Associations between knee kinematics during gait and quadriceps corticomotor excitability following anterior cruciate ligament reconstruction


Background: Impaired quadriceps function is associated with a more extended knee throughout the stance phase of gait in individuals with anterior cruciate ligament reconstruction (ACLR). This stiffened knee strategy may alter tibiofemoral loading and hasten joint breakdown and osteoarthritis development. Altered quadriceps corticomotor excitability may influence knee kinematic during gait; yet it is unknown if quadriceps corticomotor excitability associates with gait kinematics.

Purpose: To determine associations between quadriceps corticomotor excitability and sagittal plane knee kinematics during walking for ACLR individuals.

Methods: Thirty-three individuals with unilateral ACLR participated in this cross-sectional study (72% female, 22.2 ± 3.5 years; 72.5 ± 17.2 kg; 1.7 ± 0.1 m; 49.9 ± 40.4 months post-ACLR). Quadriceps corticomotor excitability was assessed as active motor threshold (AMT) from the vastus medialis of the ACLR limb using transcranial magnetic stimulation. Three dimensional biomechanics were collected during overground walking at a self-selected speed and extracted from the first 50% of stance. We evaluated sagittal plane knee kinematics for the current study including (knee flexion angle at heel strike [HS]; peak knee flexion angle; knee flexion excursion [peak angle – HS angle]). Partial Pearson product-moment correlations were used to assess associations between kinematic variables and corticomotor variables in the ACLR limb controlling for gait speed (α = 0.05).

Results: AMT was not associated with sagittal plane knee kinematics in the ACLR limb during walking (angle at HS $r = -0.13 \ P=0.47$; peak knee flexion angle $r = -0.22 \ P=0.22$; knee flexion excursion $r = -0.19 \ P=0.29$).

Conclusions: No associations were found between quadriceps corticomotor excitability and sagittal plane knee kinematics during gait in individuals with ACLR. Central pattern generators, and not cortical excitability, may more strongly influence gait kinematics. Further work is necessary to determine the influence of altered corticomotor excitability on other gait outcomes including kinetics and lower limb muscle activity patterns.