Mass Screening of Youth Athletes for High Risk Landing Patterns using a Portable and Inexpensive Motion Sensor Device

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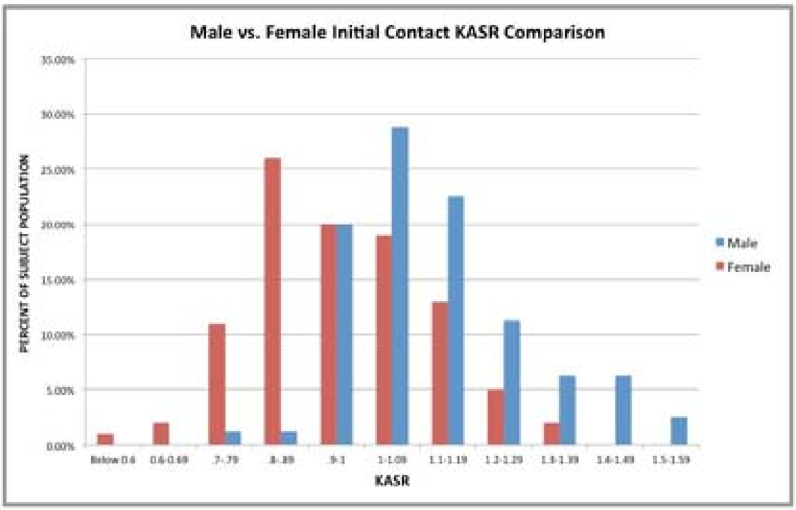
Objectives: Biomechanical factors such as dynamic knee valgus predispose young athletes to lower extremity injury including tears of the anterior cruciate ligament (ACL). Identifying these risk factors may allow for targeted injury prevention strategies. Our prior work has validated the Microsoft Kinect vs. Vicon to detect knee-ankle separation ratio (KASR) during the drop vertical jump test (DVJ). Our hypothesis is that screening with the Microsoft Kinect will be safe, efficient, and provide information to help detect injury risk in youth athletes.
Methods: A total of 180 healthy high school athletes, ages 14-18 (80 males and 100 females, age of 16.9 ± 1.31 and BMI of 22.8 ± 3.7) participated in this study. Each subject performed three successful DVJ (Fig. 1). We used an inexpensive, portable motion sensor device to measure the KASR, which captures the ratio of the horizontal distance between knees to the horizontal distance between ankles. From previous studies, a KASR value <1 indicates dynamic valgus, while being below 0.6 is considered severe risk. Demographic information and measurements for KASR on initial contact and peak flexion were analyzed statistically.
Results: Using two motion sensor device stations, it took 1.5 minutes to screen and test each subject. There were no injuries that occurred during the screening process. Our results showed a statistically significant difference between male and female KASR for both initial contact ($p<0.001$) and peak flexion ($p<0.001$). Sixty out of the 100 female subjects (60%) tested positive for valgus (9 initial contact KASR, 1 peak flexion KASR, 50 both initial contact and peak flexion KASR) with two subjects screening for severe risk (KASR<0.6). The average KASR for females was 1.01 (peak flexion) and 0.967 (initial contact). Eighteen out of the 80 male subjects (22.5%) tested positive for valgus (6 initial contact KASR, 2 peak flexion KASR, 10 both initial contact and peak flexion KASR) with no male subjects screening positive for severe risk. The average KASR for males was 1.26 (peak flexion) and 1.13 (initial contact). Comparing males and females that screened positive for KASR, there was a significant gender difference between the KASR at initial contact with females exhibiting more valgus than males ($p<0.001$) (Table 1).
Conclusion: Our findings suggest that a portable and inexpensive motion analysis device can detect dynamic valgus during the DVJ in youth athletes. Large scale screening for dynamic valgus was safe and efficient. Known gender disparities between male and females for neuromuscular imbalances were identified. Potential use of this information for targeted injury prevention is appealing and requires further investigation.



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