Association Between Tibiofemoral Cartilage Proteoglycan Density and Knee Joint Stiffness During Walking 1 Month Post-ACL Reconstruction

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Background: Individuals with a history of anterior cruciate ligament reconstruction (ACLR) are at a high risk of posttraumatic knee osteoarthritis due to aberrant gait biomechanics, such as knee joint stiffness (KJS). Early signs of cartilage deterioration are indicative of increased T1 relaxation time (T1rho), which signify decreased proteoglycan content. Prior studies have found significant correlation between increased T1rho values and maladaptive gait biomechanics at 6 months post-ACLR. It remains unclear if this association exists significantly at 1 month post-ACLR.

Purpose: This study aims to identify associations between proteoglycan content in tibiofemoral cartilage and knee joint stiffness in patients 1 month after anterior cruciate ligament reconstruction.

Methods: Subjects were 13 individuals with history of unilateral ACL rupture (54% male; age 23.5 ± 6.2 yrs; mass 71.29 ± 13.7kg; height 1.74 ± 0.09m). Peak internal knee extension moments and knee flexion angles were calculated during the first 50% of stance for each participant and knee joint stiffness was calculated by dividing the peak internal knee extension moment by peak knee flexion angle. Proteoglycan content of tibiofemoral cartilage was identified and analyzed via zero-millisecond spin lock image overlaid on a T1rho relaxation map. A partial Pearson correlation controlling for gait speed was conducted to analyze associations between T1rho values and knee joint stiffness.

Results: No significant associations were found.

Discussion: Many patients are limited in weight-bearing and ROM immediately post-ACLR, which will increase KJS values without increasing T1rho values. Associations may be further limited as 1 month may not be sufficient time for pathologies to develop and a relatively small sample size (n = 13) may not have captured real associations. Additionally, other methods of calculating knee joint stiffness are utilized and may be more appropriate in capturing existing associations at the 1-month time point.