

A Lack of Correlation between Static and Dynamic Measures of Postural Stability

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Introduction: Static balance has been used to assess postural stability (PS) and potential predisposition to injury; yet, female athletes, who are at greater risk for noncontact anterior cruciate ligament injury (ACL), demonstrate better single-leg static balance than male athletes. A dynamic functional assessment of balance seems indicated although the relationship between dynamic and static measures of PS has yet to be quantified. The purpose of this study is to determine if a relationship exists between static and dynamic single-leg measures of PS in physically active females. It is hypothesized that no relationship exists. **Methods:** A total of eight physically active females (age: 21.5 ± 0.8 yrs, mass: 62.3 ± 7.9 kg, height: 165.6 ± 5.4 cm) volunteered. Subjects reported no history of lower extremity surgery and no lower extremity injury within six months prior to testing. Postural stability was assessed using two static single-leg balance tasks (eyes open and eyes closed), and two dynamic balance tasks (anterior-posterior (AP) and medial-lateral (ML) jump). Static balance included right leg stance with hands on hips. Dynamic balance included a double-leg jump, single-right leg land, and attempt to stabilize quickly on one leg. Once stabilized subjects placed their hands on their hips and maintained single-leg balance for an additional 10s. Jumps were performed over a 12" (AP jump) or 6" (ML jump) hurdle placed halfway between the force plate and a jump distance normalized to % subject height, 40% for AP and 33% for ML. Vertical, AP and ML ground reaction forces (GRFs) were collected using a force plate. For static balance, standard deviation (stdev) for each GRF was averaged across three 10 s trials. For five dynamic balance trials, mean postural stability indices were calculated using GRFs identified within the first three seconds post initial contact. Index calculations are as follows: AP stability index (APSI) = $[\sqrt{(\sum (0 - \text{GRF}_{x_i})^2)}] / \text{body weight}$, ML stability index (MLSI) = $[\sqrt{(\sum (0 - \text{GRF}_{y_i})^2)}] / \text{body weight}$, vertical stability index (VSI) = $[\sqrt{(\sum (\text{body weight} - \text{GRF}_{z_i})^2)}] / \text{body weight}$. A series of 12 bivariate correlations were computed between the vertical, AP, and ML measures across dynamic and static balance assessments. An alpha level of 0.05 was set a priori to determine significant correlations. **Results:** None of the 12 computed Pearson correlation coefficients achieved statistical significance (p-value range = .06 to 0.937, correlation coefficient range = - 0.44 to 0.69). **Discussion:** Postural stability testing provides important insight into the underlying sensorimotor control mechanisms necessary for dynamic joint stability. The results of this study indicate that no relationship exists between the static and dynamic measures of PS tested suggesting that a dynamic assessment of PS may be a more functional assessment for risk of ACL injury. **Conclusion:** Future studies examining risk factors and modification of risk factors for noncontact ACL injury should incorporate a dynamic measure of postural stability.