

## Examination of lalopathy in Parkinson's disease-associated diseases

Nana Miyata, S.T.<sup>#1</sup>, Yuri Taniguchi, S.T.<sup>#1</sup>, Kumiko Kawamichi, S.T.<sup>#1</sup>, Toshio Inui, M.D.<sup>#2</sup>, Yoshiharu Arii, M.D.<sup>#2</sup>, Kazuyuki Kawamura, M.D.<sup>#2</sup>, Takao Mitsui, M.D.<sup>#2</sup>

*#1. Department of Rehabilitation, Tokushima National Hospital, National Hospital Organization, 1354 Shikiji, Kamojima, Yoshinogawa, Tokushima 776-8585 Japan.*

*#2. Department of neurology, Tokushima National Hospital, National Hospital Organization, 1354 Shikiji, Kamojima, Yoshinogawa, Tokushima 776-8585 Japan*

Received 28 February 2014; received in received from 14 March 2014; accepted 20 March 2014

---

### Abstract

We conducted sound analysis on the utterances of patients with Parkinson's disease (PD) or progressive supranuclear palsy (PSP). The subjects were 12 patients with PD, 12 patients with PSP, and 12 normal control subjects. No difference was found in sound pressure level / sound pressure by voice continuance. The number of occurrences of oral diadochokinesis did not show a difference. PD and PSP both showed extension of the long silence section. The extension was remarkable in PSP. Also, the sound pressure was increased compared to PSP. No difference was seen in the reading aloud time as regards sentence and sound pressure. The number of times showed no difference in the PD and PSP group. This means that the total length of the long silence section and the existence of the sound section did not show any difference. The long silence section was extended in the PD and PSP groups. This means that the existence sound section shortened. This change was more remarkable than in the PSP group.

**Keywords:** PSP, stammering symptom, freezing of gait, MRI, SPECT, PSP-PAGF

---

### Introduction

Parkinson's disease (PD)-associated syndrome is characterized by progressive neurodegeneration in the basal ganglia, including PD, progressive supranuclear palsy (PSP) and corticobasal degeneration. This syndrome merges various kinds of motor and mental manifestations. In Parkinson's disease in particular, the utterance of the patients becomes monotonous, and they speak in a low voice [1-3]. However, there has been insufficient research into the mechanism. We conducted sound analysis on the utterances of patients with PD or PSP.

### Subjects and methods

The subjects were 12 patients with PD, and 12 patients with PSP who went to hospital for the purpose of rehabilitation. In addition there were 12 healthy control subjects (Table 1). Utterance continuance, oral diadochokinesis and reading aloud of sentences were recorded. Sound analysis was conducted using an analysis system, AcousticCore 8 (Arcadia, Inc., Osaka, Japan). In the analysis of the utterance continuance, the longest phonation time (MPT) was measured (Figure 1A). A sound pressure level every one second was measured until

ten seconds after (Figure 1B). In the oral diadochokinesis analysis, the number of times that /pa/, /ta/, /ka/, /pataka/ were pronounced in five seconds was measured (Figure 1C). The sound pressure level of the first 10 words and a word at 5 seconds were measured (Figure 1D). Also we measured a long silence ward interval (Figure 1E). In the reading aloud analysis of the sentence, time was measured (Figure 1F). The prefix of each sentence and the sound pressure level of the ending of the words were measured (Figure 1F).

## Results

No significant difference was found among the three groups for the phonation time, MPT (Figure 2A). The mean sound pressure level is shown in Figure 2B. These were converted into sound pressure, but no significant difference was found among the three groups (Figure 2C). As for the number of times of oral diadochokinesis of 5 seconds, no significant difference was found for any forms of pronunciation (Figure 3). On the other hand, by analysis of the long silence section of oral diadochokinesis, extension of the long silence section was found in the PD group and PSP group. Furthermore, the long silence section was more extended in the PSP group than in the PD group (Figure 4). The results of the sound pressure level

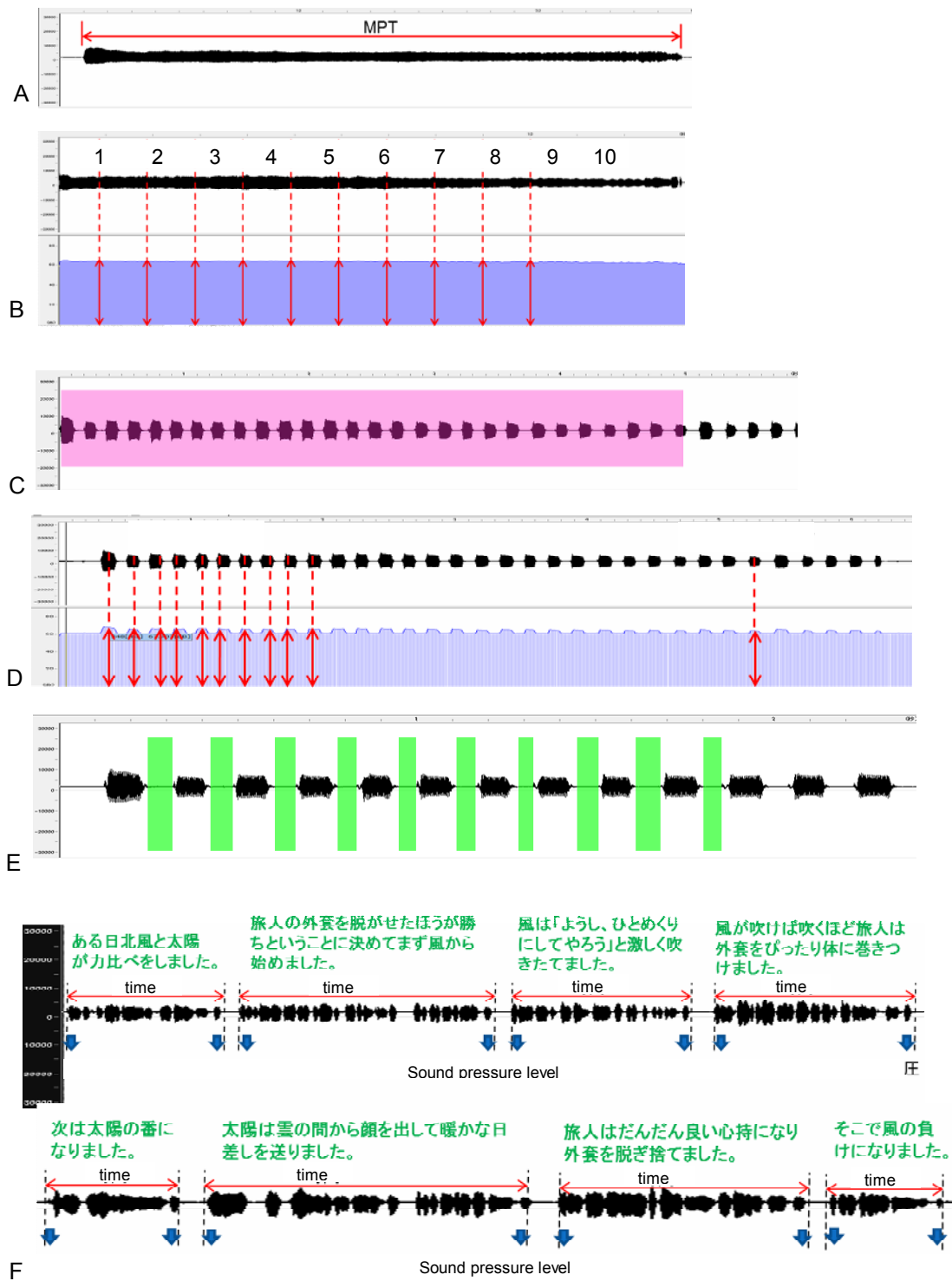
measurements of oral diadochokinesis are shown in Figure 5. After converting this into sound pressure, a significant difference was found in lip sound and anterior lingual sound between the PD and PSP groups. We found that sound pressure of the PSP group was higher than that of PD group (Figure 6). As for the reading aloud time of the common sentences, there was no significant difference among the three groups (Figure 7A). Hardly any difference was found in the reading aloud time every one minute (Figure 7B). The sound pressure level of reading the common sentences showed no significant difference among the three groups (Figure 8A). Even if it was converted into sound pressure, no difference was found (Figure 8B).

## References

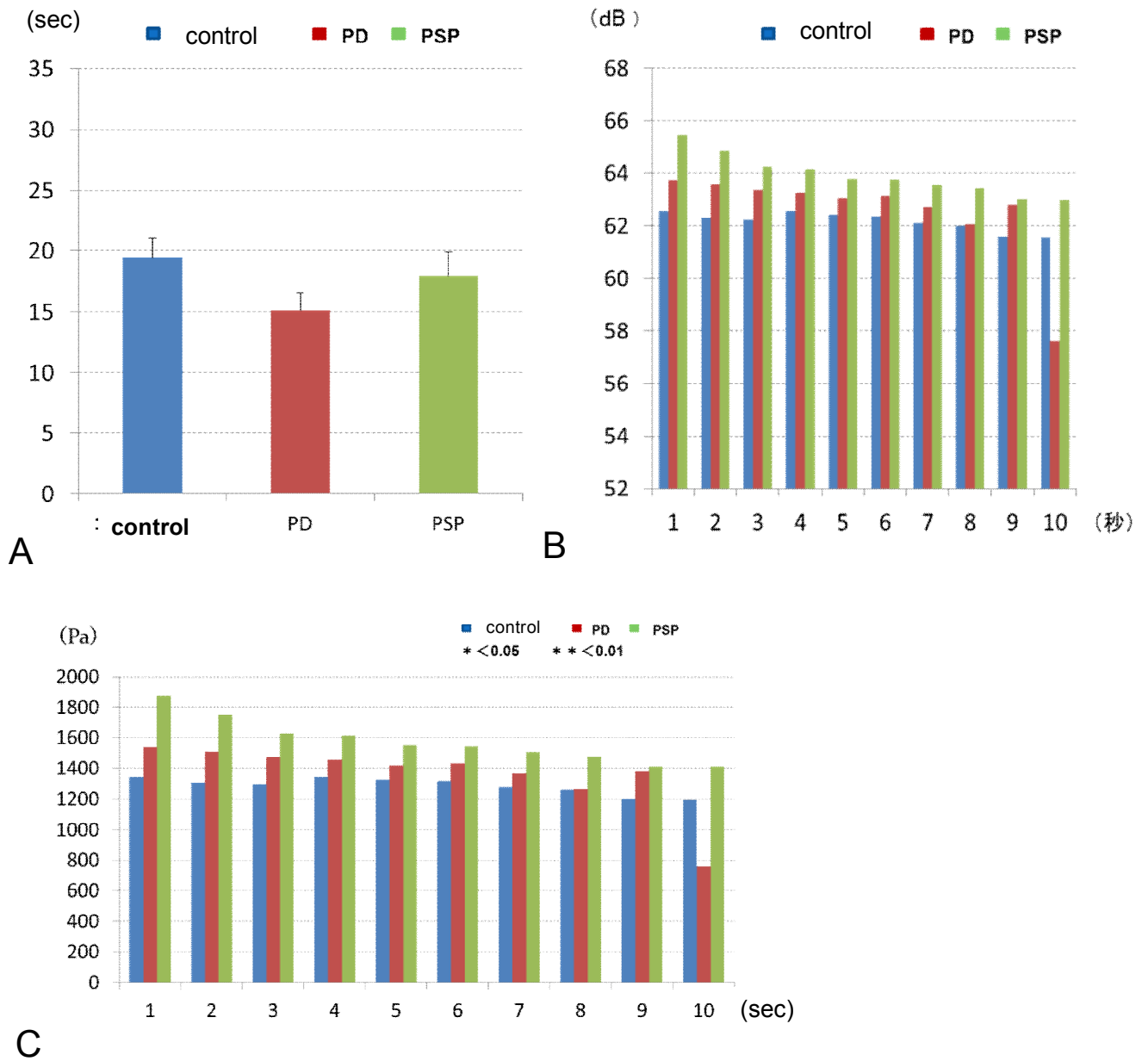
1. Williams DR, Lees AJ. Progressive supranuclear palsy: clinicopathological concepts and diagnostic challenges. *Lancet Neurol.* 2009;8(3):270-279.
2. Josephs KA, Duffy JR, Strand EA, et al. Characterizing a neurodegenerative syndrome: primary progressive apraxia of speech. *Brain.* 2012;135(Pt 5):1522-1536.
3. Josephs KA, Duffy JR, Fossett TR, et al. Fluorodeoxyglucose F18 positron emission tomography in progressive apraxia of speech and primary progressive aphasia variants. *Arch Neurol.* 2010;67(5):596-605.

**Table 1.** Summary of subjects

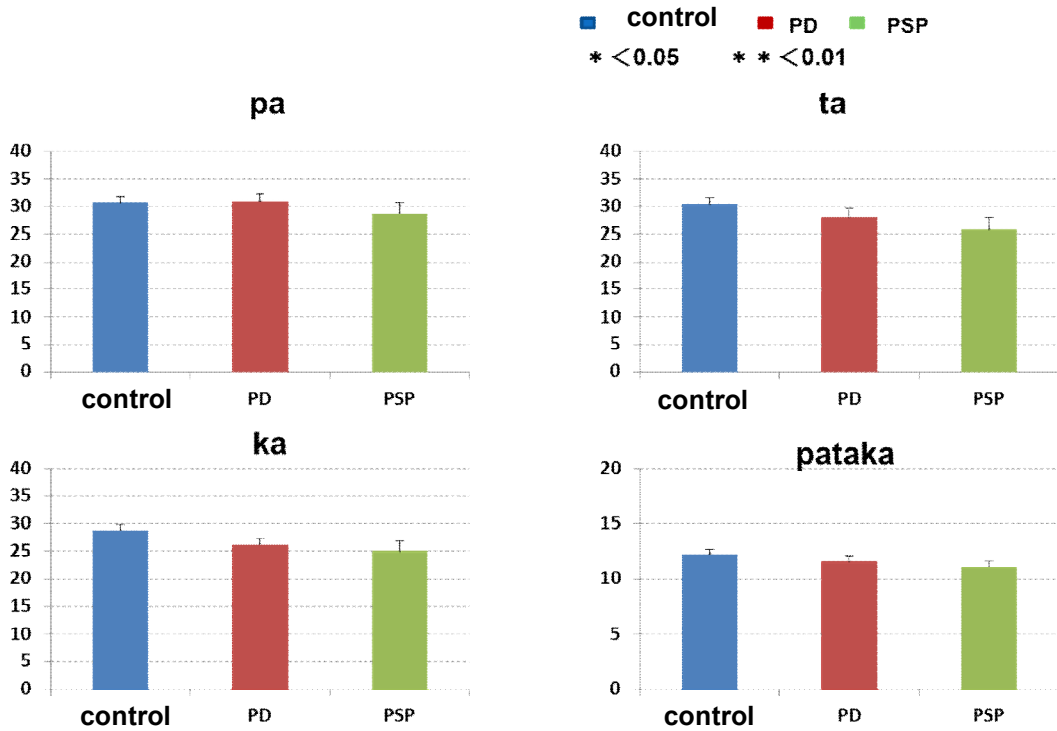
	Number	Hoehn & Yahr stage	Age	Disease duration
Parkinson's Disease	12	3.1	67.6±4.6	6.8±2.6
Progressive Supranuclear Palsy	12	-	70.6±5.3	4.5±2.9
Normal Control	12	-	-	-



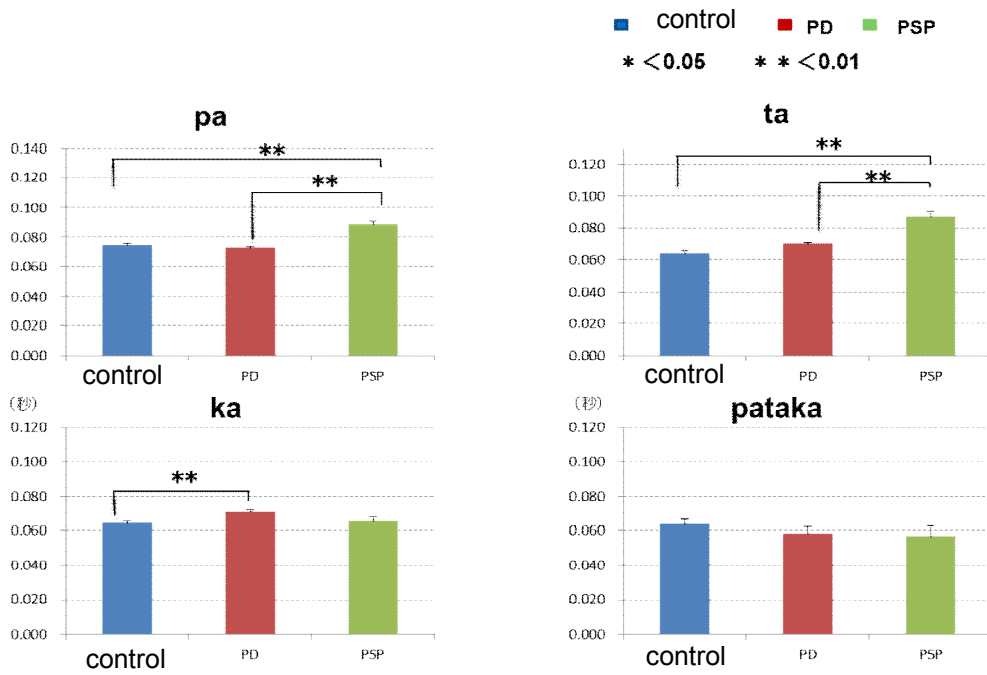
**Figure 1.** Analysis of the utterance continuance. A. Most longest phonation time B. Sound pressure level every one second. C. Oral diadochokinesis analysis. The number of times of /pa/, /ta/, /ka/, /pataka/ pronounced for five seconds were measured. D. Sound pressure level of first 10 words and a word at 5 seconds were measured.



**Figure 2.** Analysis of the utterance continuance in Parkinson’s disease (PD), progressive supranuclear palsy (PSP) and control subjects. \* <math><0.05</math>, \*\*<math><0.01</math>. A. The longest phonation time (MPT). B. Mean sound pressure level. C. Mean sound pressure level converted into sound pressure.



**Figure 3.** Number of times of oral diadochokinesis of 5 seconds in Parkinson’s disease (PD), progressive supranuclear palsy (PSP) and control subjects. No significant difference was found in any forms of pronunciation



**Figure 4.** Long silence section in Parkinson’s disease (PD), progressive supranuclear palsy (PSP) and control subjects.

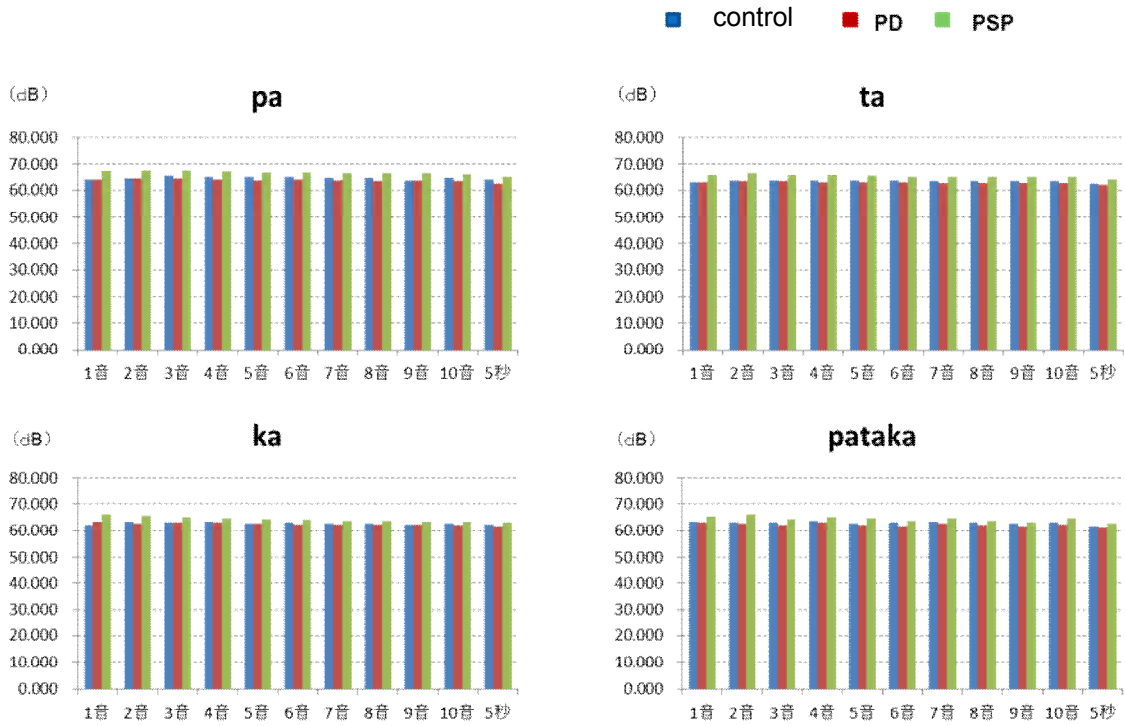


Figure 5. Sound pressure level of oral diadochokinesis.

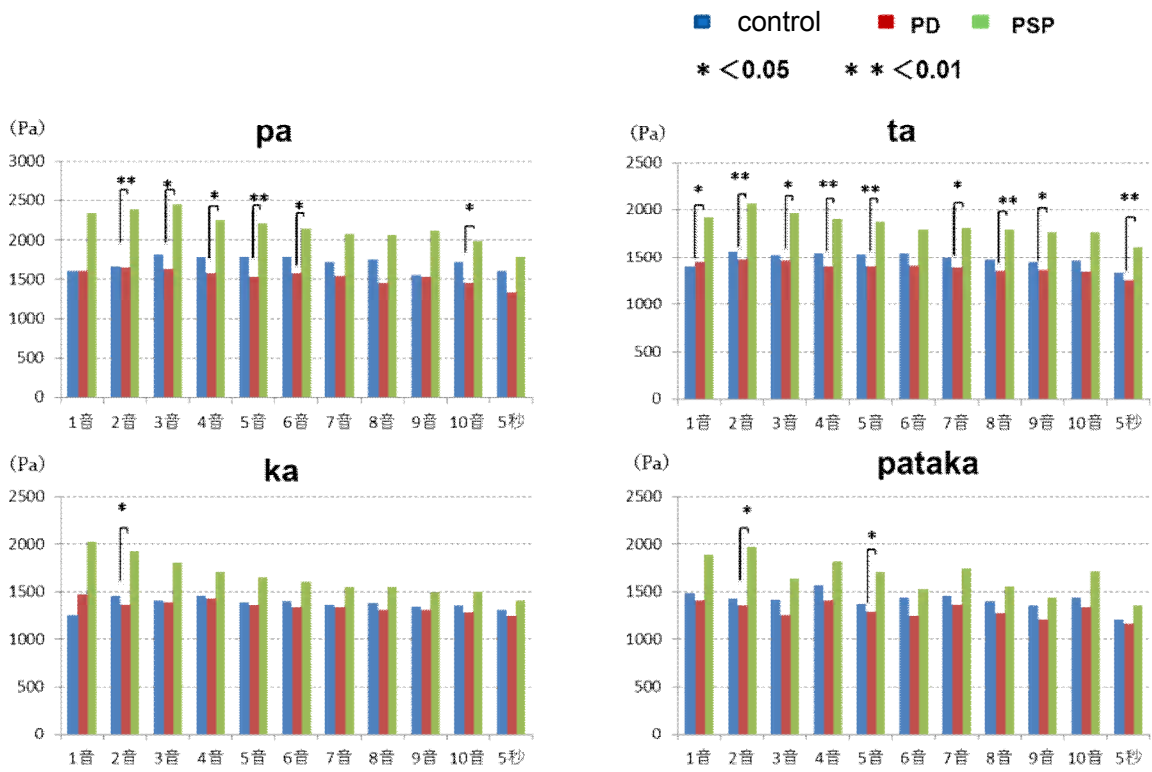
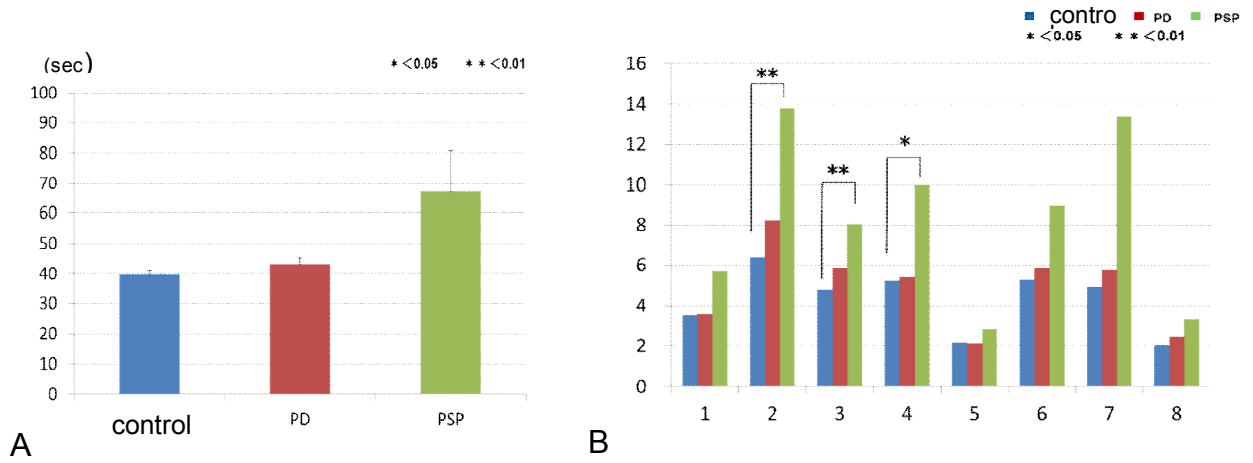
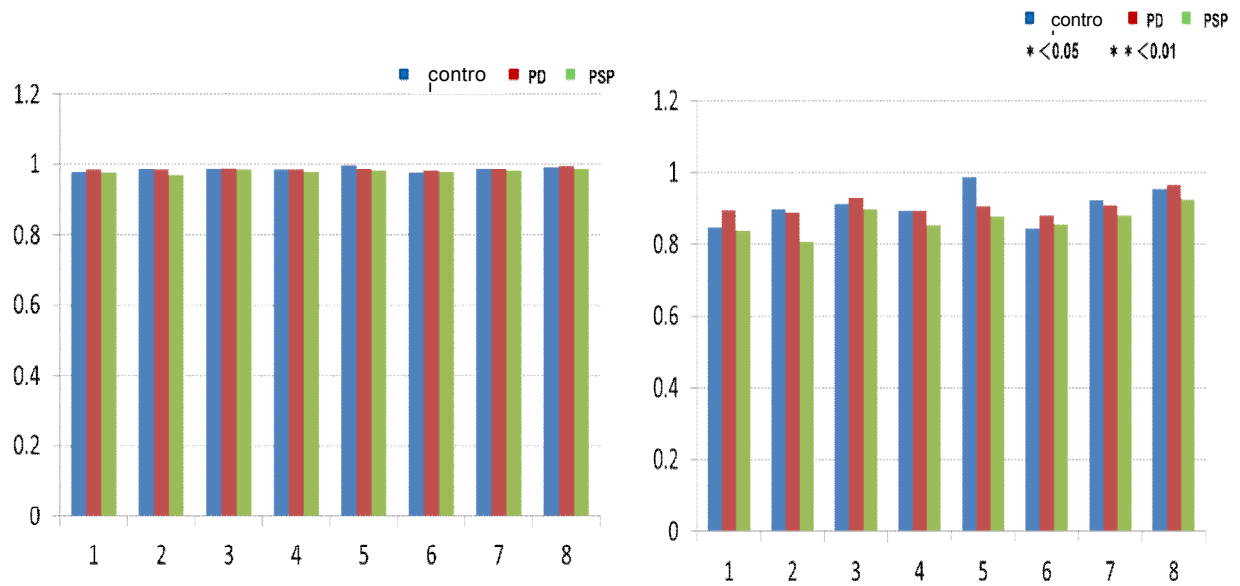


Figure 6. Sound pressure converted from sound pressure level. A significant difference was found in lip sound and anterior lingual sound between PD and PSP group. The sound pressure of the PSP group was higher than that of the PD group.



**Figure 7.** Reading aloud time of common sentences. No significant difference was found among the three groups (A). Hardly any difference was found in reading aloud time every one minute (B).



**Figure 8.** A. Sound pressure level of reading the common sentences. B. Sound pressure converted from A.