

Gait cycle in Parkinson's disease and progressive supranuclear palsy : Results of assessment using three axis acceleration sensors

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Introduction

In Parkinson's disease (PD) and associated diseases, the walk rhythm is disturbed, which is known as freezing gait and small steppage gait. The ten meter gait test is commonly used for gait evaluation. It is difficult for this test to capture the walk rhythm objectively. A three axis acceleration sensor can calculate the time of a gait cycle. This device can analyze the walk rhythm simply and objectively. We conducted a conventional walk measurement and analysis of the variation index for the gait cycle using the acceleration sensor in PD and progressive supranuclear palsy (PSP).

Subjects and methods

The subjects were 27 PD patients (18 men, nine women), and seven PSP patients (four men, three women)(Table 1). The subjects walked in a straight line along a walking track for 10m at an optimal speed. Sensors were attached to the patients on the head of the fibula and their hips. We used anacceleration analysis device (MicroStone Corp.) We calculated the coefficient variation index (CV) for a gait cycle. The variation index demanded in standard inspection / an average x 100 of the time for 1 gait cycle for a gait cycle.

Table 1. Summary of subjects

	PD (n=27)	PSP (n=7)
Men/women	18/9	4/3
Age (mean ± SD)	65.7 ± 6.6 y	70.4 ± 4 y
Disease duration	7.2 ± 5.2年	4 ± 0.4年
UPDRS	74.0 ± 22.2点	74.4 ± 15.4点
% Fall	27%	86%

PD, Parkinson's disease
PSP, progressive supranuclear palsy
UPDRS, Unified Parkinson's Disease Rating Scale

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Results

By comparison of the walking ability, it was found that CV of the PSP patients was significantly higher than that of the PD patients (Figure 1). The presence or absence of falls and differences in the walking ability were examined. The CV of the falling group was higher than that of the non-falling group (Figure 2).

Discussion

Gait difficulties are one of the first problems reported in people with PD, indicating the onset of disability [1]. Parkinsonian gait is often slow and characterized by short shuffling steps, which may contribute to postural instability. As such, problems with walking are often accompanied by falling, which occurs in 40–70% of people with PD [2]. Fallers have higher incidences of skeletal fracture, social isolation, and reduction in exercise [3]. These consequences of a fall can in turn contribute to declines in gait and balance and lead to an additional increased risk of falling. Understanding these difficulties and developing criteria to identify people with PD who are at risk of falling are crucial to interrupt this devastating cycle of falls and injuries.

It has been reported that the variation index is associated with the falling of elderly people for a gait cycle. PSP has higher disease severity in terms of the gait disturbance than PD. The PSP patients are at great risk of falling. A significant difference in PD and PSP was not found in the conventional walk rating system. From the analysis of the walk variation index using the acceleration sensor, PSP patients were found to be stronger in the disorder of the regularity of the walk than PD patients. This seems to be associated with the fall being high-risk. In other words, CV, an index of the walk rhythm, seems useful for evaluating the risk of falling.

References

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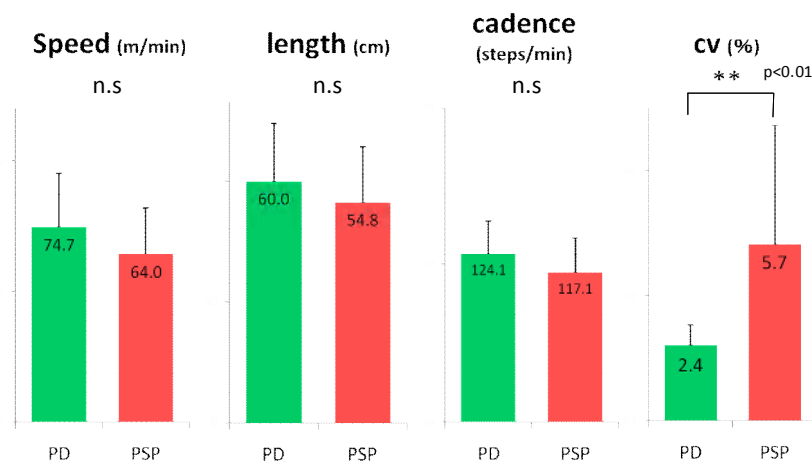


Figure 1. Comparison of the walking ability in Parkinson's disease (PD) and progressive supranuclear palsy (PSP). CV of PSP was significantly higher than that of PD

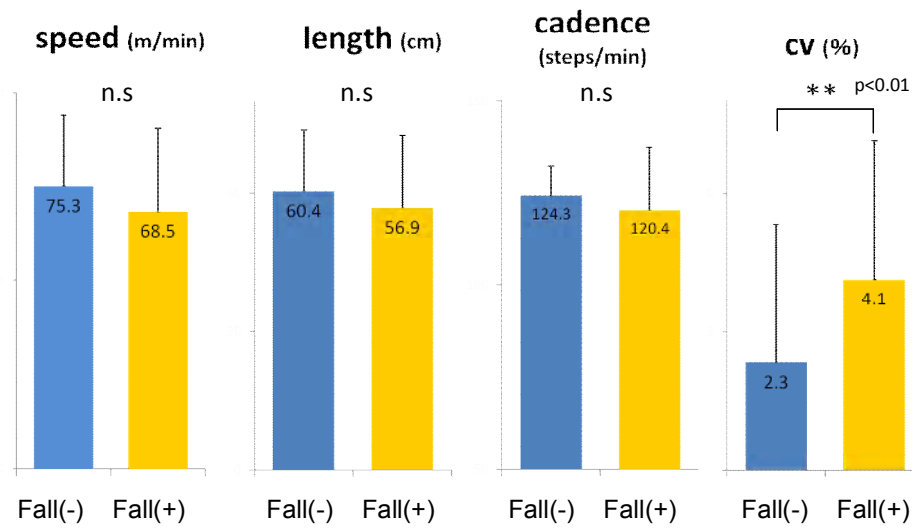


Figure 2. Comparison of the walking ability in the non-falling group (Fall(-)) and the falling group (Fall(+)). The CV of the falling group was higher than that of the non-falling group.