Video Journal of MD Original Article 1

A novel test for quantitative estimation of freezing of gait and bradykinesia in patients with Parkinson's disease

Fumio Kondo [1)]

Abstract

Freezing of gait (FOG) is a common, disabling symptom of Parkinson disease (PD). It increases the risk of falling and markedly impairs patients' quality of life. FOG is a gait pattern characterized by start hesitation at the initiation of walking, and also during turning. It induces markedly short steps, and is often observed when passing through narrow spaces or approaching doors, walking in crowded streets, performing dual tasks and getting nervous. FOG frequently occurs in patients' daily living. However, FOG is rarely observable by physicians, because patients consult doctors at on-time upon taking medications, and walk almost normally. Therefore, it is not easy for physicians to observe and assess FOG of patients. Many useful tests and scales have been proposed for rating FOG, such as Unified Parkinson's Disease Rating Scale (UPDRS) and Timed Up & Go test (TUG test), but few tests that estimates FOG quantitatively are available. We developed a novel simple quantitative FOG test that can be used to evaluate not only FOG quantitatively but also kinesis (FK test) by observing patients walking in narrow spaces.

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Introduction:

Freezing of gait (FOG) is a common but troublesome symptom in patients with advanced stage of Parkinson's disease, and is defined as a "brief episodic absence or marked reduction of forward progression of the feet despite intention of walk"[1]. FOG drastically increases the risk of falling and significantly impairs patients' quality of life. Up to 63% of patients with idiopathic Parkinson's disease (PD) and 88% of patients with microvascular ischemia experience FOG[2-4]. It is also a common feature in other Parkinson-plus syndromes such as progressive supranuclear palsy, multiple system atrophy and corticobasal degeneration.

FOG is more likely to occur when initiating walking, turning and passing through a narrow space or under certain circumstances. Other provocative situations are approaching doors, doing dual tasks, walking in crowded streets and being tense. On the other hand, ameliorating factors such as emotional relief as well as visual and auditory cueing may reduce FOG[5-6]. FOG frequently occurs in patient's daily life, but patients present to physicians at on-time and manage not to show freezing gait in the consulting room. Hence, medical professionals may not have opportunities to observe FOG. Many useful tests and scales have been proposed for rating FOG, such as Unified Parkinson's Disease Rating Scale (UPDRS) and Timed Up & Go test (TUG test), and some methods are useful to evaluate turning FOG. However, there are few rating methods that evoke and evaluate stops when walking in a narrow space[7].We established a novel simple quantitative FOG and kinesis test (FK test) for evaluating FOG and bradykinesia more accurately and conveniently.

Methods

In an examination room, a narrow space for walking was set up using two stools, a bed and a desk. Examinee was instructed to walk along a narrow path around the stools in a figure of eight shape (**Figure 1**). The distances between the desk, stools and bed were almost shoulder-width. The examinee was asked to walk the figure of eight path two times. The total time taken to complete the figure of eight walks and the frequency of stops during the walks were recorded. Doctor, nurses and/or paramedics were in attendance to record data and ensure safety of the examinees.

Preliminary experiment for rating FOG of PD patients

PD patients were divided into 4 groups: those who accomplished the test without stopping (no-stop), those who stopped once (one-stop), those who stopped twice (two-stop), and those who stopped more than three times (three-or-more-stop). Each group consisted of 15 patients. Data are expressed as mean ±S.D. Differences between groups (n=15 in all groups) were examined statistically using t-test. A p value less than 0.05 was considered a statistically significant difference.

Case Presentation

A patient with Parkinson's disease was evaluated at on-time. The patient was instructed to walk in the usual space of the consulting room and recorded by video (**Video 1**). Next, he was instructed to do the

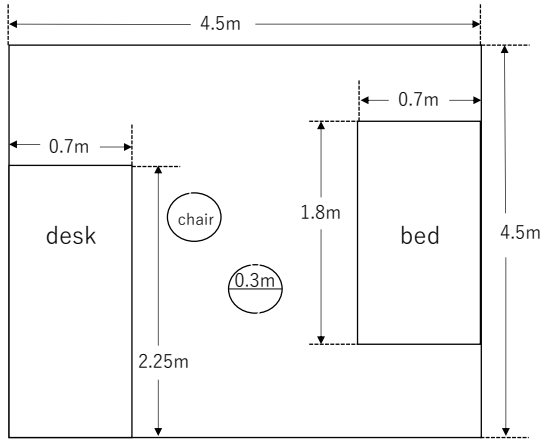

Figure 1 Lay out of stools, a desk and a bed in FOG test

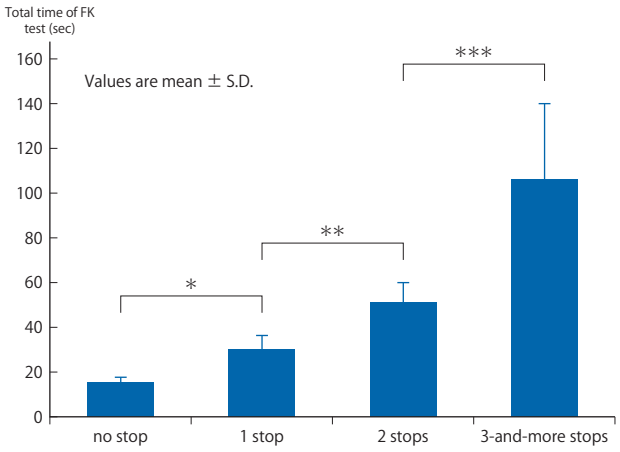

Figure 2 Times to complete FK-test and frequency of stops

FK test (**Video 2**). He was able to walk without hesitation in the consulting room, but showed a marked shuffling gait in FK test.

Results

Preliminary study for rating FOG of PD patients

The total time taken to walk the figure of eight path two times in all the PD patients ranged from 8 seconds to over 150 seconds. The total time of the one-stop group (n=15) increased significantly compared with the no-stop group (p=0.0000000983). Similarly, the total time of the two-stop group increased significantly compared with the one-stop group (p=0.0000000422). And, the total time of the three-or-more-stop group increased significantly compared with the two-stop group (p=0.000015) (**Figure 2**).

Discussion and Conclusion:

Although many good scales for FOG have been advocated, there are few quantitative methods to evaluate walking hesitation. In clinical practice, physicians do not necessarily observe FOG in their consulting rooms, because patients with PD take medication in time so as not to show FOG in the clinic. A quantitative method to evaluate gait hesitation through a narrow space in a consulting room is proposed. The test is a novel FOG provocation test that may resolve the above-mentioned drawbacks, and provides numerical estimates of FOG in PD patients by recording a simple figure of eight walk. The test may reveal latent FOG in patients with early-stage PD, and allows physicians to adjust the medications to reduce unexpected falling of PD patients.

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Video 視聴する場合には▶をクリック

Video 1　Videorecording showing the PD patient to walk on consulting room in on-time
A : Before FK test　B : After FK test

Video 2　Videorecording to show the PD patient to do FK-test
FOG was induced on FK-test.

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