Troy Blackburn Receives Grant From the Centers of Disease Control and Prevention via the UNC-CH Injury Prevention Research Center

Current knowledge of anterior cruciate ligament (ACL) injury mechanisms and causes of the higher injury rate in females is insufficient for determination of the appropriate factors to be targeted by injury prevention programs. The ACL is loaded and potentially injured via anterior tibial translation (ATT), and it has been suggested that greater ATT is indicative of a more unstable knee joint. This arthrokinematic motion lengthens the hamstrings muscles, generating tensile force which resists further lengthening, similar to a rubber band. Muscle stiffness refers to the ratio of change in resistive tensile force to change in muscle length (Δ Force/Δ Length). Thus for a given change in hamstring length produced by ATT, stiffer hamstrings will respond with a greater increase in resistive tensile force, potentially limiting ATT and ACL loading. However, the direct influence of hamstring stiffness on knee joint stability has not been investigated.

This investigation will evaluate the influence of hamstring stiffness on knee joint stability in 50 males and 50 females. Knee joint stability will be quantified as the amount of ATT resulting from a standardized knee joint perturbation using a custom-built device. Hamstring stiffness will be measured from the damping effect imposed by the hamstrings on oscillatory knee flexion/extension. Correlational analyses will be used to evaluate the relationship between hamstring stiffness and ATT, while one-way ANOVA will be used to evaluate sex differences in ATT. Finally, ANCOVA will be used to evaluate the influence that hamstring stiffness (covariate) has on the sex difference in ATT.

We hypothesize that greater hamstring stiffness will be associated with lesser ATT. As our previous work indicates that hamstring stiffness is greater in males than in females, we hypothesize that the lesser hamstring stiffness observed in females will result in greater ATT, but that this sex difference will be minimized after accounting for the influence of hamstring stiffness. As muscle stiffness can be altered via training and rehabilitation, these results may inform the development of future prospective injury prevention efforts to determine the ability to reduce ACL injury risk via enhancement of hamstring muscle stiffness.