

# **Hip adduction, not hip internal rotation, dictates knee motion related to ACL injury during cutting maneuvers.**

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## **INTRODUCTION**

The mechanisms behind ACL tears may be related to lower extremity motions in the coronal, sagittal, and transverse planes. However, only motions and torques in the coronal plane are directly related to increased risk of ACL injury. The purpose of this study was to investigate lower extremity kinematics during cutting tasks to determine the effects of increased rotation on resultant coronal plane kinematics. The hypothesis was that the cut at a 90° angle (90° cut) would induce greater internal hip and knee rotation when compared to the cut at a 45° angle (45° cut). We further hypothesized that the increased rotation induced by the 90° cut would be related to increased knee abduction measures.

## **METHODS**

Nineteen female soccer players ( $17.6 \pm 2.1$  years,  $165.6 \pm 8.2$  cm,  $60.2 \pm 5.6$  kg) were recruited for 3-D biomechanical testing. The subjects were instructed to jump across a line and cut at the appropriate angle (known prior to task) and in the appropriate direction (designated by a randomized unanticipated computer arrow shown 0.3 seconds after initiation of the jump). Lower extremity kinematic measures were taken at peak force during landing phase. A repeated measures MANOVA, a *post-hoc* univariate analysis, and a stepwise multiple linear regression were used to determine kinematic differences between the cut angles and determine their relationship to resultant knee abduction angles.

## **RESULTS**

A significant difference was observed between the 45° cut and the 90° cut with all dependent variables included within the repeated measure MANOVA ( $F_{(6,32)}=21.7, P<0.001$ ). Hip internal rotation ( $P<0.001$ ) and knee internal rotation ( $P=0.008$ ) during 90° cut were significantly greater than the 45° cut. Mean hip flexion ( $P<0.001$ ) was also greater in the 90° cut. The only significant predictor of knee abduction was hip adduction, which predicted ( $R = 0.49$ ) knee abduction angles during both tasks.

## **CONCLUSION**

The results of this study indicate that the mechanisms underlying knee abduction measures demonstrated by female athletes during cutting tasks are not dictated by lower extremity transverse plane rotations. Rather, it appears that coronal plane motions at the hip in part mediate knee abduction. Strategies to prevent knee abduction in female athletes should focus on the control of hip abduction.