**How Frequently Does Mechanically Aligning a Total Knee Arthroplasty with the Knee Set at 5° or 7° Valgus Cause Collateral Ligament Imbalance and Change Alignment from Normal?**

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**INTRODUCTION**

Surgeons that mechanically align a total knee arthroplasty (TKA) often set the knee at 5° or 7° valgus because these component positions are considered well-aligned on a short radiograph of the knee. However, aligning the TKA with the knee set at 5° or 7° valgus can cause undesirable consequences recognized as two types of collateral ligament imbalance (Figures 1, 2) and a change in the alignment of the limb and knee from normal. The present study computes the frequency that setting the knee at 5° or 7° valgus with each of four methods for setting internal-external (I-E) rotation of the femoral component create these undesirable consequences.

**METHODS AND MATERIALS**

1. Fifty-three-dimensional bone models of normal lower extremities from white subjects were created from computer tomograms with a slice thickness of 1 mm.

2. The simulation of TKA was performed with image analysis software. Each TKA was aligned with the knee set at 5° or 7° valgus, and the magnitude of the tight collateral ligament in 0° extension was computed using the thicknesses of the bone resections (Figure 1).

3. The I-E rotation of the femoral component was set perpendicular to the anteroposterior (AP) axis of the trochlear groove, parallel to the transsepicondylar axis, 3° externally rotated to the posterior condylar line, and parallel to the tibial resection at 90° of flexion after balancing to create a rectangular gap at 0° of extension.

4. The magnitude and side of the instability in a compartment between 0° extension and 90° flexion uncorrectable by collateral ligament release (Figure 2) and the change in limb and knee alignment from normal were computed.

**RESULTS**

**Figure 1.** Illustration shows the method for computing the magnitude of release of a tight collateral ligament in 0° extension on a 0° right knee.

A. Setting the knee to 5° valgus creates a trapezoidal gap.

B. Releasing the medial collateral ligament 6 mm converts the trapezoidal gap to a balanced rectangular gap.

**Figure 2.** Composite shows the method for computing the instability in a compartment between 0° extension and 90° flexion uncorrectable by collateral ligament release. A. The distal femoral cut was 5° valgus to the femoral anatomic axis. B. The posterior femoral cut was perpendicular to the AP axis. Minimum resection was set to 8 mm. C. In this example, the medial compartment has 10 mm of instability in 90° flexion because the posterior resection is 10 mm thicker than the distal resection. D. In contrast, the lateral compartment does not have instability because the thickness of the distal and posterior resections equals the thickness of the distal and posterior regions of the femoral component.

**Figure 3.** Frequency of ≥ 2-mm release of a tight collateral ligament.

**Figure 4.** Frequency of ≥ 2° instability in a compartment between 0° extension and 90° flexion uncorrectable by collateral ligament release.

**Figure 5.** Frequencies of knee (A) and limb (B) alignment before and after simulated rotation.

**DISCUSSION AND CONCLUSION**

Surgeons that mechanically align the TKA with the knee set at 5° or 7° valgus will frequently have to manage a wide range of instabilities that are complex, cumulative, and uncorrectable by collateral ligament release, and a wide range of changes in limb and knee alignment from normal. Patients who perceive these changes in stability, limb alignment, and knee alignment may be dissatisfied and require counseling.
