Arthroscopically Pertinent Anatomy of the Anterolateral and Posteromedial Bundles of the Posterior Cruciate Ligament

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Introduction: There is growing evidence that knee cruciate ligament reconstruction achieves improved results with restoration of the native anatomy [1,2]. Despite the recognized importance of anatomic reconstruction tunnel placement, an accurate and reproducible method to guide tunnel placement for posterior cruciate ligament (PCL) reconstructions has not been developed. Arthroscopically pertinent details about the locations of the anterolateral bundle (ALB) and posteromedial bundle (PMB) of the PCL are required to accurately guide anatomic tunnel placement for PCL reconstructions. The purpose of this study was to both qualitatively and quantitatively describe the positions of the ALB and PMB of the PCL relative to arthroscopically relevant osseous and soft-tissue landmarks to improve anatomic PCL reconstruction tunnel placement.

Materials and Methods: Dissections were performed and arthroscopically relevant measurements of the ALB, PMB, meniscofemoral ligaments, and pertinent anatomical landmarks were taken on twenty non-paired fresh-frozen human cadaveric knees (average age, 46 years) using a three-dimensional electromagnetic tracking system as described previously [3]. In order to establish interobserver reproducibility of the measurements between the anatomic landmarks and center of the fiber bundles, five of the cadaveric specimens were completely remeasured by a second observer and interobserver interclass correlation coefficients (ICC) were calculated based on the repeated measurements.

Results: Qualitative analysis revealed a consistent pattern to the shape of the distal margin of the intercondylar notch. Several points along this margin were identified where the slope of the cartilage immediately changed direction in a consistent and definable manner (Fig. 1). The ALB femoral attachment was located between the articular cartilage and medial intercondylar ridge (MIR), and anterior to the medial bifurcate ridge. The PMB femoral attachment was distal to the medial intercondylar ridge, posterior to the medial bifurcate ridge, and often located between the anterior and posterior meniscofemoral ligaments. The average distance between the ALB and PMB bundle centers on the tibia was 8.9 mm (+/- 1.2). The perpendicular distance from the edge of the medial femoral condyle cartilage to the center of the ALB was 7.9 mm (+/-1.5), while to the center of the PMB it was 8.6 mm (+/- 1.9).

On the tibia (Fig. 2), the ALB occupied the anteromedial PCL facet, and was enveloped on its lateral and posterior sides by the PMB. The distance between the ALB and PMB bundle centers on the tibia was 8.9 mm (+/- 1.2). The lateral articular cartilage, the fibers of the posterior attachment of the medial meniscus, the medial groove, the bundle ridge, and the champagne-glass drop-off (CGD) were identified to be arthroscopic landmarks for the ALB and PMB tibial attachments.

The interobserver ICC for the repeated measurements between the described anatomical landmarks on five of the cadaveric specimens by the two separate observers was 0.995.

Discussion: The results of this study qualitatively and quantitatively describe the positions of the ALB and PMB relative to arthroscopically pertinent landmarks with the intention of assisting anatomical tunnel placement in single- and double-bundle reconstructions. We found that the thorough qualitative descriptions of the surrounding anatomy presented herein could be used to reliably locate the positions of the ALB and PMB. Additionally, the quantitative measurements provide further guidance for accurate tunnel placement.

Significance: The descriptions and measurements presented in this study can lead to improved anatomic single- or double-bundle tunnel placement during PCL reconstruction.

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