Minimally Invasive TKA
GENESIS® II Anterior Cut First
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Surgical technique described by Steven B. Haas, M.D., M.P.H.

Nota Bene:
The technique description herein is made available to the healthcare professional to illustrate the author’s suggested treatment for the uncomplicated procedure. In the final analysis, the preferred treatment is that which addresses the needs of the patient.
Introduction

Leg Position
Appropriate leg position is crucial when performing minimally invasive total knee arthroplasty. During the procedure, the knee is flexed to 70-90°. Hyperflexion is used only intermittently for specific portions of the case, such as insertion of the tibial component. To aid in holding the leg, a sandbag is placed across from the contralateral ankle when positioning the patient on the table.

Incision
With the leg fully extended, a longitudinal incision measuring 9.5 to 12 centimeters (3 3/4 to 4 3/4 inches) is made over the anterior aspect of the knee along the medial border of the patella. The incision extends approximately from the middle of the tibial tubercle to the proximal extent of the patella to one finger’s breath proximal to the patella.

Arthrotomy
Begin 5 millimeters medial to the tibial tubercle and extend dissection around the medial border of the patella. The arthrotomy is extended up to the proximal border of the patella.

The supra-patella pouch is identified, separated from the underside of the tendon and preserved.

The distal extent of the vastus medialis (VMO) is identified and the orientation of the fibers is determined. An oblique cut is made to the VMO and the muscle fibers are then spread bluntly for approximately 2 centimeters. (Figure 1)

Exposure
With the leg extended, the patella is retracted laterally. The fat pad is excised both medially and laterally leaving a small amount of fat deep under the patella tendon. The patella tendon proximal to the tubercle is dissected from the tibia. The anterior horn of the medial meniscus is divided and dissection is carried around the proximal medial tibia using electrocautery and a boxed osteotome.

A thin bent Hohmann retractor is placed on the proximal medial tibia. The proximal soft tissue attachments extending around the proximal medial tibia are released in the standard fashion. A small window is made along the anterior surface of the distal femur with the use of electrocautery to reference the anterior cortex. (Figure 2)

Note: In patients with tight extensor mechanism (usually larger, muscular patients or those with abundant patella osteophytes), the patella is cut at this time (see page 9).
Femoral Preparation

Intramedullary Femoral Alignment

1. Flex the knee to 70-90°.

2. Place a thin bent Hohmann retractor laterally around the tibia and retract the patella laterally (not everted).

3. Divide and excise the ACL and the anterior horn of the lateral meniscus.

4. Identify the rotational reference landmarks
   • A-P axis (as described by Whiteside)
   • Medial/lateral posterior femoral condyles
   • Epicondylar axis.

5. Open the femoral canal (generally just anterior to the PCL insertion) with the 9.5 mm drill.

6. Select the valgus angle bushing/rod based on preoperative measurements. Assemble the selected bushing to the valgus alignment guide (left or right). Make sure the bushing is positioned so that “left” is facing anteriorly when operating on a left knee and “right” is facing anteriorly when operating on a right knee. Attach a quick connect handle to the valgus alignment guide. (Figure 3)

7. Insert the intramedullary rod into the canal. Position the valgus guide through the skin window until it contacts the distal femur. (Figure 4)
Femoral Rotational Alignment

Rotation of the valgus alignment guide is set neutral to the posterior femoral condyles by using the landmarks described above either with or without rotational alignment paddles.

Without Paddles

1. Flex the knee to 70-90°.
2. Align:
   (a.) The posterior aspect of the valgus alignment guide parallel to the posterior condyles.
   (b.) The line laser-etched across the distal surface of the valgus alignment guide parallel to the epicondylar axis. (The line on the valgus alignment guide is drawn such that placing it parallel to the epicondylar axis aligns the guide in neutral rotation.)
   (c.) The femoral alignment template (Figure 5a) with the A-P axis. (The femoral alignment template is designed such that setting it parallel to the A-P axis aligns the valgus alignment guide in neutral rotation.)

   The femoral alignment template is placed over the valgus angle bushing to guide rotational alignment. Make sure that the template is positioned so that “left” is facing out when operating on a left knee and “right” is facing out when operating on a right knee. The valgus alignment guide is placed in neutral orientation by aligning the outrigger of the template with the A-P line. (Figure 5b)

With Paddles

1. Flex the knee to >100° with the patella retracted laterally when inserting the valgus alignment guide with the modular paddles.
2. Unlock the capture mechanism on the modular paddles. The arm on the paddles distracts posteriorly and rotates to either side to unlock so the anterior lip can engage the slot in the posterior aspect of the valgus alignment guide.
3. Insert the anterior lip of the paddles into the slot in the valgus alignment guide. Rotating the arm back centrally into the recess will lock the paddles onto the valgus alignment guide. (Figure 6)

4. Position the paddles under the posterior condyles.

Note: Posterior condylar referencing may be less reliable in knees with deficient posterior condyles (e.g., severe valgus deformity). If the posterior condyles are deficient, the AP or epicondylar axis should be used.
Preliminary Anterior Femoral Resection

1. Secure the **valgus alignment guide** using the floating pins.
2. Release and remove the **modular paddles**.
3. Decrease knee flexion to 70-90°. (This allows the soft tissue window to be moved proximally for referencing of the anterior femoral cortex.)
4. Place the **anterior resection guide** into the **valgus alignment guide** and attach the **anterior stylus** to the **anterior resection guide** by sliding the foot into the cutting slot. Place the stylus tip on the lateral ridge of the anterior femoral cortex. (Figure 7)

*Note: The stylus is designed to insert the tip under the skin if necessary. The skin can be retracted to aid in placement of the stylus.*

5. Pin the **anterior resection guide** with a 1/8” trocar pin and remove the **anterior stylus**.
6. Resect the anterior cortex. (Figure 8)

*Note: When making this cut, a retractor is used to retract the skin upward while the cut is made (the saw blade will cut under the skin).*

Distal Femoral Resection

1. Assemble the **distal femoral cutting block** with the **distal resection stylus** (the cutting block will slide distally until it hits a stop) and attach the assembly to the **anterior resection guide**. Generally, proximal retractors are not necessary.
2. Secure the **distal femoral cutting block** to the anterior cortex by impacting or drilling pins through the holes marked “o”. (Figure 9)

![Figure 9](image)

3. Attach the **slap hammer** to the **valgus bushing** and remove the **rod, distal resection stylus**, and **valgus alignment assembly**. (Figure 10a)

![Figure 10a](image)

*Only the distal femoral cutting block should remain on the femur.* (Figure 10b)

4. Resect the distal femur and remove the **distal femoral cutting block**.

![Figure 10b](image)
Femoral Preparation (Continued)

Femoral Sizing
Size the femur using the femoral sizing guide. It may be necessary to flex the knee to position the posterior paddles on the sizing guide. (Figure 11)

For the correct size assessment, place the stylus tip on the provisional anterior cut, read the size indicated by the line across the stylus shaft (not the retention pin) and choose the smaller size if between two sizes.

A-P Femoral Resections
1. Choose the correct size A-P cutting block and place it on the distal femur in a medialized position. The block is designed to allow for angling of the saw blade during the cuts. (Figure 12)

2. Secure the A-P cutting block first with a straight pin through either the medial, lateral or central pinhole in the distal block surface. Pin through the angled holes in the ears on the medial and lateral sides of the block as bone quality dictates to achieve stability. (Figure 13)

Note: The A-P cutting block should seat flush with the cut anterior and distal surfaces.

One Recommended Sequence
- Pin through lateral hole in distal block and angled holes in posterior medial and lateral ears
- Posterior cut
- Medial anterior and posterior chamfer cuts
- Move pin in lateral hole in distal block to medial hole in distal block
- Lateral anterior and posterior chamfer cuts
- Anterior femoral cut

3. Complete the anterior, posterior and chamfer cuts. While cutting the posterior condyles, a thin bent Hohmann is placed beneath the MCL for retraction and for protection of the MCL.

Note: If it is preferable to resect the chamfers over a block rather than through slots, a chamfer cutting block is available. To align the chamfer block on the distal femur, drill 1/8” pins through the medial and lateral holes in the distal surface of the A-P cutting blocks. These are used for the spikes on the primary chamfer cutting blocks.

Posterior Stabilized Femur Resection
Femoral preparation for Posterior Stabilized Genesis II is completed after Patella Preparation. See page 10.
Tibial Preparation

Extramedullary or intramedullary alignment guides may be used. First, a thin bent Hohmann is placed around the proximal medial tibia and also laterally to retract the patella. Osteophytes are removed from the anteromedial and medial tibia.

Extramedullary Tibial Alignment

1. Assemble the extramedullary tibial alignment guide and place it onto the tibia. (Figure 14)

   Ensure that the correct left or right tibial cutting block is chosen and that the alignment guide is correctly set distally for the left or right leg. The distal portion of the guide is adjusted over the center of the ankle and the proximal portion is aligned with the tibial crest.

2. Assess rotation of the alignment guide and slope of the cutting plane. Rotational alignment is critical due to the 3° posteriorly sloped cut. The goal is to align the extramedullary alignment assembly rotationally so that it aligns over the medial third of the tibial tubercle and over the second toe. The slope can be adjusted according to the patient’s anatomy.

   Note: 4° of slope is built into the articular insert and 3° of slope is built into the tibial cutting block.
   Neutral alignment should be used.

Intramedullary Tibial Alignment

1. Open the tibial canal (generally 5 mm medial to the midline) with the 9.5mm drill. To determine correct placement, the hole can be made through the tibial drill guide with the 11 mm tibial collet. (A preliminary resection of the tibial spine may facilitate seating of the tibial drill guide onto the proximal tibia.)

2. Attach the correct left or right tibial cutting block to the intramedullary tibial alignment assembly and pass the intramedullary rod through the cannulated alignment sleeve on the alignment assembly.

3. Slowly insert the rod into the tibial canal.

4. Assess rotation of the intramedullary tibial alignment guide. Rotational alignment is critical due to the 3° posteriorly sloped cut. The alignment rod of the intramedullary tibial alignment assembly should align with the medial third of the tibial tubercle.

5. Impact the proximal end of the cannulated alignment sleeve to drive the distal spikes into the proximal tibia to lock rotation. (Figure 15)
Tibial Preparation (Continued)

Tibial Resection
1. Attach the **tibial stylus** to the **tibial block** by inserting the stylus foot into the cutting slot.

2. Lower the **cutting block** until the **stylus** touches the less affected side of the tibia. This allows placement of the 9 mm articular insert. The stylus can also be used to adjust the depth of the tibia cut (adjustable to 9, 11 or 13 mm).

3. Pin the **tibial cutting block** to the tibia. Note that the cutting block sits along the medial half of the tibia. Insert pins first through the central holes. The medial hole may also be used to secure the **tibial cutting block**.

4. Remove the intramedullary alignment assembly leaving the cutting block on the anterior tibia. The extramedullary guide may be left in place.

5. Cut the tibia by first directing the blade in the posterior direction and then laterally.

6. Inspect the surface for any cortical ridges. The proximal tibia can be visualized by extending the leg, placing a laminar spreader, and retracting the patella laterally.

7. Place the leg in 90° of flexion, insert a laminar spreader and remove remnants of the medial and lateral menisci and posterior osteophytes. *(Figure 16)*


Tibial Sizing
1. Determine the tibial implant size using the **tibial viewing template**.

2. Place the appropriate **tibial drill guide** or **stemless tibial trial** on the tibia.

3. Centralize and pin the **tibial drill guide** or **stemless trial**.

4. Drill through the **stemless trial** or place the **11 mm tibial collet** in the **drill guide** and drill with the **11 mm tibial drill**.

   If a 9.5mm drill has been used for the intramedullary tibial alignment assembly, only the **11 mm tibial punch** is needed.

5. Punch with the **11 mm tibial punch**. *(Figure 17)*

6. Remove the **tibial drill guide** if used and place the tibial trial onto the proximal tibia to assess coverage.

*(Figure 17)*
Patella Preparation

The easiest time to prepare the patella is after all tibial and femoral cuts are made, but prior to trial placement. In some cases, the patella is cut just after arthrotomy to facilitate exposure.

Rotate the patella to 90°, measure its thickness, and determine the appropriate diameter implant.

Resurfacing (Onlay) Patella
1. Place two Kocher clamps just proximal and distal to the patella to hold the patella's position.
2. Cut the patella using an oscillating saw.
3. Drill the peg holes using the drill guide.

Biconvex (Inset) Patella
1. Select the correct patellar reamer collet and slide it into place on the patellar reamer guide.
2. Attach the patellar reamer guide to the patella and tighten the reamer guide on the patella. (Figure 18)
3. Use the calipers to measure patella thickness.
4. Attach the patellar depth gauge for the selected patella design to the reamer guide.
   The reaming depth for each design is as follows:
   - Biconvex patellae: 13mm
   - Resurfacing patellae: 9mm
   - All-poly with Flex-Lok® peg: 15mm
5. Attach the patellar reamer dome and patellar depth stop to the patellar reamer shaft. Before this assembly is attached to drill, lower it through the patellar reamer guide until the reamer dome contacts the patella.
6. Swing the patellar depth gauge around so that the "claw" surrounds the patellar reamer shaft.
7. Lower the patellar depth stop until it contacts the patellar depth gauge and automatically locks in place.
8. Remove the depth gauge.
9. Attach the patellar reamer assembly to power equipment. Ream the patella until the depth stop engages the patellar reamer guide.

Figure 18

[Diagram of patellar reamer components]
1. Flex the knee to approximately 90° and center the P/S housing resection block on the distal femur. (To assist, the housing resection blocks have the same M-L dimension as the implants.)

Note: The only difference between the cruciate retaining and the posterior-stabilized femoral components is the addition of the housing for the cam mechanism. All other box dimensions are the same. The anterior and posterior chamfer resections can be made through the posterior stabilized housing resection block.

2. Secure with 1/8” trocar pins through the straight holes in the front of the block. If the chamfer cuts are made through this block, the angled holes in the sides of the block should be used.

3. Attach the P/S housing resection collet to the housing resection block. (Figure 19)

4. Attach the housing reamer dome and P/S reamer sleeve to the patellar reamer shaft.

5. Ream through the housing resection collet until the automatic depth stop contacts the collet and then move the reamer anterior and posterior until it contacts the automatic stops.

6. Impact the housing box chisel through the housing resection collet to square the corners of the housing. The housing box chisel should be used anteriorly and posteriorly to ensure that the full length of the box is prepared. (Figure 20)

7. If the chamfer resections have not been made, they can now be made by cutting through the chamfer slots in the housing resection block.
Trial Placement

Femoral and Tibial Trialing
1. Insert thin bent Hohmanns laterally and medially (an Aufranc retractor can be placed posteriorly to sublux the tibia forward if necessary) and place the tibial trial.
2. Flex the knee to 90° and place the femoral trial.
3. Use the appropriate insert trial (begin with a 9 mm trial) to determine stability and alignment.
4. Perform a trial range of motion. The alignment marks on the front of the femoral and tibial trials should line up. The quick connect handle may be attached to the tibial trial and used to set the appropriate rotational alignment.
5. Extend the knee fully with the handle attached to the tibial trial. Pass the extramedullary rod through the handle to assess full leg alignment. Mark correct tibial rotational alignment on the anterior tibia using a cautery knife. Alignment can be checked with the spacer block. Since the spacer block has one end for flexion and one for extension, ensure the appropriate end is used.
6. Determine whether a porous or nonporous tibial implant will be used. Select the appropriate tibial fin punch to prepare the fins and punch through the tibial trial.

Note: If the tibial bone is sclerotic, begin the fin slot with a burr or thin saw blade before using the fin punch to prevent tibial fracture.

Patellar Trialing
1. Place the patellar trial into the prepared patella.
2. Perform a trial range of motion to assess patellar tracking. With cruciate retaining knees, medial-lateral placement of the femoral trial can be adjusted to optimize patellar tracking.
3. For cruciate retaining femorals, drill the femoral lug holes through the femoral trial with the femoral lug drill.
4. Remove the tibial trial. Attach the end of the universal extractor to the femoral trial. Remove the femoral trial. Use a towel clip to remove the patellar trial.
Implantation and Closure

Maximally flex the knee and place a thin bent Hohmann laterally and medially and an Aufranc retractor posteriorly to sublux the tibia forward.

Tibial Implantation
1. Apply cement on the proximal tibia and seat the tibial implant with the tibial impactor. Remove excess cement.
2. If using the porous tray and screws, orient the tibial screw drill guide over the holes and drill using the tibial screw drill. Determine the appropriate screw size using the screw depth gauge. Insert screws with alternating tightening to avoid liftoff.

Femoral Implantation
1. Flex the knee to 90° keeping the thin bent Hohmann laterally and removing the Aufranc retractor.
2. Apply cement only on the femoral component.
3. Place the femoral implant onto the femur and use the femoral impactor to fully seat the implant.
4. Remove excess cement. Extend the knee to remove cement anteriorly without retracting the proximal soft tissue.
5. Place the tibial insert trial onto the tibial implant and extend the leg to pressurize the cement.

Patellar Implantation
1. Assemble the patellar cement clamp to the patellar reamer guide.
2. Apply bone cement to the patella.
3. Place the patellar implant onto the patella and clamp into the bone. Remove excess cement.

Insert Placement
1. Determine the correct articular insert thickness.
2. Clear any debris from the locking mechanism and slide the insert into the tibial baseplate engaging the locking mechanism. For the P/S insert, begin insertion in flexion and extend the leg to engage the locking mechanism.
3. Attach the articular inserter/extractor to the tibial tray. Lift the inserter superiorly until the anterior lip of the articular insert is fully seated.

Closure
1. Close the arthrotomy by placing three O-Vicryl sutures at the superior border of the patella just distal to the VMO. A stitch is placed to close the VMO fascia. The remainder of the arthrotomy is closed in the standard fashion.
2. Perform routine subcutaneous and skin closure.
**IMPORTANT MEDICAL INFORMATION**

**Smith & Nephew Knee System**

**DESCRIPTION OF SYSTEM**

Smith & Nephew Knee Systems consist of femoral components, tibial components, and accessories. The component material is provided on the outside carton label. Femoral and tibial components are available in porous and non-porous coating options. Non-porous components are to be used with cement. Porous coated devices of the Profix Total Knee System and Genesis II Total Knee System may be used without cement. Hydroxyapatite (HA) coatings include HA that is supplied either on a grit blasted or porous surface.

**NGT**: HA coated components are not available in the USA.

Each total knee system is designed as a system and does not allow the substitution of components from other systems or manufacturers. All implantable devices are designed for single use only.

**Indications**

1. Cases where there is poor bone stock which would make the procedure unjustifiable
2. Active, local infection or previous intra-articular infections
3. An adequate inventory of implant sizes should be available at the time of surgery.
4. Intraoperative fracture or breaking of instruments can occur. Instruments which have experienced extensive damage as a result of strenuous activity or trauma, and has a finite expected service life and may need to be replaced prior to surgery.

**Contraindications**

1. Postoperative patient care and directions and warnings to patients by physicians are extremely important.
2. Protected weight bearing with external support is recommended for a period of time to allow healing.
3. Use extreme care in patient handling.
4. Postoperative therapy should be structured to prevent excessive loading of the operative knee and to encourage bone healing.
5. Periodic, long-term follow-up is recommended to monitor the position and state of the prothetic components, as well as the condition of the adjoining bone.

**Packaging and Labelling**

Knee implants are sterilized products and should only be accepted if received by the hospital or surgeon with the factory packaging and labeling intact. If the sterile barrier has been broken, refer to the sterilization/resterilization section below.

**STERILIZATION/RESTERILIZATION**

Most implants are supplied sterile and have been packaged in protective trays. The method of sterilization is noted on the package label. All radiation sterilized components have been exposed to a minimum of 25 kGy/Grays of gamma radiation. If not specifically labeled sterile, the implants and instruments are supplied non-sterile and must be sterilized prior to use. Inspect packages for punctures or other damage prior to surgery.

**Metal Components**

Nonporous or non-HA coated metal components may be resterilized, if necessary, by steam autoclaving in appropriate protective wrapping, after removal of all original packaging and labeling. Protect the devices, particularly mating surfaces, from contact with metal or other hard objects which could damage the product. The following process parameters are recommended for these devices:

- **Prevacuum Cycle**: 4 pulses (Maximum = 26.0 psig & Minimum = 10.0 inHg (339 millibars)) with a minimum dwell time of 15 minutes of vacuum drying at 10 inHg (339 millibars) minimum.
- **For the United Kingdom, sterilization should be carried out in accordance with HTM 2010. The recommended parameters are as follows**:
  - **Gravity Cycle**: 270ºF to 275ºF (132ºC to 135ºC) with a minimum dwell time of 10 minutes, followed by 15 minutes of vacuum drying at 10 inHg (339 millibars) minimum.

**Plastic Components**

Plastic components may be resterilized by ethylene oxide gas. The following parameters are recommended as starting points for cycle validation by the health care facility.

**Sterilant Temp. Humidity Maximum Pressure Concentration Exposure Time**

<table>
<thead>
<tr>
<th>Sterilant</th>
<th>Temp.</th>
<th>Humidity</th>
<th>Maximum Pressure</th>
<th>Concentration</th>
<th>Exposure Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>100% EO</td>
<td>135ºF</td>
<td>55%</td>
<td>20 psig (1.4 bars)</td>
<td>725 mg/l</td>
<td>10 PSIA (695 millibars)</td>
</tr>
</tbody>
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Suggested initial starting point for aviation validation is 12 hours at 210ºF (99ºC) with power aerator. Consult airline manufacturer for more details.

**INFORMATION**

For further information, please contact Customer Service at (800)-238-7538 for all calls within the continental USA and (901)-396-2121 for all international calls.

**Authorized EC Representative**

Smith & Nephew Orthopaedics GmbH, Tuttingen, Germany

**Cautions**

Federal Law restricts this device to use by or on the order of a physician.

- Trademark of Smith & Nephew, Reg. U.S. Pat. & Trademark Office

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