

Running Biomechanics and Knee Cartilage Health in ACLR Patients

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ABSTRACT

Anterior cruciate ligament reconstruction (ACLR) patients are more likely to subsequently suffer from knee osteoarthritis than non-ACLR counterparts. Exercise is thought to influence articular cartilage, however, it is unclear how running biomechanics are associated with femoral cartilage thickness and composition in ACLR patients. **PURPOSE:** The purpose of this study was to investigate relationships between running biomechanics and measures of femoral articular cartilage condition (thickness and composition) in ACLR patients and control subjects. **METHODS:** We used ultrasound and MRI (T2 mapping sequence) to measure articular cartilage thickness and composition, respectively, for 20 ACLR patients (age: 23 ± 3 yrs; mass: 70 ± 10 kg; time post-ACLR: 14.6 ± 6.1 months) and 20 matched controls (age: 22 ± 2 yrs; mass: 67 ± 11 kg). After these measures, all participants completed a 30-minute run on a force-instrumented treadmill. Correlational analyses were used to explore relationships between running biomechanics (vertical ground reaction force (vGRF)) and femoral cartilage thickness and composition (T2 relaxation time). The present procedures were approved by the appropriate institutional board and all subjects provided informed consent before data collection was performed. **RESULTS:** Significant positive correlations existed for the control subjects only between peak vGRF and overall ($r = 0.34$; $p < 0.01$), medial ($r = 0.23$; $p < 0.01$), lateral ($r = 0.39$; $p = 0.02$), and intercondylar ($r = 0.31$; $p < 0.01$) femoral thickness. The ACLR patients showed significant negative correlations between T2 relaxation time for the central-medial region of the femoral condyle, and peak vGRF ($r = -0.53$; $p = 0.01$) and vertical impulse due to the vGRF ($r = -0.46$; $p = 0.04$). **CONCLUSION:** These findings offer some limited support for the idea that femoral articular cartilage benefits from increase vGRF during running. This is evidenced by the increased thickness for the control subjects and decreased T2 relaxation time (indicative of increased free-flowing water in the cartilage) for the ACLR patients, as running vGRF increased.