What is the Effect on Leg Length Following Lateral Opening Versus Medial Closing Distal Femoral Osteotomies?

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Introduction: The purpose of the this study is to validate a tool to predict leg length changes after distal femoral osteotomy (DFO) and demonstrate the differences in length changes in medial closing wedge (MCW) compared to lateral opening wedge (LOW) techniques.

Methods: A collaborative, IRB approved retrospective review was performed of Rush and Mayo Clinic databases for DFO patients with full-length standing radiographs pre-and postoperatively. The region on the medial (for LOW) or lateral (for MCW) distal femur cortex that would be the "hinge point" during DFO was identified. The distances from the center of the femoral head to the hinge point ("A"), from the hinge point to the center of the tibial plafond ("B"), and the resultant angle ("α") were measured **(Figure 1)**. **Figure 2** demonstrates the equation used to plot the predicted leg length changes corresponding to the change in α angle produced by DFO. The difference between predicted and true leg length changes was compared using paired Wilcoxon signed rank exact tests.

Results: For both LOW (n=10) and MCW (n=10) osteotomies, the average predicted leg length change was equivalent to the true change measured on radiographs (LOW mean difference between measurements = -0.394±0.715 mm, p=0.160; MCW difference = -0.04±1.06 mm, p=0.770).
LOW DFO's had a mean α correction of 6.52°±2.70° resulting in 5.10±2.77 mm of leg lengthening, compared to 7.28°±2.85° resulting in 2.98±1.85 mm of leg shortening (p<0.001) for MCW.
On average, there was 0.85mm of lengthening (range 0.5-1.32mm) for every 1° of mechanical axis correction with LOW DFO, compared to 0.45mm of shortening (range: 0.07-1.41mm) per 1° of MCW correction.

Discussion: This study presents a tool to accurately and reliably predict the leg length changes seen after both MCW and LOW DFO's. Surgeons can expect approximately 0.85mm of lengthening per 1° of DFO correction when performing LOW, compared to 0.45mm of shortening per 1° correction for MCW osteotomies.

Clinical Relevance: Predictive modeling of leg length post MCW and LOW DFO's allows surgeons to make a more informed decision on which procedure is best for each patient presenting with severe valgus malalignment.

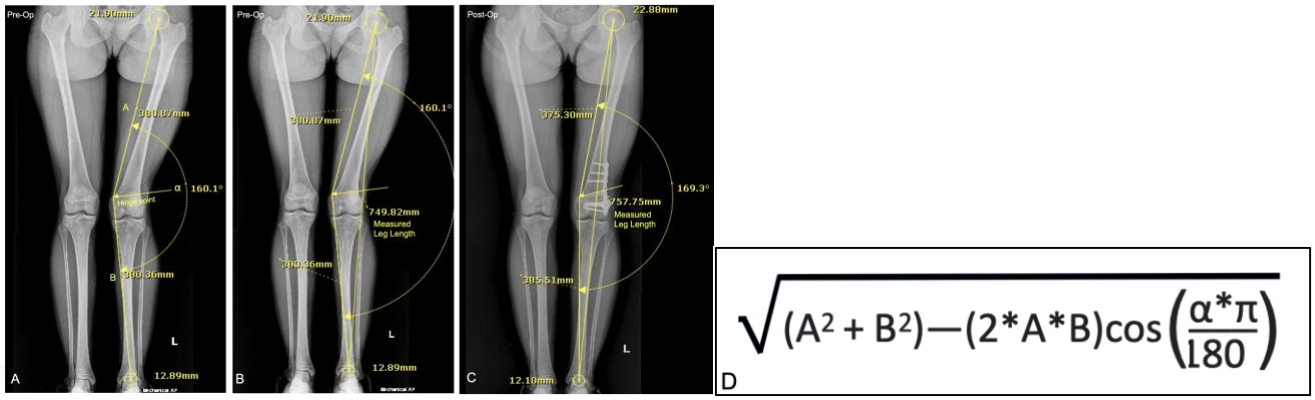

Figure 1. (A) Identify the hinge point for the DFO (LOW in this patient) and measure the distance between the femoral head and hinge point = "A", the distance between the hinge point and the tibial plafond = "B", and the resultant angle at the hinge point= "α". (B) Measuring the true leg length on pre-operative and (C) postoperative standing radiographs. This patient experienced 7.93 mm of lengthening after α-angle change of 9.2° . (D) The equation used to calculate same-image leg length.

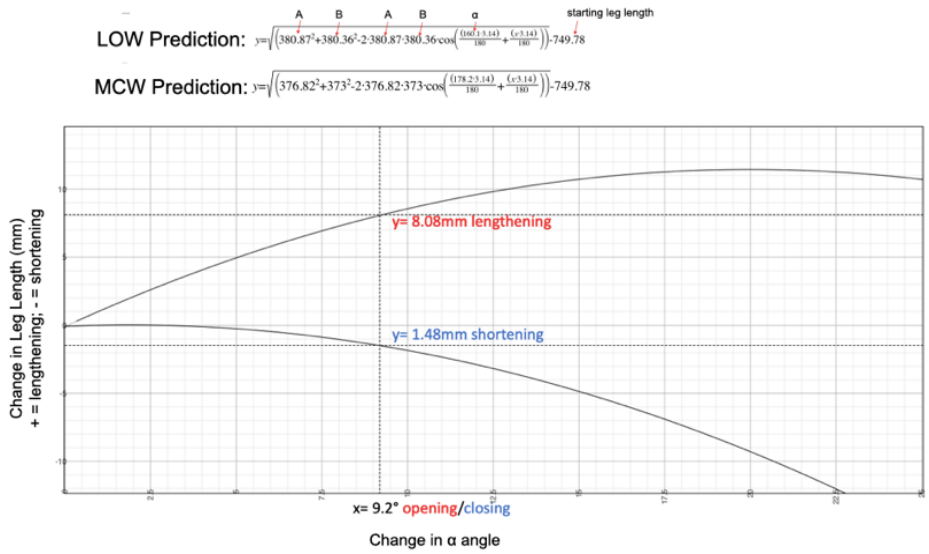

Figure 2. Demonstrating the differences in leg length changes after a LOW versus MCW DFO based on changes in the α angle for the patient in Figure 1. A change in α angle of 9.2° corresponds to an 8.08 mm increase in leg length for LOW as opposed to 1.48mm of shortening for MCW.