MULTIDIMENSIONAL BALANCE IN YOUTH WITH VISUAL IMPAIRMENTS

by

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ABSTRACT

This dissertation consists of three studies which examined multidimensional balance in youth (≤ 21 years; IDEA, 2004) with visual impairments (VIs) using the Brief-Balance Evaluation Systems Test (Brief-BESTest). These studies have the potential to inform (adapted) physical education curricula and therapeutic/rehabilitative practices by providing novel understandings of balance performance in youth with VIs. If identified as a meaningful mechanism of action, the assessment and development of multidimensional balance in youth with VIs should be given elevated status by practitioners. Thus, the purpose of this dissertation was to investigate multidimensional balance in youth with VIs.

The purpose of Study 1 was to examine the construct and convergent validity of the Brief-BESTest scores in youth with VIs. 101 youth with VIs (n_boys = 57) aged 8.7 to 20.4 years (M = 13.91 ± 2.82) completed the Brief-BESTest, the anterior reach of the Lower Quarter Y-Balance Test, the 360-degree turn test, inertial postural sway during quiet bipedal stance, and the Activities-specific Balance Confidence Scale. Favorable results were uncovered for the internal consistently reliability (.87) and Spearman inter-item correlations (.18 to .73) for Brief-BESTest item scores. A one-factor minimum residual exploratory factor analysis using oblimin rotation was supported. Using seven of the eight Brief-BESTest (i.e., one bilaterally scored item [reactive postural response to the left side] was removed due to minor multicollinearity issues) and mean and variance-adjusted weighted least squares confirmatory factor analyses, a two-factor (i.e., static and dynamic balance) model was accepted based on measures of global and local fit. Using Spearman
correlations, the Brief-BESTest total scores significantly correlated (i.e., converged) with all other balance assessment total scores (-.36 to .67). These results confirmed that Brief-BESTest scores had satisfactory construct and convergent validity in youth with VIs.

The purpose of Study 2 was to compare Brief-BESTest scores between youth with and without VIs. 287 youth with ($n_{VI} = 129$) and without VIs aged 8.7 to 20.4 years ($M = 13.80 \pm 2.32$) completed the Brief-BESTest. A one-way analysis of variance (ANOVA) suggested youth with VIs had lower total Brief-BESTest scores ($F = 225.13, p < .001, \omega^2 = .44$). Concerning the eight individual Brief-BESTest items, a one-way multivariate analysis of variance (MANOVA) was statistically significant ($F = 43.07, p < .001, \eta^2 = .55$). Games-Howell post hoc analyses highlighted significantly impaired balance performance in youth with VIs for all Brief-BESTest items except for the sensory orientation task (i.e., static bipedal stance on foam with eyes closed). The largest effect sizes ($\omega^2$) were for the anticipatory postural adjustment (i.e., right [.46] and left [.50] single leg stances; static balance) and biomechanical constraint (i.e., hip/trunk lateral strength [.26]; static balance) systems. After subsetting the youth with VIs within the sample, an analysis of covariance (ANCOVA) suggested that both degree of vision ($F = 3.60, p = .016, \omega^2 = .04$) and the presence of a comorbidity ($F = 51.21, p < .001, \omega^2 = .27$) were significant explanatory variables for total Brief-BESTest scores in youth with VIs. These results suggested that youth with VIs are likely to have impaired balance performance in both static and dynamic tasks (i.e., five out of six balance systems) when compared to peers without VIs. Balance impairments in youth with VIs are likely due to environmental and/or sociological constraints and can likely be improved with targeted intervention. Practitioners should acknowledge and consider the roles of vision level and/or the presence of a comorbidity when investigating multidimensional balance performance in youth with VIs.
The purpose of Study 3 was to investigate associations between Brief-BESTest and the Test of Gross Motor Development-3 (TGMD-3) locomotor subscale scores in youth with VIs. 96 youth with VIs (n_boys = 52) aged 8.7 to 19.0 years (M = 12.98 ± 2.28) completed the Brief-BESTest and the TGMD-3 locomotor subscale. The zero-order Spearman correlation between Brief-BESTest and TGMD-3 locomotor subscale total scores was strong (ρ = .60, p < .001, 95% CI = .46, .72). Vision level and the presence of a comorbidity were identified as confounding variables. A second-order partial Spearman correlation simultaneously controlling for the presence of a comorbidity and vision level was .42 (p < .001, 95% CI = .24, .57). These data suggest that a significant monotonic association existed between global multidimensional balance and locomotor performance in youth with VIs (i.e., total scores). Concerning individual Brief-BESTest and TGMD-3 item relationships, results were mixed. Zero-order Spearman correlations between individual Brief-BESTest and TGMD-3 locomotor subscale items ranged from -.09 to .55. Overall, relationships for the gallop item in the TGMD-3 and the sensory orientation and reactive postural response to the right and left sides were low to negligible. In contrast, anticipatory postural adjustment while standing on the left and right legs, stability in gait, stability limits, and the biomechanical constraint items had several strong-to-moderate correlations with various TGMD-3 items. It could be suggested that certain balance systems may play a role in (e.g., constrain) certain locomotor skills in youth with VIs. Practitioners should view multidimensional balance as a prerequisite to locomotor skills and acknowledge that specific balance systems may play a more prominent or withdrawn role in different locomotor skills (i.e., inter-task specificity). Practitioners should actively develop multidimensional balance skills in youth with VIs in tandem with other motor skills.
These data have the potential to significantly impact balance assessment which could in turn influence (adapted) physical education curricula (e.g., Individualized Education Program goals) or therapeutic/rehabilitative decisions for youth with VIs. Information gleaned from this dissertation suggests that multidimensional balance could be posited as a significant (yet modifiable) mechanism of action which could be constraining health- and movement-based outcomes in youth with VIs.