extension stem to the tibial tray and position it within the prepared medullary canal. The tibial trial will act as a reference point for femoral rotation.

In a knee with competent collateral ligaments, the femoral positioner that references the tibial plateau will create a rectangular extension gap. Use the femoral epicondylar axis to confirm proper femoral rotation. In cases with incompetent collateral ligaments, position rotation with reference to the epicondyles.

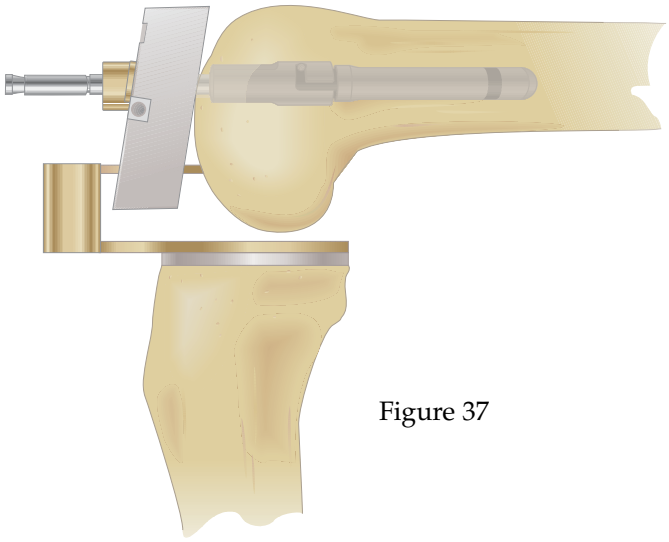


Figure 37

Femoral Rotation Determination and Flexion Balancing

Slide the femoral guide positioner into the joint space, engaging the slot of the femoral A/P resection guide. Slightly flex or extend the knee until the positioner lies flat on the tibial tray trial.

If the positioner does not fit snugly into the joint space, add tibial spacer shims corresponding to the tibial implant thickness and reassess until equal medial and lateral collateral ligament tension is achieved. If the desired extension gap does not equal the flexion gap, consider a different size femoral component (Figure 37). It is important to note that the desired extension gap is rarely smaller and often bigger.

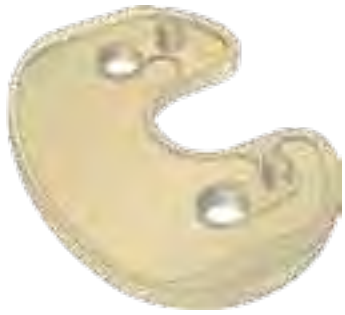


Figure 38

Attach tibial shims corresponding to the insert thicknesses to the posterior surface of the femoral positioner (Figure 38).

Evaluate femoral rotation prior to pinning the resection guide in place. It is customary to implant the femoral component in relative external rotation. Take care to avoid anterior displacement of the A/P cutting block as rotation is set. This is more likely with osteoporotic bone or when a defect exists in the distal femoral metaphysis. The goal is to establish a quadrilateral space with the resected posterior femoral condylar surfaces parallel to the resected tibial surfaces when the collateral ligaments are tensioned (Figure 39).

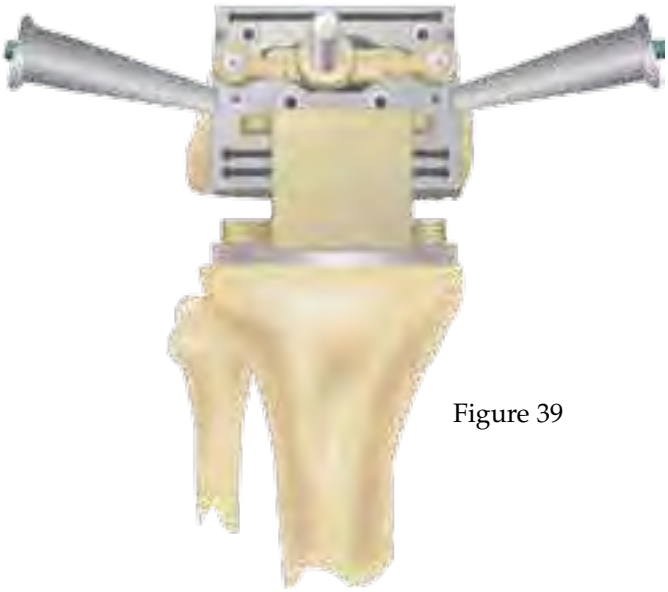


Figure 39

With rotation confirmed, attach the cutting block handles to the A/P cutting block if desired. Gain further fixation by affixing fixation pins through the designated holes. Introduce the visualization wing through the anterior slot of the A/P cutting block. Pass the visualization wing over the anterior cortex to ensure against femoral notching (Figure 40).

Perform anterior resection through the anterior slot using a 1.52 mm oscillating sawblade.

Posterior resection is made off the block's posterior surface or, where there is posterior condylar deficiency use the appropriate 5 or 10 mm slot to accommodate posterior augments (Figures 41 and 42).

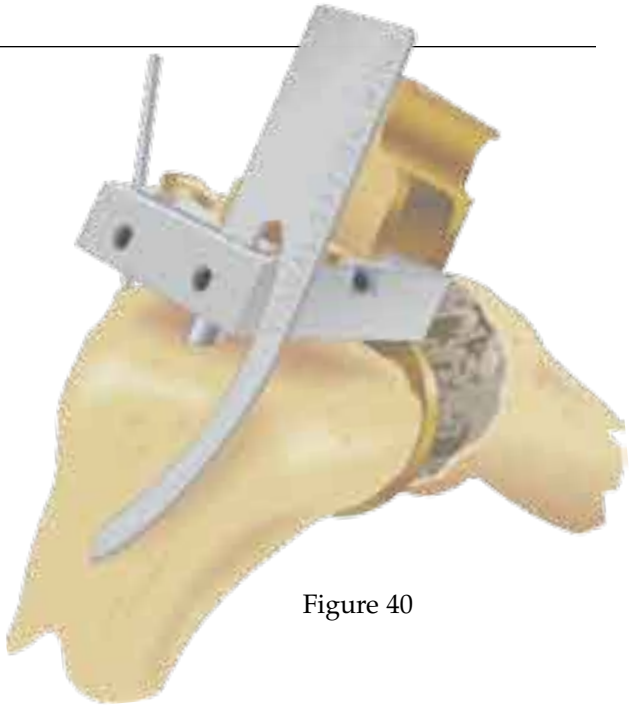


Figure 40

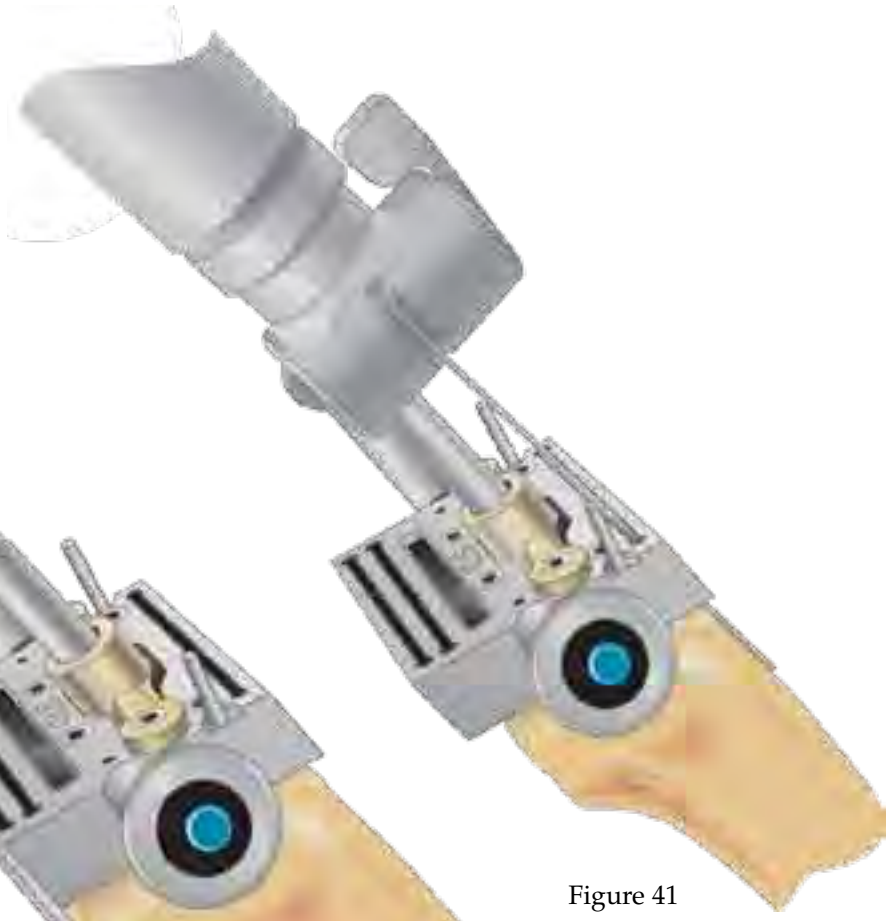


Figure 41

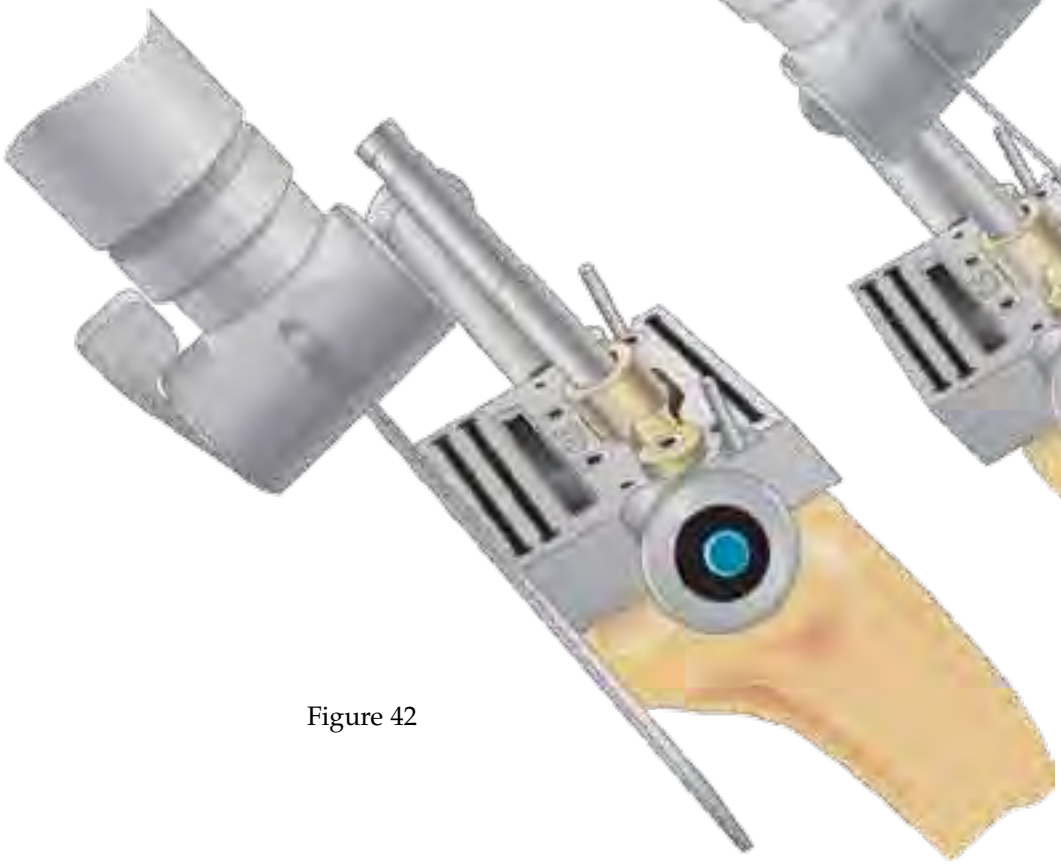


Figure 42

Flexion Gap Assessment

Once the A/P resections are completed, leave the tibial trial in place, remove the A/P cutting guide and insert the spacer block assembly into the flexion gap. The appropriate size revision femoral shim should be assembled to the spacer block. The assembly mimics the thickness of the femoral and 10 mm bearing components. Assure equal medial and lateral compartmental tension. If necessary, add an augment button to the spacer block to fill the gap (Figure 43).

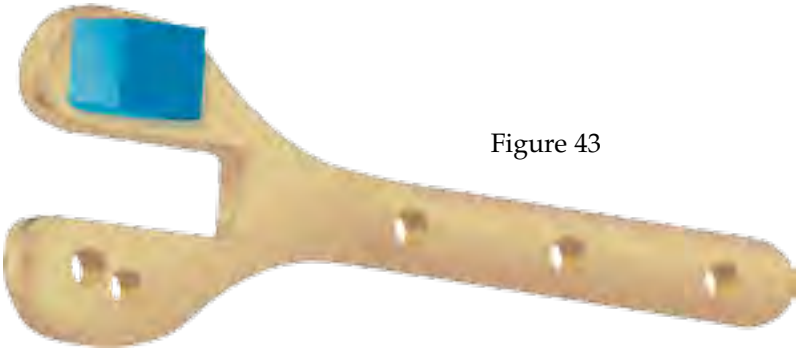


Figure 43

Note: If one compartment is still too tight in flexion put leg into extension and release additional soft tissue to achieve equal compartmental tension. Note that this will affect extension alignment. Insert the external alignment rod through the spacer block handle to again check the frontal and lateral plane alignment on the tibia. Make a note of the spacer block thickness utilized to fill the flexion gap. This will subsequently determine the extension gap.

Distal Resection

Assemble the distal femoral cutting block onto the A/P cutting block (Figures 44 and 45). The cutting block has slots to allow for a 0 mm clean-up cut, 5 or 10 mm distal augment. If a 15 mm distal augment is indicated, remove the distal cutting block and move it up one pin row proximally on the Steinmann pins for 15 mm cut.

Figure 44

Introduce either $\frac{1}{8}$ in. drill bits or Steinmann pins through the center two holes.

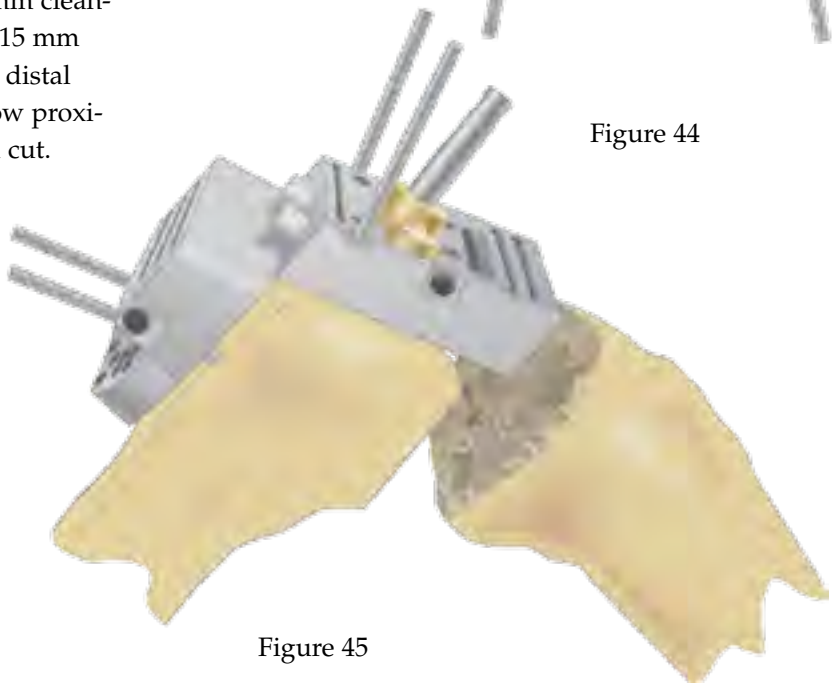


Figure 45

Additional Distal Resection Notes

The distal cutting block, A/P cutting block and IM rod assembly are subsequently removed. Place the distal cutting block back over the Steinmann pins.

In many cases little, if any, bone is removed from the distal femur as the joint line is effectively elevated with the removal of the primary femoral component. As the resection level is predicated on the preservation of bone stock, cut each condyle only to the level required to establish a viable surface, with augmentation employed to correct imbalance.

Perform resection accordingly through the slot appropriate for each condyle (Figure 46).

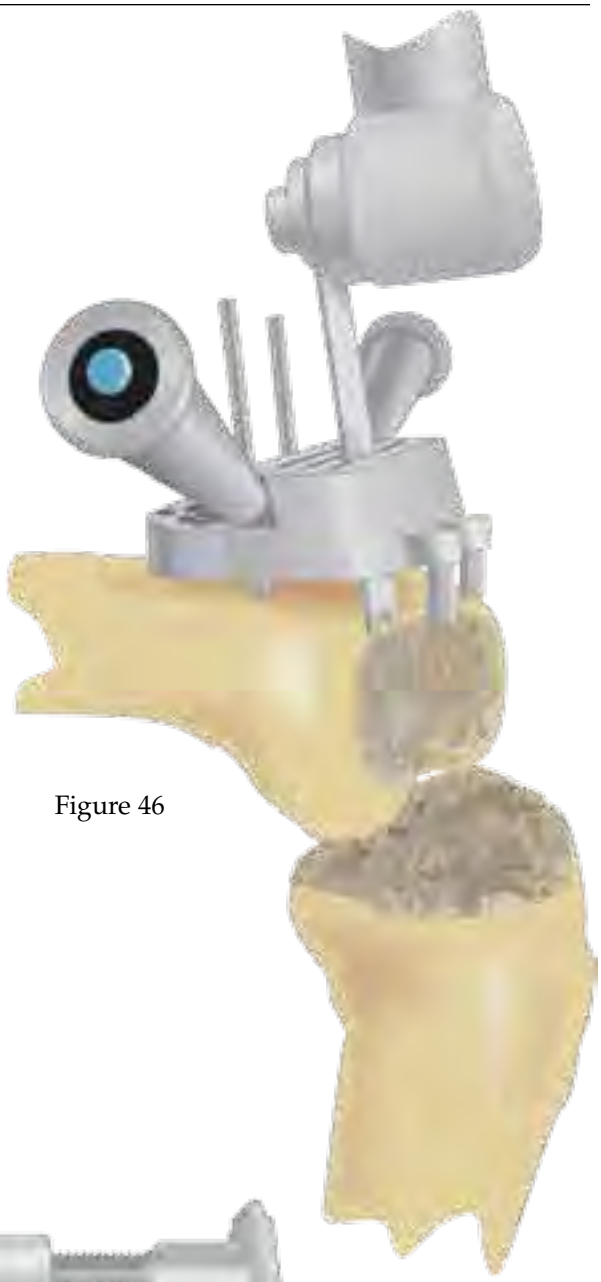


Figure 46

Utilizing Spacer Blocks

Once the resection is completed, remove the distal cutting block and fixation pins, attach the femoral IM plate to the femoral collar (Figure 47) and then attach the appropriate stem trial. Extend the knee and slide the spacer block assembly over the IM plate (with the shim that was used for the flexion gap) (Figure 48). It should fit snugly in the gap with equal MCL and LCL tension. Remove the spacer block assembly and remove the IM plate. Attach the threaded shaft to the femoral collar and introduce it into the femur.

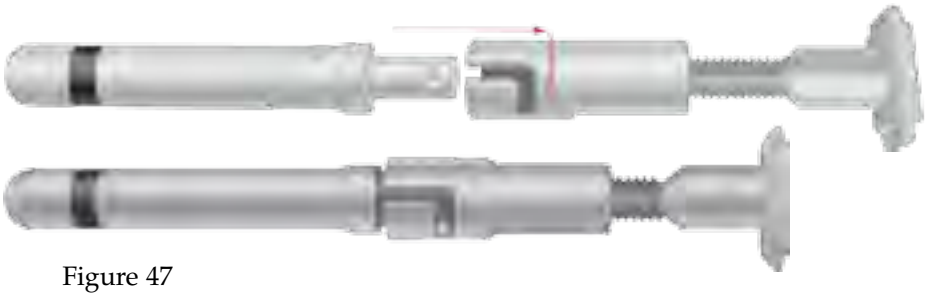


Figure 47

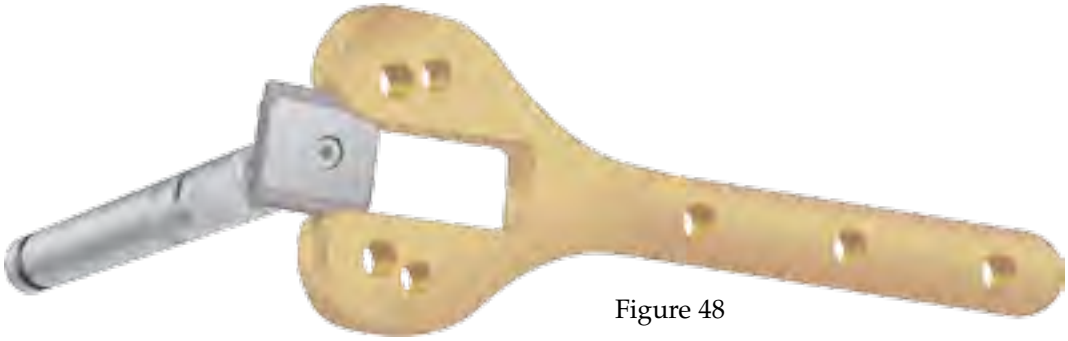


Figure 48

Notch and Chamfer Resection

Figure 49

Where distal or posterior augmentation is planned, insert the appropriate augment button into its receptacle on the finishing guide (Figure 49).

When placing augment buttons on the finishing guide, ensure orientation as shown in Figure 49.

Select the appropriate notch/chamfer bushing. This corresponds to the bushing that was used on the A/P cutting block, 8, 9 mm bushing or cemented. Assemble it onto the notch/chamfer cutting guide, with the appropriate Right/Left designation facing up and locked into position by rotating the tables anteriorly to the stop (Figure 50).

Slide the block on to the threaded shaft, through the bushing position and seat it flush against the femur (Figure 51).

Introduce fixation pins to secure cutting block. (Figure 51).

Figure 50

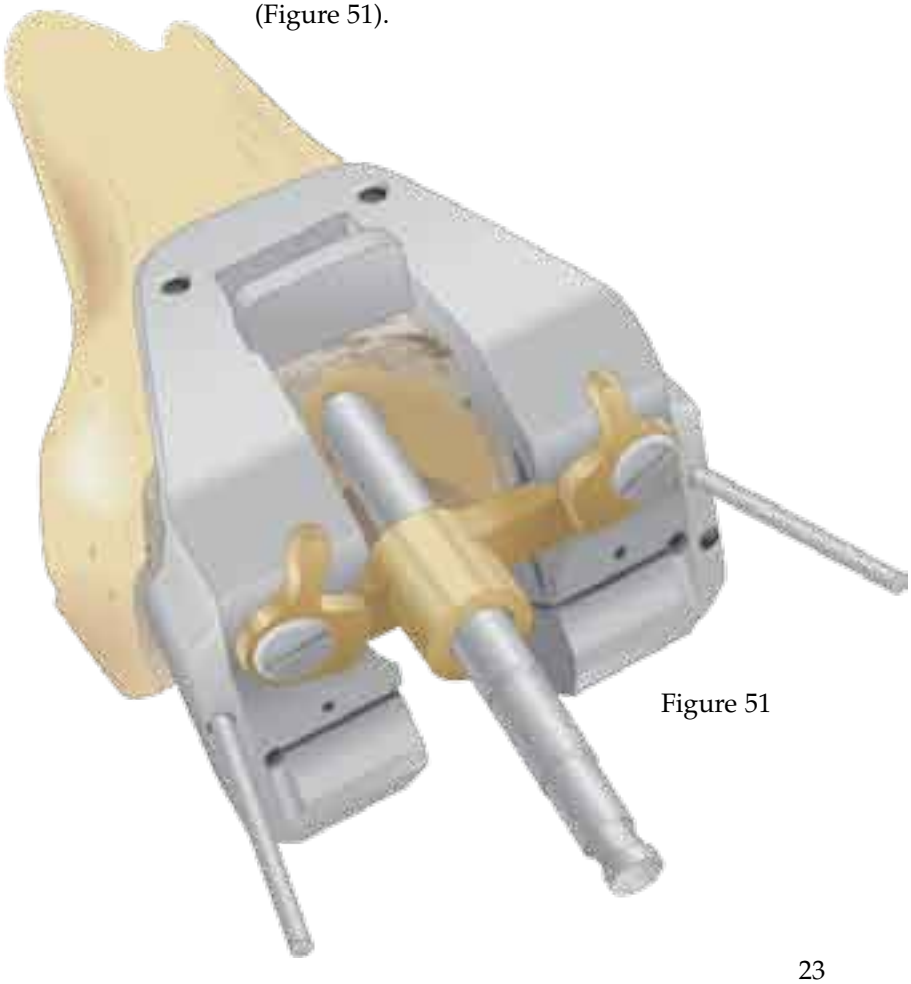


Figure 51

Notch and Chamfer Resection

Subsequently remove the notch/chamfer bushing and carefully disengage the IM threaded shaft assembly or reamer from the reamed canal to preserve the established configuration.

Make the notch and chamfer cuts with an oscillating saw (Figures 52 and 53). Do not allow the saw blade to come in contact with the augment buttons (Figure 53).

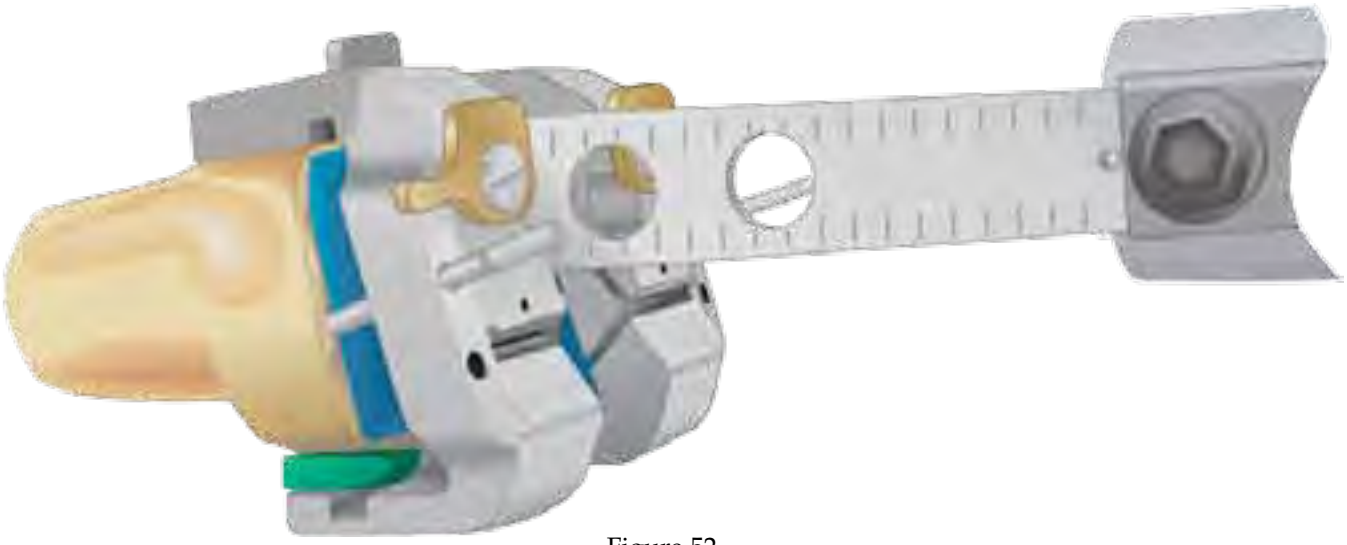


Figure 52

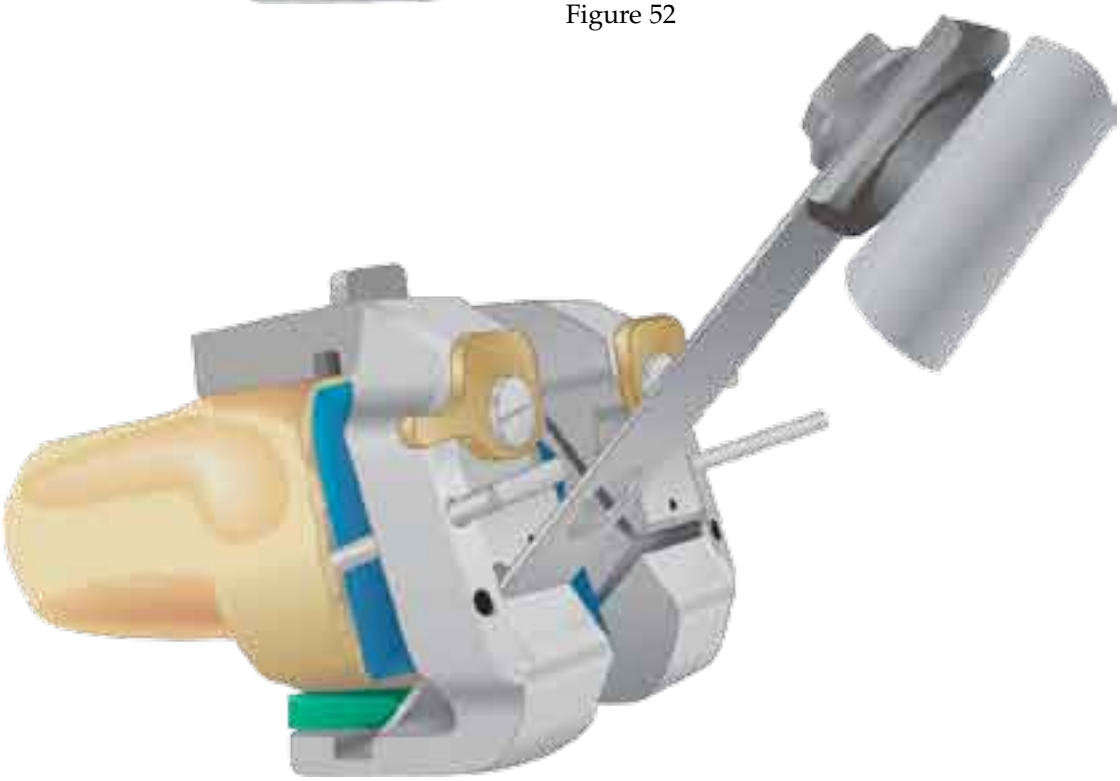


Figure 53

Sulcus Cut

Perform resection either with an oscillating saw using a 12.7 mm wide blade or with a thin osteotome (Figure 54). A reciprocating saw can also be used.

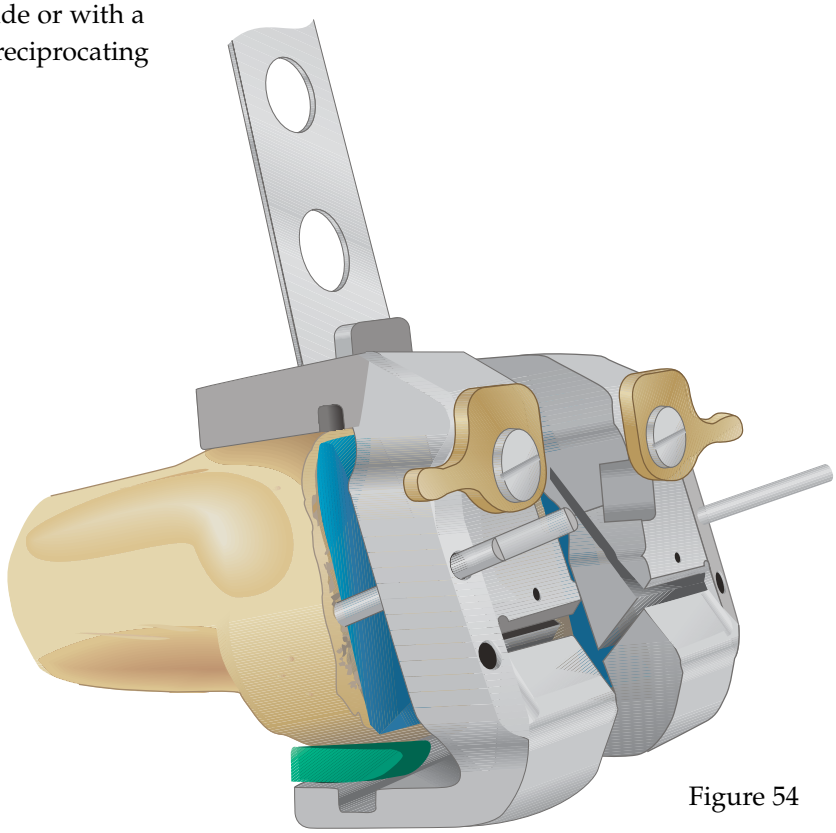


Figure 54

Figure 55

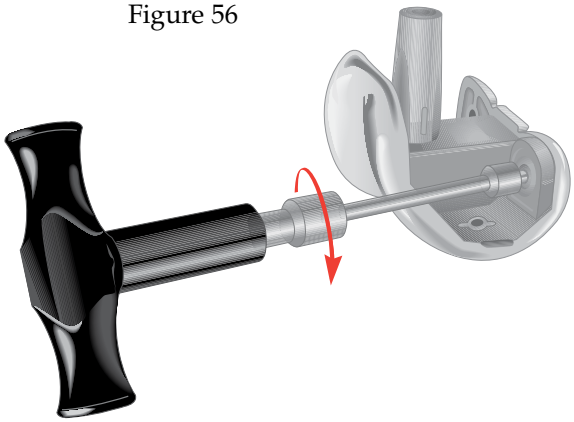
The Trial Femoral Component

Attach the appropriate trial extension stem and trial augments to the trial femoral component (Figure 55). If using a sleeve, attach the trial femoral component to the trial sleeve using the trial screw with the trial polyethylene insert in place (as shown in Appendix II). Flex the knee to between 90 degrees and 100 degrees and slide the trial onto the femur. Pass the knee through a range of motion to verify function.

See page 36 for sleeve trial assembly.

Remove the trial components in reverse order and clean the site thoroughly using pulse lavage before implantation. Before implant fixation proceeds, attach all augments and modular stems to the femoral and tibial components. Attach the augments using the wobble bits included in the augment package. Use the augment T-handle to attach the femoral and tibial augments to the components provided. It may be necessary to use the T-handle extension in conjunction with the augment T-handle to attach the augments. Fully seat the augments on the component before tightening the screw thread mechanism. **Attach the posterior augments to the femoral component before the distal augments, if both are required (Figures 56 and 57).** Note: 15 mm distal augments may only be used on Standard +, Large and Large + femoral components

Figure 56



Attach the stems using the revision femoral/tibial sleeve clamp to grip the component and the stem extension wrench to grasp the stem.

Apply sufficient force to both wrenches to ensure that the stems are secure (Figure 58).

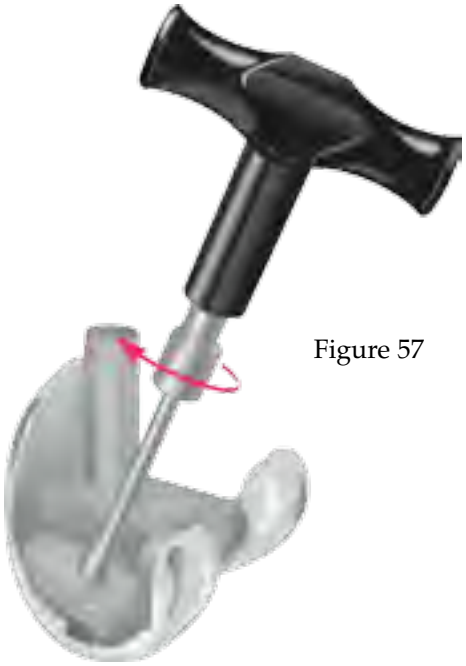


Figure 57

Implant the definitive components in the following order:

- Tibial tray (with stem and wedges)
- Femoral component (with stem and augments)
- LCS Complete Revision insert

Implant the femoral and tibial components using the femoral impactor.

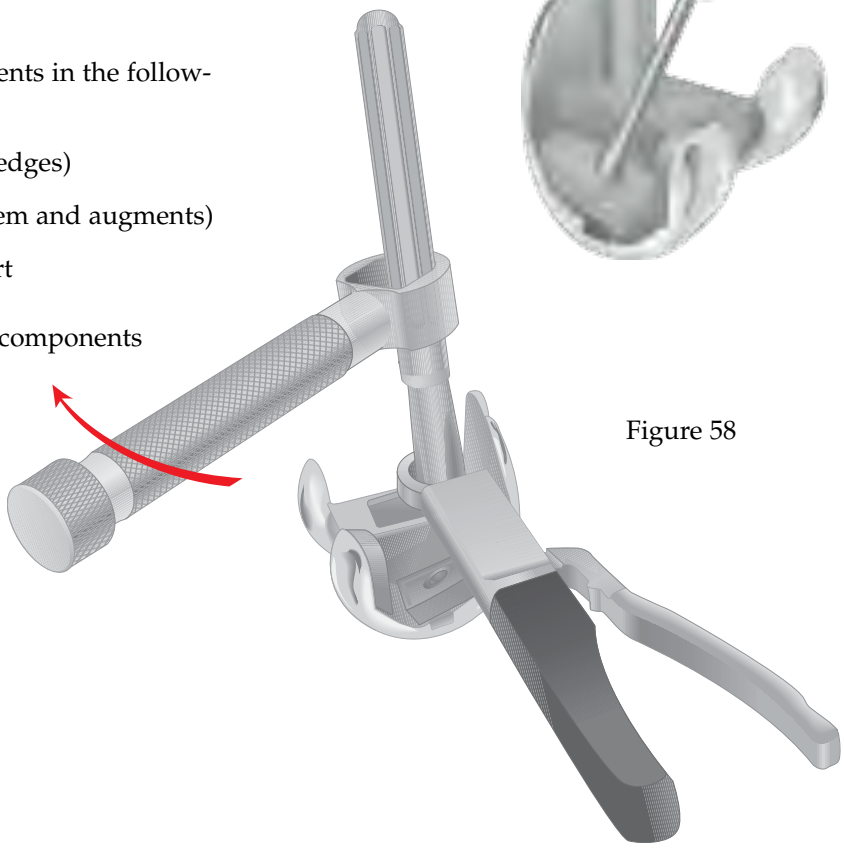


Figure 58

Postoperative Managment

The incidence and severity of complications from any total knee replacement are usually greater in surgical revisions than primary operations. Common problems include incision placement, ectopic bone, old bone cement or prosthesis positioning.

In summary, increased operative time, blood loss, increased incidence of infection, pulmonary embolus and wound haematoma can be expected with revision procedures. The functional life expectancy of a prosthetic implant, its fixation and the effects of long-term tissue tolerance are at present not clearly established. A continuing program of periodic follow-up controls is essential and should be strictly enforced. Because of an unknown functional union of the prosthesis with the bone, take weight bearing AP and lateral radiographs of the knee at the time of each checkup, compare with any earlier radiographs and correlate with the clinical assessment of the patient.

If any radiographic changes are observed, particularly any changes in the position of the implants, radiolucencies along the implant-to-cement, cement-to-bone, bone-prosthesis interfaces, evidence of cement fracture or bone resorption, these should be monitored to determine whether they are satisfactory or progressive. With evidence of these conditions, patients should be closely observed, revised patient instructions considered, and possibilities of further deterioration evaluated.

THE CEMENTED TIBIAL STEM EXTENSIONS

CEMENTED STEM REAMER

Align the tibial tray and secure with two fixation pins inserted through the holes designated. (Figure 59)

Seat the M.B.T. revision drill bushing onto the tibia trial. Place in the posterior holes.

Place the cemented drill bushing into the M.B.T. revision drill bushing. (Figure 60)

Use the "cemented" reamer to ream to the predetermined selected depths for tray only **or** the tray with a 30 or 60 mm cemented stem.

Remove the reamer and "cemented" bushing, leaving the tray trial **and** M.B.T. revision drill bushing in place. (Figure 61)

Note: Only a 13 mm diameter cemented stem should be used in conjunction with the M.B.T. revision tray to avoid a step off at the stem/tray junction.

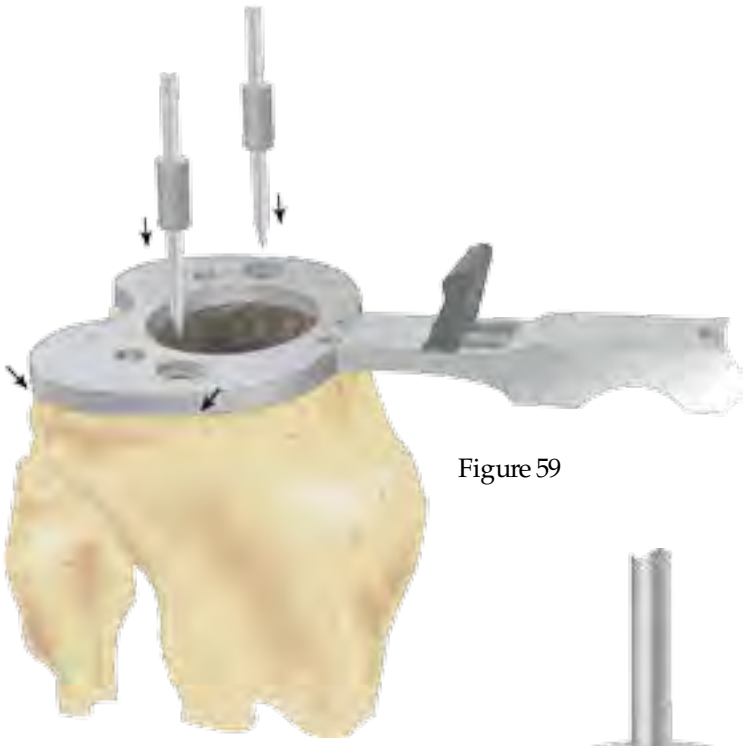


Figure 59

Figure 60

Figure 61

Tapered Reamer

Assemble the revision reamer adapter onto the cemented tapered reamer.

Next, attach the modified Hudson adapter to the tapered reamer, if power reaming.

Attach the appropriately sized cemented stem trial (13 x 30 mm or 13 x 60 mm) to the tapered reamer if utilizing a cemented stem extension. (Figure 62)

Ream until the revision reamer adapter is flush with the M.B.T. revision drill bushing. (Figure 63)

Note: To avoid stem trial disengagement, do not reverse ream.

Figure 62

Figure 63

Tibial Keel Preparation

Place the knee in full extension and determine appropriate rotation of the tibial tray.

Mark the appropriate rotation with electrocautery on the anterior tibial cortex at the center and sides of the alignment handle.

Assemble the appropriate stem trial to the M.B.T. revision tray trial and seat in the prepared bone bed.

Impact the cemented keel punch if a cement mantle is desired or the press-fit keel punch if line-to-line contact is desired. (Figure 64)

Disconnect the universal handle leaving the keel punch in place for trial reduction (if appropriate).

It is recommended that a cement restrictor be placed at the appropriate level prior to cementing the component. Use a cement gun to fill the canal with methyl methacrylate.

Figure 64

STEP WEDGE PREPARATION

STEP WEDGE AUGMENTATION

Resection for supplementary tibial augmentation may be based on the established position of the trial tray. Remove the femoral trial to provide greater access. Confirm rotational alignment of the tibial tray stem trial. Secure the tray with two fixation pins. Attach the tray trial wedge cutting attachment with the step wedge cutting guide to the trial tray. Slide the block forward to the anterior proximal tibia and secure in place with two Steinmann pins through the holes marked with □. (Figure 65)

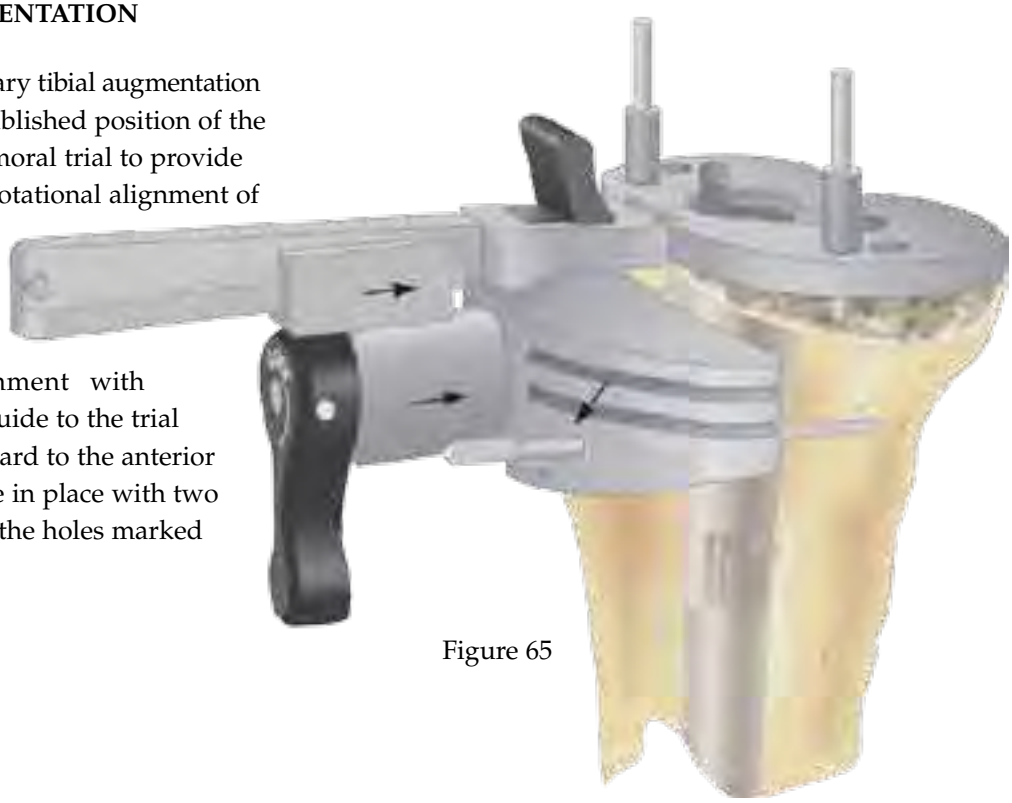


Figure 65

Unlock the block and slide the assembly out of the block. Disconnect the handle from the trial tray.

Position the step wedge cutting block on the pins so the appropriate cutting surface (5, 10 or 15 mm step) is at the deficient condyle. (Figure 66)

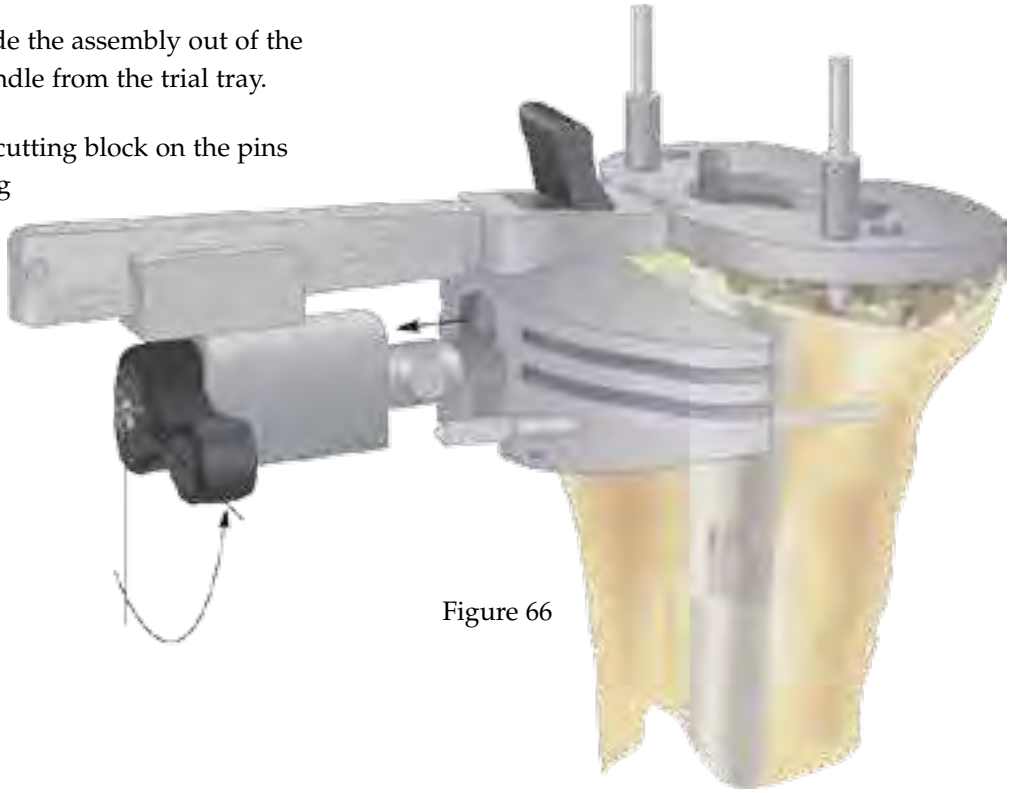


Figure 66

Trim the tibia accordingly with an oscillating saw so the cut does not extend beyond the central riser. Remove the block and pins. (Figure 67)

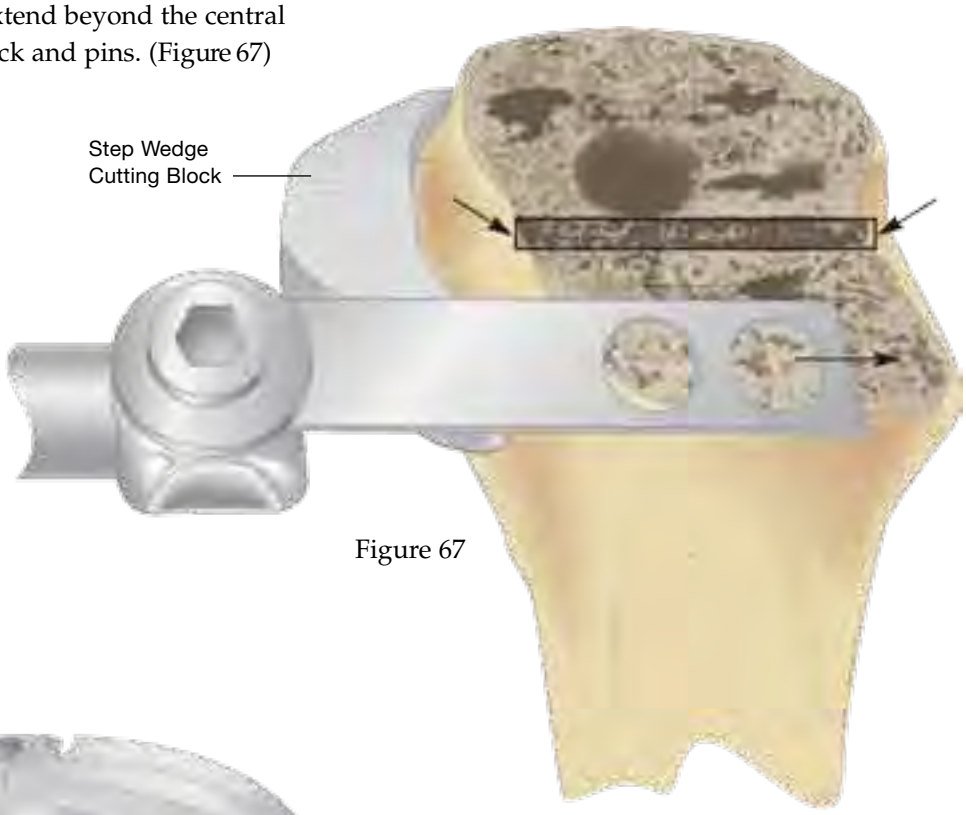


Figure 67

Figure 68

Assemble the trial wedge to the appropriate tibial tray trial and introduce into the prepared site. Perform minimal correction with a bone file where indicated to ensure maximal contact. (Figure 68)

Cemented Femoral Component Implantation
Apply methyl methacrylate cement to all cut surfaces and cemented stem extensions. If needed, plug the canal, lavage and cement with a cement gun. Press it into the cancellous bone at the anterior, anterior chamfer, distal chamfer and box cut surfaces. Also apply cement to the femoral component at the posterior chamfer and posterior condylar recesses (Figure 69). Take care to avoid the articular surface of the implant. As the component is implanted, the leading edges must advance in alignment with the bone cuts.

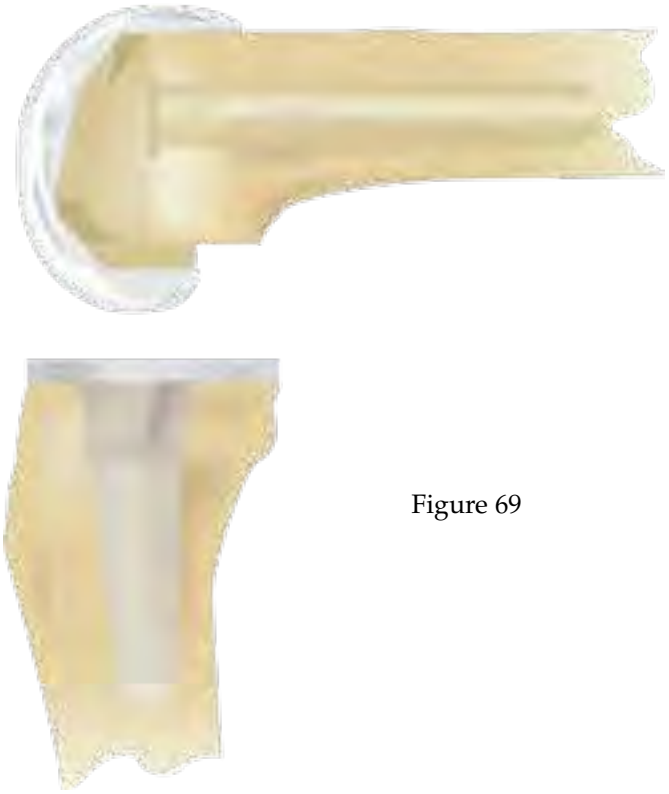


Figure 69

Firmly seat the femoral component with the femoral impactor and clear any extruded cement.

Tibial Insert Implantation
Carefully clean any loose fragments or particulate from the permanent tibial tray. Sublux the proximal tibia anteriorily for improved visualization and insert the appropriate size and thickness tibial insert into the M.B.T. Revision tray (Figure 70).

Bring the knee into full extension to produce maximum axial pressure on the bone-cement interface until the cement has polymerized. With the knee in flexion, remove all remaining extruded cement with an osteotome.

The insert size must match the femoral component size.

Figure 70

THICK TRAY PREPARATION

After impacting the cement or press-fit keel punch, remove the keel punch. Insert the M.B.T. thick tray trial adapter (15 or 25 mm) onto the tibial tray trial. [Figs. 42 and 43]

Note: The tibial tray trial must be used with the thick tray adapters as the two pieces equal the appropriate sizing—15 or 25 mm.

Perform the final trial reductions utilizing the same technique as the standard M.B.T. revision tray. Implant assembly and implantation is also the same as with the standard M.B.T. revision tray (see Assembling the Prosthesis, on page 13, for more information). If utilizing a wedge, refer to the step wedge preparation in Appendix II.

Note: A tibial wedge can be used with all thick tray sizes, except for size 2. Sleeves may be used with all thick trays.

Fig. 42

Fig. 43

Cemented Femoral Stem Extensions

Smooth, cemented modular stems are available in 13 mm diameter and 30 and 60 mm lengths. Cemented tapered stems are available in 13 mm diameter and 90, 120 and 150 mm lengths. See page 25 for an explanation of trial assembly and page 26 for implant assembly.

Position with the finishing guide on the distal femur and select the 8 or 9 mm bushing that was utilized for the A/P cutting block to set placement on the femur (Figure 71). Pin the finishing guide in place both proximally and distally. Remove the 8 or 9 mm bushing and replace with the bushing for cemented stems. Lock the bushing into place on the finishing guide paying close attention to the markings for left or right knee.

Starting with the 10 mm straight reamer, progressively ream to the **13 mm cemented reamer**.

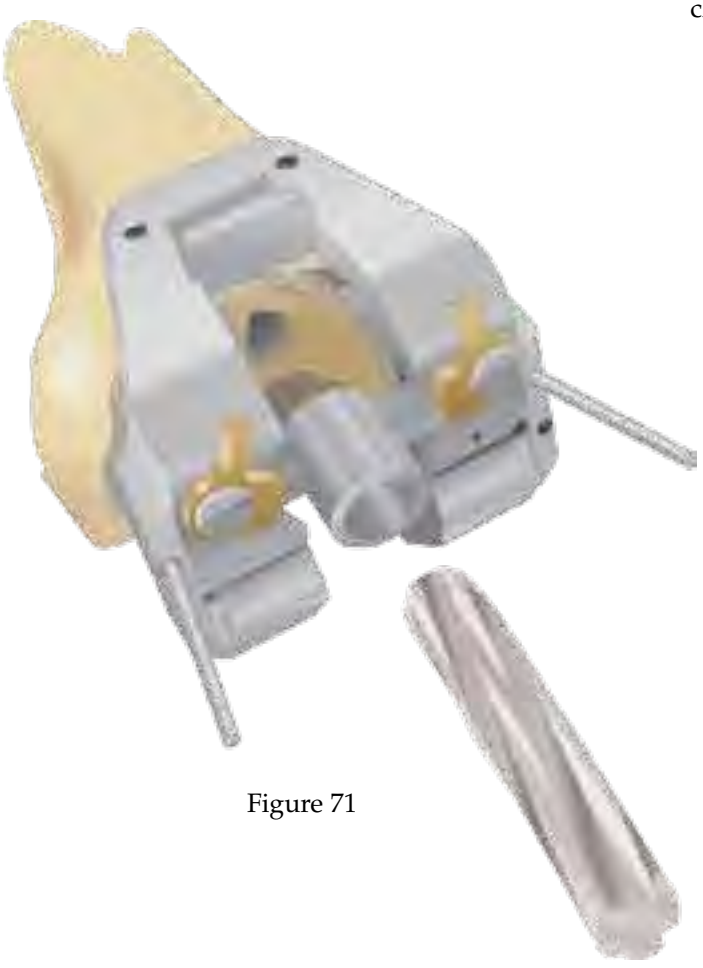


Figure 71

Advance the drill to the desired depth according to the markings on the depth scale.

Attach the appropriate cemented trial to the stem reamer and attach stem reamer to the threaded shaft. Ream to the appropriate markings on the threaded shaft for the fixed stem of the femur (Figure 72). **Do not reverse ream.**

To assess flexion and extension gaps, attach the appropriate IM plate to the stem reamer or to the stem collar, which is attached to the stem trial. Slide onto the spacer block handle.

After reaming through the finishing guide, proceed with the chamfer and sulcus cuts.

Figure 72

Femoral Sleeves

Straight Ream

Assemble the reamer handle to the straight reamer. The shaft contains markings of 25 mm increments. Measure the precise depth against the depth scale or a pre-assembled femoral trial. Smooth, cemented stems are available in 30 and 60 mm lengths. Cemented tapered stems are available in 13 mm diameter and 90, 120 and 150 mm lengths. Cemented tapered 15 mm diameter is available in 90 mm. The fluted femoral stem lengths available are 75, 115 and 150 mm in even size diameters of 10-24 mm. Sequentially open the medullary canal with straight reamers of progressively greater size until firm endosteal engagement is established (Figure 73). If using a 15 mm cemented stem, straight ream up to 17 mm diameter reamer to create space for the cement mantle.

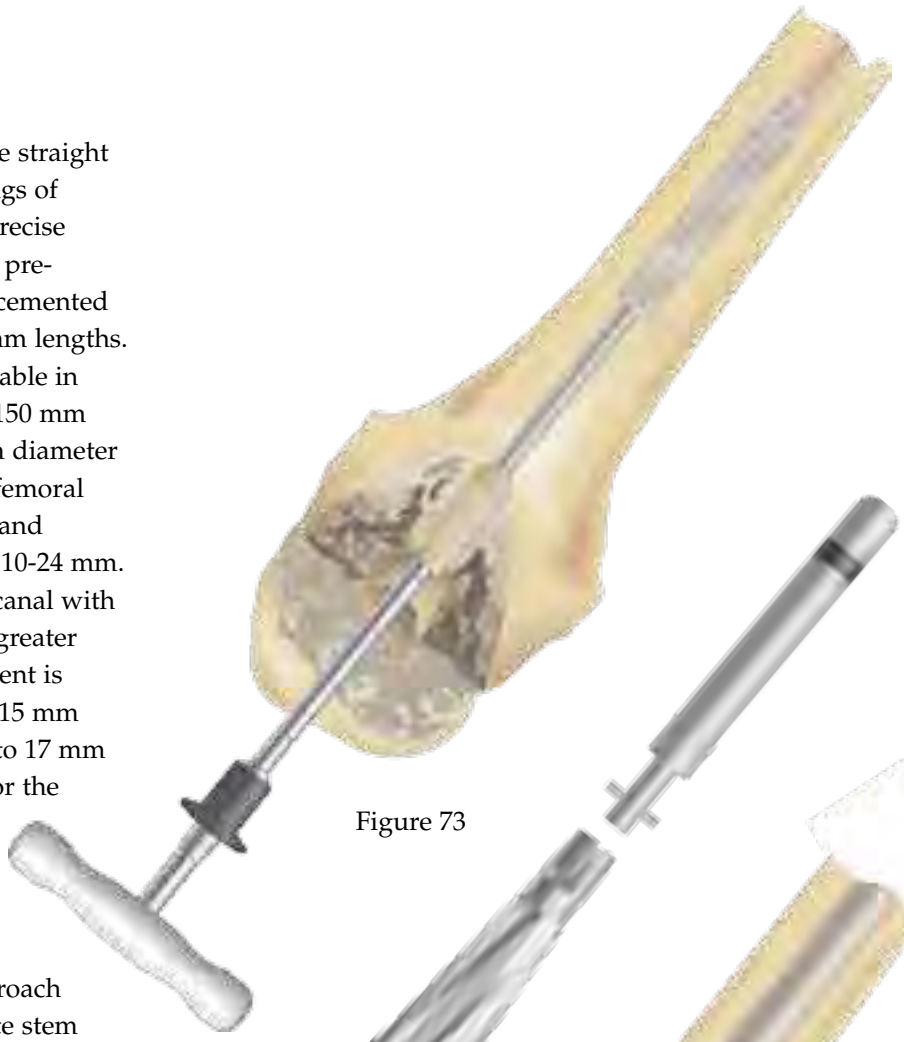


Figure 73

Broach Ream

Attach the threaded shaft to the broach reamer and then to the appropriate stem trial determined by straight reaming (Figure 74). This broach reamer will be necessary for utilizing the 20 mm sleeve and/or for the beginning of larger sequential broaching.

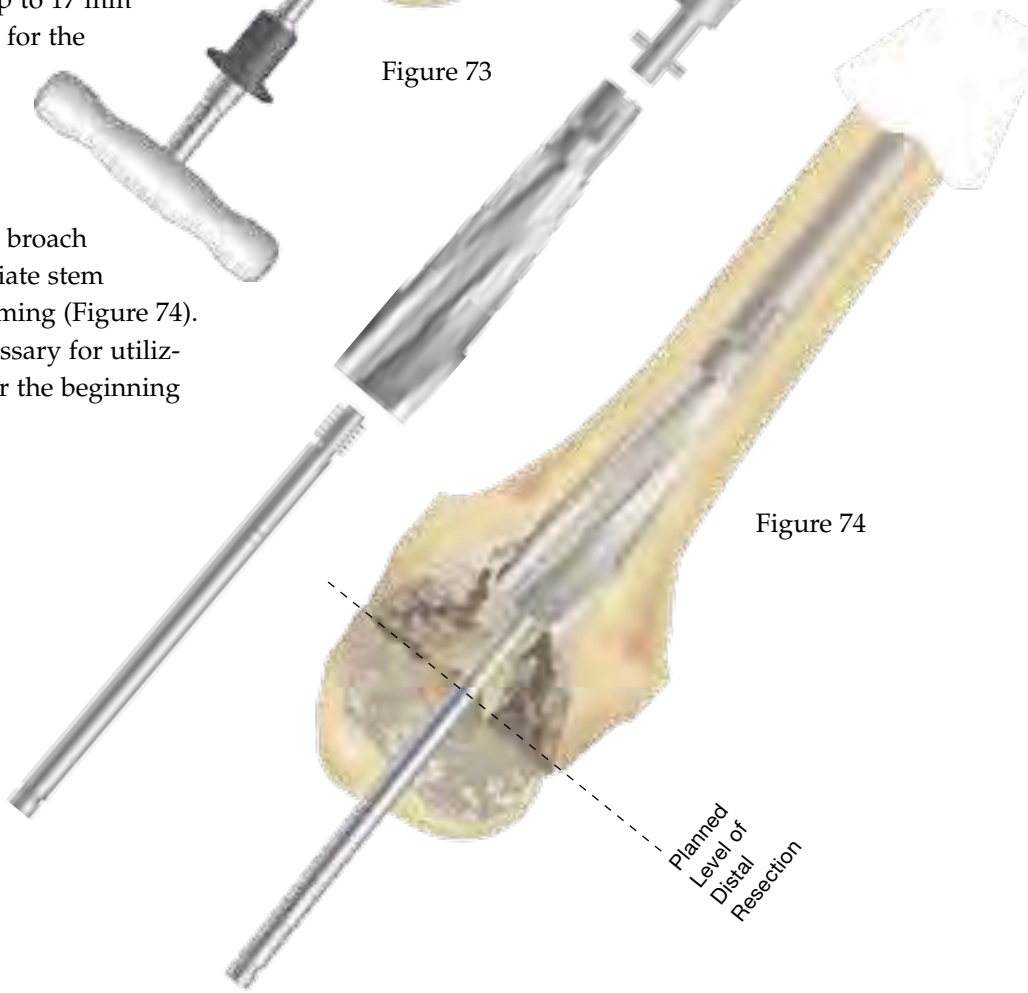


Figure 74

If it is planned to utilize a sleeve larger than 20 mm, attach the universal handle to the revision femoral impaction shaft. Attach this to the broach, which is attached to the appropriate stem trial (Figure 75). Give close attention to medial orientation of the broach. Sequentially broach to desired dimension of 31, 34, 40 or 46 mm. With the final broach choice, broach to the appropriate markings on the revision femoral impaction shaft for the proper femoral size, designating the planned distal resection (Figure 76).

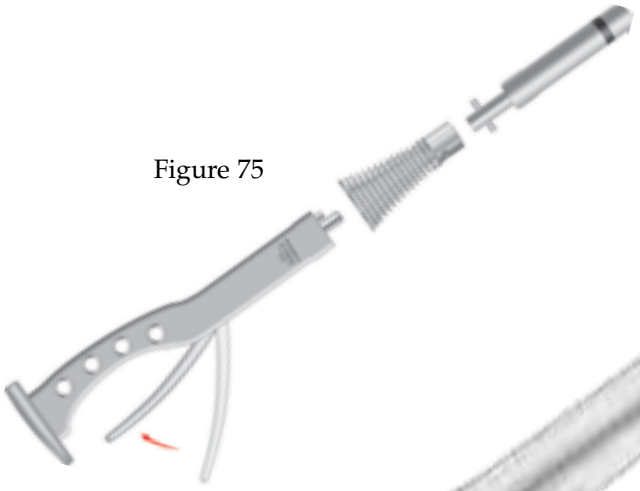


Figure 75

After completion of broaching, remove the broach handle from the broach and attach the threaded shaft to the broach (Figure 77) and continue with A/P, distal and finish cuts as shown in Figure 21 and following the cuts, proceed to the trial phase.

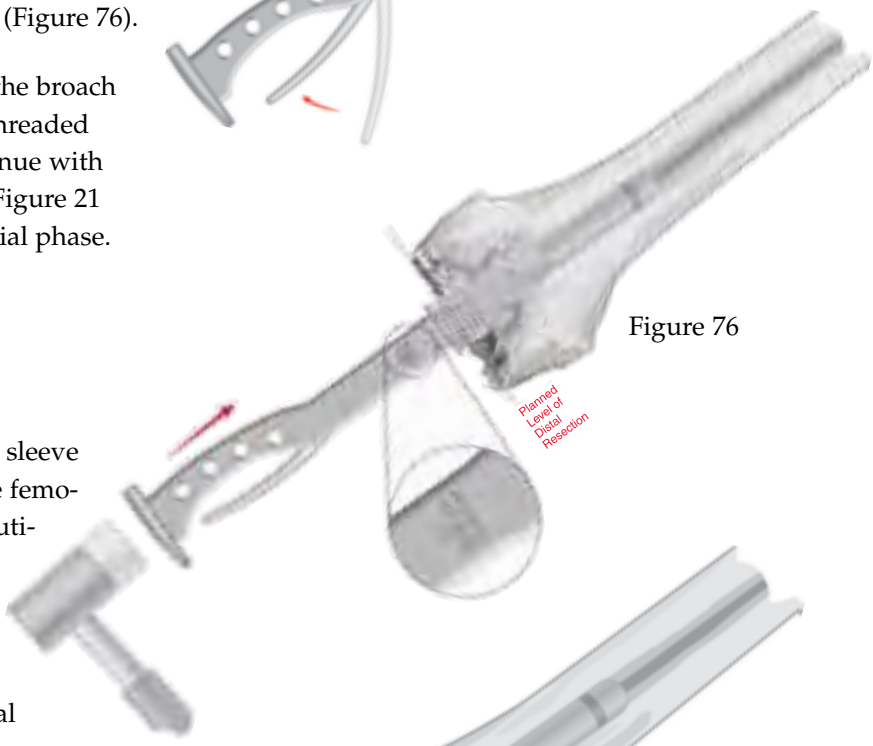


Figure 76

Femoral Trial with Sleeve

When preparing the femoral trial with a sleeve trial, loosely attach the sleeve trial to the femoral trial with the trial attachment screw utilizing the white hex head screwdriver (Figure 78). Attach a stem trial if a stem is to be used. After sleeve rotation is determined by the broach cuts, tighten screw and mimic rotation on final implant.

For femoral sleeve implant assembly, see Appendix V.

Figure 77

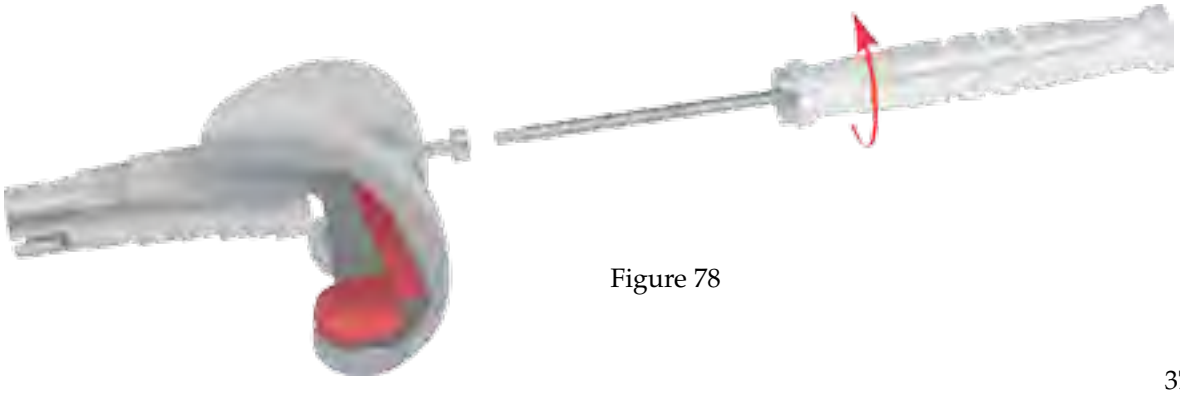


Figure 78

Femoral Implantation with Sleeve

Remove the trial components in reverse order and clean the site thoroughly using pulse lavage before implantation. Before fixation of the implants proceeds, attach all the augments, sleeves and modular stems to the femoral and tibial components. Attach the augments using the wobble bits included in the augment package. Attach the femoral and tibial augments to the components using the augment T-handle provided. It may be necessary to use the T-handle extension in conjunction with the augment T-handle to attach the augments. Fully seat the augments on the component before tightening the screw thread mechanism. Attach the posterior augments to the femoral component before the distal augments, if both are required (Figure 79).

Attach the stems using the revision femoral/tibial sleeve clamp to grip the component and the stem extension wrench to grasp the stem.

Apply sufficient force to both wrenches to ensure that the stem is secure (Figure 80).

Figure 79

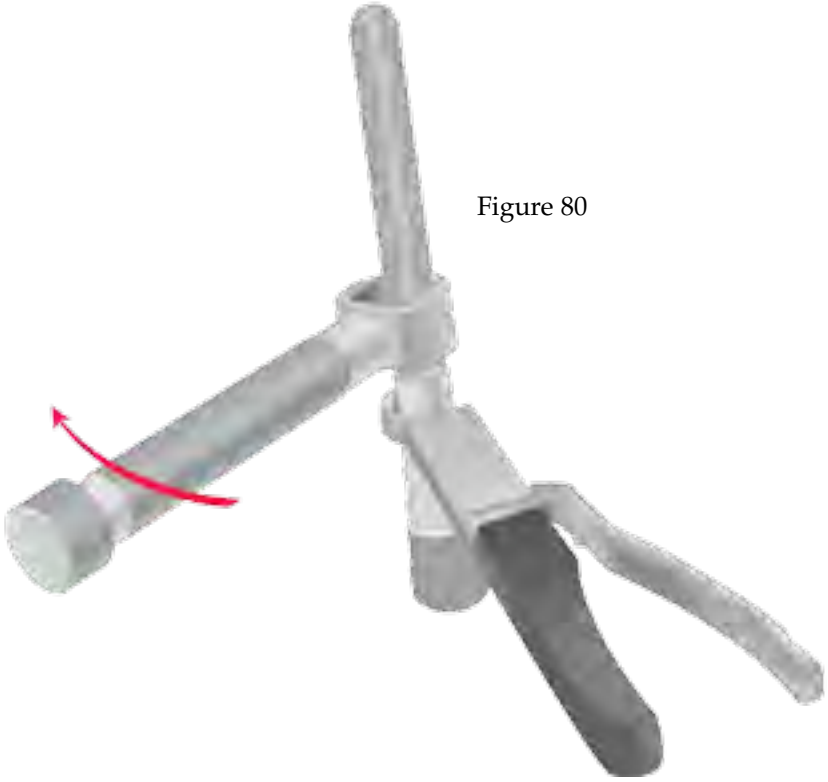


Figure 80

Attach the tibial sleeves to the fixed stem on the M.B.T. Revision tibial base plate using the M.B.T. Revision sleeve impactor and a mallet. Place the tibial base plate on a firm, stable surface. Place the appropriate sleeve on the tibial base plate. Slide the M.B.T. Revision sleeve impactor on top of the sleeve and forcefully apply three strikes with a mallet to engage the two components.

Attach the femoral sleeves to the fixed stem on the LCS Complete Revision femoral component using the LCS Complete Revision sleeve and stem impactor. Place the femoral component on a firm, stable surface. Place the appropriate sleeve on the femoral component. Slide the LCS Complete Revision sleeve and stem impactor on top of the sleeve or on top of the stem, depending on implant choice, and forcefully apply three strikes with a mallet to engage the two components (Figure 81 and 82).

Note: The LCS Complete Revision sleeve and stem impactor has two uses, one end for the sleeve without a stem extension and one end for a sleeve and stem combination.

Implant the definitive components in the following order:

- Tibial tray (with stem, sleeve or wedges)
- Femoral component (with stem, sleeve and augments)
- LCS Complete Revision Insert

Impact the femoral and tibial components using the femoral impactor.

Figure 81

Figure 82

Femoral Sleeve with Stem Construct Lengths

Sleeve/Stem Combination

Stem Type & Length	Fixed Stem Length (mm)*	Femoral Box Height (mm) for LCS Rev STD	Femoral Sleeve Height (Size M/L)	Distance between distal part of sleeve and most proximal part of box	Total (mm) from distal resection level
Fluted, 75mm	40	18.9	60mm (20)	5mm	158.9
	40	18.9	64mm (31)	5mm	162.9
	40	18.9	68mm (34)	5mm	166.9
	40	18.9	72mm (40)	5mm	170.9
	40	18.9	76mm (46)	5mm	174.9
Fluted, 115mm	40	18.9	60mm (20)	5mm	198.9
	40	18.9	64mm (31)	5mm	202.9
	40	18.9	68mm (34)	5mm	206.9
	40	18.9	72mm (40)	5mm	210.9
	40	18.9	76mm (46)	5mm	214.9
Fluted, 150mm	40	18.9	60mm (20)	5mm	233.9
	40	18.9	64mm (31)	5mm	237.9
	40	18.9	68mm (34)	5mm	241.9
	40	18.9	72mm (40)	5mm	245.9
	40	18.9	76mm (46)	5mm	249.9
Cemented, 30mm	40	18.9	60mm (20)	5mm	113.9
	40	18.9	64mm (31)	5mm	117.9
	40	18.9	68mm (34)	5mm	121.9
	40	18.9	72mm (40)	5mm	125.9
	40	18.9	76mm (46)	5mm	129.9
Cemented, 60mm	40	18.9	60mm (20)	5mm	143.9
	40	18.9	64mm (31)	5mm	147.9
	40	18.9	68mm (34)	5mm	151.9
	40	18.9	72mm (40)	5mm	155.9
	40	18.9	76mm (46)	5mm	159.9
Cemented Tapered, 90mm	40	18.9	60mm (20)	5mm	179.9
	40	18.9	64mm (31)	5mm	177.9
	40	18.9	68mm (34)	5mm	181.9
	40	18.9	72mm (40)	5mm	185.9
	40	18.9	76mm (46)	5mm	190.9
Cemented Tapered, 120mm	40	18.9	60mm (20)	5mm	203.9
	40	18.9	64mm (31)	5mm	207.9
	40	18.9	68mm (34)	5mm	211.9
	40	18.9	72mm (40)	5mm	215.9
	40	18.9	76mm (46)	5mm	219.9
Cemented Tapered, 150mm	40	18.9	60mm (20)	5mm	233.9
	40	18.9	64mm (31)	5mm	237.9
	40	18.9	68mm (34)	5mm	241.9
	40	18.9	72mm (40)	5mm	245.9
	40	18.9	76mm (46)	5mm	249.9

Sleeve Only

	Fixed Stem Length (mm)*	Femoral Box Height (mm) For LCS Rev STD	Sleeve Height (Size M/L)	Distance between distal part of sleeve and most proximal part of box	Total (mm) from distal resection level
NA	40	18.9	60mm (20)	5mm	83.9
NA	40	18.9	64mm (31)	5mm	87.9
NA	40	18.9	68mm (34)	5mm	91.9
NA	40	18.9	72mm (40)	5mm	95.9
NA	40	18.9	76mm (46)	5mm	99.9

Anteroposterior Chart (With Sleeve Use)

The following chart shows the distance (mm) between the anterior flange of a femoral component and the sleeve, based on the size of the component and the anteroposterior option chosen.

Femoral Size

Size of Sleeve (M/L)	Sm	Sm+	Med	Std	Std+	Lg	Lg+
20mm	2.64 mm	2.49 mm	2.49 mm	2.49 mm	3.28 mm	4.30 mm	5.54 mm
31mm	3.71 mm	3.68 mm	3.68 mm	3.68 mm	4.47 mm	5.49 mm	6.73 mm
34mm	2.71 mm	2.69 mm	2.69 mm	2.69 mm	3.48 mm	4.50 mm	5.74 mm
40mm	1.49 mm	2.77 mm	1.47 mm	1.47 mm	2.26 mm	3.28 mm	4.57 mm
46mm	1.52 mm	1.49 mm	1.49 mm	1.49 mm	2.29 mm	3.30 mm	4.55 mm

Implant Listing

Size	A/P (mm)	M/L (mm)	Distal	Box Height (mm)	Inner Box Width
Small	49.6	53.8	6.2	22.0	13.7
Small +	54.7	59.2	6.9	24.2	15.1
Medium	57.8	61.9	7.2	25.5	15.8
Standard	60.9	64.6	7.5	26.4	16.5
Standard +	65.4	69.6	8.1	28.4	17.8
Large	70.4	74.9	8.7	30.6	19.2
Large +	75.8	80.6	9.4	32.9	20.6

Express Care Kits - Implants

Kit No.	Kit Name
313A	LCS COM MOD/REV IMPS SM/SM+ LT
314A	LCS COM MOD/REV IMPS SM/SM+ RT
370A	LCS COMP REV RPS POLY IMPLANTS
371A	LCS COMP REV VVC POLY IMPLANTS
373A	LCS COMP REV FEMUR RT IMPLANT
374A	LCS COMP REV FEMUR LT IMPLANTS
375A	SIG/LCS COMP REV FEM SLEEVES
376A	LCS COMP REV DIST AUG RT IMP
377A	LCS COMP REV POST AUG IMPLANTS
378A	LCS COMP REV DIST AUG LEFT IMP
379A	LCS COMP REV INSERT IMP SM/SM+
380A	LCS COMP RPS INSERT IMP SM/SM+

Express Care Kits - Instruments

Kit No.	Kit Name
312B	LCS COMP MOD AND REV FEM INST
313B	LCS COM MOD/REV INS TRL SM/SM+
370B	LCS COMP REV RPS TRLS MED-LG+
371B	LCS COMP REV VVC TRLS MED-LG+
372B	LCS COMP REV FEM TRLS MED-LG+

Femoral Components:

1294-28-010	LCS COMP REV CEM R SM
1294-29-010	LCS COMP REV CEM L SM
1294-28-020	LCS COMP REV CEM R SM+
1294-29-020	LCS COMP REV CEM L SM+
1294-28-030	LCS COMP REV CEM R MED
1294-29-030	LCS COMP REV CEM L MED
1294-28-040	LCS COMP REV CEM R STD
1294-29-040	LCS COMP REV CEM L STD
1294-28-050	LCS COMP REV CEM R STD+
1294-29-050	LCS COMP REV CEM L STD+
1294-28-060	LCS COMP REV CEM R LG
1294-29-060	LCS COMP REV CEM L LG
1294-28-070	LCS COMP REV CEM R LG+
1294-29-070	LCS COMP REV CEM L LG+

Inserts:

1294-16-110/ 125	LCS Comp RPS Ins SM 10-25 mm
1294-24-110/ 125	LCS Comp VVC Ins SM 10-25 mm
1294-16-210/ 225	LCS Comp RPS Ins SM+ 10-25 mm
1294-24-210/ 225	LCS Comp VVC Ins SM+ 10-25 mm
1294-16-310/ 325	LCS Comp RPS Ins MED 10-25mm
1294-24-310/ 325	LCS Comp VVC Ins MED 10-25mm
1294-16-410/ 425	LCS Comp RPS Ins STD 10-25 mm
1294-24-410/ 425	LCS Comp VVC Ins STD 10-25 mm
1294-16-510/ 525	LCS Comp RPS Ins STD+ 10-25 mm
1294-24-510/ 525	LCS Comp VVC Ins STD+ 10-25 mm
1294-16-610/ 625	LCS Comp RPS Ins LG 10-25 mm
1294-24-610/ 625	LCS Comp VVC Ins LG 10-25 mm
1294-16-710/ 725	LCS Comp RPS Ins LG+ 10-25 mm
1294-24-710/ 725	LCS Comp VVC Ins LG+ 10-25 mm

Femoral Trials:

2294-28-010	LCS COMP REV CEM R SM
2294-29-010	LCS COMP REV CEM L SM
2294-28-020	LCS COMP REV CEM R SM+
2294-29-020	LCS COMP REV CEM L SM+
2294-28-030	LCS COMP REV CEM R MED
2294-29-030	LCS COMP REV CEM L MED
2294-28-040	LCS COMP REV CEM R STD
2294-29-040	LCS COMP REV CEM L STD
2294-28-050	LCS COMP REV CEM R STD+
2294-29-050	LCS COMP REV CEM L STD+
2294-28-060	LCS COMP REV CEM R LG
2294-29-060	LCS COMP REV CEM L LG
2294-28-070	LCS COMP REV CEM R LG+
2294-29-070	LCS COMP REV CEM L LG+

Insert Trials:

2294-16-110/ 125	LCS Comp RPS Ins Trl SM 10-25 mm
2294-24-110/ 125	LCS Comp VVC Ins Trl SM 10-25 mm
2294-16-210/ 225	LCS Comp RPS Ins Trl SM+ 10-25 mm
2294-24-210/ 225	LCS Comp VVC Ins Trl SM+ 10-25 mm
2294-16-310/ 325	LCS Comp RPS Ins Trl MED 10-25 mm
2294-24-310/ 325	LCS Comp VVC Ins Trl MED 10-25 mm
2294-16-410/ 425	LCS Comp RPS Ins Trl STD 10-25 mm
2294-24-410/ 425	LCS Comp VVC Ins Trl STD 10-25 mm
2294-16-510/ 525	LCS Comp RPS Ins Trl STD+ 10-25 mm
2294-24-510/ 525	LCS Comp VVC Ins Trl STD+ 10-25 mm
2294-16-610/ 625	LCS Comp RPS Ins Trl LG 10-25 mm
2294-24-610/ 625	LCS Comp VVC Ins Trl LG 10-25 mm
2294-16-710/ 725	LCS Comp RPS Ins Trl LG+ 10-25 mm
2294-24-710/ 725	LCS Comp VVC Ins Trl LG+ 10-25 mm

Femoral Sleeves:

1294-53-100	LCS Complete Fem Sleeve 20 mm
1294-53-110	LCS Complete Fem Sleeve 31 mm
1294-53-120	LCS Complete Fem Sleeve 34 mm
1294-53-130	LCS Complete Fem Sleeve 40 mm
1294-53-140	LCS Complete Fem Sleeve 46 mm

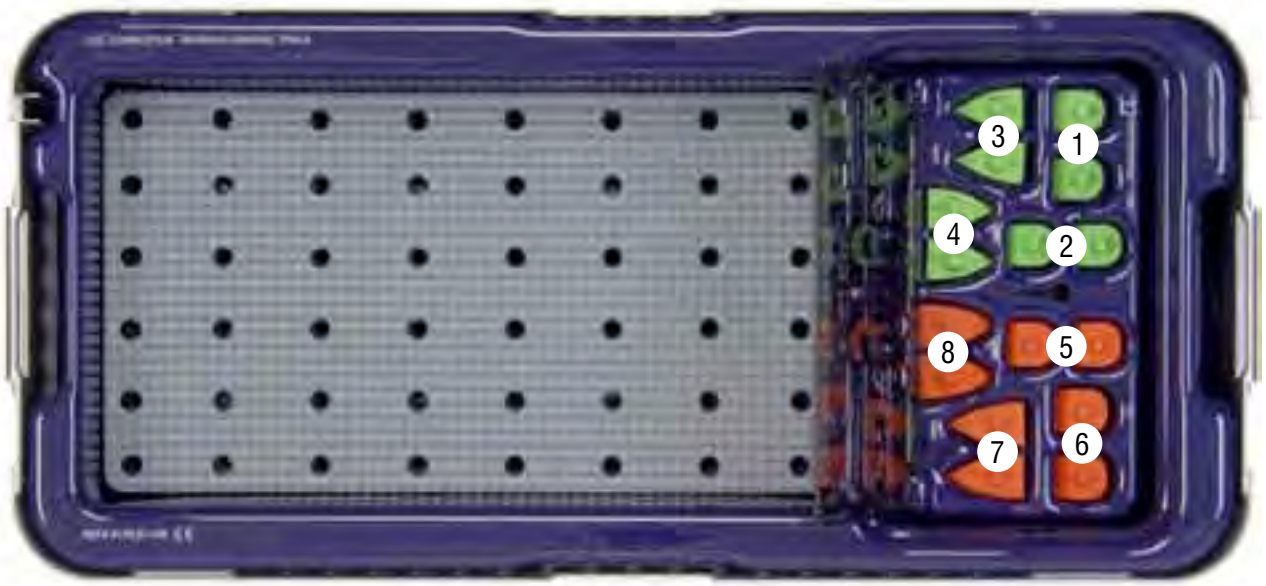
Femoral Sleeve Trials:

2294-53-100	LCS Complete Fem Sleeve Trl 20 mm
2294-53-110	LCS Complete Fem Sleeve Trl 31 mm
2294-53-120	LCS Complete Fem Sleeve Trl 34 mm
2294-53-130	LCS Complete Fem Sleeve Trl 40 mm
2294-53-140	LCS Complete Fem Sleeve Trl 46 mm

DNIs

2294-90-039	LCS Complete Revision Femur DNI STD+
2294-90-040	LCS Comp VVC Ins STD+ 10 mm DNI
2294-90-041	LCS Comp RPS Ins STD+ 10 mm DNI

LCS Complete Revision Implant Trial Set



LCS COM REV IMPLANT TRIAL SET
CAT NO. 2178-33-003

Number	P/N	Description
1	2294-27-030	LCS Complete Post Aug Trial 5mm MED
2	2294-27-031	LCS Complete Post Aug Trial 10mm MED
3	2294-26-030	LCS Complete Distl Aug Trial 5mm MED
4	2294-26-031	LCS Complete Distl Aug Trial 10mm MED
5	2294-27-040	LCS Complete Post Aug Trial 5mm Std
6	2294-27-041	LCS Complete Post Aug Trial 10mm Std
7	2294-26-040	LCS Complete Distl Aug Trial 5mm Std
8	2294-26-041	LCS Complete Distl Aug Trial 10mm Std

LCS Complete Revision Implant Trial Set

LCS COM REV IMPLANT TRIAL SET
CAT NO. 2178-33-003

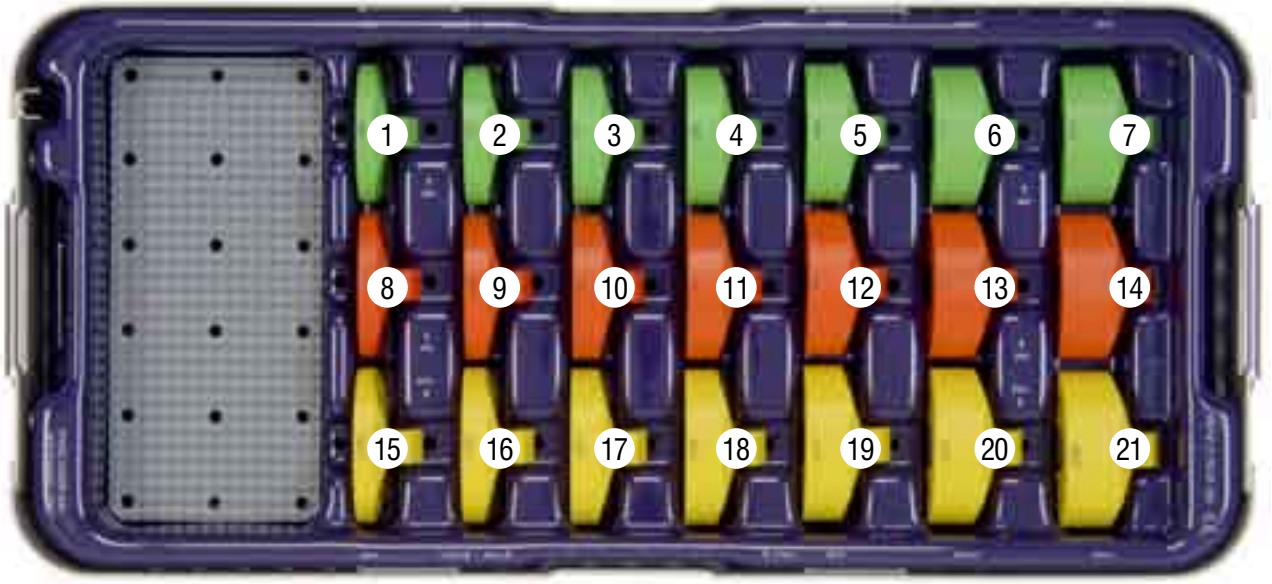
Number	P/N	Description
9	2294-27-050	LCS Complete Post Aug Trial 5mm Std+
10	2294-27-051	LCS Complete Post Aug Trial 10mm Std+
11	2294-26-050	LCS Complete Distl Aug Trial 5mm Std+
12	2294-26-051	LCS Complete Distl Aug Trial 10mm Std+
13	2294-26-052	LCS Complete Distl Aug Trial 15mm Std+
14	2294-27-060	LCS Complete Post Aug Trial 5mm Lg/Lg+
15	2294-27-061	LCS Complete Post Aug Trial 10mm Lg/Lg+
16	2294-26-060	LCS Complete Distl Aug Trial 5mm Lg/Lg+
17	2294-26-061	LCS Complete Distl Aug Trial 10mm Lg/Lg+
18	2294-26-062	LCS Complete Distl Aug Trial 15mm Lg/Lg+

LCS Complete Revision Implant Trial Set

LCS COM REV IMPLANT TRIAL SET
CAT NO. 2178-33-003

Number	P/N	Description
1	2294-29-030	LCS COMP REV CEM L MED
2	2294-29-040	LCS COMP REV CEM L STD
3	2294-29-050	LCS COMP REV CEM L STD+
4	2294-29-060	LCS COMP REV CEM L LG
5	2294-29-070	LCS COMP REV CEM L LG+
6	2294-28-030	LCS COMP REV CEM R MED
7	2294-28-040	LCS COMP REV CEM R STD
8	2294-28-050	LCS COMP REV CEM R STD+
9	2294-28-060	LCS COMP REV CEM R LG
10	2294-28-070	LCS COMP REV CEM R LG+
11	2294-53-100	LCS/SIG REVFEM SLVE TRL 20MM
12	2294-53-110	LCS/SIG REVFEM SLVE TRL 31MM
13	2294-53-120	LCS/SIG REVFEM SLVE TRL 34MM
14	2294-53-130	LCS/SIG REVFEM SLVE TRL 40MM
15	2294-53-140	LCS/SIG REVFEM SLVE TRL 46MM
16	2178-61-100	COMP REVFEM SLV TRL ATT SCREW

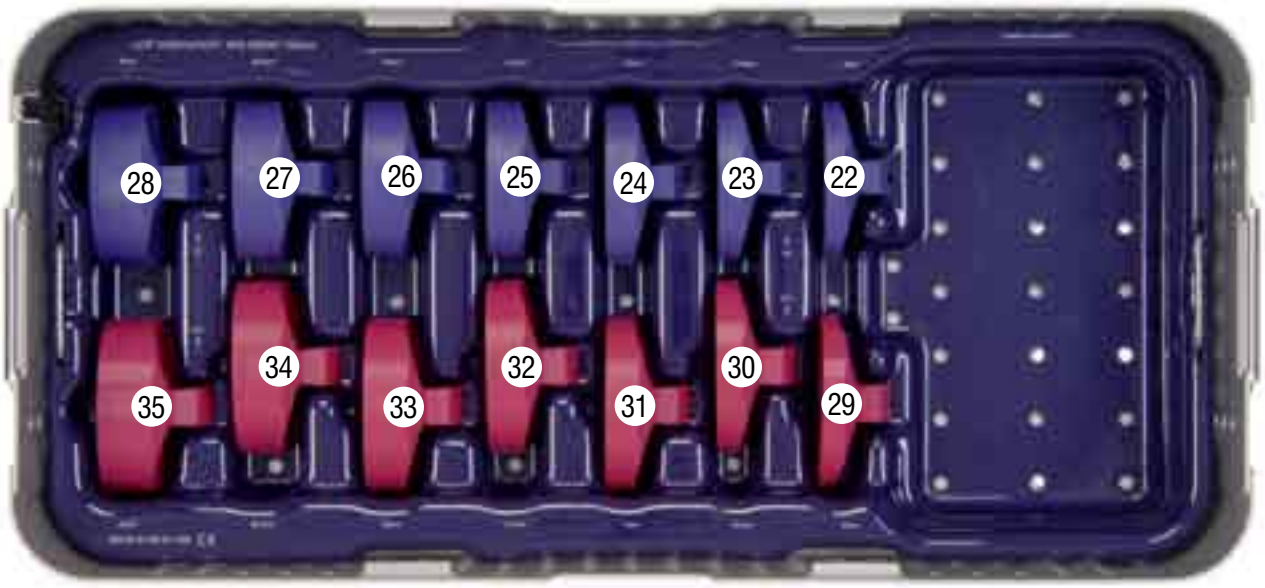
LCS Complete RPS Trials Case Set



LCS COMP RPS TRIALS CASE SET
CAT NO. 2178-33-002

Number	P/N	Description
1	2294-16-310	LCS Comp RPS Ins Trl MED 10mm
2	2294-16-312	LCS Comp RPS Ins Trl MED 12.5mm
3	2294-16-315	LCS Comp RPS Ins Trl MED 15mm
4	2294-16-317	LCS Comp RPS Ins Trl MED 17.5mm
5	2294-16-320	LCS Comp RPS Ins Trl MED 20mm
6	2294-16-322	LCS Comp RPS Ins Trl MED 22.5mm
7	2294-16-325	LCS Comp RPS Ins Trl MED 25mm
8	2294-16-410	LCS Comp RPS Ins Trl STD 10mm
9	2294-16-412	LCS Comp RPS Ins Trl STD 12.5mm
10	2294-16-415	LCS Comp RPS Ins Trl STD 15mm
11	2294-16-417	LCS Comp RPS Ins Trl STD 17.5mm
12	2294-16-420	LCS Comp RPS Ins Trl STD 20mm
13	2294-16-422	LCS Comp RPS Ins Trl STD 22.5mm
14	2294-16-425	LCS Comp RPS Ins Trl STD 25mm
15	2294-16-510	LCS Comp RPS Ins Trl STD+ 10mm
16	2294-16-512	LCS Comp RPS Ins Trl STD+ 12.5mm
17	2294-16-515	LCS Comp RPS Ins Trl STD+ 15mm
18	2294-16-517	LCS Comp RPS Ins Trl STD+ 17.5mm
19	2294-16-520	LCS Comp RPS Ins Trl STD+ 20mm
20	2294-16-522	LCS Comp RPS Ins Trl STD+ 22.5mm
21	2294-16-525	LCS Comp RPS Ins Trl STD+ 25mm

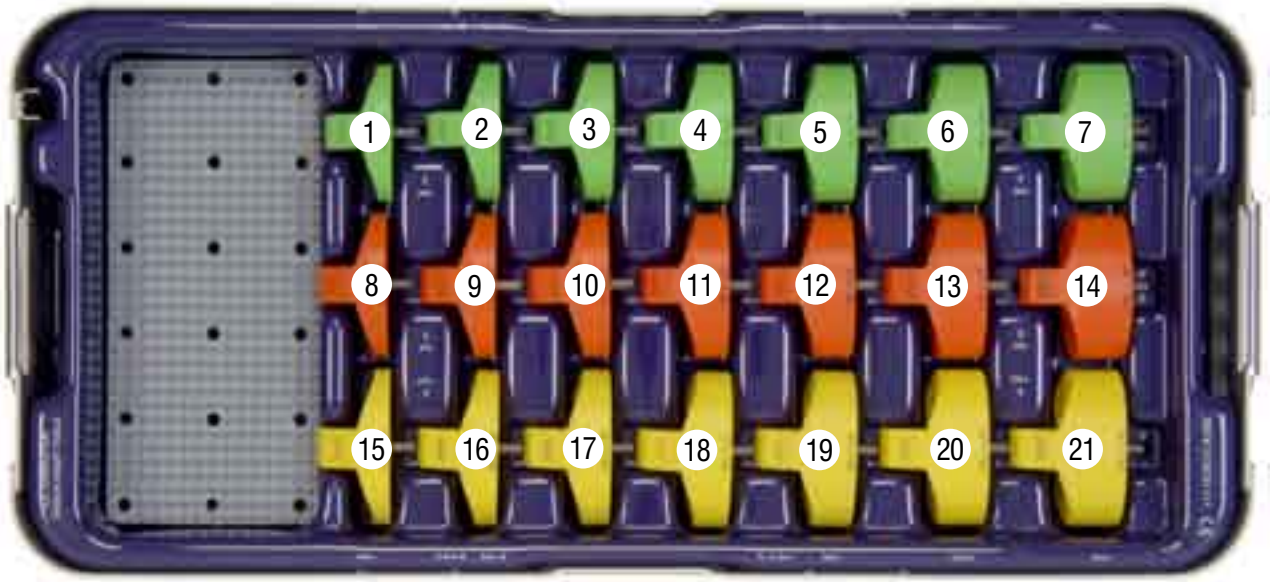
LCS Complete RPS Trials Case Set



LCS COMP RPS TRIALS CASE SET
CAT NO. 2178-33-002

Number	P/N	Description
22	2294-16-610	LCS Comp RPS Ins Trl LG 10mm
23	2294-16-612	LCS Comp RPS Ins Trl LG 12.5mm
24	2294-16-615	LCS Comp RPS Ins Trl LG 15mm
25	2294-16-617	LCS Comp RPS Ins Trl LG 17.5mm
26	2294-16-620	LCS Comp RPS Ins Trl LG 20mm
27	2294-16-622	LCS Comp RPS Ins Trl LG 22.5mm
28	2294-16-625	LCS Comp RPS Ins Trl LG 25mm
29	2294-16-710	LCS Comp RPS Ins Trl LG+ 10mm
30	2294-16-712	LCS Comp RPS Ins Trl LG+ 12.5mm
31	2294-16-715	LCS Comp RPS Ins Trl LG+ 15mm
32	2294-16-717	LCS Comp RPS Ins Trl LG+ 17.5mm
33	2294-16-720	LCS Comp RPS Ins Trl LG+ 20mm
34	2294-16-722	LCS Comp RPS Ins Trl LG+ 22.5mm
35	2294-16-725	LCS Comp RPS Ins Trl LG+ 25mm

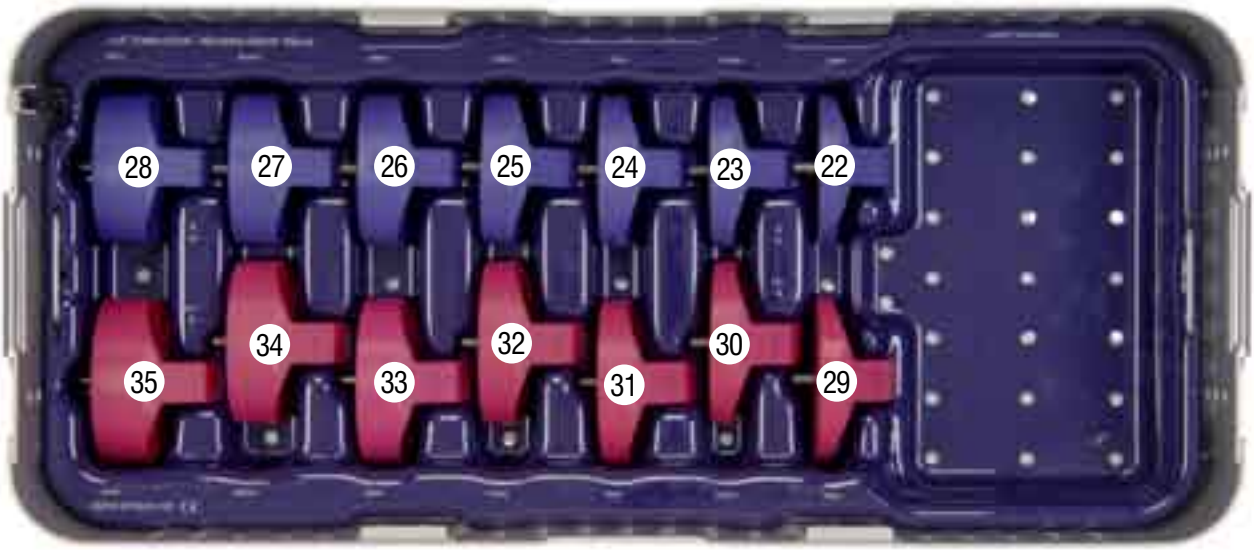
LCS Complete Revision Insert Trials Set



LCS COMP REV INSERT TRIALS SET
CAT NO. 2178-33-004

Number	P/N	Description
1	2294-24-310	LCS Comp VVC Ins Trl MED 10mm
2	2294-24-312	LCS Comp VVC Ins Trl MED 12.5mm
3	2294-24-315	LCS Comp VVC Ins Trl MED 15mm
4	2294-24-317	LCS Comp VVC Ins Trl MED 17.5mm
5	2294-24-320	LCS Comp VVC Ins Trl MED 20mm
6	2294-24-322	LCS Comp VVC Ins Trl MED 22.5mm
7	2294-24-325	LCS Comp VVC Ins Trl MED 25mm
8	2294-24-410	LCS Comp VVC Ins Trl STD 10mm
9	2294-24-412	LCS Comp VVC Ins Trl STD 12.5mm
10	2294-24-415	LCS Comp VVC Ins Trl STD 15mm
11	2294-24-417	LCS Comp VVC Ins Trl STD 17.5mm
12	2294-24-420	LCS Comp VVC Ins Trl STD 20mm
13	2294-24-422	LCS Comp VVC Ins Trl STD 22.5mm
14	2294-24-425	LCS Comp VVC Ins Trl STD 25mm
15	2294-24-510	LCS Comp VVC Ins Trl STD+ 10mm
16	2294-24-512	LCS Comp VVC Ins Trl STD+ 12.5mm
17	2294-24-515	LCS Comp VVC Ins Trl STD+ 15mm
18	2294-24-517	LCS Comp VVC Ins Trl STD+ 17.5mm
19	2294-24-520	LCS Comp VVC Ins Trl STD+ 20mm
20	2294-24-522	LCS Comp VVC Ins Trl STD+ 22.5mm
21	2294-24-525	LCS Comp VVC Ins Trl STD+ 25mm

LCS Complete Revision Insert Trials Set



LCS COMP REV INSERT TRIALS SET
CAT NO. 2178-33-004

Number	P/N	Description
22	2294-24-610	LCS Comp VVC Ins Trl LG 10mm
23	2294-24-612	LCS Comp VVC Ins Trl LG 12.5mm
24	2294-24-615	LCS Comp VVC Ins Trl LG 15mm
25	2294-24-617	LCS Comp VVC Ins Trl LG 17.5mm
26	2294-24-620	LCS Comp VVC Ins Trl LG 20mm
27	2294-24-622	LCS Comp VVC Ins Trl LG 22.5mm
28	2294-24-625	LCS Comp VVC Ins Trl LG 25mm
29	2294-24-710	LCS Comp VVC Ins Trl LG+ 10mm
30	2294-24-712	LCS Comp VVC Ins Trl LG+ 12.5mm
31	2294-24-715	LCS Comp VVC Ins Trl LG+ 15mm
32	2294-24-717	LCS Comp VVC Ins Trl LG+ 17.5mm
33	2294-24-720	LCS Comp VVC Ins Trl LG+ 20mm
34	2294-24-722	LCS Comp VVC Ins Trl LG+ 22.5mm
35	2294-24-725	LCS Comp VVC Ins Trl LG+ 25mm

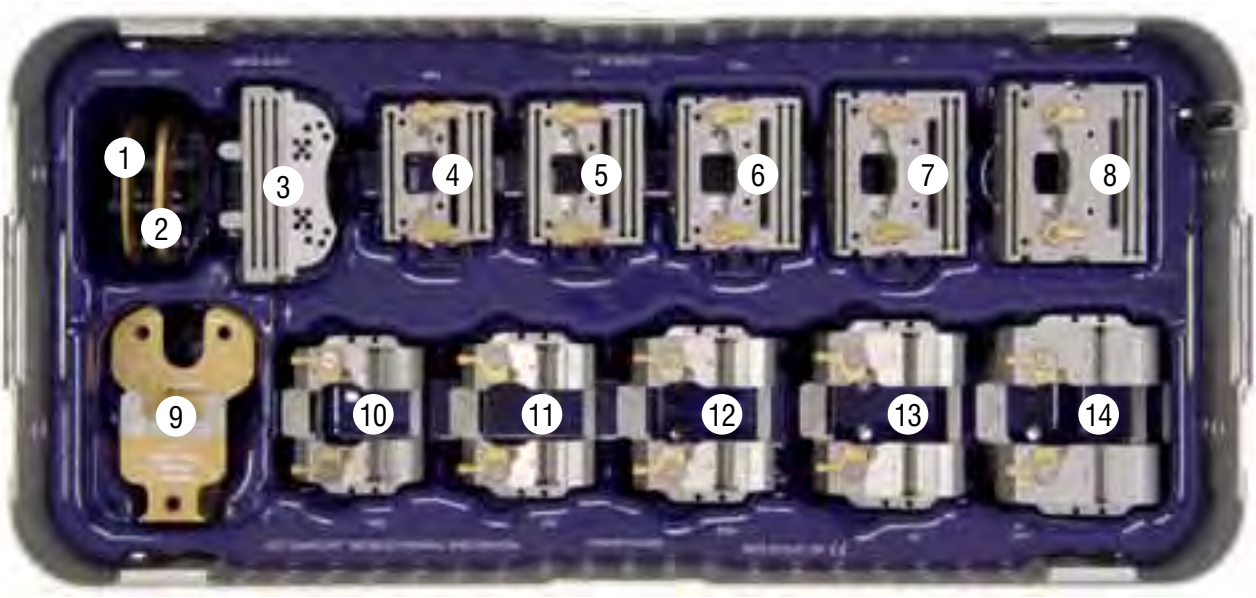
LCS COM REV IMPLANT FEMORAL PREP
CAT NO. 2178-33-019

Number	P/N	Description
1	96-1683	UNIVERSAL REVISION FEMORAL BROACH 31MM
2	96-1684	UNIVERSAL REVISION FEMORAL BROACH 34MM
3	96-1685	UNIVERSAL REVISION FEMORAL BROACH 40MM
4	96-1686	UNIVERSAL REVISION FEMORAL BROACH 46MM
5	2267-77-000	PW FEM IMPACTOR
6	2421-02-000	FEM/TIB EXTRAC 11X7 3/4 IN
7	2178-60-030	COMPLETION REV FEM TAPERED RMR
8	96-1671	UNIV REV FEM BROACH RMR
9	2178-61-090	COMPLETION REV FEM IM PLATE LT
10	2178-61-092	COMPLETION REV FEM IM PLATE RT
11	2178-60-016	COMPLETION REV FEM COLLAR 16MM
12	2178-60-018	COMPLETION REV FEM COLLAR 18MM
13	2178-60-020	COMPLETION REV FEM COLLAR 20MM
14	2178-60-022	COMPLETION REV FEM COLLAR 22MM
15	2178-60-024	COMPLETION REV FEM COLLAR 24MM
16	2178-61-095	COMP REV 2.5MM HEX SCRWDRIVER
17	2178-60-028	COMPLETION REV FEM IMPCT SHAFT
18	96-6147	SP2 REMOVABLE HANDLES PKG 2EA
18	96-6147	SP2 REMOVABLE HANDLES PKG 2EA
NOT SHOWN	96-1682	UNIVERSAL REVISION FEMORAL BROACH HANDLE

LCS Complete Revision Implant Femoral Prep

LCS COM REV IMPLANT FEMORAL PREP
CAT NO. 2178-33-019

Number	P/N	Description
19	2178-60-063	COMP REV CEM STEM BUSHING 15MM
20	2178-60-060	COMPLET REV FEM BSHNG 5DEG 9MM
21	2178-60-065	COMPLET REV FEM BSHNG 5DEG 8MM
22	2178-60-062	COMP REV CEM STEM BUSHING 13MM
23	2178-60-013	COMPLETION REV FEM COLLAR 13MM
24	2178-60-014	COMPLETION REV FEM COLLAR 15MM
25	2178-60-075	COMP FEM AUG BTN SM/LG+ 5 POS
26	2178-60-076	COMP FEM AUG BTN SM/LG+ 10 POS
27	2178-60-077	COMP FEM AUG BTN SM/MED 5 DTL
28	2178-60-078	COMP FEM AUG BTN SM/MED 10 DTL
29	2178-60-082	COMP FEM AUG BTN STD/LG+ 5 DTL
30	2178-60-085	COMP FEM AUG BTN STD/LG+ 10DTL
31	2178-60-086	COMP FEM AUG BTN STD+/LG+15DTL
32	2589-19-050	LCS 2ND GEN VISUALIZATION WING



LCS COM REV IMPLANT FEMORAL PREP
CAT NO. 2178-33-019

Number	P/N	Description
1	2178-60-004	COMPLETION REV FM SHIM MD/STD+
2	2178-60-006	COMPLETION REV FEM SHIM LG/LG+
3	2178-60-070	COMPLETION REV FEM DISTL BLOCK
4	2178-61-015	COMPLETION REV FEM AP BLOCK MED
5	2178-61-020	COMPLETION REV FEM AP BLCK STD
6	2178-61-025	COMPLETION REV FEM AP BLK STD+
7	2178-61-030	COMPLETION REV FEM AP BLOCK LG
8	2178-61-035	COMPLETION REV FEM AP BLCK LG+
9	2178-55-035	COMPLETION FEM POSTNR MED/LG+
10	2178-61-065	COMPLETION REV FEM FIN GDE MED
11	2178-61-070	COMPLETION REV FEM FIN GDE STD
12	2178-61-075	COMPLETION REV FEM FIN GDE STD+
13	2178-61-080	COMPLETION REV FEM FIN GDE LG
14	2178-61-085	COMPLETION REV FEM FIN GDE LG+

Completion Balancing and Tibial Prep Set

COMPLETION BAL & TIB PRP TRAY SET
CAT NO. 2178-33-011

Number	P/N	Description
1	2178-55-006	LCS PW IM PLT 4deg LT
2	2178-55-008	LCS PW IM PLT 4deg RT
3	2178-55-010	LCS PW IM PLT 5deg LT
4	2178-55-012	LCS PW IM PLT 5deg RT
5	2178-55-014	LCS PW IM PLT 6deg LT
6	2178-55-016	LCS PW IM PLT 6deg RT
7	2178-55-030	COMP FEM POSTNR SM/SM+
8	2178-55-035	COMP FEM POSTNR MED/LG+
9	2178-43-046	LCS PW MIN SPAC BLK SM/SM+
10	2178-43-066	LCS PW MIN SPAC BLK MED/LG+
11	2178-43-010	LCS PW SPACER BLK SM/SM+
12	2178-43-015	LCS PW SPACER BLK MED/LG+
13	2178-43-020	LCS PW FEM SHIM SM/SM+
14	2178-43-023	LCS PW FEM SHIM MED/STD+
15	2178-43-026	LCS PW FEM SHIM LG/LG+
16	2178-43-030	LCS PW TIB SHIM SM/SM+ 12.5
17	2178-43-032	LCS PW TIB SHIM SM/SM+ 15.0
18	2178-43-034	LCS PW TIB SHIM SM/SM+ 17.5
19	2178-43-036	LCS PW TIB SHIM SM/SM+ 20.0
20	2178-43-050	LCS PW TIB SHIM MED/LG+ 12.5
21	2178-43-052	LCS PW TIB SHIM MED/LG+ 15.0
22	2178-43-054	LCS PW TIB SHIM MED/LG+ 17.5
23	2178-43-056	LCS PW TIB SHIM MED/LG+ 20.0

LCS Complete – P.F.C. Sigma RP Mobile Bearing Total Knee System

Important: This Essential Product Information sheet does not include all of the information necessary for selection and use of a device. Please see full labeling for all necessary information.

Indications

Cemented Use:
The LCS Complete – P.F.C. Sigma RP Mobile Bearing Total Knee System is indicated for cemented use in cases of osteoarthritis and rheumatoid arthritis. The RPF insert and femoral component are indicated where a higher than normal degree of postoperative flexion is required. The rotating platform prosthesis and modular revision components are indicated for revision of failed knee prostheses.

Uncemented Use:
The porous coated keeled and non-keeled M.B.T. (Mobile Bearing Tibial) Tray configurations of the LCS Total Knee System are indicated for noncemented use in skeletally mature individuals undergoing primary surgery for reconstructing knees damaged as a result of noninflammatory degenerative joint disease (NIDJD) or either of its composite diagnoses of osteoarthritis and post-traumatic arthritis pathologies. The Rotating Platform device configuration is indicated for use in knees whose anterior and posterior cruciate ligaments are absent or are in such condition as to justify their sacrifice. The P.F.C. Sigma RP Curved bearings, when used with the P.F.C. Sigma Cruciate Retaining Femoral Component, can be used in posterior cruciate ligament retaining procedures.

Contraindications: The use of the LCS Complete – P.F.C. Sigma RP Mobile Bearing Total Knee System is contraindicated in:

- the presence of osteomyelitis, pyrogenic infection or other overt infection of the knee joint;
- patients with any active infection at sites such as the genitourinary tract, pulmonary system, skin or any other site. Should a patient have any infection prior to implantation, the foci of the infection must be treated prior to, during and after implantation.
- patients with loss of musculature or neuromuscular compromise leading to loss of function in the involved limb or in whom the requirements for its use would affect recommended rehabilitation procedures.
- patients with severe osteoporosis or other metabolic bone diseases of the knee.
- patients with any of the following conditions:
- lesions of the supporting bone structures (e.g. aneurysmal or simple bone cysts, giant cell tumor or any malignant tumor),
- systemic and metabolic disorders leading to progressive deterioration of solid bone support,
- the presence of severe instability secondary to advanced loss of osteochondral structure or the absence of collateral ligament integrity, fixed deformities greater than 60° of flexion, 45° of genu varus or valgus,
- known drug or alcohol addiction,
- skeletally immature individuals and the presence of allergic reaction to implant metals or polyethylene are also contraindications for the noncemented, porous coated, M.B.T. and LCS Complete – P.F.C. Sigma RP Mobile Bearing device configurations, and for the cemented use of all device configurations of the LCS Complete – P.F.C. Sigma RP Mobile Bearing Total Knee System.

Contraindications for use without cement:
Noncemented use of the porous coated keeled or non-keeled M.B.T. Tray device configurations is contraindicated in patients with sufficient loss in quantity or quality of bone stock (as determined on X-ray) such that successful noncemented fixation is unlikely. Additional contraindications may become apparent at the time of surgery. These include:

- vascular deficiency at the bone site;
- inadequate bone stock to assure both a firm press fit and close apposition of the cut bone surfaces to the prosthesis;
- the inability to make bone cuts so as to assure both correct component position and intimate apposition of bone and prosthetic surfaces;
- inadequate bone quality (e.g. severe osteoporosis) and lack of stability of the implanted components.

In the presence of any of the above conditions the components should be fixed with cement.

Warnings and Precautions: Components labeled for "Cemented Use Only" are to be implanted only with bone cement. The following conditions tend to adversely affect knee replacement implants: excessive patient weight, high levels of patient activity, likelihood of falls, poor bone stock, metabolic disorders, disabilities of other joints. The P.F.C. stem extensions can only be used with M.B.T. revision trays and LCS Complete Revision and Modular femoral components.

Adverse Events: The following are the most frequent adverse events after knee arthroplasty: change in position of the components, loosening, bending, cracking, fracture, deformation or wear of one or more of the components, infection, tissue reaction to implant materials or wear debris; pain, dislocation, subluxation, flexion contracture, decreased range of motion, lengthening or shortening of leg caused by improper positioning, looseness or wear of components; fractures of the femur or tibia.

Reference
1. Linden, U. "Fatigue Properties of Bone Cement: Comparison of Mixing Techniques." *Acta Orthopaedic* Vol. 60. No. 4, 1989: 431-433.

NOTES

DePuy
a Johnson & Johnson company

DePuy Orthopaedics, Inc.
700 Orthopaedic Drive
Warsaw, IN 46581-0988
USA
Tel: +1 (800) 366 8143
Fax: +1 (574) 371 4865

DePuy International Ltd
St Anthony's Road
Leeds LS11 8DT
England
Tel: +44 (113) 387 7800
Fax: +44 (113) 387 7890

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