DIFFERENCES IN NEUROMUSCULAR CONTROL STRATEGIES WITH LANDING AND CUTTING BIOMECHANICS IN FEMALE BASKETBALL AND SOCCER PLAYERS

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INTRODUCTION

Soccer and basketball account for the majority of all ACL injuries. Female soccer and basketball are 4-6 times more likely to sustain a noncontact ACL injury compared to males participating in the same sport. Female high school basketball players injure their ACL more often while jumping/landing (60%) than soccer players (25%). The ACL injury mechanism in soccer appears to occur during a quick change of direction or twisting maneuver more often than during a landing. Sport-specific injury prevention programs should target the injury mechanisms found in individual sports.

The purpose of this study was to compare the mechanics of jumping and cutting movements in female basketball and soccer players. The hypothesis was that female basketball and soccer players would demonstrate different neuromuscular control patterns when performing jumping and cutting tasks. More specifically, basketball players would have greater valgus knee moments and angles and increased ground reaction forces compared to soccer players during a drop vertical jump (DVJ) maneuver. Conversely, soccer players would have increased force, moments and motion during the unanticipated cutting task (CUT).

These different biomechanical and neuromuscular control strategies help explain the sport specific ACL injury mechanisms that exist between female basketball and soccer players.

METHODS

Thirty high school female athletes participated in this study (basketball: N=15, age 15.1 ± 1.7 yrs, years experience 6.9 ± 2.2 yrs, height 165.3 ± 7.9 cm, weight 61.8 ± 9.3 kg; soccer: N=15, age 14.8 ± 0.8 yrs, years experience 8.8 ± 2.5 yrs, height 161.8 ± 4.1 cm, weight 54.6 ± 7.6 kg). Subjects were included within the study if they listed basketball or soccer as their only sport of participation. Thirty high school female athletes participated in this study (basketball: N=15, age 15.1 ± 1.7 yrs, years experience 6.9 ± 2.2 yrs, height 165.3 ± 7.9 cm, weight 61.8 ± 9.3 kg; soccer: N=15, age 14.8 ± 0.8 yrs, years experience 8.8 ± 2.5 yrs, height 161.8 ± 4.1 cm, weight 54.6 ± 7.6 kg). Subjects were included within the study if they listed basketball or soccer as their only sport of participation. Thirty-two reflective markers were placed on each athlete and movement was recorded for two tasks using a motion analysis system consisting of eight digital cameras (Eagle cameras, Motion Analysis Corporation). Two force plates (AMTI) were time synchronized with the motion analysis system. The first task was a DVJ off a 31 cm box onto two force plates with an 45 degree angle. The direction of the cut was randomly displayed 0.3 seconds after the athlete initiated movement. 3 trials were collected for the DVJ and 3 trials for each direction of the CUT. A 3-way ANOVA was used to analyze the interaction between sport (basketball-soccer), task (jump-cut) and side (dominant-nondominant) in SPSS (P < 0.05).

RESULTS

Several key differences were found in the way each group performed the two maneuvers. For example, basketball athletes, compared to soccer, had greater VGRF (task * sport, p<0.001) and decreased stance time (task * sport, p=0.001) during the jump (Figure 1). Soccer players showed the same tendency during the cut with greater VGRF (task * sport, p<0.001) and decreased stance time (task * sport, p=0.001) (Figure2). Measures of knee valgus were high for both groups of female athletes, however they were not different between sports. During cutting, both sports had greater external valgus moments (p=0.032) and angles (at initial contact and maximum (p=0.02, p=0.012)) compared to the DVJ. A side-to-side difference existed during the cut with greater valgus moments (p=0.006) on the dominant side.

DISCUSSION

Both groups of female athletes shared characteristics that may put them at risk for a noncontact ACL injury, especially during the cut. The valgus moments and angles were greater during cutting with a side-to-side difference in external valgus moments in both sports. Basketball and soccer players, however, did show differences in how they performed the tasks. Basketball players had a shorter stance time and VGRF during the DVJ, whereas soccer players had a shorter stance time and VGRF for the CUT. The higher forces over a shorter time period may allow an athlete to perform the skill more quickly, but may concomitantly increase the risk for injury due to the higher forces and moments. Although female basketball and soccer players share certain injury risk factors, they demonstrate differences in the way they perform the two major maneuvers associated with noncontact ACL injuries. Further research is required to explore the possibility that the differences in performance in these tasks between sports may be related to different mechanisms of noncontact ACL injuries. In addition, injury prevention programs for female athletes should include both landing and cutting technique training with a focus on reducing valgus knee moments and motion. The differences between single-sport athletes demonstrated in this study may warrant the investigation in sport-specific neuromuscular training programs for these athletes.

REFERENCES


51st Annual Meeting of the Orthopaedic Research Society
Poster No: 0556