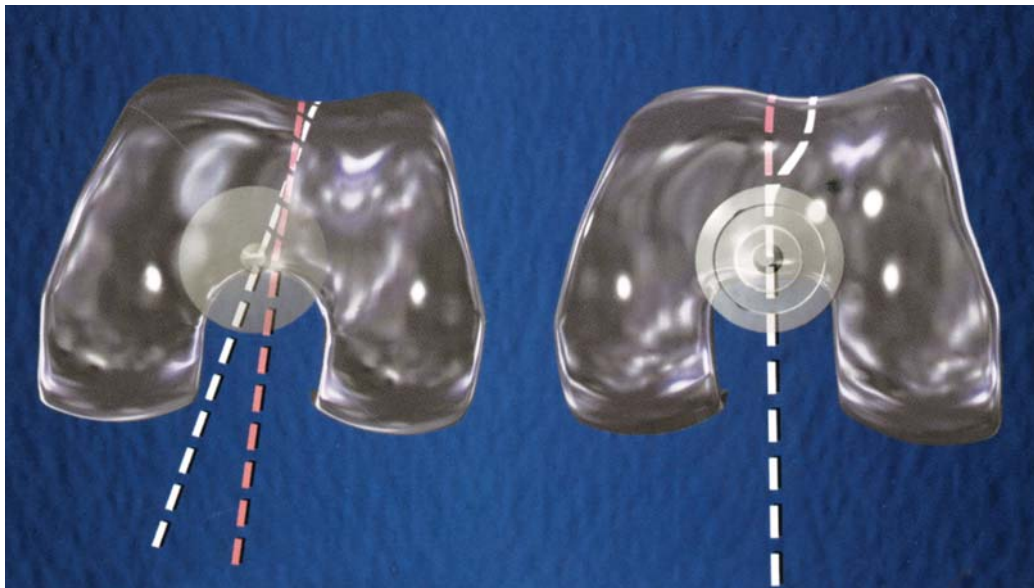


An Alternative to the Consequences Associated with External Rotation of the Femoral Component in Total Knee Arthroplasty

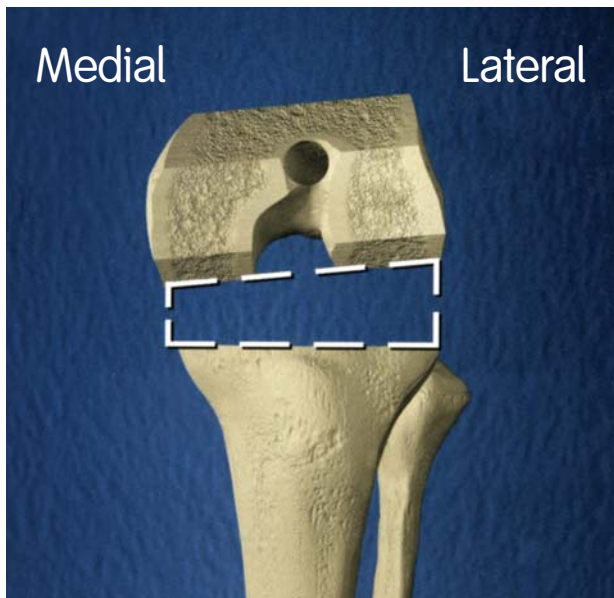
Externally Rotated

GENESIS II



A Modified Femoral Component In Neutral Rotation Will Improve Patellar Tracking

Externally rotating the femoral component has become a well accepted technique in TKA. It accomplishes two things: First, it helps balance the flexion space, and second, it lateralizes the trochlear groove in extension to improve patellar tracking. However, there are several problems with externally rotating the femoral component. This brochure discusses those concerns and suggests solutions.



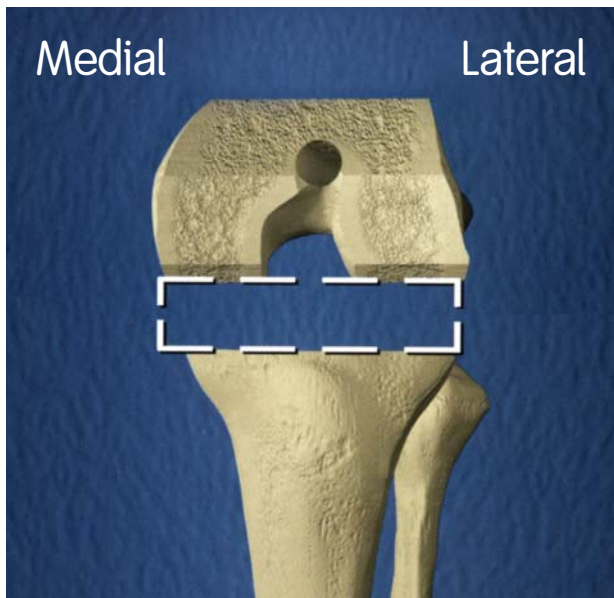
Neutral Bone Cuts in Total Knee Arthroplasty

Total knee arthroplasties were originally performed with neutral femoral and tibial bone cuts.

A neutral tibial cut (90° resection) removes more bone from the lateral than the medial plateau.⁴

A neutral femoral cut removes the same amount of bone from the posteromedial and posterolateral condyles, creating a trapezoidal space when the knee is flexed. This is undesirable, as it may result in tight medial or a loose lateral collateral ligament.

In order to address these concerns, the idea of externally rotating the femoral component was developed.^{1,3}



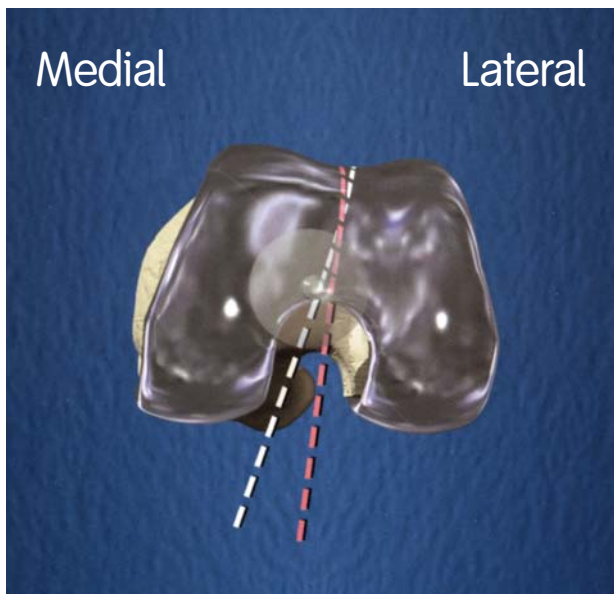
External Rotation of the Femoral Component

Rotating the femoral cutting block removes more bone posteromedially than posterolaterally and creates a rectangular space when the knee is flexed.

The external rotation of the femoral component may also:

Improve range of motion.⁵

Decrease the incidence of Zone I tibial radiolucencies.⁵



Adverse Effects of Femoral Component External Rotation

A. Patellar Maltracking

Externally rotating the femoral component has some potentially adverse effects.

First, when the femoral component is externally rotated, the proximal patellar track is lateralized but distally the groove is medialized. As a result when the knee goes to flexion, the patella crosses the midline and moves medially.⁷

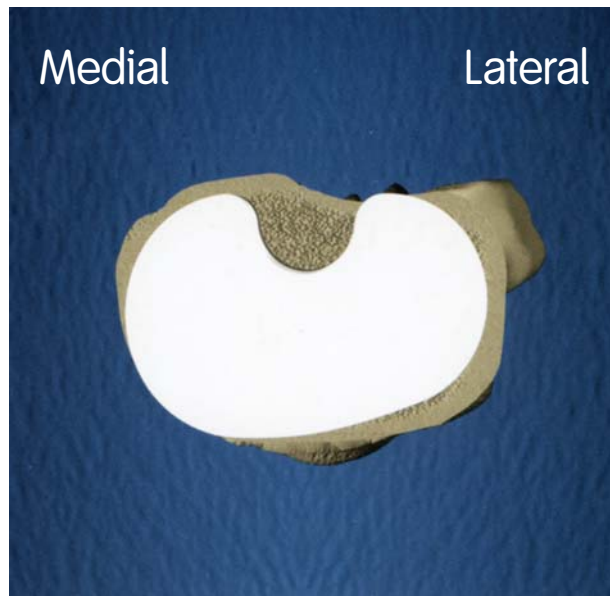
Medializing the patellar track can be a contributing factor to patellar maltracking that may lead to wear, loosening, fracture, and pain.

Adverse Effects of Femoral Component External Rotation

B. Smaller Tibial Component

When the femoral component is externally rotated, it makes sense to externally rotate the tibial component as well, to line up femur and tibia in extension. This could result in the tibial baseplate extending over the bone, forcing the surgeon to use a smaller component.

This creates another concern: If a smaller tibial component is used, the bone coverage will be compromised.

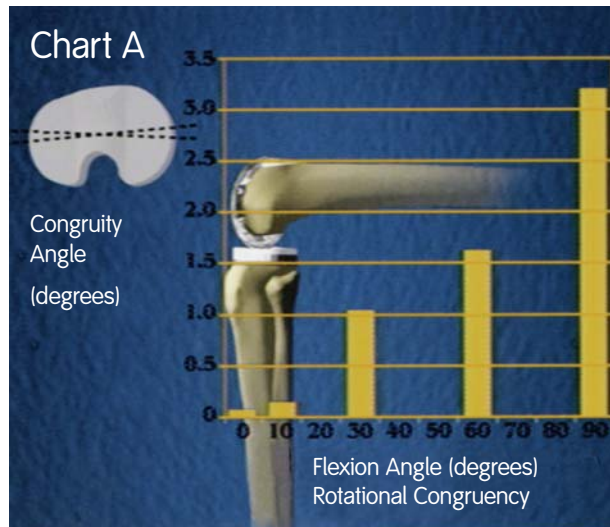


Adverse Effects of Femoral Component External Rotation

C. Rotational Malalignment

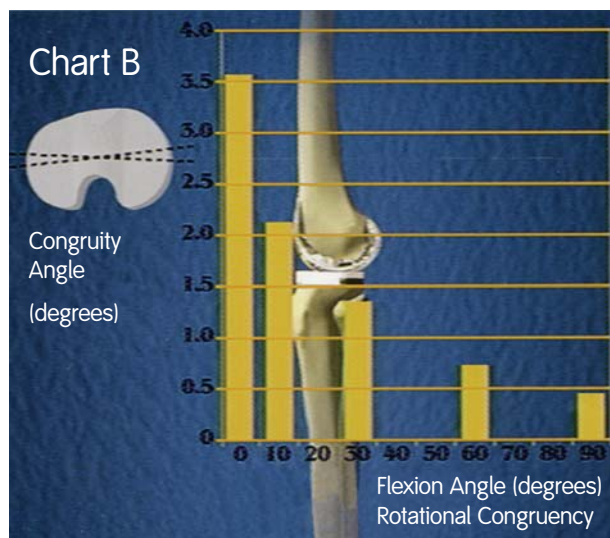
Femoral and tibial components should be rotationally aligned throughout range of motion in order to reduce polyethylene wear.⁶ Correct alignment, and therefore reduced wear, is indicated by small congruency angles in the attached chart.

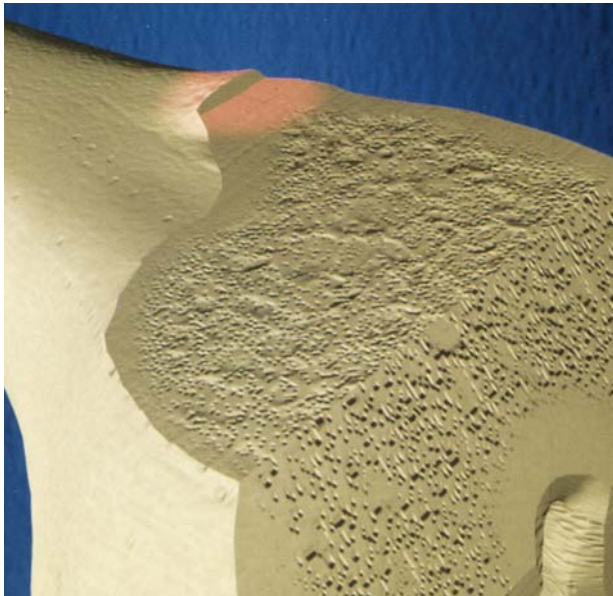
When both the femoral and tibial components are externally rotated, the congruency angle is small in extension but higher in flexion. As a result, the contact area between the femur and the tibia is maximized in extension, but is reduced as the knee goes into flexion (Chart A).



If the tibial component is placed in neutral rotation with the femoral component externally rotated, the congruency angle is small in flexion but high in extension. As a result, the contact area is maximized in flexion and reduced in extension (Chart B).

From the last two graphs it becomes apparent that regardless of the orientation of the tibial component, when the femoral component is externally rotated, congruency can not be maintained throughout the range of motion. This becomes a critical factor with more conforming knee designs.





Adverse Effects of Femoral Component External Rotation

D. Femoral Notching

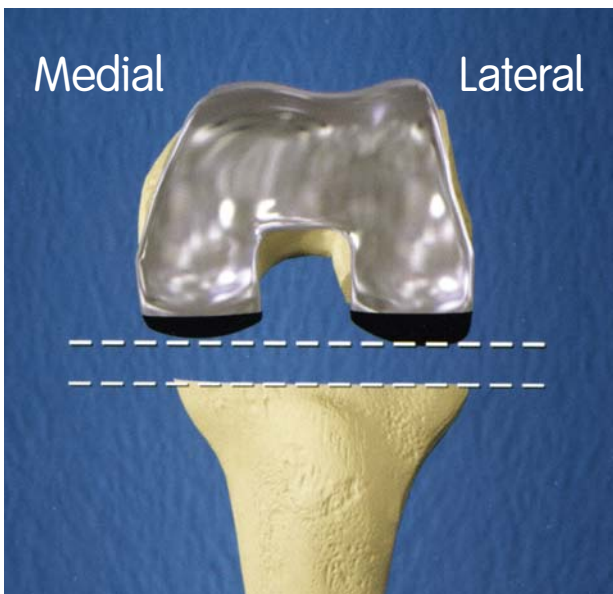
Another concern with externally rotating the femoral component is notching the femur. Externally rotating the femoral cuts removes more bone from the anterolateral side and increases the likelihood of a notch. That may predispose the femur to fracture.



Adverse Effects of Femoral Component External Rotation

E. Bone Fixation

Inadequate bone removal from the anteromedial femur may create a gap between the implant and the bone and may compromise the fixation of the implant.



Alternative Design Modifications

Using a modified femoral component with a thicker posterior lateral than posterior medial condyle has all the benefits of the external rotation, without any of the concerns.

- Patellar maltracking.
- Compromised coverage of the tibia.
- Rotational malalignment of femur and tibia.
- Femoral notching/bone fixation.

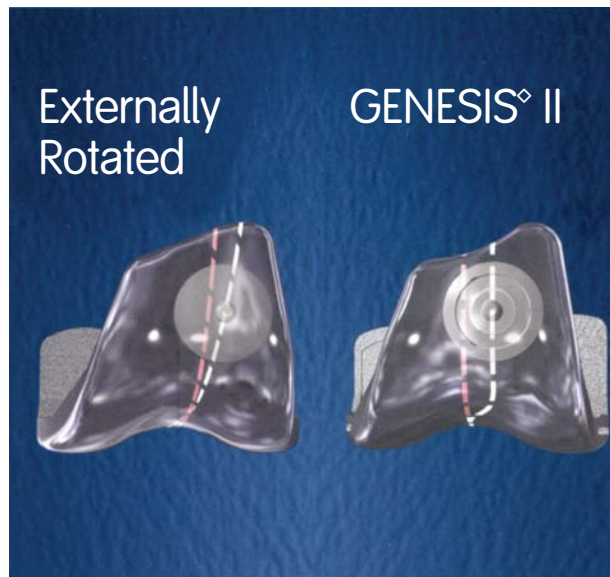
The modified design provides:

- Balanced flexion space.
- Improved patellar tracking in flexion.
- Maximum contact area throughout ROM.

Benefits of Modified Femoral Component

A. Improved Patellar Tracking

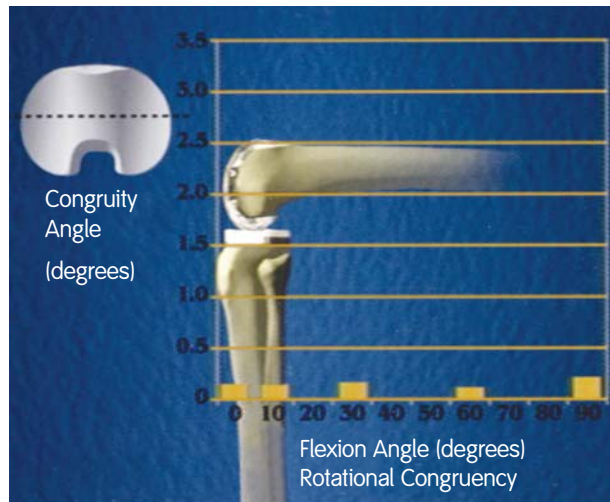
The GENESIS II femoral component has both asymmetric posterior condyles and a modified trochlear groove. The trochlear groove on the anterior aspect of the GENESIS II component has been lateralized to mimic the patellar tracking of an externally rotated femur. The trochlear groove then gently funnels the patella to midline in flexion.



Benefits of a Modified Femoral Component

B. Congruency Maintained Throughout Range of Motion

The GENESIS II femoral and tibial components are implanted at neutral rotation. This means that the knee is congruent and the contact area is maximized throughout the range of motion.



Summary

Externally rotating a conventional femoral component causes the patella to move medially in flexion, which may contribute to patella problems. It also causes incongruity between the femur and tibia throughout range of motion. This may lead to increased wear, particularly in more conforming designs.

The patented new GENESIS II femoral component fills the flexion space, optimizes patellar tracking, and maintains maximum congruency throughout range of motion.

All of the benefits, none of the problems!



References

- ¹ Anouchi, Y.S.; Whiteside, L.A.; Kaiser, A.D.; Milliano, M.T.: The Effects of Axial Rotational Alignment of the Femoral Component of Knee Stability and Patellar Tracking in Total Knee Arthroplasty Demonstrated on Autopsy Specimens. *Clinical Orthopedics*, 287:170-177, 1993.
- ² Eckhoff, D.G.; Montgomery, W.K.; Stamm, E.R.; Kilcoyne, R.F.: Location of the Femoral Sulcus in the Osteoarthritic Knee. *Journal of Arthroplasty*, 11:163-165, 1996.
- ³ Insall, J.: Surgery of the Knee. Churchill Livingstone, New York, NY, 1984.
- ⁴ Krackow, K.A.: The Technique of Total Knee Arthroplasty. C.V. Mosby, St. Louis, MO, 1990.
- ⁵ Laskin, R.S.: Flexion Space Configuration in Total Knee Arthroplasty. *Journal of Arthroplasty*, 5:657-660, 1995.
- ⁶ Northmore-Ball, M.D.; Freeman, M.A.R.; Barnes, K.A.: Sub-clinical Rotational Malposition: A Potential Cause of Catastrophic Wear in Conforming Condylar Knee Arthroplasty. *The Knee*, 2: 177-180, 1995.
- ⁷ Rhoads, D.D.; Noble, P.C.; Reuben, J.D.; Tullos, H.S.: The Effect of Femoral Component Position on the Kinematics of Total Knee Arthroplasty. *Clinical Orthopedics*, 286:122-129, 1993.

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