Sixteen years ago, when we began studying the realm of knee prostheses, the focus was on new materials, posterior stabilized vs cruciate retaining, whether to perform patella resurfacing, wear, and varus/valgus alignment. At that point, we had not heard of rotational alignment of the prosthetic components. However, with time, we began studying alignment in the frontal and sagittal planes, considering it essential for a good functional, durable outcome.

When knee arthroplasty began, the major focus was on axial alignment. According to the literature, a tibial varus/valgus malalignment of greater than 3° may change the distribution of load and shear forces between medial and lateral compartments.1,2

We gained knowledge of varus/valgus alignment and rotational malalignment by reading the early work of Berger et al.3-5 However, an instructional course conducted by Vince opened our minds and caused us to turn our attention to the rotational malalignment of prosthetic components, especially the tibial component.6

The incorrect rotational orientation of a system inevitably leads to a painful, loose, and poorly positioned prosthesis and a dissatisfied patient (ie, an unsatisfactory result). Anterior knee pain continues to be a relatively common finding after total knee replacement, having a reported incidence of 10% to 20%.7

Tibial malrotation is responsible for anterior-posterior translation. Furthermore, it is possible to observe a decreasing of patellofemoral shear forces due to femoral internal rotation and polyethylene component impingement. The malalignment of prosthetic components is responsible for patellofemoral maltracking. Various computer models and cadaveric studies have confirmed the alterations of the patellar biomechanics.8,9 Computed tomography has clearly established the relationship between patellar complications (eg, subluxation and dislocation) and patellar component failure with component malrotation. The association between malrotation and the presence of anterior knee pain has not been well documented. Relative internal rotation of the tibial component effectively increases the Q angle and changes the force vector on the extensor mechanism. The abnormal stress on the patella and surrounding soft tissue could explain the anterior pain.

During total knee arthroplasty, it is difficult to restore the patellofemoral joint, considering its mobility and physiological tension of alar ligaments. In the normal joint, the patella is slightly lateral to the femur in full extension; when the knee is flexed, the patella is slightly medial compared with its previous position. Internal rotation of both prosthetic components increases the valgus angle value (Q angle), and sometimes the extensor compartment applies more force than the physiological condition. Internal femoral rotation may increase patellar medial tilt and medial shift. The external femoral component rotation reduces the Q angle value and causes an increase in patellar lateral tilt and lateral shift. It is possible to describe the maximal changes in early flexion; this effect decreases in extension. According to the literature, it is possible to decrease patellar shear forces by researching the good alignment to the epicondyles axes or optimal femoral component rotation.4,7,10-12
The other complication linked to alignment is polyethylene wear due to high contact stresses. There have been several studies of the effects of the shear forces and the contact stresses related to the insert of various prostheses, including fixed bearing and rotating bearing designs.4,7,10-12 A decrease of contact stresses has been described when the knee is well aligned because of a better conformity of the tibiofemoral joint.4,7,10-13 In malrotated knees, the high contact stresses on polyethylene are responsible for early wear and delamination of inserts.

**Conclusion**

Component internal rotation is a significant factor predisposing to the development of anterior knee pain after total knee arthroplasty, leading to poor motion, patellofemoral complications, and loosening. Devices or positioning techniques must be developed to improve precision, surgical performance, and component lifespan.

**References**


