

ORIGINAL ARTICLE



Comparison of the Test-Retest Reliability of the Balance Computerized Adaptive Test and a Computerized Posturography Instrument in Patients With Stroke

Chia-Hsin Chen, MD, PhD,^{a,b,c,*} Shih-Feng Lin, BS,^{a,*} Wan-Hui Yu, MS,^d
Jau-Hong Lin, PhD,^{e,f} Hao-Ling Chen, PhD,^d Ching-Lin Hsieh, PhD^d

From the ^aDepartment of Physical Medicine and Rehabilitation, Kaohsiung Municipal Ta-Tung Hospital, Kaohsiung; ^bDepartment of Physical Medicine and Rehabilitation, Kaohsiung Medical University Hospital, Kaohsiung; ^cDepartment of Physical Medicine and Rehabilitation, School of Medicine, Graduate Institute of Neuroscience, College of Medicine, Kaohsiung Medical University, Kaohsiung; ^dSchool of Occupational Therapy, College of Medicine, National Taiwan University, Taipei City; ^eDepartment of Physical Therapy, College of Health Science, Kaohsiung Medical University, Kaohsiung; and ^fDepartment and Graduate Institute of Neurology, College of Medicine, Kaohsiung Medical University, Kaohsiung, Taiwan.

*Chen and Lin contributed equally to this work.

Abstract

Objective: To compare the test-retest reliabilities of the scores of the Balance Computerized Adaptive Test (CAT) and the Biodex Balance System in patients with stroke.

Design: A repeated-measures design (at a 1-wk interval) was used to examine the test-retest reliabilities of the scores of the Balance CAT and the Biodex Balance System.

Setting: One rehabilitation unit in a local hospital.

Participants: Patients (NZ50) with stroke for more than 6 months and undergoing outpatient rehabilitation completed the Balance CAT and the eyes open (EO)/closed (EC) tests, but only 17 patients finished the Limit of Stability (LOS) test because they were unable to reach all the targets.

Interventions: Not applicable.

Main Outcome Measures: The Balance CAT and 2 computerized tests of the Biodex Balance System, namely the EO/EC test and the LOS, were used to evaluate balance function.

Results: The test-retest reliabilities of the scores of the Balance CAT (Pearson $r=0.92$, minimal detectable change [MDC] percent 12.8%) was excellent. Those of the EO/EC and LOS tests were poor to good (Pearson $r=0.56$ to 0.85 , MDC 25.8% to 126.9%).

Conclusions: The test-retest reliabilities of the scores of the Balance CAT were sufficient for assessing balance function in patients with stroke. Moreover, the test-retest reliabilities of the scores of the Balance CAT, one of the functional balance measures, were superior to those of the Biodex Balance System, 1 type of computerized posturography instrument. Therefore, the Balance CAT may be a more reliable measure for clinicians and researchers to use in assessing the balance function of patients with stroke for more than 6 months. Archives of Physical Medicine and Rehabilitation 2014;95:1477-83

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A deficit in balance is a common problem in patients with stroke. This deficit may seriously impair their function in activities of daily living such as walking and stair climbing, thereby increasing the risk of falling.¹⁻⁴ Improving balance function is an important goal of rehabilitation.⁵ Through the use of reliable functional balance measurements, clinicians can effectively assess and monitor the balance function of patients with stroke.

Functional balance measures, which assess balance function through functional tasks, are one type of balance measure frequently used in clinical and research settings. These functional balance measures, such as the Berg Balance Scale and Postural Assessment Scale for Stroke Patients (PASS), have practical advantages, including ease of use and low cost.⁸ Unfortunately, few of them can achieve both efficiency and precision, both of which are needed in busy clinics. Computerized adaptive testing has been suggested to meet this need.^{9,10} The Balance Computerized Adaptive Test (CAT) has been developed to efficiently and precisely assess balance function in patients with stroke through a computerized adaptive testing system.¹¹ The Balance CAT chooses items tailored to an individual patient and skips items that are too easy or too difficult for that patient. This advantage allows clinicians to efficiently assess balance function when time is limited. Some psychometric properties of the scores of the Balance CAT in inpatients with stroke receiving rehabilitation, namely the responsiveness and predictive validity, have been verified.¹² However, the test-retest reliability of the Balance CAT in patients with stroke has not been examined. Apart from functional balance scales, another type of balance measure is computerized posturography instruments, such as the Smart Balance Master System (SBM) and Biodex Balance System.^a This type of balance measure has been developed to objectively quantify standing balance function with high resolution and thus help clinicians precisely monitor the changes in patients' balance function.^{13,14} Objective quantification with high resolution is thought to be helpful for yielding better test-retest reliability (eg, test-retest reliability). Thus, the test-retest reliabilities of the scores of computerized posturography instruments in patients with stroke might be better than those of functional balance scales. Recently, the Biodex Balance System, which is less expensive and more portable than the SBM, has frequently been used in clinical or sports rehabilitation settings.¹⁵ However, since no studies have examined the test-retest reliabilities of the scores of the Biodex Balance System in patients with stroke, its utility in such patients is limited. Although the Biodex Balance System and the Balance CAT measure balance function in different ways, both are frequently used to represent and monitor the balance function of patients in clinics and research. Before these balance measures are used, their test-retest reliabilities must be confirmed, compared head to head, or both. Therefore, the purposes of the study were to compare the test-retest reliabilities and random measurement errors (ie, minimal detectable change [MDC]) of the Biodex Balance System and Balance CAT in patients with chronic stroke. The results should be useful for both clinicians and researchers in selecting an appropriate balance measure for patients with chronic stroke. We hypothesized that the test-retest reliabilities of the scores of the Biodex Balance System, which can objectively quantify balance function with high resolution, would be superior to that of a functional balance measure, namely the Balance CAT.

List of abbreviations

CAT	Computerized Adaptive Test
EC	eyes closed
EO	eyes open
LOS	limit of stability
MDC	minimal detectable change
PASS	Postural assessment Scale for Stroke Patients
SBM	Smart Balance Master System
SEM	standard error of measurement

daily living such as walking and stair climbing, thereby increasing the risk of falling.¹⁻⁴ Improving balance function is an important goal of rehabilitation.⁵ Through the use of reliable functional balance measurements, clinicians can effectively assess and monitor the balance function of patients with stroke.

Keywords: postural balance; Psychometrics; Rehabilitation; Stroke

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