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**생체내에서 슬관절 굴곡시 후방십자인대 다발의 기능
Function of Posterior Cruciate Ligament Bundles During
In Vivo Knee Flexion**

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INTRODUCTION

In the double bundle technique, the tension in the 2 bundles changes reciprocally during knee flexion; that is, 1 bundle is taut in flexion whereas the other is taut in extension. However, much of the knowledge of the biomechanics of the PCL has been obtained from cadaveric investigations under either a passive load or simulated muscle loads. The PCL may function differently under in vivo physiologic conditions compared with its function measured in in vitro experiments. The biomechanical functions of the anterolateral and posteromedial bundles of the posterior cruciate ligament over the range of flexion of the knee joint remain unclear.

MATERIALS AND METHODS

Seven knees from normal, healthy subjects were scanned with magnetic resonance, and 3-dimensional models of the femur, tibia, and posterior cruciate ligament attachment sites were created. The lines connecting the centroids of the corresponding bundle attachment sites on the femur and tibia represented the anterolateral and posteromedial bundles of the PCL. Each knee was imaged during weight bearing flexion (from 0° to maximal flexion) using a dual-orthogonal fluoroscopic system. The length, elevation, deviation, and twist of the PCL bundles were measured as a function of flexion.

RESULTS

The lengths of the anterolateral and posteromedial bundles increased with flexion from 0° to 120° and decreased beyond 120° of flexion. The posteromedial bundle had

a lower elevation angle than the anterolateral bundle beyond 60° of flexion. The anterolateral bundle had a larger deviation angle than the posteromedial bundle beyond 75° of flexion. The femoral attachment of the PCL twisted externally with increasing flexion and reached a maximum of $86.4^\circ \pm 14.7^\circ$ at 135° of flexion ($P < .05$).

CONCLUSION

These data suggest that there is no reciprocal function of the bundles with flexion, which is contrary to previous findings. The orientation of the anterolateral and posteromedial bundles suggests that at high flexion, the anterolateral bundle might play an important role in constraining the mediolateral translation, whereas the posteromedial bundle might play an important role in constraining the anteroposterior translation of the tibia.

Key Words: Posterior cruciate ligament, in vivo kinematics, double bundle PCL reconstruction