Patellofemoral Research Excellence Award

Three-dimensional in vivo patellofemoral kinematics and contact area of ACL deficient and ACL reconstructed subjects using MR images

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Purpose
The purpose of this study was to test following hypotheses: 1) three-dimensional in vivo patellofemoral kinematics and contact area of ACL-deficient knees are different from those of normal, contralateral knees; 2) ACL reconstruction restores in vivo patellofemoral kinematics and contact area.

Methods
Ten ACL-deficient knees, nine ACL-reconstructed knees and their contralateral uninjured knees were tested. MRI was performed at full extension and 40° of flexion under weight bearing conditions. Six degrees of freedom patellofemoral kinematics, patellofemoral contact area, and contact location were analyzed using MR image-based 3D patellofemoral knee models.

Results
Reproducibility of all patellofemoral kinematic parameters, contact centroid translation, and contact area demonstrated less than 6.8% coefficient of variation. The patella in the ACL-deficient knees underwent significantly more lateral tilt during flexion (P<0.05) and tended to translate more laterally (P=0.083) than in contralateral knees. After ACL reconstruction, no kinematic parameters were significantly different from contralateral knees. Patellofemoral contact areas of ACL-deficient knees at both extended and flexed positions (37±22mm²; 357±53mm²) were significantly smaller than those of contralateral knees (78±45mm²; 437±119 mm²) (P<0.05). After reconstruction, patellofemoral contact area of ACL-reconstructed knees in the extended position (86±41mm²) was significantly larger (P<0.05) than that of contralateral knees (50±34mm²), but no difference in the flexed position.

Conclusions
ACL-deficient knees have altered patellofemoral kinematics and a smaller patellofemoral contact area. ACL-reconstructed knees restore patellar tilt to normal levels, but have a larger contact area in the extended position.