

Intraoperative Comparative Femoral Rotation Imaging: Are We Getting It Wrong?

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Purpose: Treatment of diaphyseal fractures require reestablishing length, alignment, and rotation to maximize functional recovery. Numerous fluoroscopic methods to assess femoral rotation exist, and almost all involve obtaining comparative imaging of the uninjured femur using the distal condyles to create a femoral reference position. As comparative imaging is typically obtained in the operating room at the time of surgery, the fluoroscopy base remains on the uninjured side for rotational imaging of both femurs. This results in the x-ray generator effectively being placed on different sides of each knee, likely resulting in differing magnification of the femoral condyles and potentially providing dissimilar rotational imaging. The purpose of this study is to determine the degree of malrotation that results from unequal femoral condyle magnification.

Methods: 12 fresh frozen lower extremity cadaveric specimens were studied. None of the specimens had evidence of prior knee surgery. The limbs were positioned on a radiolucent flat-top table and a fluoroscopy C-arm was brought in from the contralateral side. Imaging was obtained of the distal femur and the leg was rotated until the posterior femoral condyles appeared perfectly superimposed on the lateral view. The limb was then secured in this position with a clamp. A separate, yet identical, fluoroscopic C-arm was then brought in on the ipsilateral side of the limb and rotated until the 2 distal posterior femoral condyles appeared superimposed. This degree of rotational discrepancy between the 2 C-arm units was recorded.

Results: None of the 12 specimens had perfectly overlapping femoral condyles on both ipsilateral and contralateral fluoroscopic imaging at a horizontal position. The mean rotational difference between the 2 C-arms for each specimen was 6.1° (range, $2-13^\circ$).

Conclusion: We found that distal femoral condyle magnification occurs when comparing fluoroscopic imaging obtained from opposite sides. This magnification resulted in a mean difference of 6° . Therefore, keeping the C-arm on the same side of the patient when assessing the injured and uninjured femurs can result in as great as a 13° rotational discrepancy between sides even if the rotational imaging appears to be perfectly matched. We recommend performing rotational imaging of the uninjured extremity with the x-ray generator positioned similarly to how it will be used for the injured femur.