



# 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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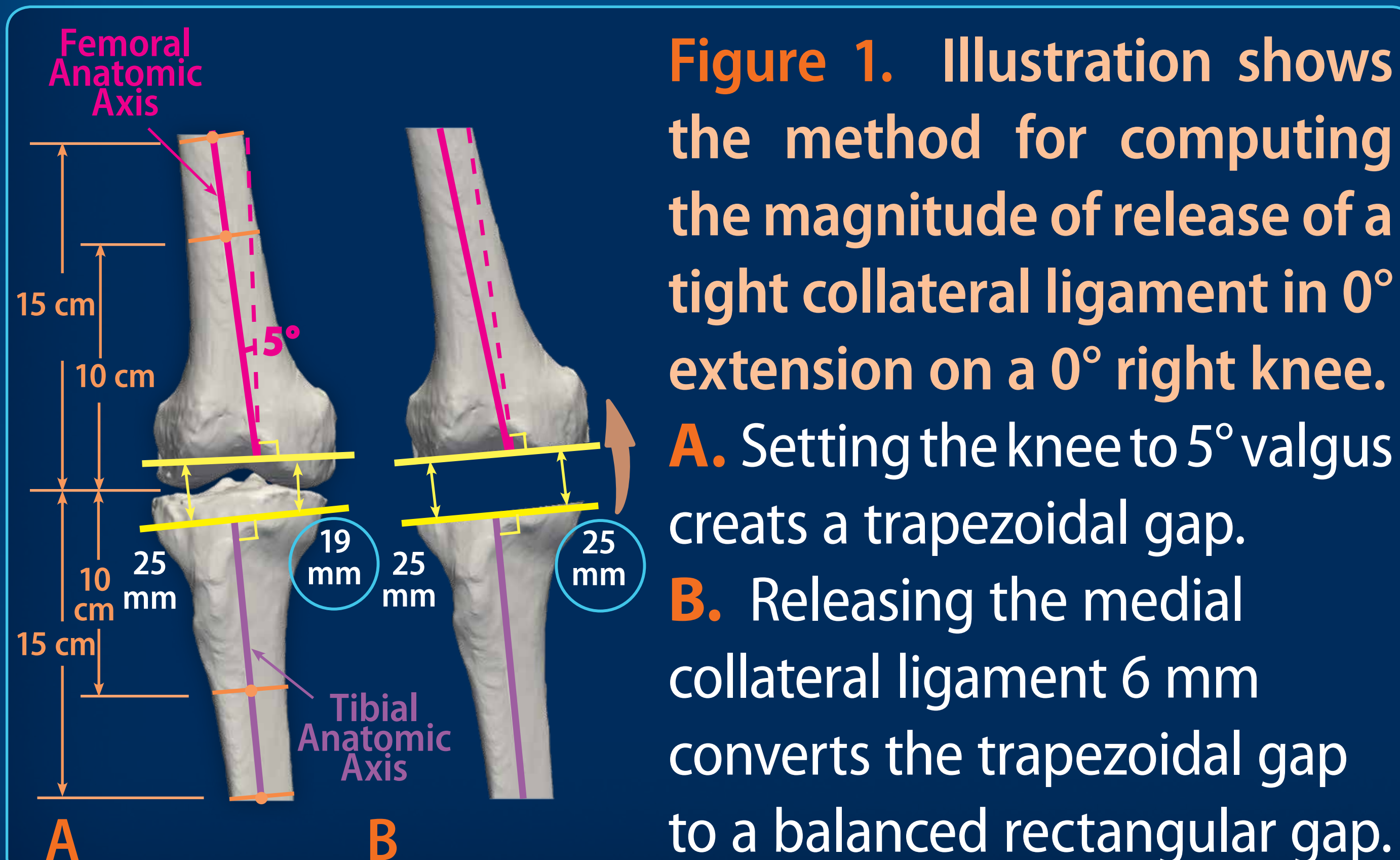
## INTRODUCTION

Surgeons that mechanically align a total knee arthroplasty (TKA) often set the the knee at 5° or 7° valgus because these component positions are considered well-aligned on a short radiograph of the knee<sup>1,2</sup>. 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.

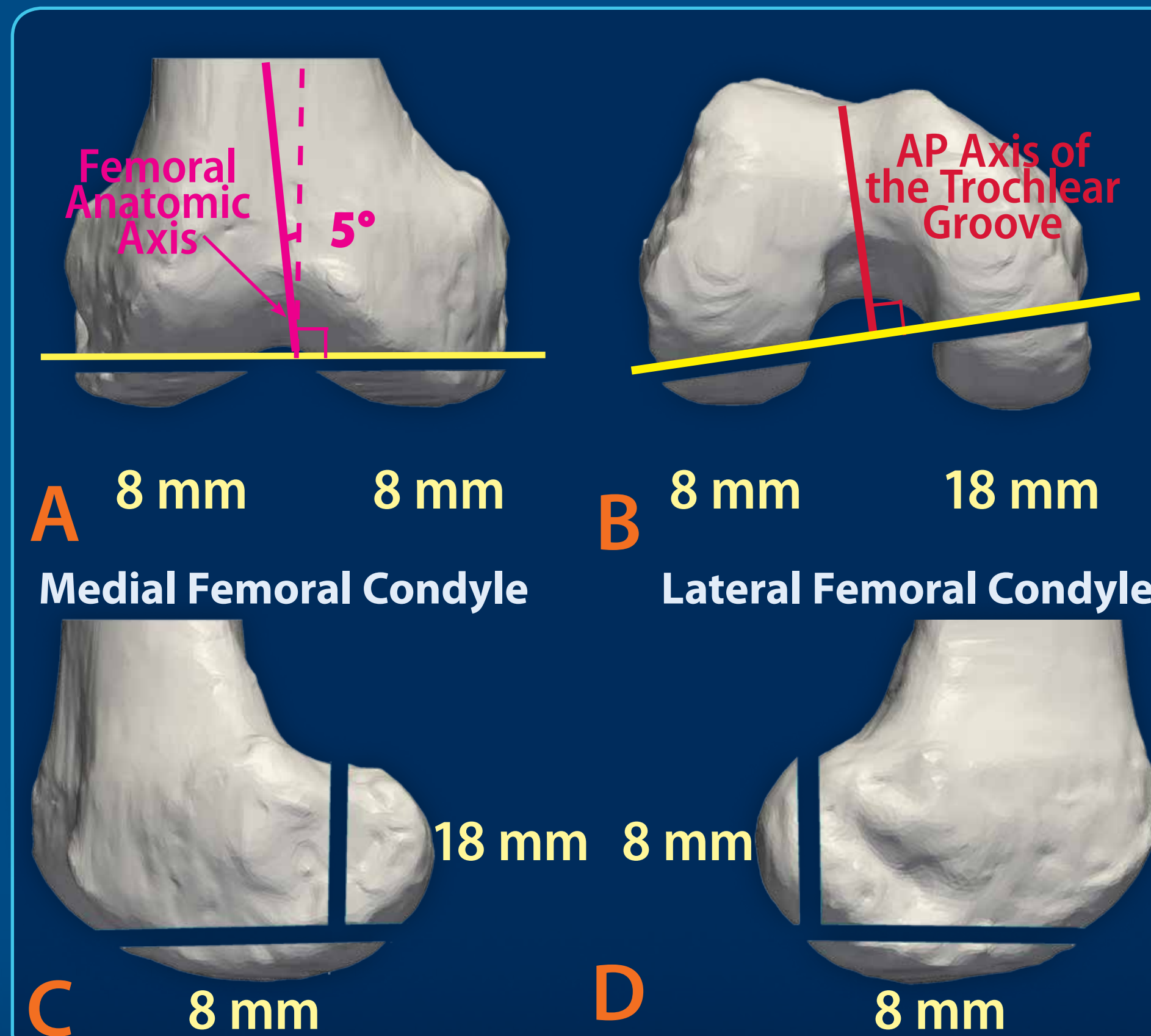
## METHODS AND MATERIALS

- 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 transepicondylar 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.



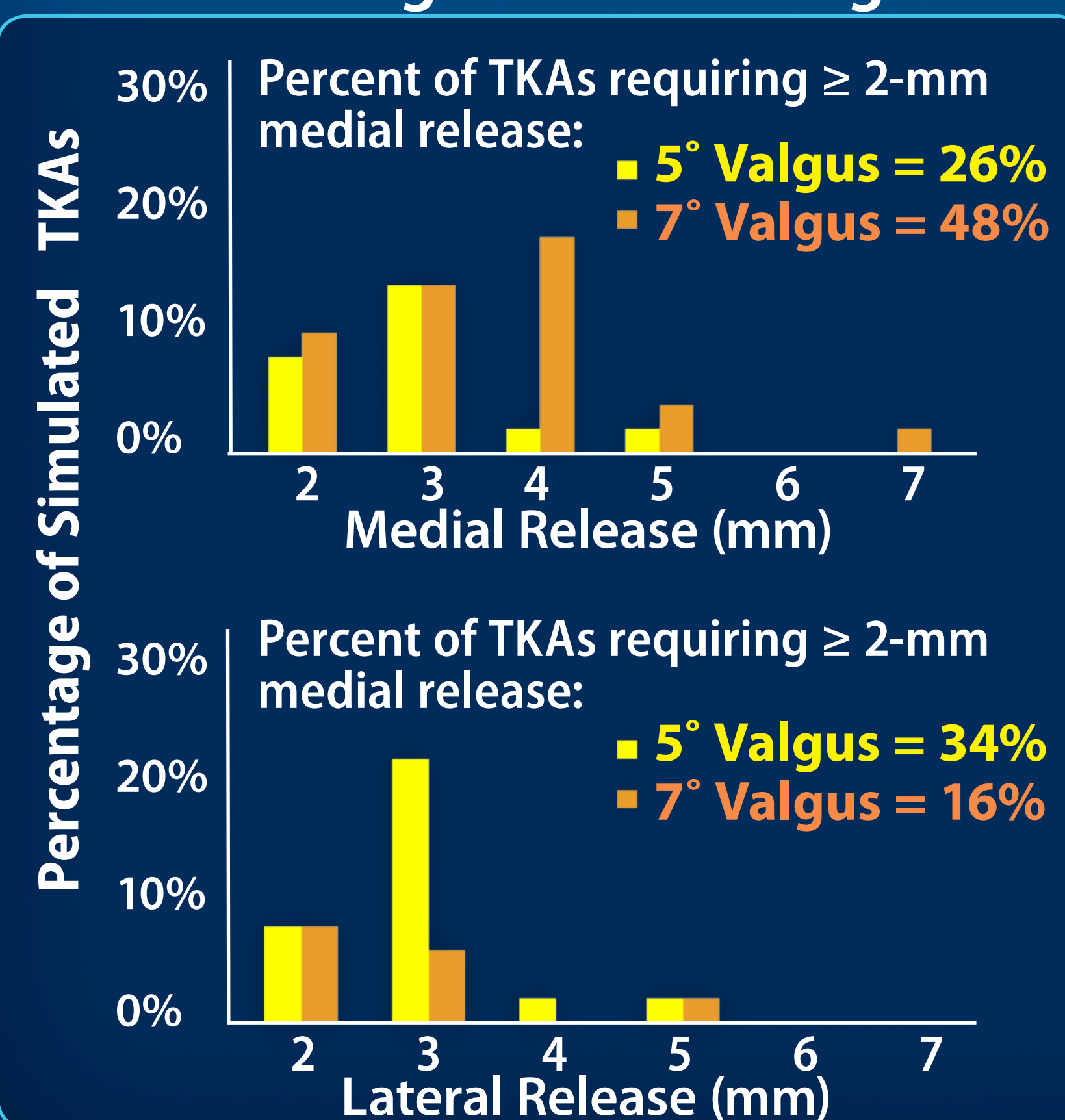
**Figure 1.** Illustration shows the method for computing the magnitude of release of a tight collateral ligament in 0° extension on a 0° right knee. **A.** Setting the knee to 5° valgus creates a trapezoidal gap. **B.** Releasing the medial collateral ligament 6 mm converts the trapezoidal gap to a balanced rectangular gap.



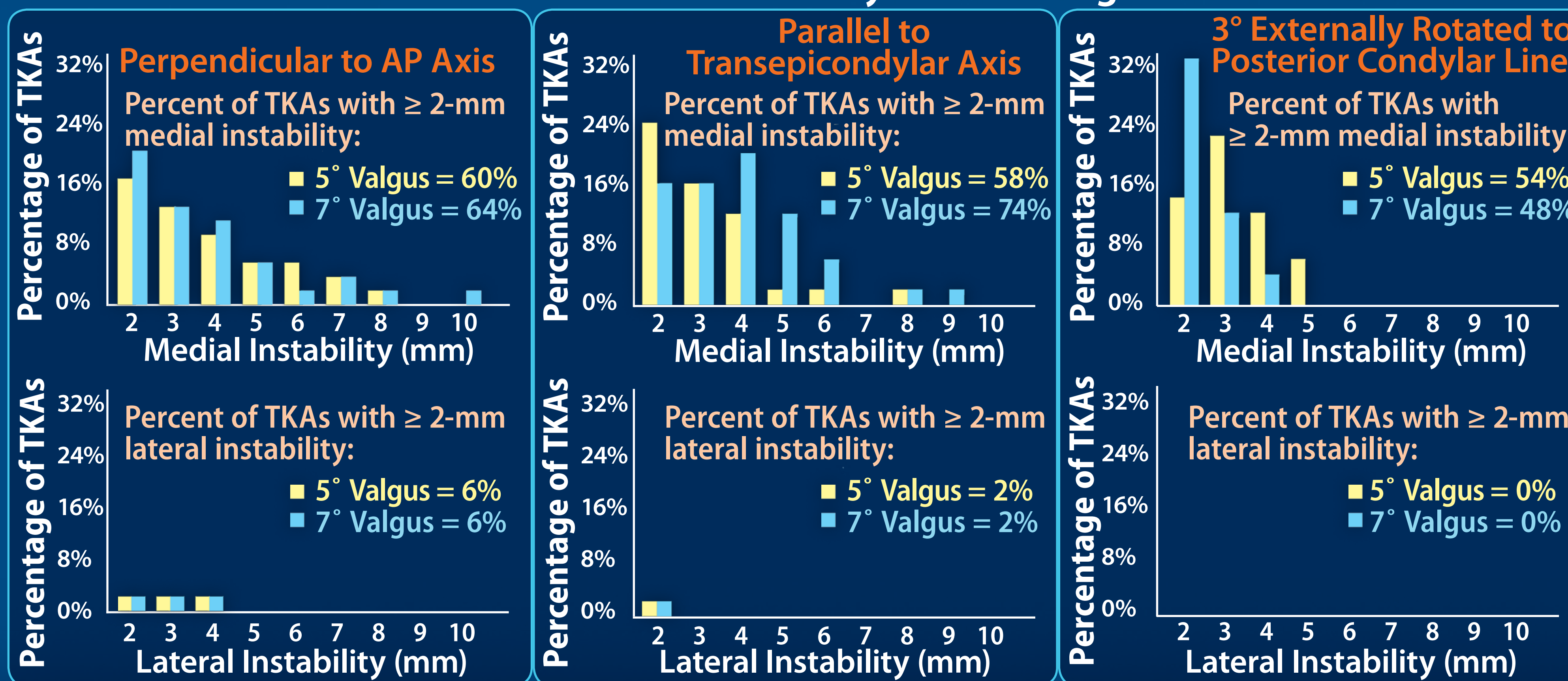
**Figure 2.** Composite shows the method for computing the instability in a compartment between 0° extension and 90° flexion uncorrectable by collateral ligament release. **A.** The distal femoral cut was 5° valgus to the femoral anatomic axis. **B.** The posterior femoral cut was perpendicular to the 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.

## RESULTS

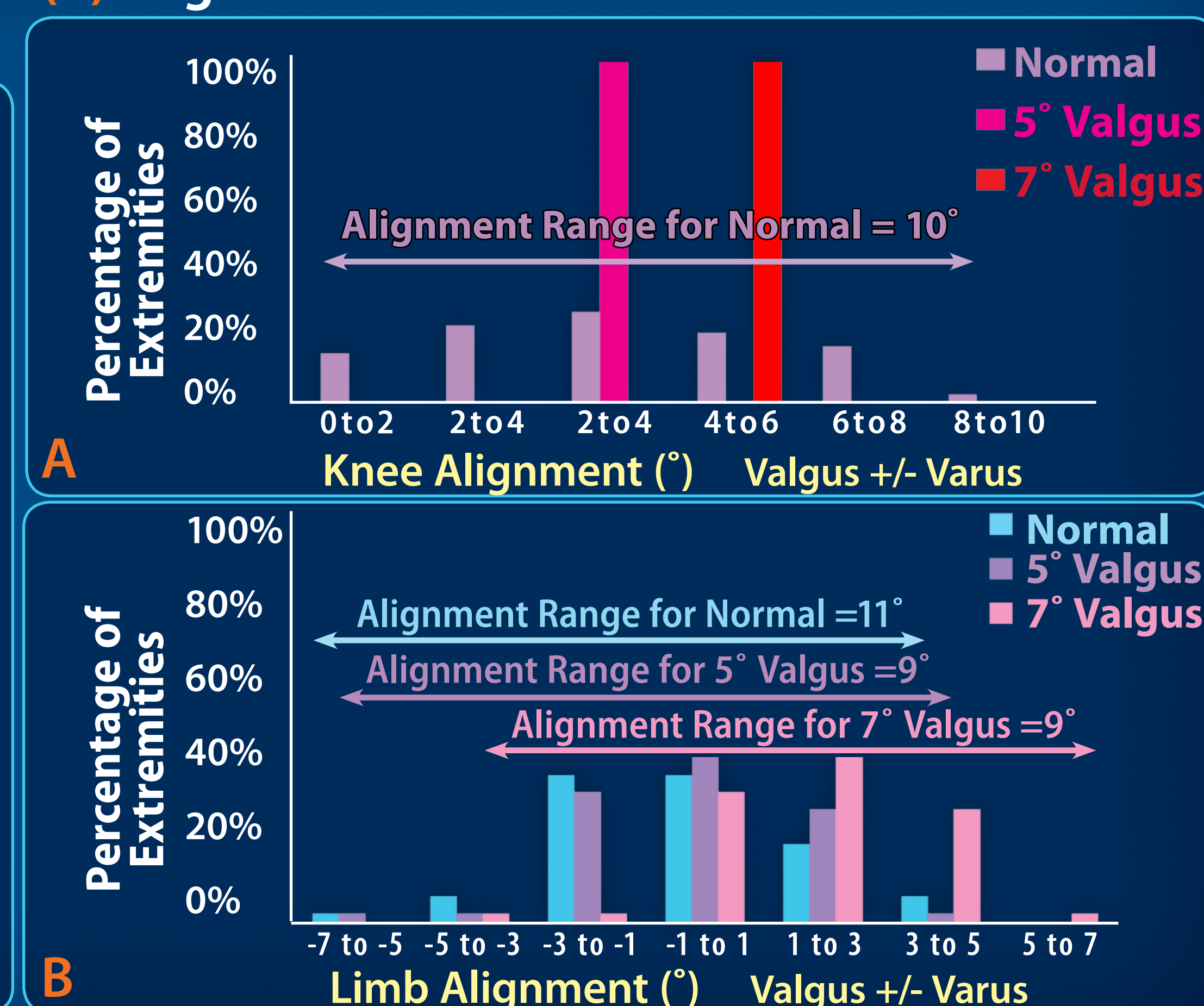
**Figure 3.** Frequency of ≥ 2-mm release of a tight collateral ligament.



**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



## 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.