

INTRASESSION AND INTERSESSION RELIABILITY OF POSTURAL CONTROL IN PARTICIPANTS WITH AND WITHOUT NONSPECIFIC LOW BACK PAIN USING THE BIODEX BALANCE SYSTEM

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Abstract

Objective: The purpose of this study was to evaluate the reliability of the Biodex Balance System (BBS) (Biodex Medical Systems, Shirley, NY) in chronic low back pain (CLBP) patients and healthy individuals in various conditions of postural and cognitive difficulty.

Methods: In this methodological study, using the BBS, dynamic balance of 15 CLBP patients and 15 healthy matched individuals was assessed during bilateral stance in combined conditions of visual feedback (eyes open and eyes closed) and platform stability (levels 5 and 3), either isolated or concurrent with performing cognitive task (auditory Stroop task). The Overall stability index, anterior-posterior stability index, and medial-lateral stability index, provided by BBS as measures of postural performance, were recorded. Intraclass correlation coefficient (ICC), standard error of measurement, and coefficient of variation were used to determine intersession and intrasession reliability of postural and cognitive measures.

Results: Biodex Balance System stability indices were more reliable in the CLBP (compared with healthy) group. The intersession ICCs in CLBP group for anterior-posterior stability index ranged from 0.60 to 0.88, for medial-lateral stability index from 0.64 to 0.94, and for OASI from 0.63 to 0.91. The intersession ICCs in healthy group for anterior-posterior stability index ranged from 0.42 to 0.86, for medial-lateral stability index from 0.56 to 0.89, and for OASI from 0.54 to 0.84. Biodex Balance System stability indices were more reliable in eyes-closed (compared with eyesopen) condition and platform stability level 5 (compared with level 3).

Conclusion: Biodex Balance System stability indices appear to be reliable measures of postural control in the CLBP patients especially in more challenging conditions, such as when standing with eyes closed. (*J Manipulative Physiol Ther* 2013;36:111-118)

Key Indexing Terms: Low Back Pain; Attention; Postural Balance; Reliability and Validity

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Patients with back problems constitute more than half of the population with musculoskeletal disorders.¹ Approximately 70% to 85% of people experience 1 episode of low back pain (LBP) during their lifetime. 1 With a point prevalence of 15% to 30%, LBP is a major cause of disability among those individuals who do not recover after 12 weeks. 1 Daily activities may have a pain-provoking effect in patients with LBP. Evidence indicates that 73% of patients with LBP experience pain while standing. 2 Standing postural control has been the focus of recent research in LBP. Based on a recent systematic review,³ which investigated changes of postural sway in LBP under several conditions of sensory manipulations, the evidence for altered postural sway in LBP is equivocal. The results were also inconsistent across various sensory manipulations. For instance, in the condition where none of the sensory systems underlying postural control (eg, visual, proprioceptive, and vestibular) are manipulated, some studies reported greater sway magnitude in LBP patients,^{4,5} whereas others found the sway magnitude to be indifferent^{6,7} or even smaller^{8,9} compared with healthy individuals. All have investigated static balance control by recording the body's center of pressure excursion using a force platform. A possible explanation for the inconsistent results may be that quiet standing on a static platform is not sensitive enough to detect minor differences between groups with and without LBP. Hence, it may be more sensitive to expose LBP patients to more challenging balance conditions like standing on a movable platform, such as the Biodex Balance System (BBS) (Biodex Medical Systems, Shirley, NY). Biodex Balance System is a widely used device that quantifies dynamic balance performance. It evaluates the ability to maintain equilibrium while standing on a movable support surface with varying degrees of instability.¹⁰ Like other clinical instruments, the first prerequisite to use of BBS is to determine the degree to which its scores are reproducible with repeated measurements in conditions where the response variable (ie, balance performance) is stable. Establishing reliability is necessary for either situation, when using BBS to discriminate balance among individuals or using it to evaluate balance changes over time following an intervention program. 11 Few studies have tested the reliability of postural assessment using BBS. 10,12,13 Reliability of BBS has been investigated in various populations, comprising active¹² and nonactive^{10,13} adults, elderly people¹⁰ and patients with a history of ankle sprain. 12 Heterogeneity of experimental protocols and studied populations precludes comparison being made among these studies. In the only study published so far examining subjects with LBP,¹⁴ the reliability of BBS was investigated using a variable stability protocol when standing on one and both legs, with eyes open and eyes closed. Platform stability ranged from stability levels 6 to 3 during bilateral stance and

stability levels 8 to 4 during unilateral stance. However, the authors did not evaluate the reliability of BBS variables at constant stability levels, a factor that limits the comparability of results with other studies. Most studies use unchanged stability levels for assessing dynamic balance when using BBS. 10,12 Furthermore, although current research emphasizes the assessment of balance under various experimental conditions of cognitive and sensory manipulations,¹⁵ the above study evaluated reliability of balance performance only under perturbation of visual information. Dual-task methodology has been used in recent years as an emerging field of study to examine the cognitive demands of various motor skills, including balance.^{15,16} Concurrent performance of primary task (ie, postural control) and secondary task (ie, mental activity) may lead to interference, that is, decrement in performance of postural, cognitive, or both tasks when compare with their baseline conditions. This paradigm has been widely used in literature related to older adults¹⁷ and patients with neurologic conditions.¹⁸ This methodology has also been incorporated into balance assessment of patients with musculoskeletal disorders, such as LBP.^{9,19} Therefore, the primary aim of this study was to evaluate the intrasession and intersession reliability of BBS indices, as measures of dynamic balance performance, while performing a concurrent cognitive task in participants with and without nonspecific chronic LBP (CLBP).

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