Femoral length on lateral knee radiographs influences accuracy of radiographic landmarks for MPFC reconstruction

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INTRODUCTION: Accuracy of femoral tunnel positioning is critical during medial patellofemoral complex (MPFC) reconstruction, as even 5mm of malpositioning has been associated with altered patellofemoral contact pressures. To help identify the appropriate position for femoral tunnel placement, Schottle and others have described radiographic landmarks to identify the MPFC footprint on lateral knee radiographs. These measurements are based on an extension of the posterior cortical line, which can vary based on the length of the femur visible on the radiograph. Because the scope of view can vary between intraoperative imaging modalities, the aim of this study was to assess the effect of femoral length on the accuracy of radiographic landmarks of the MPFC.

METHODS: In 9 unpaired cadaveric knees, the MPFC footprint was exposed on the medial femur, and the proximal and distal boundaries of the footprint were marked. Lateral fluoroscopic images of the knee were obtained and assessed in 1 cm length increments, beginning 1cm proximal to the posterior condyle and continuing proximally to a femoral length of 8 cms. The MPFC midpoint was described on each image relative to the posterior cortical line of the femur and a line perpendicular to this line, relative to the proximal margin of the posterior condyle. Linear regression analysis was used to assess the effect of femoral length on the radiographic position of the MPFC. ROC curve analysis and Delong test were used to determine ROC curve analysis and Delong test were used, and the minimum amount of femoral length required on radiographs to accurately identify an anatomic femoral tunnel was determined using Youden's J statistic.

RESULTS: Using the posterior cortical line as a reference, the radiographic description of the MPFC footprint moved anteriorly with decreasing femoral length on the radiographs, particularly at 4cm and less. However, no proximal-distal change was seen in relation to the line through the proximal margin of the posterior condyle with changing femoral lengths. Linear regression analysis showed a significant relationship between the femoral length and anterior radiographic position of the MPFC on radiographs ($R = 0.5$, $R^2 = 0.212$, $B= -0.636$, $p < 0.001$). The slope coefficient was -0.636 mm, indicating that for every cm decrease in femoral length, the actual anatomic footprint of the MPFC moves anteriorly by 0.636 mm in relation to the posterior cortical line. Furthermore, ROC curve analysis revealed that a minimum of 4 cm of femoral length on lateral radiographs is required to accurately localize the footprint of the MPFC (AUC 0.79; sensitivity 76.7 %; specificity 69 %; $p < 0.001$).

DISCUSSION AND CONCLUSION: The radiographic landmarks for the MPFC femoral footprint can change depending on the length of the distal femur visible on radiographs. We found that at least 4cm of the femoral shaft should be visible for the radiographic landmarks to be accurate. As fluoroscopy is frequently used intraoperatively for MPFC reconstruction, our findings may serve as a guide for accurate femoral tunnel placement.

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Figures:

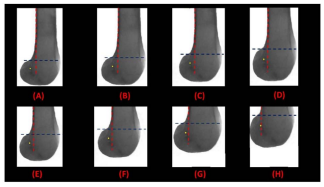

Figure 1. Lateral views of the knee with varying femoral length from the proximal margin of the posterior condyle. (A) Femoral length of 8cm. (B) Femoral length of 7cm. (B) Femoral length of 6cm. (B) Femoral length of 5cm. (B) Femoral length of 4cm. (B) Femoral length of 3cm. (B) Femoral length of 2cm. (B) Femoral length of 1cm. The red dashed line indicates the extension of posterior cortical line of the femur. The blue dashed line is perpendicular to the posterior cortical line and passes through proximal margin of the posterior condyle. The yellow dot indicates the midpoint of the medial patellofemoral complex.