

## 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 ( $37 \pm 22 \text{mm}^2$ ;  $357 \pm 53 \text{mm}^2$ ) were significantly smaller than those of contralateral knees ( $78 \pm 45 \text{mm}^2$ ;  $437 \pm 119 \text{mm}^2$ ) ( $P < 0.05$ ). After reconstruction, patellofemoral contact area of ACL-reconstructed knees in the extended position ( $86 \pm 41 \text{mm}^2$ ) was significantly larger ( $P < 0.05$ ) than that of contralateral knees ( $50 \pm 34 \text{mm}^2$ ), 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.