ORIGINAL ARTICLE

Comparing the Fullerton Advanced Balance Scale With the Mini-BESTest and Berg Balance Scale to Assess Postural Control in Patients With Parkinson Disease

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Abstract

Objectives: To validate the Fullerton Advanced Balance (FAB) Scale for patients with idiopathic Parkinson disease (PD); and to compare the FAB Scale with the Mini-Balance Evaluation Systems Test (Mini-BESTest) and Berg Balance Scale (BBS).

Design: Observational study to assess concurrent validity, test-retest, and interrater reliability of the FAB Scale in patients with PD and to compare the distribution of the scale with the Mini-BESTest and BBS.

Setting: University hospital in an urban community.

Participants: Patients with idiopathic PD (N=85; Hoehn and Yahr stages 1–4).

Interventions: Not applicable.

Main Outcome Measures: FAB Scale, Mini-BESTest, BBS, timed Up and Go test, Unified Parkinson's Disease Rating Scale, and visual analog scale.

Results: Interrater (3 raters) and test-retest (3±1d) reliability were high for all scales (ICCs≥.95). The FAB Scale was highly correlated with the Mini-BESTest (Spearman ρ=.87) and timed Up and Go test item of the Mini-BESTest (Spearman ρ=.83). In contrast with the BBS, the FAB Scale and Mini-BESTest have only minimal ceiling effects. The FAB Scale demonstrated the most symmetric distribution when compared with the Mini-BESTest and BBS (skewness: FAB scale: −.54; Mini-BESTest: −1.07; BBS: −2.14).

Conclusions: The FAB Scale is a valid and reliable tool to assess postural control in patients with PD. No ceiling effect was noted for the FAB Scale. Although the items of the FAB Scale are more detailed when compared with the Mini-BESTest, interrater and test-retest reliability were excellent. The scale is a promising tool to detect small changes of the postural control system in individuals with PD.

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One of the most disabling symptoms of idiopathic Parkinson disease (PD) is postural instability. Specifically, balance disturbances are associated with impaired quality of life,[1] and the reported postural impairments usually worsen with disease progression.[2-5] Postural instability has been identified as one of the independent risk factors for falls,[6-8] with fall rates ranging from 39% to 68% in patients with PD.[9,10] In comparison with aged-matched healthy control subjects, patients with PD have smaller limits of stability[11-14] and show larger sway during quiet stance in the mediolateral direction.[3,15,16] When perturbing the stance surface, individuals with PD use several slow steps to recover equilibrium[17,18] and have excessive antagonistic activity.[19,20] In comparison with healthy older adults, patients with PD also present with impairments in the adaptation to different perturbation and stance conditions.[19,21,22] Patients' balance performance worsens while performing a secondary cognitive task.[23,24]

The assessment of balance performance is mandatory for the initiation of effective therapy. Balance tests should be able to reflect various dimensions of postural instability, as previously mentioned. Because of the complexity of postural control mechanisms, multidimensional clinical balance scales often describe the overall balance performance more accurately than simple tests or biomechanical measurements.[25] Additionally, clinical balance scales evaluate postural stability in a more functional way and are closer related to real-life situations.[25] To improve patient care and initiate an appropriate treatment at early disease stages, it is mandatory that clinical balance scales are sensitive to small differences in balance performance. Additionally, clinical balance scales need to be sensitive to therapeutically induced changes, particularly when interpreting intervention effects of 2 competing therapies. The detailed assessment of postural control is an important aim, especially when comparing exercise interventions where effect sizes are usually relatively small.[26]

One of the standard clinical measures to assess balance disturbances in healthy older adults and patients with PD is the Berg Balance Scale (BBS).[27,28] Previous studies have demonstrated that this 14-item scale is a valid and reliable measure of postural control.[28,29] However, the test has some limitations, such as the lack of assessing reactive postural control (eg, response to a perturbation),[27] a low responsiveness,[29,30] and a ceiling effect.[29,31]

Recently, Franchignoni et al[32] introduced the 14-item Mini-Balance Evaluation Systems Test (Mini-BESTest), a shorter version of the Balance Evaluation Systems Test developed by Horak et al.[33] Previous studies did not report any ceiling effects of the Mini-BESTest when assessing balance performance in patients with balance disorders caused by neurologic diseases.[29,31] The test is highly reliable[34] and includes the assessment of dynamic postural control.[32] Each task of the Mini-BESTest is assessed with a 3-point ordinal scale. Because ceiling and floor effects have not been documented, the scaling of the items covers a large range and might not be able to detect small differences of balance performance.

The Fullerton Advanced Balance (FAB) Scale was developed to assess postural control in higher functioning older adults. It consists of 10 items that require static and dynamic postural control, sensory reception and integration, and feedforward/feedback postural control.[35] In contrast with the BBS, the FAB Scale includes the assessment of dynamic postural control (eg, reactive postural control to a perturbation, gait performance). Furthermore, the FAB Scale incorporates a secondary task during walking. These features are known to reflect balance challenges during activities of daily living.[36] Because the test was developed for higher functioning older adults, ceiling effects as reported in the BBS might be avoided. One advantage to the FAB Scale relative to the Mini-BESTest and BBS is the efficient test time. The 10-item

FAB Scale takes only 10 to 12 minutes to complete,[33,35] whereas the 14-item Mini-BESTest and 14-item BBS require up to 10 to 15 and 20 minutes, respectively.[27,30,32,37]

Another potential advantage of the FAB Scale is the more sophisticated scaling. In contrast with the 3-point ordinal scale of the Mini-BESTest, each task of the FAB Scale has a 5-point ordinal scale. Hence, the scaling of the items of the FAB Scale appears more detailed than the scaling of the Mini-BESTest. The FAB Scale might therefore be able to better detect small differences in balance performance and might be more sensitive to therapeutically induced changes than the Mini-BESTest. Because of the differentiated scale incorporated in the FAB Scale, this test can potentially be less reliable than the Mini-BESTest. However, if it proves reliable, the FAB Scale will be a promising quick and easy to use tool that allows for a more detailed assessment of postural control in patients with PD.

The purpose of this study was to analyze the concurrent validity of the FAB Scale for the assessment of postural control in individuals with PD. Moreover, we aimed to compare the interrater and test-retest reliability of the FAB Scale with the BBS and Mini-BESTest. We hypothesized that despite its differentiated scaling, the FAB Scale would prove as reliable as the Mini-BESTest. The third aim of our study was the comparison of the distributions of the 3 balance scales. We expected that in contrast to the BBS, ceiling effects could be avoided when using the FAB Scale.

Methods

Participants

There were 85 patients with idiopathic PD who completed this study. All patients met the following inclusion criteria: diagnosed with idiopathic PD by a neurologist specialized in movement disorders with a Hoehn and Yahr (H&Y) stage of 1 to 4 and >40 years of age. Exclusion criteria were as follows: deep brain stimulation; other diseases and conditions that could influence stance and gait performance (eg, peripheral neuropathy, orthopedic injuries), as determined through clinical examination by a neurologist; cognitive impairment (patients with cognitive impairments were excluded because they might not be able to follow the instructions of the performed tests; this was determined through clinical examination by a neurologist; and in ambiguous cases, patients were excluded); and any change of medication during the 4 weeks prior to participation. The study protocol was approved by the local ethics committee, and all patients gave written informed consent prior to participating.

Testing procedure

All patients took their regular PD medication. Patients were assessed approximately 1 to 1.5 hours after medication administration (ON state of medication). Each subject underwent the same order of testing for the following tests: FAB Scale, Mini-BESTest, BBS, Unified Parkinson's Disease Rating Scale (UPDRS), timed Up and Go (TUG) test,[38] and visual analog scale (VAS). Any item that was duplicated between different balance scales was performed only once and scored using criteria from each scale. The TUG test therefore was not performed separately, but item 14 of the Mini-BESTest was used. To let the patients perform each test under the same physical conditions, a seated rest was proposed by the assessor several times. If the assessor had the impression

List of abbreviations:

BBS	Berg Balance Scale
FAB	Fullerton Advanced Balance
H&Y	Hoehn and Yahr
ICC	intraclass correlation coefficient
Mini-BESTest	Mini-Balance Evaluation Systems Test
PD	Parkinson disease
TUG	timed Up and Go
UPDRS	Unified Parkinson's Disease Rating Scale
VAS	visual analog scale