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The Relationship Between Neuroplasticity Associated With Anterior Cruciate Ligament Reconstruction and Patient reported Function

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The Relationship Between Neuroplasticity Associated With Anterior Cruciate Ligament Reconstruction and Patient reported Function

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Objective: To determine the relationship between brain activation changes for knee motor control after anterior cruciate ligament reconstruction (ACLR) and patient reported outcomes.
Design and Setting: Cross-sectional descriptive laboratory study.
Participants: Fourteen left ACLR participants (23.7±3.20 years, 1.80±0.08 m, 83.0±19.8 kg, Tegner activity level 6.75±2.0, 36±24 months post-surgery) and fourteen matched healthy controls (CON) (24.6±2.08 years, 1.74±0.06 m, 80.5±12.55 kg, Tegner activity level 6.75±2.0). Participants were matched on height, mass, extremity dominance, education level and physical activity level.
Intervention: All individuals completed the knee osteoarthritis outcomes scale (KOOS) and underwent a brain functional magnetic resonance imaging (fMRI) session during a knee motor task. The knee movement was block designed consisting of four repeated 30 second cycles of unilateral left (involved) knee extension\flexion from 45° flexion to 0° extension while lying supine in the MRI scanner. Brain activation patterns during movement were contrasted with an interspersed rest condition. The fMRI data were collected on a 3T Siemens Magnetom scanner with a sixteen channel array head coil with 90 whole brain gradient-echo scans every 3 seconds with slice thickness of 2.5 mm for 55 transversal slices. Before the functional run an anatomical 3-D high resolution T1 scan was taken for anatomical registration.
Main Outcome Measurement: The total KOOS score was extracted for analysis. Regarding the fMRI, the two groups were compared with a general linear model second-level fixed-effects paired analysis *a priori* threshold at p <.01 corrected. The mean signal change in the knee area of the primary motor cortex during knee movement relative to rest was the fMRI variable of interest for each participant. **Results:** ACLR participants had a significantly lower KOOS score (ACLR: 87.10±8.31; CON: 99.6±0.49; p=.03) and higher primary motor cortex activation (ACLR: 2.38±0.47; CON: 1.80±0.65; p=.02). KOOS score and mean motor cortex activation was correlated across the entire cohort (r=-0.421; p=0.026). **Conclusions:** The changes associated with neuromotor control after ACLR are associated with patient reported outcomes. Higher motor cortex activation to engage in knee movement was correlated with decreased KOOS score or poorer subjective patient function. The increased motor cortex activation may be due to adaptations in neuromuscular control after injury causing decreased function. This indicates that orthopedic rehabilitation should consider neuroplastic changes in addition to the typical strength and movement goals in therapy.

Key Words: Brain, neuromuscular, knee