

Injury Rate Ratio and Knee Load Threshold Related to Increased Risk of Knee Injury

Myer GD^{1,2,3}, Ford KR^{1,2}, Chaudhari AM³, Hewett TE^{1,2,3}

¹Cincinnati Children's Hospital Medical Center, Division of Sports Medicine, Cincinnati, Ohio

²Department of Pediatrics, College of Medicine, University of Cincinnati

³The Ohio State University Sports Medicine, The Ohio State University

ABSTRACT

Patellofemoral dysfunction and resultant pain symptoms (PFP) and Anterior Cruciate Ligament (ACL) injuries are major concerns in the young athlete that lead to potential long-term consequences for health and physical activity. Young women experience both PFP and ACL injury 2-10 times more often than males. Decreased motor control during physical activities results in excessive knee abduction moment load that may increase risk of acute ACL injury and chronic PFP in females. To determine the load thresholds that are associated with increased risk of ACL or PFP injury by comparison of injury incidence rates to knee abduction moments during landing (KAM). KAM was assessed in middle and high school female basketball, volleyball, and soccer athletes prior to their competitive seasons and subsequent injuries were recorded through the season (n=145 for PFP, n=205 for ACL). Logistic regression analyses determined KAM threshold scores that provided the maximal sensitivity and specificity for prediction of PFP and ACL injury risk. The cumulative incidence rate for new PFP was 2.2x greater (95% CI 1.11 to 4.34) relative to ACL injury when normalized per 100 athlete seasons (PFP 9.7 vs. ACL 4.4). Regression analysis indicated that PFP risk increased in athletes with $KAM > 15.4$ Nm, while ACL injury risk increased with $KAM > 25.3$ Nm. Females who demonstrate $KAM > 15.4$ Nm may be at increased risk for development of PFP and those with $KAM > 25.3$ Nm may be at increased risk for both PFP and ACL injury. The increased incidence of PFP relative to ACL injury is likely associated with the reduced threshold of KAM for increased injury risk. Focused pre-season exercise intervention may be warranted for females who land with $KAM > 15$ Nm, while those females who land with $KAM > 25$ Nm may benefit from increased treatment dosage gained from both pre-season and in-season neuromuscular training.