

Original Research

Relationship Between the Kinematics of the Trunk and Lower Extremity and Performance on the Y-Balance Test

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Abstract

Background: The lower quarter Y-balance test (YBT-LQ) has been recommended as a measure of dynamic postural control in the clinical setting; however, information about the relationship between performance on the YBT-LQ and joint kinematics is limited. Thus, the kinematic predictors responsible for performance on the YBT-LQ need to be identified for accurate evaluation of dynamic postural control.

Objectives: To identify the kinematic predictors that best explain variance in performance on the YBT-LQ.

Design: Cross-sectional design.

Setting: University motion analysis laboratory.

Participants: Thirty physically active participants.

Methods: All participants performed the YBT-LQ. The kinematics of the trunk and lower extremity at maximal reach in each direction of the YBT-LQ were monitored using a 3-dimensional motion analysis system.

Main Outcome Measurements: The correlations between reach distance and joint kinematics were assessed using Pearson's correlation coefficient, and the best predictors of performance on the YBT-LQ were determined using a stepwise multiple regression analysis.

Results: Ankle dorsiflexion was the best single predictor of normalized reach in the anterior direction of the YBT-LQ ($r^2 = 0.50$), and the combination of ankle dorsiflexion and trunk extension explained 65% of the variance in the anterior normalized reach. Hip flexion was the best single predictor of posteromedial ($r^2 = 0.60$) and posterolateral ($r^2 = 0.71$) normalized reaches of the YBT-LQ. The combination of hip flexion and ipsilateral trunk bending and the combination of hip flexion and contralateral trunk bending accounted for 69% and 80% of the variance in the posteromedial and posterolateral normalized reaches of the YBT-LQ, respectively.

Conclusions: These findings provide useful information on the relative contribution of joint kinematics to performance on the YBT-LQ when evaluating dynamic postural control.

Introduction

Performance under unilateral weight-bearing conditions, including the star excursion balance test (SEBT) [1,2] and lower quarter Y-balance test (YBT-LQ) [3,4], has been used frequently to assess dynamic postural control in the clinical setting. In the SEBT, individuals reach maximally with the nonstance limb and touch a point along each of eight lines spaced 45° apart without weight support upon touch-down under the unilateral weight-bearing condition [5]. However, it is difficult to quantify the amount of support obtained by

the reaching foot at touch-down during the SEBT, and the test is time consuming because of the 8 different reach tasks [4]. The need for redundancy in reach directions was first proposed by Hertel et al [6], and Plisky et al [7] used anterior, posteromedial, and posterolateral reach directions to identify high school basketball players who were at increased risk of injury, which subsequently led to development of the directional components in the YBT-LQ. Additionally, reach is measured with the YBT-LQ using a reach indicator instead of touch-down to reduce the possibility of misleading measurements that result from different