

Speech analysis in Parkinson's disease

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Abstract

We conducted sound analysis of the utterances of PD patients, and the condition of the patients was examined. The subjects were six patients with PD admitted to hospital for rehabilitation purposes, and six healthy controls. Sound pressure gradually decreased by the voice continuance in PD. In oral diadochokinesis, no difference was found in the number of times. The extended periods of silence were found with PD patients. The unevenness tended to increase in PD. No difference was seen in the time required for reading sentences aloud, or sound pressure. Thus, it seems to be primary that a long period of silence extends the disorder of the utterance of PD. This was regarded as start hesitation of the pronunciation.

Keywords : sound analysis, PD ,Sound pressure, oral diadochokinesis, unevenness ,extended periods of silence

Introduction

Parkinson's disease (PD) is a slow progress-related neurodegenerative disease. The utterances of PD patients feature monotonous intonation in a low voice or gradually fast talking [1]. Insufficient acoustic examinations have been carried out. We conducted sound analysis of the utterances of PD patients, and also examined the condition of the patients.

Materials and methods

The subjects were six patients with PD admitted to hospital for rehabilitation purposes, and six healthy controls. The patients were six women, with average age of 68.8 years old (Table 1). Utterance

continuance, oral diadochokinesis, reading aloud of "north wind and the sun" were recorded, respectively, and sound analysis was conducted. By the utterance continuance, the longest phonation time (MPT) was measured, and the sound pressure level was measured every second for ten seconds. In oral diadochokinesis, we measured the time of /pa/, /ta/, and /ka/ of 5 seconds, the number of times of each /pataka/ and the sound pressure level of the initial 10 sounds. We set a single sound and a silent interval as a silence section, and the measurement was performed of the time. In reading aloud of "north wind and the sun", the time required for reading aloud one sentence was measured. Also, the prefix of each sentence and the sound pressure level of the ending of a word were measured. The statistical analysis used Mann-Whitney's U (MW) test

and F test.

Results

In the phonation time, the significant difference was not thought to be control group in Parkinson's disease group. The sound pressure at ten seconds, compared to nine seconds, decreased remarkably in PD patients. As for the number of times of oral diadochokinesis of 5 seconds, the difference was found in none of /pa/ta/ka/pataka/. The silence section significantly extended the results of the silence section of oral diadochokinesis in /ta/ and /ka/. Also, the silence section was uneven with /pataka/. A fall in the sound pressure and an increase of the change were found in the sound pressure level of oral diadochokinesis generally (Figure 1). The reading aloud time of "north wind and the sun" showed no difference, and the reading aloud time of each sentence showed almost no significant difference (Figure 2). No difference was seen in the sound pressure.

Discussion

We found that the PD patients gradually showed decreased sound pressure by the

voice continuance. In oral diadochokinesis, no difference was found in the number of times, but extension of the long silence section was found in PD patients. Also, the sound pressure decreased generally, and the unevenness tended to increase. No difference was seen in the reading aloud time of the sentence, or in sound pressure. We considered the utterance pattern of PD patients. When it was pronounced by fast talking, the number of times did not show a difference between the control group and the PD group. That means, it is expected that the total of silence section and the existence sound section does not have a difference. The extension of the long silence section shows the shortening of the existence sound section. Furthermore, it will be a compensatory change to shorten existence sound section that sound pressure has decreased. Thus, it is thought whether a disorder of this utterance of PD is the disorder that it is primary that long silence section extends. The extension of the long silence section suggests a delay in the start of speaking. This is regarded as starting hesitation in speaking, which may occur in a program disorder similar to the starting difficulty in walking in PD patients [2, 3].

Table 1. Summary of patients with Parkinson's disease

Patient	Age	Sex (M/F)	Hoehn & Yahr stage	Disease duration (years)
1	71	F	3	7
2	65	F	3	6
3	67	F	3	14
4	71	F	3	4
5	66	F	3.5	10
6	73	F	3	13

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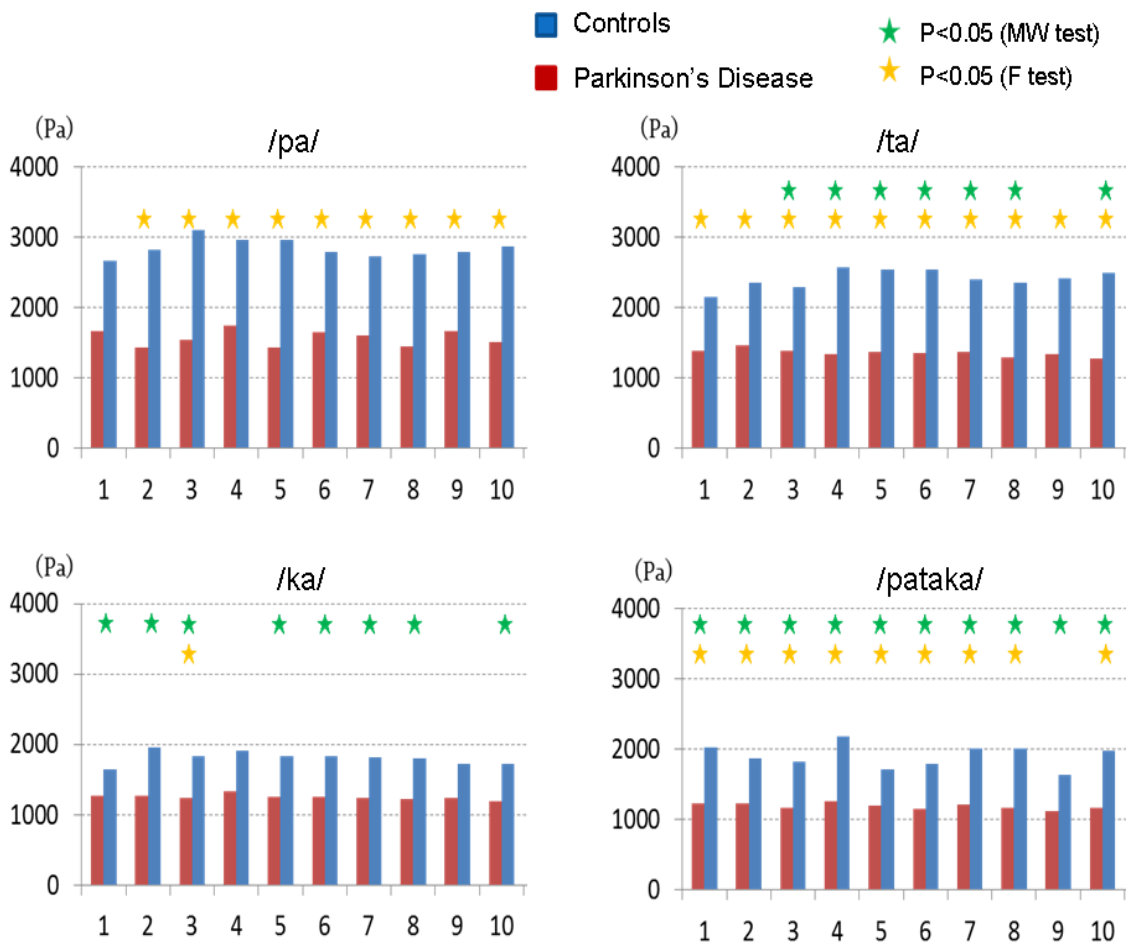


Figure 1. Oral diadochokinesis of 5 seconds. A fall in the sound pressure and an increase of the change were found in the sound pressure level of oral diadochokinesis generally. MW test, Mann-Whitney's U test.

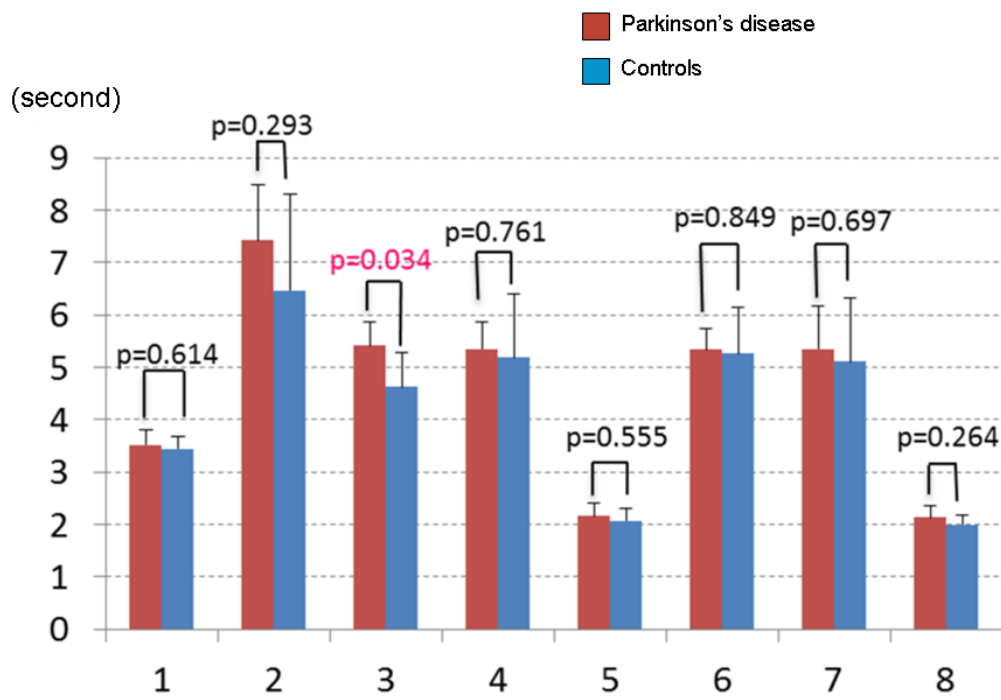


Figure 2. Reading aloud time of the sentence of "north wind and the sun" was not generally changed in patients with Parkinson's disease.