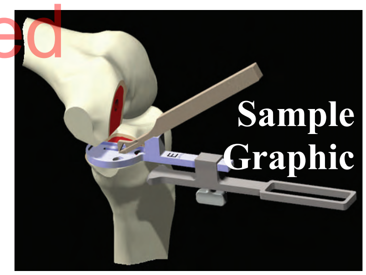
Cardo Medical

Revolution

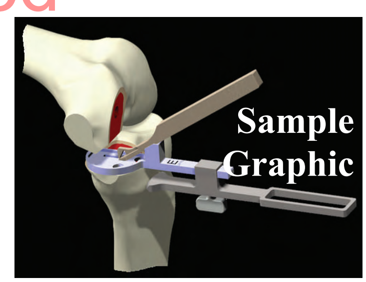
Unicompartmental Knee System



While Total Knee Arthroplasty (TKA) is one of the most predictable procedures in orthopedic surgery, many patients undergoing TKA are in fact excellent candidates for Uni-compartmental Knee Arthroplasty (UKA).

Unicompartmental Knee Arthroplasty offers :

- ✓ **a quicker surgical procedure**
- ✓ **little or no hospitalization**
- ✓ **shorter recovery**
- ✓ **less morbidity**



Current UKA techniques can be intimidating to orthopedic surgeons for a variety of reasons related to experience, instrument and implant design.

The Cardo *Revolution* uni-compartmental knee replacement was developed to eliminate these concerns, and bridge the gap between a sports medicine 'soft tissue driven' type surgical technique and the traditional 'total knee' arthroplasty techniques.

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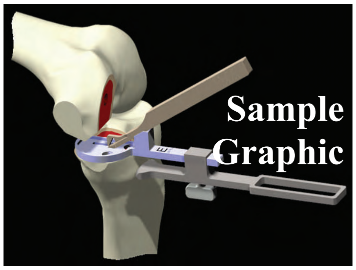
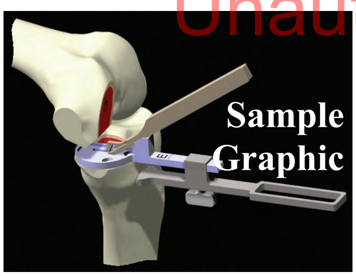


The ***Revolution*** **Unicompartmental Knee Arthroplasty System utilizes time proven techniques of gap balancing, to create optimal bone cuts for joint resurfacing. The system's flexibility in being able to address *unexpected* and *difficult* situations for UKA is unparalleled.**

The system can be adapted to suit the individual surgeon's preference and technique as well as the patient's unique needs.



The *Revolution* UKA instrument system is the only system on the market which allows the surgeon to make all femoral bone cuts directly off the spacer block with the joint space under *optimal tension*. The knee is therefore balanced prior to commitment of implant sizing.

The *Revolution* UKA is a minimally invasive technique which is designed to :

- **preserve bone stock**
- **ensure highly reproducible bone cuts**
- **accurately align the components with optimal tension.**

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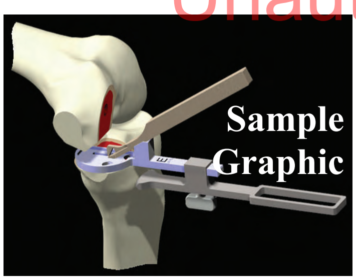

This guide to the surgical technique is a concise step by step procedure written for medial compartment UKA. The same principles can also be applied to the lateral compartment as the system is designed for *either* compartment.

The Cardo Medical *Revolution* UKA design combines an *effective*, *reproducible* and *easily accomplished* surgical technique.

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Patient Selection

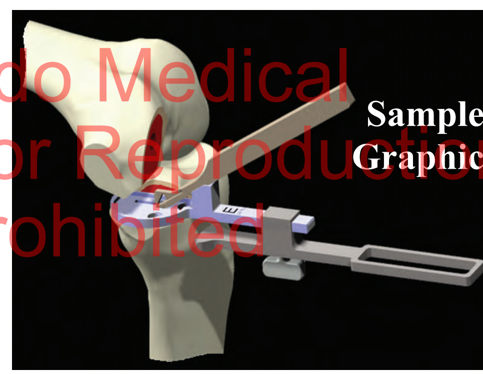
Unicompartmental knee arthroplasty is contraindicated in all forms of inflammatory arthritis. The operation is suitable for either medial or lateral compartment arthritis. The patient must have both ACL and PCL intact; deficiency of *either* cruciate ligament is a contraindication to the procedure. The contralateral compartment should be well preserved with an intact meniscus and full thickness of articular cartilage. This is best demonstrated by the presence of a full thickness joint space visible on AP radiograph. A Grade 1 cartilage defect or small **marginal osteophytes** of the contralateral compartment are **not** contraindications to Unicompartmental knee arthroplasty. **Patellofemoral arthritis** is not a contraindication to UKA. It is common to see extensive fibrillation and full thickness erosions on the trochlear groove and/or patellar facet; unicompartmental knee arthroplasty *realigns* the limb and helps to unload these damaged areas of the patellofemoral joint.

Malalignment of the limb should be passively correctable to neutral. The degree of deformity is *less* important than the ability to be able to passively correct it with varus or valgus force. UKA has limited ability to correct flexion deformity, thus flexion deformity should be less than 15 degrees. The knee should be able to flex to at least 115 degrees under anesthesia to allow proper bone preparation.

There are **no** contraindications to the procedure based on patient's **age**, **weight** or **activity** level.

Femoral Component

The uniquely designed femoral components are made of cast **cobalt chromium alloy** for optimal strength, wear resistance and biocompatibility. The components are designed for right and left knees and are available in six sizes to provide optimal fit. The thickness of the femoral component is an optimal 7 mm thick and is designed to allow high conformance with varus/valgus angulation of 10 degrees The articulating surface is highly polished.



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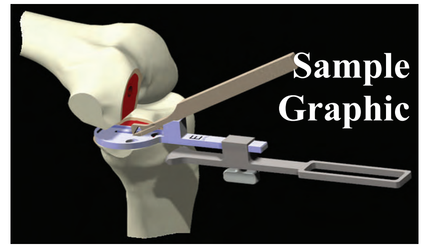
Tibial Tray Component

The tibial components, also made of cast cobalt chromium alloy, are available in six sizes both right and left. The shape is optimized for maximal tibial bone coverage. A **unique locking mechanism** for the tibial bearing surface is incorporated into the tibial component.

Tibial Bearing Insert



The tibial bearing insert is made from **direct compression molded**, ultra high molecular weight (UHMW) polyethylene and ethylene oxide sterilized. The tibial bearing insert is flat and is sized in 1 mm increments from 8 to 14 mm.

Pre-operative Requirements

A careful **preoperative X-ray** is necessary to ascertain alignment and provide a precise idea of wear pattern. Three types of radiographs are recommended:

- Full length AP radiographs of the lower limb in full weight bearing to allow calculation of anatomic and mechanical axis.
- An AP x-ray in full weight bearing
- A lateral x-ray in full weight bearing

Patient Preparation and Surgical Approach

Positioning
With the patient supine, an ankle support attached to the operating table is helpful to support the foot and maintain position with the knee in flexion.

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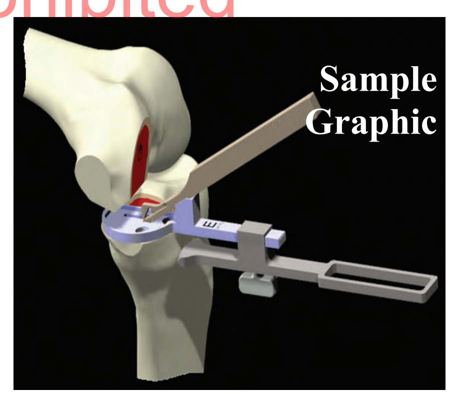
Surgical Incision
A 3-4 inch longitudinal incision is made medial to the midline of the knee; the quadriceps can be handled with either a sub-vastus approach or by a mid-vastus incision either medially or laterally.



Exposure
Depending on which compartment is being resurfaced, release the very proximal edge of the corresponding plateau to allow insertion of a small retractor. Often, it is helpful to remove a small amount of the anterior fat pad. Identify the tibial eminence and mark an AP line using the bovie electrocautery approximately in the middle between the tip of the eminence and its base.

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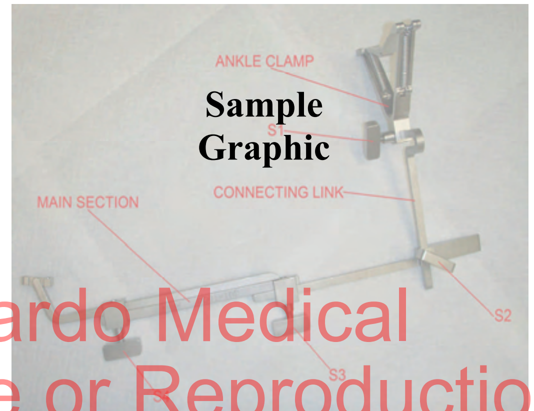
Tibial Preparation



Tibial alignment is accomplished using the **tibia alignment guide**. The tibia alignment guide is stored in the sterilization case in three sections. Assemble the tibia alignment guide as shown in the illustration:

The **ankle clamp** is used to distally secure the tibia alignment guide to the leg. Open the clamping arms on the ankle clamp and place the "V" section of the ankle clamp over the ankle. Close the clamping arms to secure.

A single pin is used initially to proximally secure the tibia alignment guide to the leg. Adjust the length of the tibia alignment guide to allow the alignment "T" to reach the tibia tubercle. Pin the tibia alignment guide to the proximal tibia, through the top hole on the alignment "T", putting the alignment "T" just medial to the tubercle and centered under the intercondylar eminence. Tighten screws **S3** and **S4** to lock length in place.

Varus/valgus alignment is accomplished by pointing the **distal pointer** on the tibia alignment guide between the second and third metatarsals. Loosen screw S1 to allow mediolateral motion of the tibia alignment guide relative to the ankle clamp and adjust the position of the guide so that the distal pointer is pointed between the second and third metatarsals. Tighten screw **S1** to secure varus/valgus alignment. It is recommended that the tibia resection slope is set parallel to anatomic tibia slope. The tibial bearing inserts incorporate a neutral posterior slope.

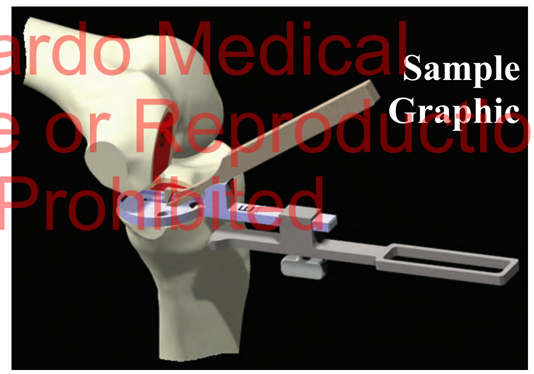
Attach the appropriate (left-medial or right-medial) **tibia resection guide** to the tibia alignment guide as shown. The curved edge of the tibia resection guide should contact the anterior part of the tibia. Loosen the screw that allows anterior/posterior motion of the tibia alignment guide

Tibial Preparation (Cont'd)

relative to the ankle clamp and adjust the alignment guide so the proximal surface of the guide is parallel to the anatomic slope of the tibia. Tighten the screw to secure tibia slope alignment. At this point the tibia alignment guide may be cross-pinned for additional stability.

Tibia Resection Depth

Loosen the tibia resection guide screw so that the resection guide slides proximal/distal on the tibia alignment guide. Slide the **tibia stylus** over the tibia resection guide as shown and place the stylus pointer on the tibia plateau. The tip of the stylus shows the plane the saw will cut through, representing zero resection depth. Lock the tibia resection guide in place on the tibia alignment guide. Remove the tibia stylus by pulling on the handle section that attaches to the tibia resection guide while *pushing* on the stylus section.



At this point the tibia resection guide is set to *just skim* the tibia plateau. Tibia resection depth is adjusted by moving the tibia resection guide distally or proximally on the tibia alignment guide. Each notch on the tibia alignment guide shaft represents 1mm. The tibia resection guide should be lowered to the desired resection depth and the screw **S5** should be retightened to secure the guide. In some cases it may be desirable to make a **skim cut** at zero resection depth to verify tibia resection slope before making the final tibia resection.

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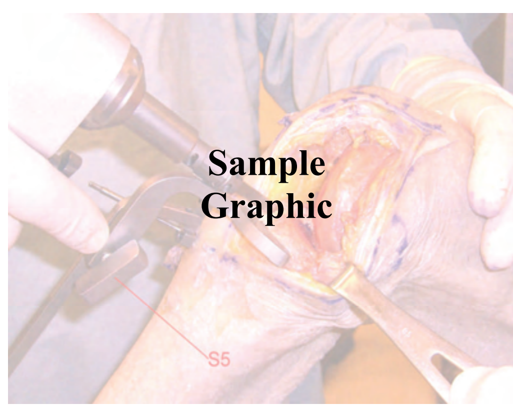
Tibia Resection

Transverse

A reciprocating saw is used to make the transverse tibial resection. Make the resection parallel to and located at the edge of the tibia eminence. *Do not* cut beyond the sagittal tibia resection. Use caution to avoid cutting into the ACL attachment.



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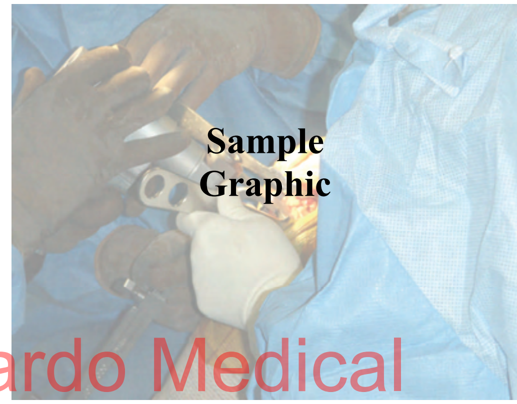
Tibia Resection (Cont'd)

Sagittal

The sagittal tibial resection is made using a sagittal saw. The flat surface on the tibia resection guide is used to guide the saw for the sagittal resection. Hold the saw flat against the guide surface while making the resection, being sure to *not flex* the saw blade



Measure Flexion and Extension Space

Flexion and extension space are measured using the **spacer block** handle and modular **spacer blocks**. The spacer blocks are attached to the handle magnetically.

<u>Extension</u> space is measured with the leg in full extension (or as close as possible) with the leg in proper varus/valgus alignment. Varus/valgus alignment is determined through the use of **alignment rods** used along with the spacer block handle as shown.

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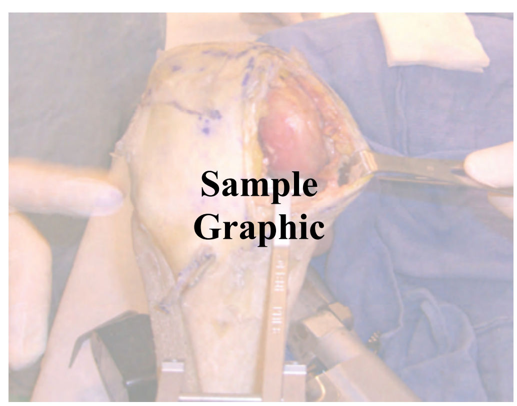
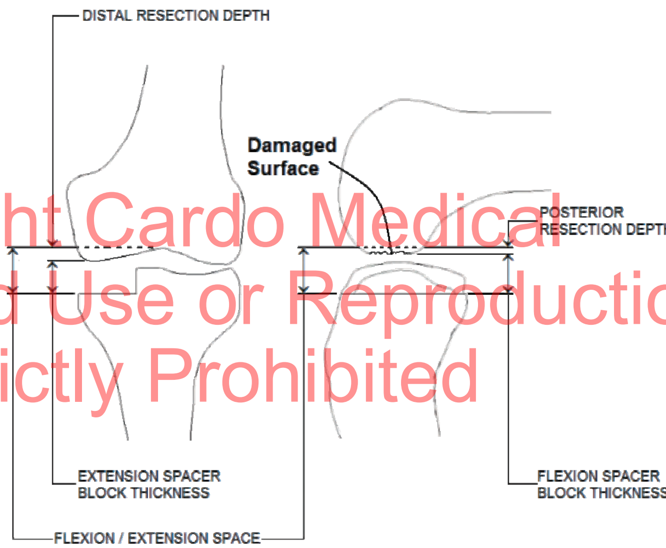
<u>Flexion</u> space is measured with the femur in 90° of flexion with the leg in proper varus/valgus alignment. Varus/valgus alignment is determined through the use of alignment rods used along with the spacer block handle.



Determine Flexion/Extension Balance

Flexion / extension balancing is determined by referencing the unaffected femoral condyle.

<u>If the **distal** condyle is damaged</u> then the posterior condyle is referenced to determine balance. Flexion and extension spaces are measured using spacer blocks *before* any femoral resections are made. The **target** flexion/extension space is determined by adding <u>7mm</u> (the femoral component thickness) to the flexion spacer block thickness. The distal resection depth is determined by *subtracting* the extension spacer block thickness from the target flexion/extension space. The posterior resection depth is equal to the component thickness, which is 7mm.



<u>If the **posterior** condyle is damaged</u> then the distal condyle is referenced to determine balance. Flexion and extension spaces are measured using spacer blocks before any femoral resections are made. The **target** flexion/extension space is determined by adding <u>7mm</u> (the femoral component thickness) to the extension spacer block thickness. The distal resection depth is equal to the component thickness, which is 7mm. The posterior resection depth is determined by *subtracting* the flexion spacer block thickness from the target flexion/extension space.

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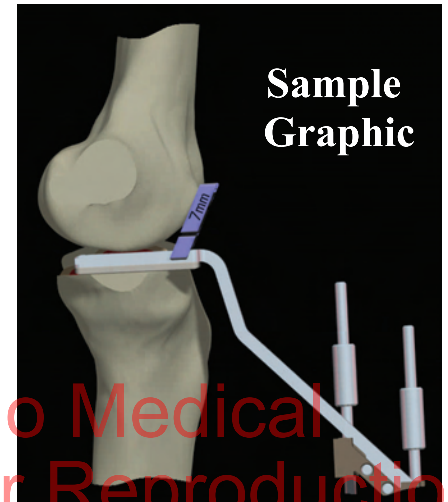
Distal Resection

The **distal resection guide** is positioned using the spacer block handle and appropriate spacer block as shown. The spacer block is used to provide appropriate collateral ligament tension and varus/valgus alignment. The spacer block handle, spacer block and appropriate distal resection guide are inserted into the joint, between the distal condyle and tibia resection, with the leg in extension as shown. Alignment rods can be used to check varus/valgus alignment before the distal resection is made.

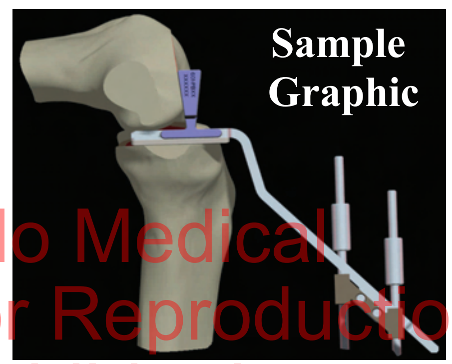
Distal Resection (cont'd)



The distal resection is made using a **1.25mm thick X 12mm wide** sagittal saw. Use of a thinner saw could lead to an inaccurate distal resection and is <u>not recommended</u>.

The distal resection can be made with or without pinning the distal resection guide. The spacer block handle along with collateral ligament tension from the spacer block are used to keep the distal resection guide in place. The resection is made in extension in this case, as shown :

Posterior Resection



The **posterior resection guide** is positioned using the spacer block handle and appropriate spacer block as shown. The spacer block is used to provide appropriate collateral ligament tension and varus/valgus alignment. The spacer block handle, spacer block and appropriate distal resection guide are inserted into the joint, between the distal condyle and tibia resection, with the leg in flexion as shown. The angled surface of the posterior resection guide is placed against the previously made distal resection to provide the correct angle between the posterior and distal resections. Alignment rods can be used to check varus/valgus alignment before the posterior resection is made. The femoral sizing and finishing guide can be used to check the angle of the posterior resection relative to the distal resection.

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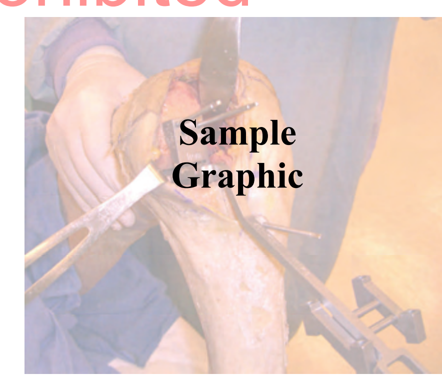

The posterior resection is made using a **1.25mm thick X 12mm wide** sagittal saw. Use of a thinner saw could lead to an inaccurate posterior resection and is <u>not recommended</u>. The posterior resection can also be made with the distal resection guide pinned and the knee in flexion, as shown. The spacer block handle would be removed before making the posterior resection.

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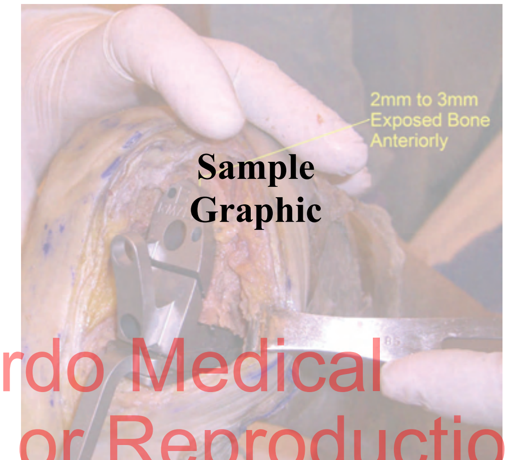
Femoral Sizing



Femoral sizing is done using the **size**, **peg** and **chamfer guides** along with the spacer block handle and spacer blocks. The anterior and posterior profiles of the guides match the profiles of the implants.

Place the guide on the distal and posterior resections as shown. When properly sized, there should be 2mm to 3mm of exposed bone above the anterior flange of the guide, with no medial overhang.

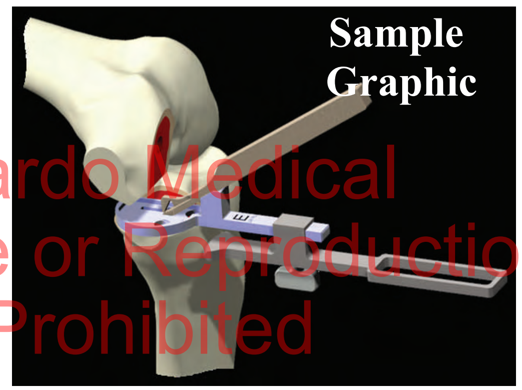
Femoral Peg Holes and Chamfer

The femoral chamfer resection is made using the femoral size, peg and chamfer guide, the spacer block handle and a sagittal saw as shown. The guide attaches to the spacer block handle so that the spacer block handle and spacers can be used to hold the guide in place while the chamfer cut is made. If more stability is required the guide can also be pinned in place using 1/8" headless drill-pins, as shown. The femoral resections can be checked using the appropriate femoral trial.

Femoral peg holes are made using the femoral size, peg and chamfer guide and femoral peg **step drill**. Place the guide on the resected femur as described above for the chamfer resection, being sure the mediolateral position is correct, and drill two holes using the femoral step drill. It also may be desirable to drill only the anterior peg hole and drill the chamfer peg hole using the femoral trial later in the procedure. The femoral resections can be checked for fit using the appropriate femoral trial.

Tibia Sizing and Finishing

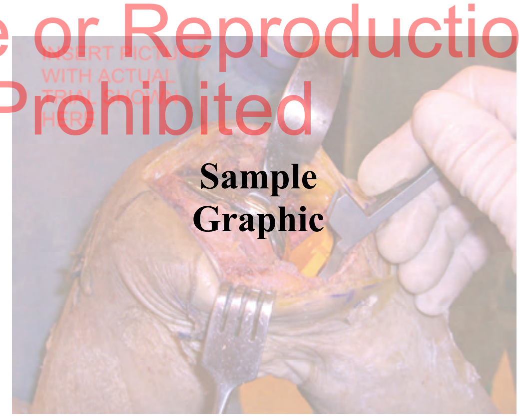
Tibia sizing is done using the tibia **sizing** and **finishing guides** as shown. Try several guides to determine which size fits best. Exposed tibia bone should be well covered but there should be no overhang. The **trial bearing puller** can be used to check posterior coverage.



The appropriate size tibia sizing and finishing guide, along with the **spur-handle**, **keel-punch** and **step drill**, is used for keel preparation and lug holes in the tibia. Insert the guide into the spur-handle and position it on the tibia as shown. Adjust the anterior/posterior position of the guide. Lock the guide in the spur handle using the locking screw. Place the guide and spur handle onto the tibia, pushing the spur into the anterior tibia bone and simultaneously pushing down into the tibia to hold the guide in place. Use the tibia keel-punch and a mallet to prepare for the keel as shown. Use the tibia peg step drill to drill two tibia lug holes

Trial Reduction

Femoral and tibia bearing trials, sizing and finishing guides are used for trial reduction. The bearing trials work with the finishing and sizing guides and also with the tibia tray implants. With the trial components in place, check for proper range of motion and ligament stability.



In extension, the joint should be stable but *not excessively tight* as this can cause the contralateral compartment to be over-stressed. The bearing thickness selected should provide the correction desired, but *not* over-stress the collateral ligaments. The correct tibia bearing thickness should allow the joint-space to open up 1mm to 2mm under varus/valgus stress. The black **feeler gauge** can be inserted to check optimal tension. Use a thinner tibia bearing or re-cut the tibia to correct excess tightness in extension.

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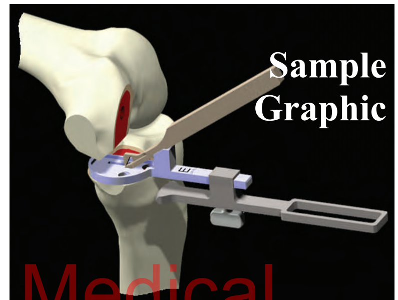
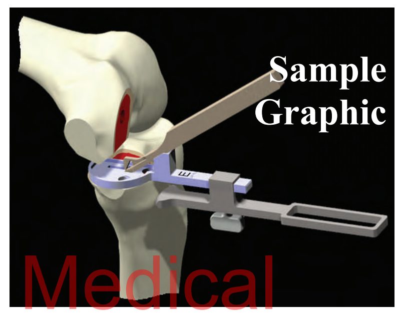
In flexion, the joint space should also open up 1mm to 2mm under stress. Another indicator of excess tightness in flexion is if the tibia bearing trial *lifts up anteriorly* during flexion. Re-cut the tibia to increase **slope** if the joint is excessively tight in flexion but *not extension*.

Implantation



The **tibial component** is implanted first. Flex the knee and rotate the tibia externally to aid insertion. Apply cement and apply the tibial tray component to the prepared tibia. Insert the keel of the tibial tray component into the prepared slot in the tibia, keeping the tibia tray parallel to the tibia resection and pushing the component from anterior to posterior and down into the prepared tibia surface at an angle of approximately 30°. Finish seating the tibia tray component using the **tibia tray impactor**. Remove excess cement from around the component using the **cement remover**.



The **femoral component** is implanted with the leg flexed as much as possible. Apply cement and insert the long post first. Adjust the rotation of the femoral component to align the short peg and insert the short peg. Push the femoral component onto the femur in a direction that is as close as possible to being normal to the chamfer surface, depending on how much flexion can be achieved. Finish seating the femoral component using the **femoral impactor**. Remove excess cement from around the component using the cement remover.

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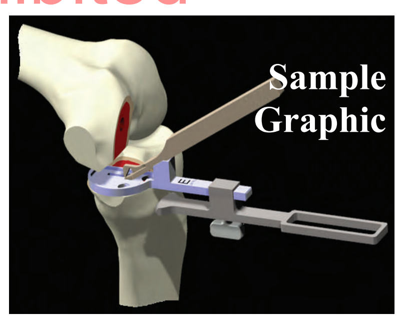
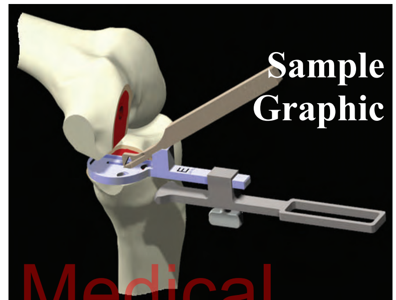


Determine the **final thickness** of the tibia bearing component by using trial tibial bearing components placed in the definitive tibial tray component. With the correct tibial bearing in place, the joint space should open up 1mm to 2mm under varus/valgus strain, in both flexion and extension, as described previously in the Trial Reduction section. The black feeler gauge can be inserted between the bearing surface and femoral component to confirm tension. Leave the appropriate trial bearing *in-place* to maintain pressure on the femoral and tibial tray components while the cement is curing.

Implantation (Cont'd)



The **tibial bearing component** is inserted after the cement has fully cured. Remove the tibial bearing trial using the tibial bearing trial puller instrument. Insert the tibia bearing component into the tibia tray component from the anterior, with the articulating surface facing the femoral component.

Slide the tibia bearing component posterior until the **posterior slot** on the bearing engages the **posterior lip** on the tibia tray. Push the anterior of the tibia bearing down into the tibia tray component using thumb pressure until it snaps into place.

The knee joint is ready for closure.

Instert Chart of Uni Knee Component
Sizes and Model Numbers

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