

Surgical Technique

## Femur-First

 **smith&nephew**  
**TC-PLUS<sup>®</sup> PRIMARY**  
Primary Knee System



PLUS SOLUTION  
KNEE FAMILY



# TC-PLUS<sup>◇</sup> PRIMARY

## Surgical Technique Femur-First

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### Nota Bene

The technique description herein is made available to the healthcare professional to illustrate the authors' suggested treatment for the uncomplicated procedure. In the final analysis, the preferred treatment is that which addresses the needs of the patient.



# Indications

The principal preoperative planning factor is the correct diagnosis. It has to be determined whether the bone and stability situation allow the implantation of an uncoupled prosthesis.

## **The main indications for the implantation are**

- degenerative or posttraumatic osteoarthritis
- rheumatoid arthritis
- avascular necrosis of the femoral condyles
- moderately abnormal varus, valgus or flexion postures

# Contraindications

## **The following contraindications exist:**

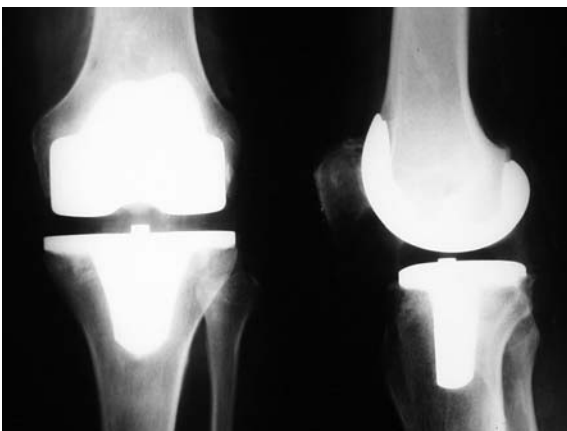
- acute or chronic local or systemic infections (or a history of such infections)
- severe muscle, nerve or vessel disorders that jeopardize the affected limb
- any concomitant disorders that may jeopardize implant functioning
- hypersensitivity to the component materials
- loss of the ligament apparatus (if insufficiency of the posterior cruciate ligament is present)
- strenuous physical activity (e.g. competitive sport, hard physical work)

See also the instructions on the package insert.

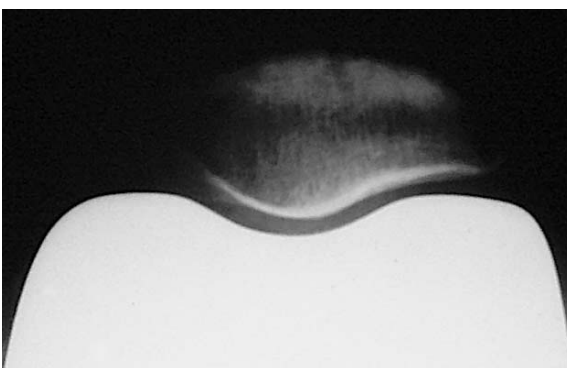
## Case Study



80-year-old male patient, medial osteoarthritis of the knee, preoperative status.



Immediate postoperative status: functional and pain-free reconstruction with TC-PLUS<sup>®</sup> PRIMARY, non-cemented femoral and cemented tibial component.



Axial view of an unresurfaced patella, articulating with a TC-PLUS PRIMARY femoral component.

# Preoperative Planning

A full-leg X-ray with the patient in the standing position is recommended for preoperative planning purposes. If this is not possible, an X-ray of the thigh, including the femoral head, should be taken. X-ray images of the knee joint at three levels (cassette 20/40) should be available for planning the surgery. A patella tangential image, a frontal image and a sagittal to the leg axis image have to be taken.

There are, however, also X-ray templates available for preoperative planning. The lateral view of the condyles is decisive. If these are no longer completely intact, it is possible to switch to the condylar width. If in doubt, select the smaller implant to prevent prosthesis components from protruding. In normal cases, the size determination and the correct positioning of the prosthesis are controlled intraoperatively by using the relevant instruments. Intraoperative control during these procedures is provided by corresponding alignment and test guides.

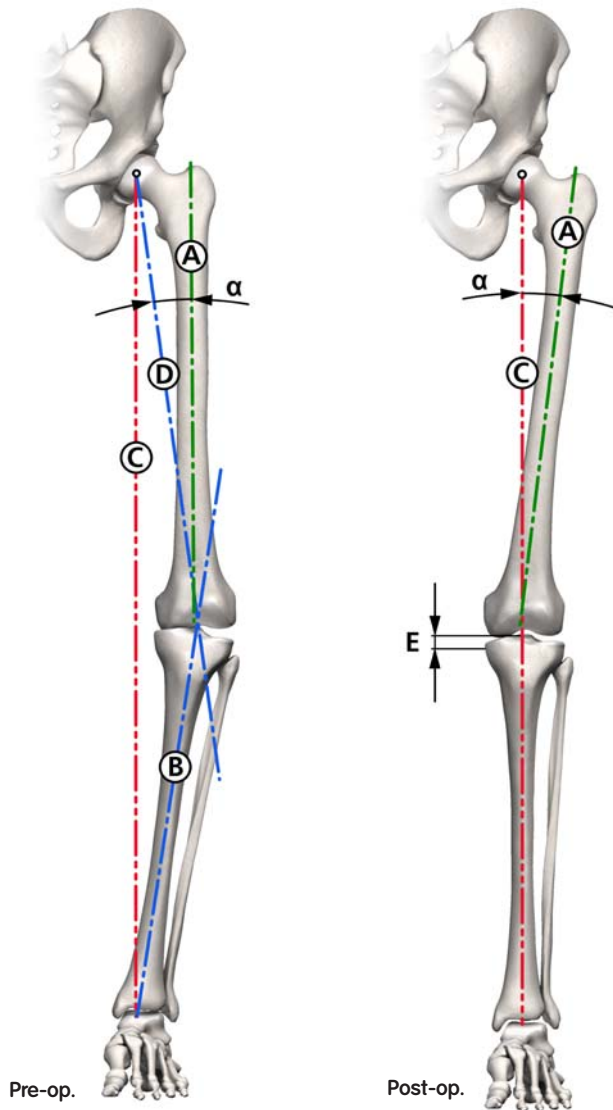
## **Note**

The femoral and tibial component sizes can all be combined with the next size up or down.

In the event of unequal femur and tibia sizes, it is an advantage that the sizes of the femoral and tibial components in the CR design (maintaining the posterior cruciate ligament) can be freely combined with each other. When using the CS (deep dish) tibial insert or the PS (posterior stabilized) version, the size compatibility is limited to the next size up or down.

Deviations of the femoral neck angle and clear deformities of the femur and tibia (e.g. post-traumatic axis errors) must be taken into account when planning surgery.

## Planning of Surgery Using the Radiograph



The following procedure is recommended for the A/P whole-leg imaging process:

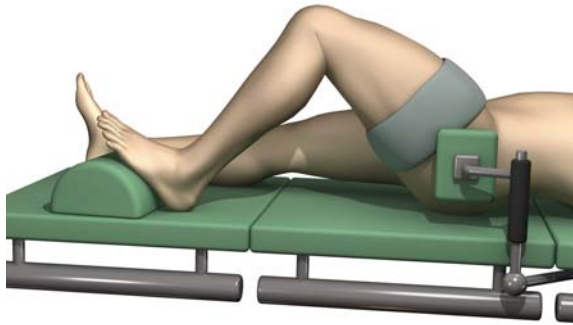
1. The femur axis A (anatomical axis) is drawn onto the radiograph.
2. A line is drawn from the head of the hip to the center of the knee (mechanical axis D) onto the radiograph.
3. The angle measured between the anatomical and mechanical axis ( $= \alpha$ ) determines the valgus angle.
4. The tibial axis B is drawn in and the tibial resection plane E is determined to avoid too much resection, especially where there are defects.
5. The component sizes and resection depths are determined preoperatively using the radiograph templates in anterior, posterior and lateral planes.
6. The mechanical leg axis C should merge with the lines D and B after correction.

- A Anatomical femur axis
- B Anatomical tibia axis
- C Mechanical leg axis
- D Mechanical femur axis
- E Resection depth for tibia (mm)
- $\alpha$  Valgus angle



# Surgical Technique

## Position of the patient for surgery



Surgery is performed whilst the patient is supine. It is recommended that the blood supply be partially blocked, but this is not absolutely necessary. The leg must be covered, so as to allow movement, and secured to the operating table so that the knee joint is brought into a stable 90° flexion position. Most of the surgical steps are performed in this position.

## Operative procedure



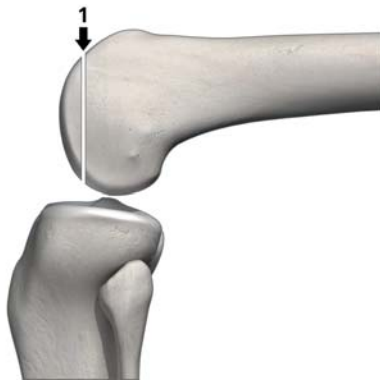
The skin incision may be undertaken as a midline incision or as a parapatellar cut.

If present, the scars of previous skin incisions from earlier operations should be used in order to reduce the risk of cutaneous blood flow disorders. Medial arthrotomy is recommended.

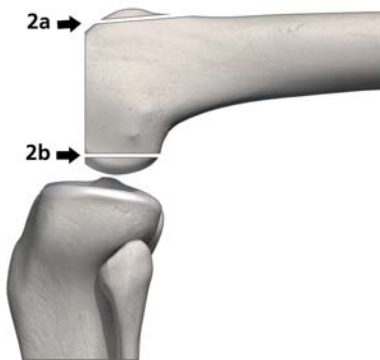
After the usual preparation (meniscus resection, removal of osteophytes, synovectomy if necessary), the anterior cruciate ligament is resected. This will provide good exposure of the individual knee sections.

# Overview of the Sequences of Cuts for Primary Use

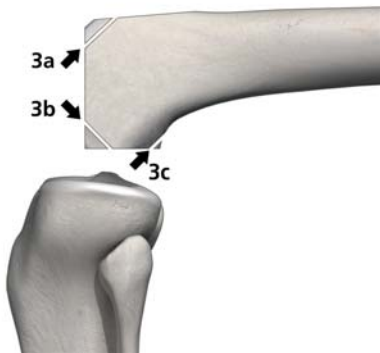
It is important that the flexion gap and extension gap are identical.



1. Distal femur cut



2. A/P femur cut



3. Oblique cuts



4. Tibial cut



5. Patellar cut (optional)

## Note

*Only 1.27 mm saw blades must be used for all bone cuts!*

# General Warnings and Comments



**Warnings** are indicated by a red background. They must be observed as they relate to critical functions.



**Comments** are indicated by a blue background. This information should be noted as it contains valuable advice which helps the user to operate the system.

**Training:** Only adequately trained operators are permitted to use the TC-PLUS<sup>®</sup> PRIMARY module. This Surgical Technique and accompanying documentation must be fully read and understood as part of the training. If any part of this documentation is not clear, please contact your Smith & Nephew representative.

**Implants:** TC-PLUS<sup>®</sup> PRIMARY is only designed for use with the indicated implants and instruments. Implants and instruments must be used in accordance with the instructions in all other relevant Surgical Techniques.

**Responsibility:** The operator checks and decides. All the information provided by the instruments is to help the operator make decisions during the operation. The operator must check all the suggestions made by the instruments and is responsible for the decisions taken.

**Cleaning and Sterilization:** All instruments must be sterilized before use. Detailed information on cleaning and sterilization of components is contained in the separate cleaning and sterilization instructions Lit. No. 1363-e.

**Additional Warnings:** Warnings and comments cited in operational procedures, product information and other documents relating to TC-PLUS PRIMARY must also be observed and are in no way replaced by the present document.

# Use of Speedpins

We recommend using the speedpins for pinning in this Surgical Technique. Classic pins might be used alternatively.

The speedpins are available in different lengths and types:



Speedpin with shoulder (30 mm)



Speedpin (65 mm, 80 mm, 110 mm)



AO adapter for speedpins

For detailed instructions, refer to “Surgical Technique PiGalileo Speedpin System, Use of Speedpin and Adapter”, Document Lit. No. 1450-e.

# Surgical Procedure

## 1. Femoral Preparation

### Approach

Please refer to the relevant surgical textbooks for the initial approach to the knee.

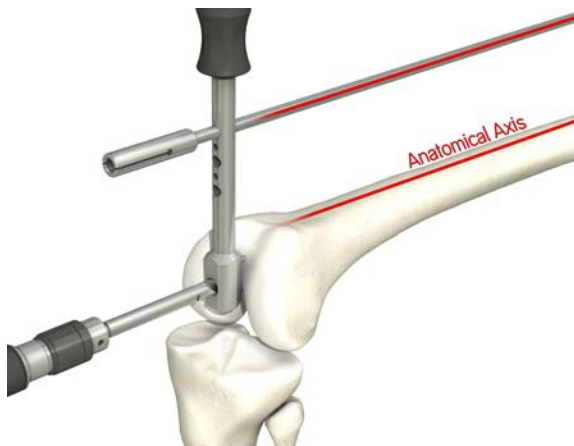


### Note

In addition to the bone resections it is important to correct any ligament imbalances by corresponding soft-tissue procedures.

If necessary, a general release should be performed on the side of the contracture prior to the bone resections. Additionally, any osteophytes on the femur and tibia should be removed. This will produce good exposure of the individual knee sections, thus facilitating size determination.

### 1.1 Intramedullary femoral alignment

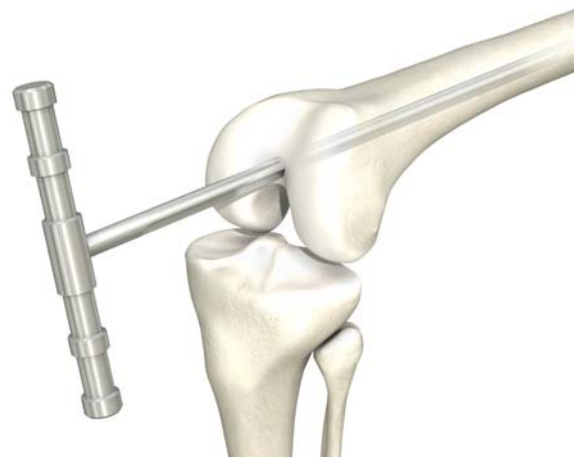


Remove the marginal osteophytes and, if necessary, perform a (partial) synovectomy, expose the intercondylar notch.

Locate the intramedullary (IM) femoral drill guide centrally in M/L alignment approximately 0.5 to 1 cm anteriorly to the insertion point for the posterior cruciate ligament.

The intramedullary femoral drill guide has three holes for inserting a long pin or external alignment rod to indicate the direction of the central hole.

Open the femoral canal using the  $\varnothing$  8 mm intramedullary drill.



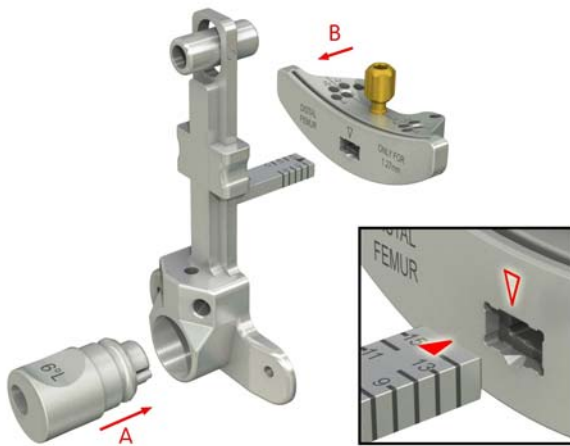
Slowly insert the intramedullary (IM) rod with T-handle into the femoral canal with rotational movements. Remove the rod.

## 1.2 Distal femoral resection



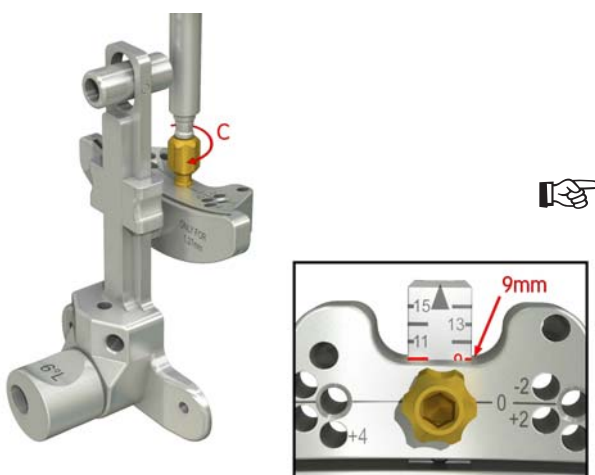
Femoral bushing 6° left and right

Select the appropriate femoral bushing – either 4°, 6° or 8° (optional: 5° or 7°) – as determined during the preoperative planning.



Insert the bushing into the femoral suspension device so that the “L” (left knee) or “R” (right knee) marking is visible at the top, depending on the side to be operated [A].

Slide the distal femoral cutting block onto the suspension device (arrow to arrow) and fix it at your desired cutting resection depth [B].



Instrument assembly

The distal femoral cutting block will slightly snap in position at 9 mm. Fix the cutting block with the golden set screw [C].

### Note

The saw capture must point to the distal side of the cutting block and the golden screw has to be on top.

The cutting block can also be fixed in a proximal or distal position if more or less distal bone needs to be resected according to the anatomical situation of the patient.

### Note

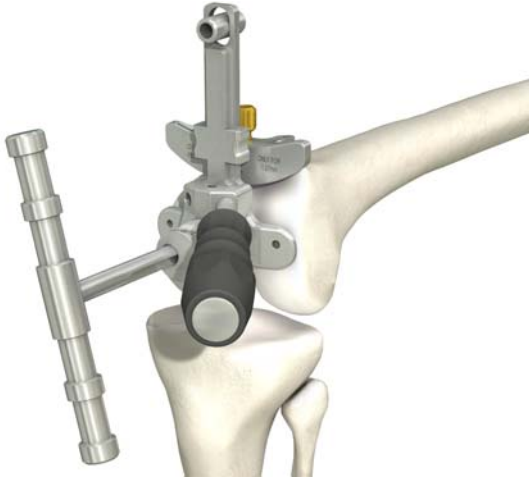
The distal and dorsal thickness of the femoral component is 9 mm.

## 1.2 Distal femoral resection

### Positioning of distal femoral cutting block

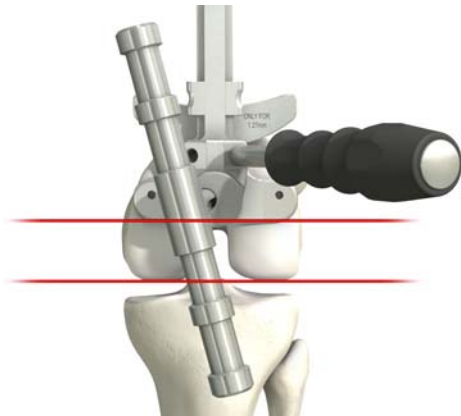
Slide the distal femoral cutting block assembly over the intramedullary rod with T-handle into the bushing and push the suspension device forward until it touches at least one of the distal femoral condyles.

Use the MIS handle to guide the assembly.

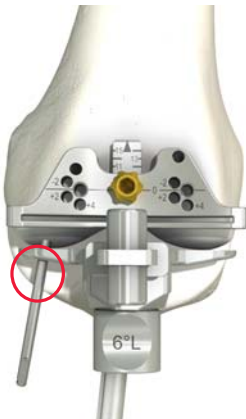


Carry out rotational alignment using known landmarks.

Align the rotation until the visible dorsal condylar section is at the same level medially and laterally. Orient the rotation of the assembly neutral to the A/P axis.



If desired, secure the suspension device with a pin distally.



Secure the distal cutting block to the anterior femur with pins through the holes marked "0".

It is advised to predrill the holes to prevent liftoff of the assembly in case of using classic pins.



## 1.2 distal femoral resection

### Alignment control

Before the distal cut is made, the surgeon should check whether the cutting block is positioned at the right angles to the load axis of the knee: place the alignment rod into the bushing of the suspension device.

The alignment is correct when the axial alignment rod lies over the midpoint of the femoral head. If it does not pass through this point the distal femoral cutting block can be exchanged for the 2 degrees varus/valgus correction cutting block.



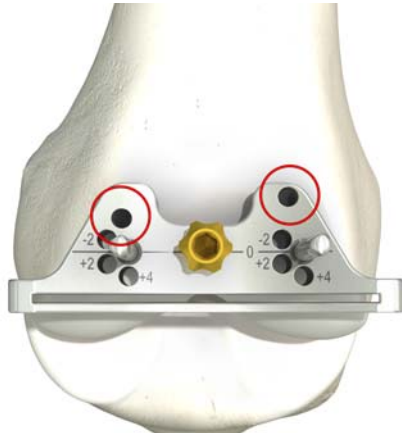
This allows the distal femoral cut to be corrected at an angle of 2° more in varus or, by turning the block around, in 2° of valgus. The load axis is rechecked using the external alignment tower and the alignment rod.

Remove the distal pin from the femoral suspension device, the IM rod and unlock the golden set screw of the distal femoral cutting block.

The femoral suspension device can now be removed.

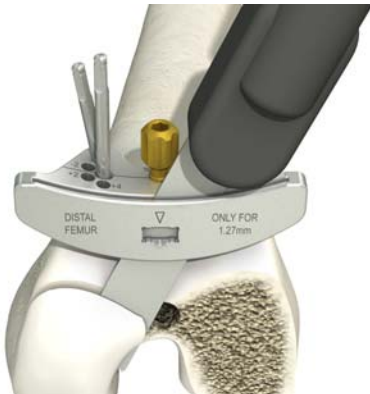


## 1.2 Distal femoral resection



The femoral cutting block should be fixed with an additional auxiliary oblique pin (marked red).

Check the distal resection by inserting the resection stylus in the slot of the distal femoral cutting block.



Perform the distal femoral resection. A **1.27 mm** saw blade is used for all femoral and tibial resections.



### Note

To avoid overheating of the bone, perform all resections under cooling with physiological saline solution.

Remove the oblique pin first and then the distal femoral cutting block.

If an additional distal femoral resection is required, place the cutting block over the straight pins through the +2 mm or +4 mm holes. Place at least one oblique pin and recut the distal femur.

### 1.3 Femoral sizing procedure

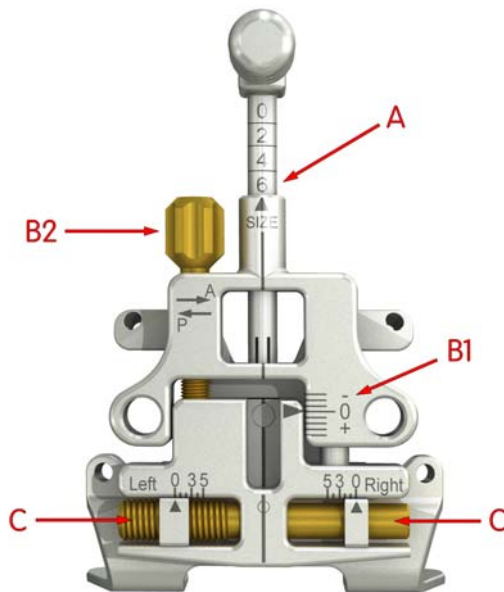
#### Femoral sizing guide

Insert the sizing stylus into the proximal guide part of the femoral sizing guide [A].

The femoral sizing guide allows adjustments in the A/P direction in case an in-between size is measured [B1/B2]. This feature prevents an overhang of the anterior flange when a bigger size is chosen or an anterior notching when a smaller size is chosen. By turning the yellow set screw, the correct size and A/P position is set [B2].

Set the sizer in the neutral position by turning the yellow screw [B2] (arrow to zero position as shown in B1). Start at zero position.

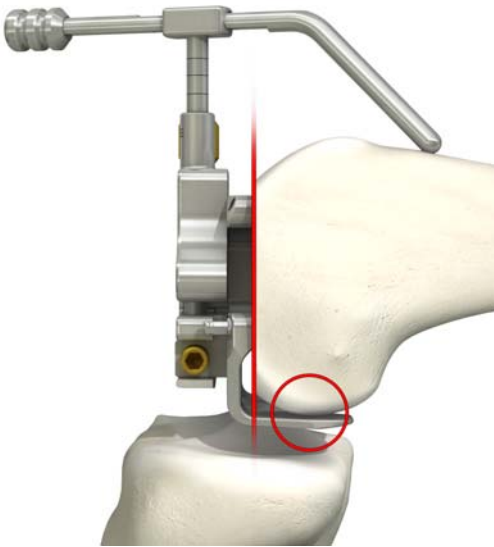
The external rotation can be continuously adjusted from 0 to 5 degrees with the MIS handle from the left or from the right side [C]. The scales show the degrees of rotation between the implant and the posterior condyles.



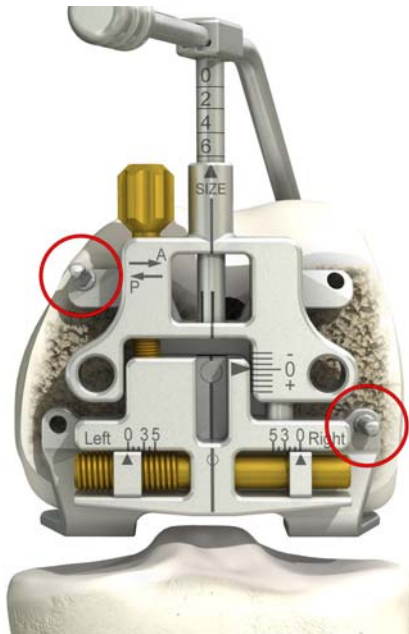
### 1.3 Femoral sizing procedure

#### Positioning of femoral sizing guide

Place the femoral sizing guide centrally aligned and make sure, that the posterior condyles of the femur touch the posterior part of the femoral sizing guide.



Make sure, that the femoral sizing guide is flush with the distal cut surface.



Fix the femoral sizing guide on the bone by using oblique pins for a more stable fixation. All necessary adjustments can be performed after pinning as well.

### 1.3 Femoral sizing procedure

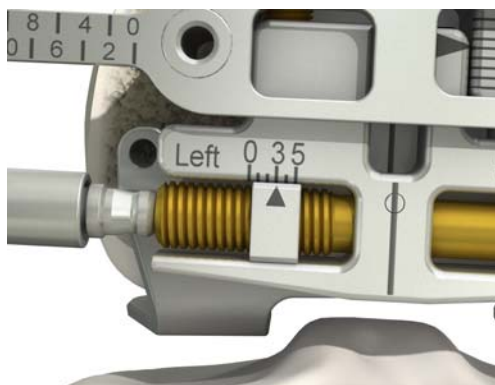


#### Rotational alignment

The external rotation of the femur can be adjusted from 0 to 5 degrees with the MIS handle according to the clinical case and anatomical landmarks (epicondylar axis, whiteside line, posterior condyles).

#### Note

There is no rotation built into the femoral implant.



In this example: 3 degrees of external rotation for a left knee

The scale shows the degrees of rotation between the implant and the posterior condyles.



Be careful of right and left designations. The scale of the external femoral rotation for a left knee is indicated with "LEFT" and the rotation for a right knee is indicated with "RIGHT".

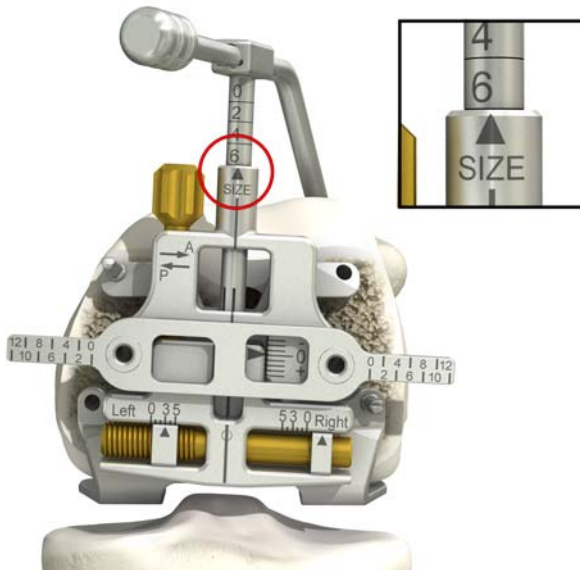
The drill guide for the 3.2 mm holes might be used as a reference for the epicondylar axis and should be positioned parallel to this axis.

### 1.3 Femoral sizing procedure

#### Size determination

Extend the leg as much as possible to get the best view for the stylus. Position the tip of the stylus onto the anterior surface of the lateral bone. The best point to establish a reference is the transition to the lateral third (lateral run-out of the patellar groove).

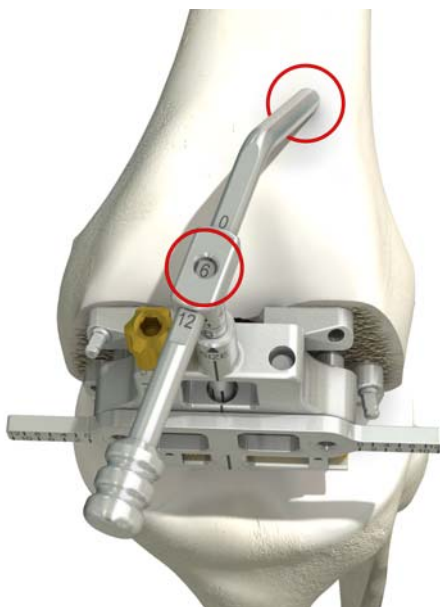
Read the femur size on the stylus above the arrow.



Read the size above the arrow. In this example a size 6 would fit perfectly.

At the upper scale the corresponding size is dialled in.

For reference purposes, size markings stating the M/L widths are provided on the lateral and medial arms of the drill guide.

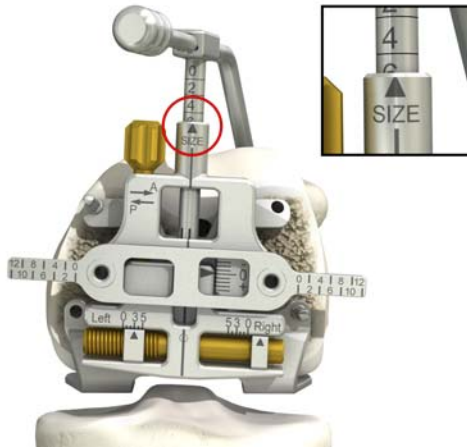


The upper scale shows the corresponding size. In this example a size 6 is dialled in.

### 1.3 Femoral sizing procedure

#### Anterior/posterior referencing

With the femoral sizing guide, both anterior and posterior referencing is possible.

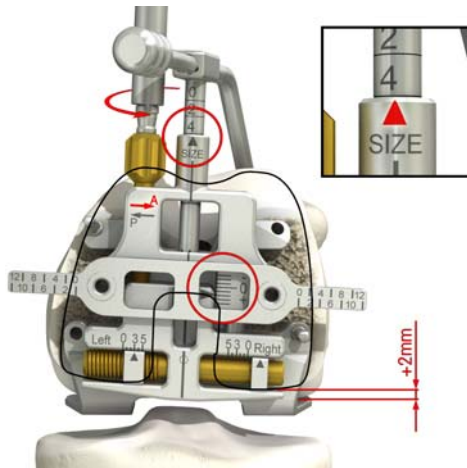


In this example: in between size 4 and 6

#### Anterior referencing

Read the size on the scale. If the scale shows an in-between size it is recommended to use the next smaller size to prevent a narrow flexion gap.

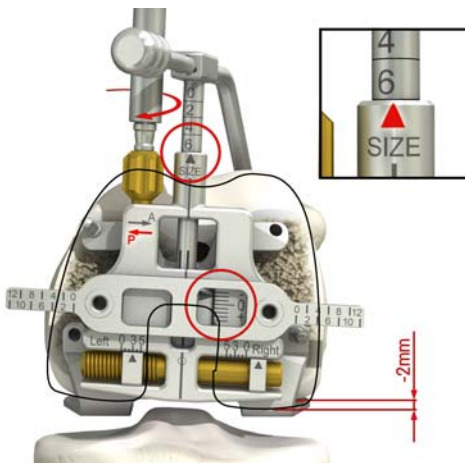
Turn the yellow screw with a screwdriver to shift the A/P position until the next smaller size is reached while the stylus remains in contact with the bone surface.



Anterior referencing: A/P adjustment to smaller size 4

#### Posterior referencing

Turn the yellow screw to shift the A/P position until the next bigger size is reached (bigger size to prevent anterior notching). The stylus remains in contact with the bone surface while turning the screw.



Posterior referencing: A/P adjustment to larger size 6

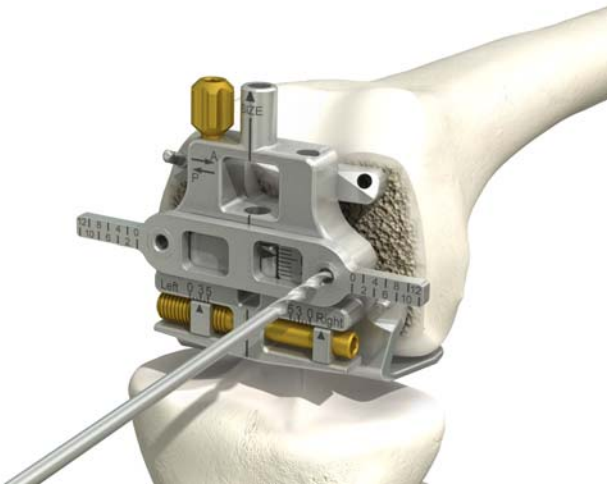
### 1.3 Femoral sizing procedure

#### Measuring and drill guide for the implant size

After determination of the rotation and femoral size the anterior reference guide might be used together with the drill guide to determine the anterior cut accuracy using the resection stylus.



Use the 3.2 mm drill to drill the peg holes for the 4-in-1 femoral cutting block. Remove the pins and femoral sizing guide.



## 1.4 Femoral resections



Use the 4-in-1 femoral cutting block of the previously determined size to perform the additional femoral resections.

The universal handle with the appropriate adapter might be used for positioning the 4-in-1 femoral cutting block and should be removed during the resections.



Pin the cutting block with long oblique pins for a better stability.



Make sure, that the 4-in-1 femoral cutting block is flush on the distal femoral cut surface.



Check the anterior resection by inserting the resection stylus in the anterior slot of the femoral cutting block.



**Perform the resections in the following order:**

- anterior cut
- posterior cut
- chamfer resections



**Note:** The order enables the most stability of the cutting block during the resection.



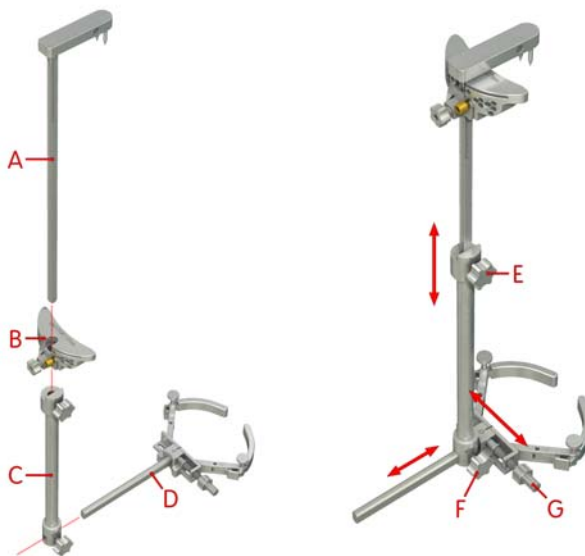
After having completed the femoral resections, remove the 4-in-1 cutting block.



## 2. Tibial Preparation

### A) Extramedullary Tibial Alignment

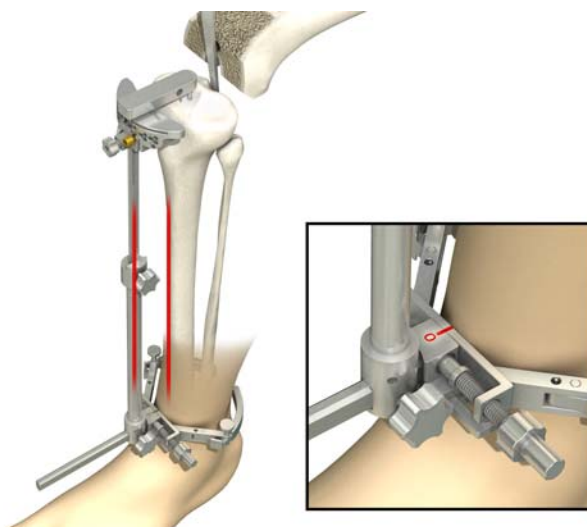
#### 2.1 Positioning of the extramedullary tibial alignment guide



Instrument assembly

Mount the tibial cutting block [B] on the extramedullary tibial alignment guide [A] and secure the block with the central screw. Assemble the tibial alignment guide [A] with the guide tube [C]. Secure the guide tube [C] on the distal end of the lower leg using the ankle fork [D].

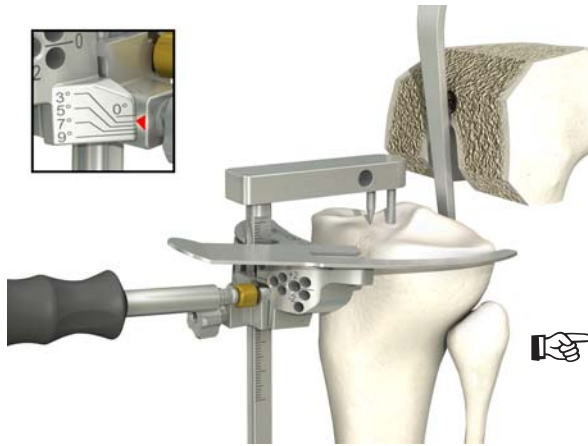
Adjust the overall length of the alignment guide [A] to the length of the tibia and secure it with the screw [E].



Anchor the proximal end of the guide tube to the central plateau by gently hammering the longer spike into the bone.

Centralize the distal part of the tibial alignment guide on the ankle joint by turning the screw on the side of the ankle fork [G] and positioning the guide in the correct M/L position. Make sure, that the alignment guide is aligned parallel to the tibial axis in the coronal and sagittal planes and locked on the distal end [F].

## 2.2 Adjusting the posterior slope



Adjust the posterior slope of the tibial cutting block by turning the yellow screw with the MIS handle. The posterior slope can be adjusted continuously from 0 to 9 degrees. The scale on the left side of the cutting block shows the adjusted degrees of the posterior slope.

### Note

There is no inclination built into the tibial cutting block nor into the tibial component.

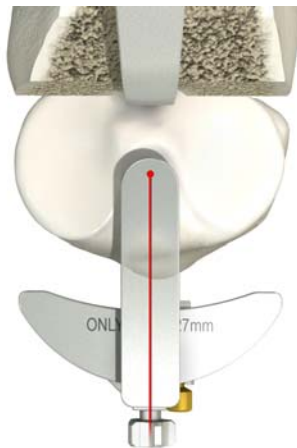
Take the natural angle of the tibial plateau into account when selecting the posterior slope.



### Note

It may be helpful to place the resection stylus on the upper surface of the cutting block. This way, the natural slope of the tibial joint surface can be assessed.

## 2.3 Determining rotation



The following criterion serves as a rotation guide for the extramedullary tibial alignment guide:

The center of the alignment guide is located slightly to the medial side of the tibial tuberosity.

When the rotation has been determined, hammer both bone pins home.

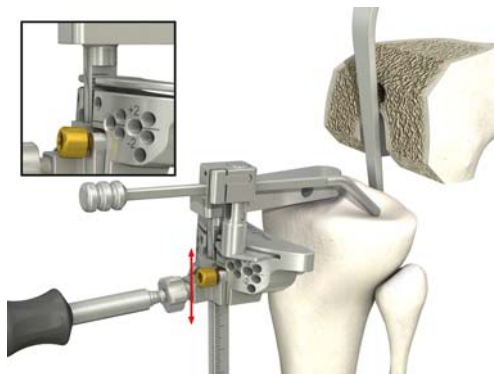
## 2.4 Adjusting the resection depth



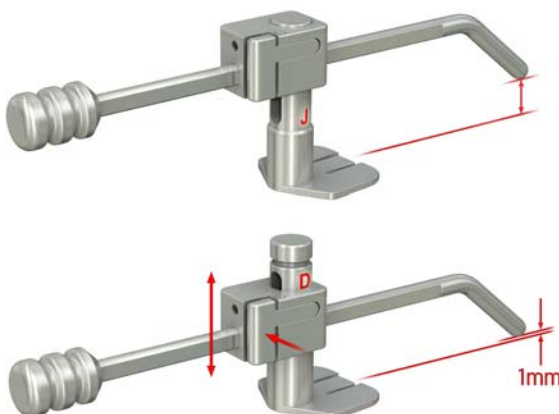
As a general rule, a conservative tibial resection is desirable.

The desired resection level can be determined through preoperative planning.

Adjust the resection level on the tibial stylus to the desired level. Insert the tibial stylus into the tibial cutting block.



Adjust the resection level of the tibial cutting block and use the central set screw to lock the position with the MIS handle.



**Option 1: tibial stylus J/D**

### Tibial stylus options

The tibial stylus always shows the dimension of the resection level.

#### Option 1: tibial stylus J/D

The stylus can be positioned either in the “J” position for joint line level or in the “D” position for defect bone level.

The “J” position is especially used for uni-compartmental (usually medial) defects. In this position the stylus is referenced on the intact (usually lateral) side in the center of the compartment and measures the resection level of the lowest PE-inlay. If the resulting resection proves inadequate, proceed as for bilateral defects in order to reach the lowest point of the damaged compartment.

In case of extensive bicompartamental defects place the stylus into the “D” position at the lowest point of the tibial plateau. Based on the lowest point the resection level is measured 1 mm below the reference.

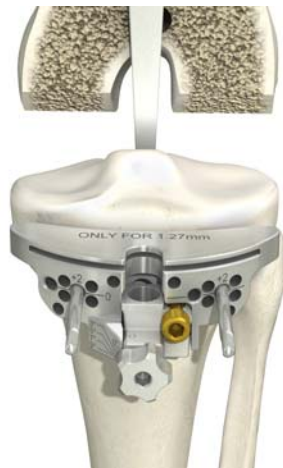


### Option 2: tibial stylus adjustable

The stylus can be adjusted continuously from 0 to 14 mm according to the desired resection level.

Option 2: tibial stylus adjustable

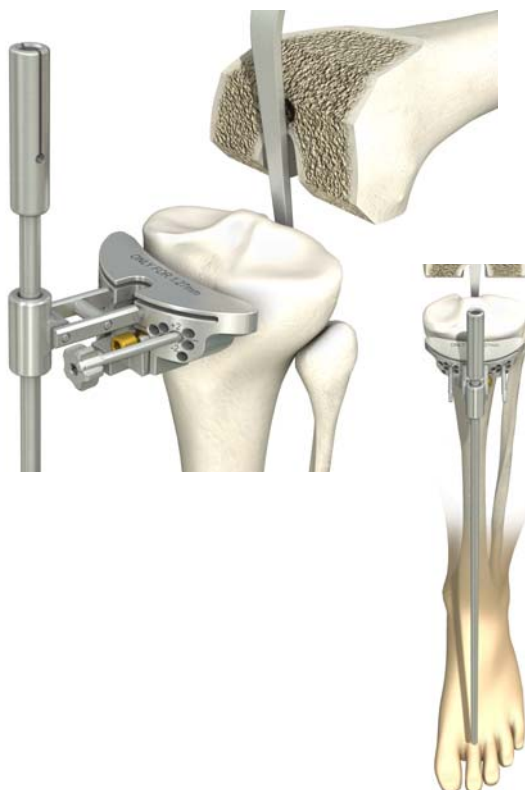
### 2.5 Tibial cutting block fixation



Pin the block into place in at least two of the 0 mm resection holes.

Open the two proximal screws (on the cutting block and the alignment guide) and remove the proximal part of the alignment guide by tapping the proximal part with the slap hammer.

### 2.6 Alignment control



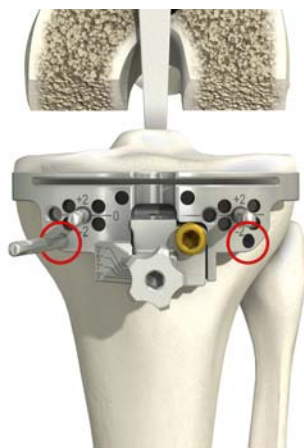
If desired, the load axis can be checked using the external alignment tower and the alignment rod mounted on the tibial cutting block.

## 2.7 Varus/valgus correction



If the distal end of the axial alignment rod does not pass over the midpoint of the ankle, the tibial cutting block can be exchanged for the varus/valgus cutting block. The tibia can then be resected at an angle of 2° more in valgus. A corresponding correction in varus can be achieved by turning the block around. The load axis is rechecked with the alignment tower and alignment rod.

## 2.8 Tibial resection



For a better stability it is recommended to fix the tibial cutting block with at least one auxiliary oblique pin (marked red).

Check the tibial resection by inserting the resection stylus in the anterior slot of the tibial cutting block.



Perform the tibial resection with the oscillating 1.27 mm saw blade.



### Note

Ensure that the posterior cruciate ligament remains intact during the tibial resection.

Remove the oblique pin first and then the tibial cutting block.

If an additional tibial resection is required, place the tibial cutting block over the straight pins through the +2 mm or +4 mm holes. Place at least one oblique pin and recut the tibia.

## 2. Tibial Preparation

### B) Intramedullary Tibial Alignment

#### 2.1 Positioning of the intramedullary tibial alignment guide



Open the tibial canal with the  $\varnothing 8$  mm intramedullary drill. Position the hole centrally in the M/L plane and in the anterior third in the A/P plane. This ensures ideal positioning of the rod.



Slowly insert the intramedullary rod into the tibial canal. remove the rod again.



Slide the tibial cutting block over the intramedullary alignment guide down the rod from the distal end and lock it with the central set screw.

Insert the intramedullary rod in conjunction with the assembled intramedullary alignment guide.

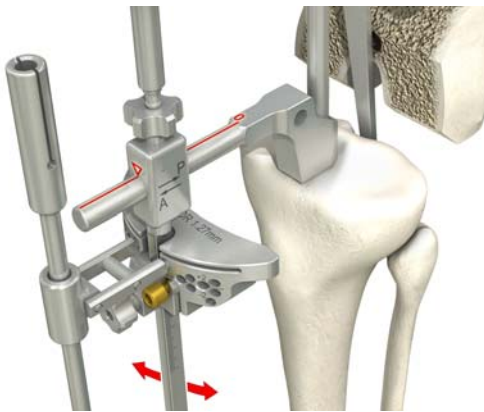
Determine the rotation as described on page 24.

## 2.2 Alignment control

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If desired, the load axis can be checked using the external alignment tower and the axial alignment rod mounted on the tibial cutting clock.



If the distal end of the axial alignment rod does not pass over the midpoint of the ankle the varus/valgus position of the cutting block can be adapted.

Open the screw on top of the proximal part of the intramedullary tibial guide and adjust the intramedullary alignment guide in the desired varus/valgus angle. The set screw is locked in the adjusted angle.

Proceed as described on page 24 (2.2 Adjusting the posterior slope).

The load axis should be checked with the alignment tower and alignment rod after pinning again.

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**Continue with the final femoral and tibial preparation as indicated in the Surgical Techniques TC-PLUS<sup>°</sup> PRIMARY Fixed Bearing Lit. No. 1702/1859 and TC-PLUS<sup>°</sup> PRIMARY Mobile Bearing Lit. No. 1703.**

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# Sterilization

## **Implants**

All the implants described in this Surgical Technique are sterile when they are delivered by the manufacturer. Resterilization is not allowed.

## **Instruments**

System components and instruments are not sterile when they are delivered. Before use they must be cleaned by the usual methods in accordance with internal hospital regulations and sterilized in an autoclave in accordance with the legal regulations and guidelines applicable in the relevant country. (For detailed information please refer to leaflet Lit. No. 1363.)

The correct settings are given in the instructions for use issued by the autoclave manufacturer. Instrument manufacturers and dealers accept no responsibility for sterilization of products by the customer.

# Notes



**Manufacturer**

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6343 Rotkreuz  
Switzerland

For further information please contact  
our local sales office.  
[www.smith-nephew.com](http://www.smith-nephew.com)