Comparison of Postural Sway Measures Using a Balance Platform and Mobile Application

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Abstract
Balance training has become common in therapeutic exercise routines for rehabilitation, injury prevention, and fall prevention. Unstable surfaces such as foam pads are commonly used in these purportedly to improve balance. While postural sway is often used as a measure of balance ability and to evaluate the efficacy of such programs to improve postural balance, there is little research regarding the measurement of sway while standing on foam pads. Purpose: To compare measures of postural sway from a clinical balance platform against a mobile application. Method: Two devices were used to obtain the postural dynamics of static balance for each subject: 1) a balance platform (Biodex Balance System SD) and 2) a mobile application (SWAY Balance) that utilizes the built-in tri-axial accelerometer within an iPhone or iPod Touch to measure balance. The mobile device is held against the chest so data from both devices can be collected simultaneously. 57 participants (28 male; 29 female) aged 24.3 ± 6.8 yr completed the study in which they stood bilaterally and then unilaterally on a firm surface and then on foam pads using both devices to evaluate postural sway. Results: There were no significant differences between the two devices as measured on the firm surface. However, there was a difference (p<0.05) when standing on foam (balance platform = 3.775; mobile application = 5.659) between the two devices. Unilateral stance on foam (9.887) was higher (p<0.05) than unilateral stance on the solid surface (4.862) when only the mobile application. Conclusion: Based on these results, the mobile application is a valid and useful clinical tool for the evaluation of balance as results did not differ with the balance platform when measuring balance on the stable surface. However, given that postural sway did not differ between unilateral stance on firm versus foam surfaces with the balance platform, it appears that the balance platform strain gauges do not effectively measure sway while standing on foam. Therefore, this mobile application may be a better tool for quantification of sway while standing on foam.

Methods
Participants
- 57 participants (28 male; 29 female)
- Ages 24.3 ± 6.8 yr

Protocol
- 2 devices were used to obtain postural dynamics of static balance:
  - a balance platform (Biodex Balance System SD)
  - a mobile application (SWAY Balance) that utilizes the built-in tri-axial accelerometer within an iPod Touch to measure balance.
- The mobile device was held against the chest so data collection on both devices was performed simultaneously.
- Each device measured anterior/posterior and medial/lateral stability as the displacement in degrees from level. (Actual Stability Score.)
- Stances: stable surface - feet together with eyes closed, feet together eyes closed on a foam surface, single leg eyes closed on stable surface, and single leg eyes closed on foam surface.

Results
There were no significant differences between the two devices as measured on the firm surface.

There was a difference (p<0.05) when standing on foam (balance platform = 3.775; mobile application = 5.659) between the two devices.

Unilateral stance on foam (9.887) was higher (p<0.05) than unilateral stance on the solid surface (4.862) with only the mobile application.

Conclusions
The mobile application is a valid and useful clinical tool for the evaluation of balance as results did not differ with the balance platform when measuring balance on the stable surface.

Given that postural sway did not differ between unilateral stance on firm versus foam surfaces with the balance platform, it appears that the balance platform does not effectively measure sway while standing on foam. Therefore, this mobile application may be a better tool for quantification of sway while standing on foam.