TACSM Abstract

Isokinetic Knee Strength is Associated with Knee Landing Kinematics during Double-Leg Vertical and Depth Jumps

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ABSTRACT

Muscular deficiencies, imbalances, or incorrect mechanics in jumping and landing may result in significant knee ligament strain and increased risk for injury in athletes. PURPOSE: This study aimed to identify possible associations between isokinetic knee flexion and extension strength and peak knee flexion and knee adduction landing angles during multiple jumping tasks. We hypothesized that males and females with greater quadriceps and hamstrings strength would land with greater peak knee flexion and less knee adduction. METHODS: After signing informed consent or adolescent assent forms approved by the committee for the protection of human subjects, eighteen participants (8 female; 10 male) volunteered for this project (24.4±8.7 y; 68.3±18.3 kg; 166.5±15.3 cm).The testing session began with anthropometric measurements of the subjects' height, weight, and lean body mass. Following a standardized cycle warm-up, participants were outfitted with a lower-body marker set and 3D motion capture data were collected during two countermovement vertical jumps (CMVJ) and depth jumps from a small, 30-cm box (SBDJ) and large, 46-cm box (LBDJ). Isokinetic knee flexion-extension peak torques were then collected at 60˚/sec and 240˚/sec. Pearson correlation coefficients were computed between the peak flexion-extension torques at each angular velocity and peak right knee flexion and adduction landing angles. Alpha was set at a critical level of $p<0.05$. RESULTS: Strength in the quadriceps at 60˚/sec was significantly correlated with peak knee flexion angles in the CMVJ (r=0.41), SBDJ (r=0.41), and LBDJ (r=0.39) and with peak knee adduction angles in each jump: CMVJ (r=0.47), SBDJ (r=0.61), and LBDJ (r=0.43). Hamstrings strength at 60˚/sec was significantly correlated with knee flexion angles in the CMVJ (r=0.45), SBDJ (r=0.44), approached significance in the LBDJ (r=0.38), trended towards significance with knee adduction in CMVJ (r=0.35), and significantly correlated with knee adduction in SBDJ (r=0.62) and LBDJ (r=0.43). Strength in the quadriceps at 240˚/sec was not correlated with knee flexion angles in CMVJ (r=0.30), but correlated with knee flexion in SBDJ (r=0.47) and LBDJ (r=0.43), did not correlate with knee adduction in CMVJ (r=0.30), but significantly correlated with knee adduction in SBDJ (r=0.60) and LBDJ (r=0.41). Strength in the hamstrings at 240˚/sec was not correlated with knee flexion angles in the CMVJ (r=0.32), but there was an association with knee flexion in SBDJ (0.50) and LBDJ (0.43) and with knee adduction in each jump: CMVJ (r=0.39), SBDJ (r=0.68), and LBDJ (r=0.49). CONCLUSIONS: Our results suggest that quadriceps and hamstrings strength may be a better predictor of peak lower extremity landing angles in small- and large-box depth jumps than the CMVJ; these associations are stronger at fast, compared to slow, isokinetic velocities. Strength and rehabilitation professionals should focus training on high velocity strength development in the quadriceps and hamstrings which may allow better knee stabilization and reduce ligament strain during the dynamic landings of jumping activities.