The Relationship between Trunk Kinematics and the Dynamic Postural Stability Index


Context: The inability to maintain trunk position during landing tasks has been established as a risk factor for lower extremity (LE) injury. Decreased trunk forward flexion and increased lateral flexion (LF) are indicators of risky movement patterns negatively affecting the ability to maintain or return the body’s center of mass over a base of support during dynamic tasks. Establishing the relationship between trunk kinematics and dynamic postural stability, measured with the Dynamic Postural Stability Index (DPSI), is an important first step in determining the role of trunk kinematics on balance during sport-specific activities. Objective: To determine the relationship between trunk kinematics and DPSI, during forward (FJL) and sideways (SJL) jump landings. Design: Descriptive cohort study Setting: Sports medicine research laboratory Participants: A total of 20 healthy and physically active males and females (age: 24.0±2.8 years, height: 173.0±10.5 cm, weight: 70.1±12.6 kg) participated. Interventions: Trunk kinematics and ground reaction forces were collected at 250Hz and 1500Hz, respectively, utilizing a passive marker set with a motion capture system and force plate. Subjects performed a minimum of three practice trials and five successful test trials for each JL. The FJL was assessed at 40% of the subject’s height with a 30.48cm hurdle at the midpoint of the distance; SJL was assessed at 33% of the subject’s height and a 15.24cm hurdle. Subjects jumped off two-feet, landing only on the dominant leg, and maintained balance for five-seconds following landing. Main Outcome Measures: Trunk kinematics (absolute values of forward flexion/extension [FFE], and LF) were assessed at initial contact (IC), 150ms prior to and 150ms following IC, and as total excursion (TE=max-min) during the landing phase of JL. Thorax angles were calculated relative to the global coordinate system, spine angles relative to the pelvis. For both tasks, DPSI composite and component scores in the anterior/posterior (APSI), medial/lateral (MLSI), and vertical (VSI) were calculated. All data were assessed for normality. If normally distributed, Pearson correlation coefficients were calculated; if normality was violated, Spearman Rho correlation coefficients were calculated. Significance level of <0.050 was established a priori. Results: During the FJL significant positive correlations were observed between APSI and spine FFE at IC (r=0.450,p=0.046). Additionally, MLSI was significantly positively correlated with: spine LF TE, thorax LF TE, and FFE TE, (r=0.514-0.724,p<0.050). No significant correlations were observed during SJL. Conclusions: These results demonstrate that during FJL decrements in DPSI are related to increased movement away from a neutral spine position in the direction of FFE and LF. The identification of these characteristics should help guide future research to determine the relationship between these trunk kinematics and proper landing mechanics. Once this relationship has been established the role of trunk kinematics on balance during sport-specific tasks can be properly addressed. Word Count: 450