ABSTRACT BODY:

Introduction: Laboratory measures of postural stability (PS) typically incorporate force measurement platforms which provide high fidelity but can be expensive and lack portability. Clinical measures of PS typically do not include dynamic balance measurement conditions and may not have the resolution needed to discriminate risk of injury in athletic populations. A compromise between the two is necessary to provide high resolution and the portability necessary for large-scale studies in athletic populations. Accelerometers are easy to use, portable, and have greater resolution compared standard to clinical measures. The purpose of this study was to examine the ability of a 3D accelerometer to quantify relevant static and dynamic PS measures.

Methods: Data were collected on thirteen healthy, physically active male subjects (age 24.3±4.1 years; height 176.8±4.6 cm; weight 76.2±9.4 kg) defined by participating in physical activity at least three days per week for thirty minutes per session. Written informed consent was obtained for all subjects and all procedures were approved by the Institutional Review Board. Force plate and accelerometry measures were collected concurrently while individuals performed eight static and two dynamic PS tasks in order to effectively examine the capability of an accelerometer to measure PS. The static PS tasks included single and double-leg stance conditions (eyes open and closed). The standard deviation of the ground reaction forces (GRF) were calculated during 3 ten-second trials for the static PS. Dynamic PS was assessed during a forward and lateral jump-landing maneuver. A tri-axial ±16g accelerometer was placed over the approximate center of mass and synced with force plate data. The root mean square (RMS) for was calculated from accelerometer data. Kruskal-Wallis test was used to determine the ability to distinguish between tasks and Spearman’s ranked correlations to determine the relationship between the force plate and accelerometer measures (alpha = 0.05).

Results: Postural stability scores calculated from the force plate data were significantly different across the static tasks and between static and dynamic tasks (p ≤ 0.001). Postural stability scores calculated from the accelerometer data were significantly different across the static tasks and between static and dynamic tasks (p ≤ 0.001). Force plate and accelerometer scores were significantly correlated with weak to moderate correlations (rho = 0.40–0.77, p ≤ 0.001).

Discussion: The results demonstrated the ability of an accelerometer to distinguish between static and dynamic postural tasks and it was correlated with force plate measures. This indicates that an accelerometer is a valid tool for measuring postural stability as utilized in this study. Additionally, accelerometer scores offer greater resolution of postural stability because they are continuous measures where some traditional clinical measures, such as the Balance Error Scoring system, are Ordinal.

Significance: Accelerometers provide valid measures of postural stability that is easy to use, portable, and has greater resolution than traditional clinical measures. This technology should enable researchers to collect higher resolution postural stability data in the field and in the clinic.

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