How Does the Secondary Task of Heading a Soccer Ball Impact Jumping Kinematics and Kinetics?

Braydon Lazzara, Dr. Tomas Barrett

Abstract

Noncontact anterior cruciate ligament (ACL) injuries are on the rise in the US, with more than 127, 000 ACL reconstructive surgeries being performed annually[1]. Specifically, in the athletic population over 120,000 ACL tears occur every year[2]. Soccer has not been immune from such increases in prevalence, and this has led to a substantial increase in research to understand the injury mechanics and how athletes can be screened to identify those at risk.

Research has previously been conducted to examine how jump landing mechanics can predict those that are susceptible to an ACL tear[3-10]. Drop jumps have been performed to see differences in landing mechanics between sand and firm ground, firm ground and surprise landing (floor breaks), and between female athletes vs non-athletes[4-6]. While some of these were prospective studies did identify associations between 3D kinematic data and future knee injury, they may not be maximizing external validity as the jump tasks performed do not mimic those seen in the athletes sport. While participating in competition, athletes are not asked to perform simulated jumps that are not relevant to their sport. Athletes instead execute secondary tasks while performing these jumps that may distract from proper landing form. Research has been conducted to assess how the secondary task of counting and retaining numbers impact jumping performance[11-12]. The findings showed that a secondary task did impact jump landing kinematics, identified as movement patterns that increased the risk of an ACL tear[11-12]. As this secondary task was not sport specific, here we ask what if the secondary task assigned was specific to their sport? To the author's knowledge, no study has examined the impacts of a specific sports secondary task on jumping kinematics and kinetics. The present study will examine how the secondary task of heading a soccer ball will impact jumping and landing kinematics and kinetics, and how this may affect variables associated with increased ACL injury risk.

This research is currently in data collection phase which will end in mid-March. Previous research has identified increased knee valgus, knee internal rotation, hip adduction, and decreased hip and knee flexion during landing as the variables which are strongly associated with injury[13]. To assess these variables, participants will perform eight jumps in an eight Vicon camera motion lab. Fourteen-millimeter diameter reflective markers are placed on the participants lower body following the Conventional Gait Model 2.3 landmarks and trials are collected via Vicon NEXUS software. The trials performed include two jumps with and without the secondary task of heading a soccer ball, and two drop jumps (from a 0.3m box) with and without the secondary task of heading a soccer ball. Ground reaction force data is collected using AMTI force plates. Each foot is on a different force plate, allowing for the identification of any asymmetries between the two limbs. If the findings of this study highlight differences in the aforementioned variables with the addition of a secondary task, this may suggest using secondary tasks to increase the higher predictive value of such analyses.