

In Tibial Plateau Fracture Patients, the Contralateral Knee Serves as a Better Anatomical Template to Restore Articular Height and Width than Historical Norms

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INTRODUCTION: Restoration of pre-injury knee anatomy, i.e. anatomic reduction, is a goal of tibial plateau fracture management. Condylar width and articular height are anatomic parameters commonly considered. Historical unscientific literature suggests the lateral articular surface is higher than the medial, and tibial condylar width is typically equal to femoral condylar width. However, these anatomic relationships may not be universally true for all patients. This study determined variation in articular height and tibial condylar width between patients and determined if an individual's contralateral uninjured knee would be an accurate template for the injured knee.

METHODS: After IRB approval, calibrated bilateral whole-body standing AP radiographs from 2018-2022 were retrospectively reviewed. Patients with knee pathology or malrotated images were excluded. Relative heights of medial and lateral articular surfaces and relative width of the tibial plateau and femoral condyles were measured. Patient-to-patient and side-to-side differences were evaluated.

RESULTS:

206 patients met eligibility. A random sample of 30 patients was analyzed (mean age 44 years (18-65)).

Patient-to-Patient Variation: The lateral tibial articular surface ranged from 1.5mm lower to 7.7mm higher than the ipsilateral medial articular surface (average 3.6mm higher, SD=2.0mm). The lateral tibial condyle width ranged from 1.0mm narrower to 8.0mm wider than the femoral condyle (average 3.2mm wider, SD=1.8mm). The medial tibial condyle width ranged from 6.8mm narrower to 3.3mm wider than the femoral condyle (average 0.8mm narrower, SD=2.1mm).

Side-to-Side Variation: Compared to the medial, the left lateral tibial articular surface ranged from 3.6mm lower to 2.6mm higher than the right (average 1.0mm lower, SD=1.3mm). The left lateral tibial condyle ranged from 3.2mm narrower to 2mm wider than the right contralateral lateral tibial condyle (average 0.5mm narrower, SD=1.4mm). The left medial tibial condyle ranged from 4.8mm narrower to 3.4mm wider than the right contralateral medial tibial condyle (average 0.2mm narrower, SD=1.3mm).

DISCUSSION AND CONCLUSION: There is substantial patient-to-patient variation in tibial plateau anatomy. The contralateral knee can serve as an accurate anatomical template for articular height and width restoration in patients with tibial plateau fractures.

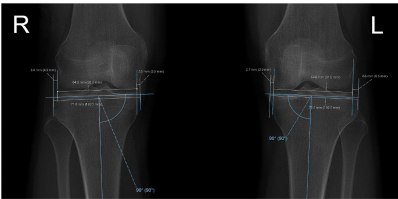


Figure 2: Case example of 18-year-old female with differences in contralateral and ipsilateral anatomy. The left medial tibial condyle is 0.2mm wider than the right tibial condyle (2.7mm-2.5mm=0.2mm). The left lateral tibial condyle is 1.2mm wider than the right lateral tibial condyle (4.6mm-3.4mm=1.2mm).

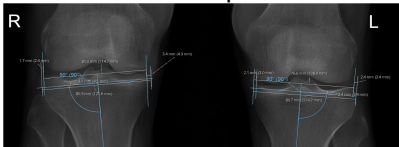


Figure 1: Case example of 31-year-old male with differences in contralateral and ipsilateral anatomy.

Table 1			
Variables	N (%)	Mean (SD)	Range
Total Patients	30		
Sex			
Male	12 (40%)		
Female	18 (60%)		
Age	44 (15.7)		18-66
BMI	26.4 (6.1)		17.9-43.6

Table 1: Cohort baseline patient characteristics