Opening wedge tibial osteotomy: the 3-triangle method to correct axial alignment and tibial slope


Abstract: BACKGROUND: Although a change in tibial slope may occur during a medial opening wedge osteotomy, calculations have not been defined to address this problem. The authors investigated geometric factors important to correct axial alignment and tibial slope during osteotomy. PURPOSE: To calculate, through 3-dimensional analysis of the proximal tibia, how the angle of the opening wedge along the anteromedial tibial cortex influences the tibial slope (sagittal plane) and valgus correction (coronal plane) during osteotomy, and to analyze the different radiographic methods reported in the literature to measure medial and lateral tibial slope. The authors postulated that differences in reported normal values of tibial slope in the sagittal plane were technique dependent. STUDY DESIGN: Descriptive laboratory study.

METHODS: The proximal anteromedial tibial cortex obliquity on magnetic resonance imaging was measured in 35 knees. Serial computed tomography images of the proximal tibia were digitized, allowing a series of virtual opening wedge osteotomies to be performed. Algebraic calculations defined the effect of an opening wedge osteotomy on the anteromedial tibial cortex opening wedge angle, sagittal tibial slope angle, and coronal valgus alignment. RESULTS: The anteromedial tibial cortex oblique angle at the medial osteotomy site was 45 degrees +/- 6 degrees and determined, along with the degrees of valgus correction, the degrees of the opening wedge angle in the oblique plane. The anterior osteotomy gap at the tibial tubercle was generally one half of the posteromedial gap to maintain the normal sagittal tibial slope. Every millimeter of gap error at the tibial tubercle resulted in approximately 2 degrees of change in the tibial slope. The width of the buttress plate along the anteromedial tibial cortex was 2 to 3 mm less than the computed coronal valgus posteromedial osteotomy gap to achieve tibiofemoral valgus correction.

CONCLUSIONS: A series of measurements preoperatively and intraoperatively are required to obtain the desired correction of tibial slope and valgus alignment.