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Clinical application of a card-type odor identification test to olfactory assessment in Parkinson's disease

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ABSTRACT

Objectives: Current studies have provided valuable evidence that Parkinson's disease (PD) is closely associated with olfactory loss and that the use of olfactory testing is regarded as one of the potential screening tools for early diagnosis of PD.
Methods: Twenty-six patients with PD, age- and sex-matched 14 patients with other neurological diseases and 10 healthy controls were evaluated the sense of smell by the Open Essence (OE).
Results: The motor performance of the patients with PD was assessed using the Hoehn and Yahr scale. The OE scores for patients with PD were significantly lower than those with both the patients with other neurological diseases and controls. There was no significant difference of the OE scores between patients with other neurological diseases and controls. In the PD group, the OE score was not correlated with gender, smoking habit, disease duration, age at examination, or cognitive status. However, the OE scores were significantly correlated with Hoehn and Yahr stages.
Conclusion: OE was found to be practically self-administered, time-saving, reliable, and inexpensive method for correct diagnosis of olfactory dysfunction associated with PD.

1. Introduction

Current studies have provided valuable evidence that Parkinson's disease (PD) is closely associated with olfactory loss and that the use of olfactory testing is regarded as one of the potential screening tools for early diagnosis of PD [1,2]. Several reports [3,4] concluded that a combination of olfactory testing and other tests such as transcranial sonography of the substabtia nigra and single-photon emission computed tomography constitutes a screening tool for the risk to develop PD. Furthermore, olfactory dysfunction has been shown to help in the differentiation of PD from other forms of parkinsonism, to be predictive of development of PD, and to use as a potential biomarker of preclinical PD [5].

Olfactory testing offers an inexpensive, reliable method for screening those patients already known to be at risk and discriminating between PD and other parkinsonism [5,6]. Olfactory identification has been the most widely used as assessment of olfaction. There are the 27 olfactory tests currently used clinically in the world [7]. The University Pennsylvania Smell Identification Test has been validated as a reliable method of quantifying olfactory identification [8]. Another olfactory testing method, Sniffin' Sticks, uses a pen-like device to test odor threshold, discrimination and identification [9]. The price of The University Pennsylvania Smell Identification Test and Sniffin' Sticks is approximately 30 and 230–325 US dollars, respectively. Although many smell identification tests have been developed in western countries, their odorants are not familiar to Japanese people.

In Japan, T&T olfactometer has been used as a standard method to determine the olfactory threshold [10,11] as well as intravenous administration of thiamine propyldisulfide (Alinamin test) [12] and further Jet Stream Olfactometer modified based on T&T olfactometer has been also used [12]. However, T&T olfactometer has several disadvantages including time-consuming and requirement of fume hood, which enables to be less distributed to ENT office. The cost of a set of T&T olfactometer in Japan was approximately 17 US dollars. The odor stick identification test is a new type of smell identification test recently developed in Japan; it consists of 12 odorants that are all familiar to Japanese subjects [13], but was not commercially available. Very currently, the odor stick identification test has been modified to the smell identification test cards, Open Essence® (OE, Wako Pure Chemical Industries, Tokyo, Japan), for Japanese population. In this study, we assessed the olfactory dysfunction in PD patients by using the new odor identification test.

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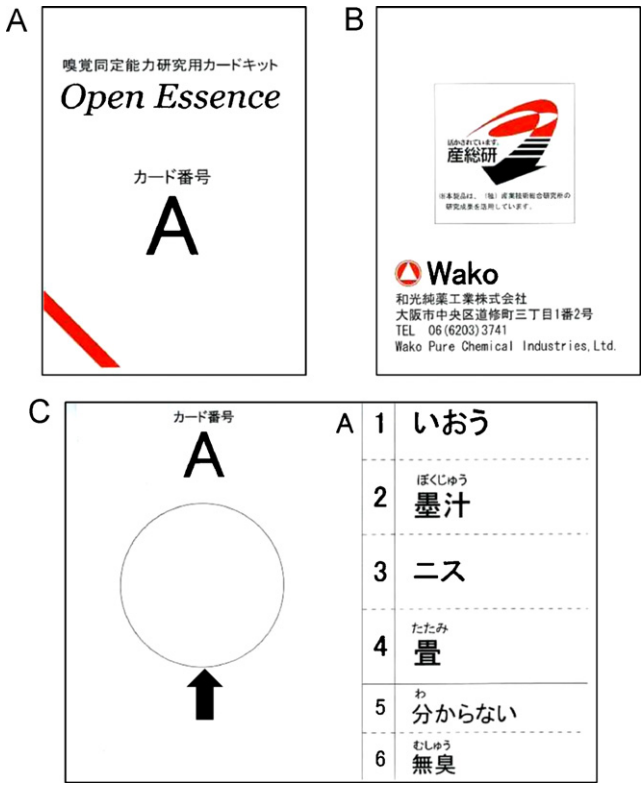

Fig. 1. Picture of a card-type odor identification test, Open Essence®. A: Front, B: Back, C: Inside the card, the microencapsulated odorant is located at the circle area (an arrow) in the left page. In the right page, four alternatives of odor name (1: Sulfur, 2: Indian ink, 3: Vanish, 4: "Tatami" mat), and two additional choices of "5: detectable but not recognized" and "6: no smell detected" are noted in Japanese.

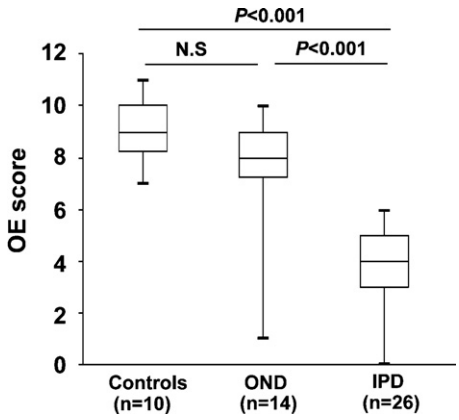

Fig. 2. A comparison of the Open Essence (OE) scores between Parkinson's disease (PD), other neurologic diseases (OND), and controls. Comparison of mean score of OE. Error bars are S.D. The box-and-whisker plots show the median and the interquartile range of OE score. The whiskers extend to the maximum and the minimum data points of OE score.

2. Subjects and methods

Twenty-six patients with PD (12 females aged 51–83 years with a mean age of 71.1 ± 8.6 years and 14 males aged 51–85 years with a mean age of 67.2 ± 8.4 years), age- and sex-matched 14 patients with other neurological diseases (OND) having no sign of olfactory dysfunction (8 females aged 47–78 years with a mean age of 63.8 ± 12.2 years and 6 males aged 59–82 years with a mean age of 69.7 ± 9.5 years), and age- and sex-matched 10 healthy controls having no olfactory complaints (5 females aged 53–78 years with a mean age of 64 ± 9 years and 5 males aged 58–79 years with a mean age of 69 ± 14 years) were enrolled in this study after giving informed consent. All the subjects had no sinonasal lesions, which were confirmed by nasal endoscopy and/or computed tomography. The diagnosis of PD was made based on the United Kingdom Brain Bank and a negative family history of PD. OND included multiple system atrophy, spinocerebellar degeneration, corticobasal degeneration, cerebritis, cerebral infarction, lacunar infarction, etc. The cognitive status was evaluated by the Mini Mental State Examination (MMSE). The severity of the PD patients was assessed using the modified Hoehn and Yahr (H&Y) scale during on conditions. The subjects having an MMSE score of less than 24 were excluded because of inadequate comprehensibility to respond to the odor. The study was approved by the ethics committee of the Juntendo University Faculty of Medicine.

Olfaction in all three groups was assessed by the OE. The OE is comprised of 12 kinds of card-type materials embedded with

Table 1
Clinical profiles of subjects.

	Number of patients	Age (year)	Disease duration (year)	Gender (female/male)	Smoking/non-smoking	MMSE score	OE score
Parkinson's disease	26	69.0 ± 8.6	10.3 ± 5.8	12/14	8/18	27.4 ± 1.9	3.5 ± 1.7
Other neurologic diseases	14	67.3 ± 11.1	9.6 ± 6.6	8/6	5/9	28.4 ± 1.5	7.6 ± 2.4
Control	10	66.2 ± 11.2	–	5/5	3/7	–	9.0 ± 1.3

Age, disease duration, Mini Mental State Examination (MMSE) score, and Open Essence (OE) score are expressed as mean ± S.D.

Table 2
The mean rate of identification of each odor.

Odor item	PD	OND	Control	*p* value		
				PD vs OND	OND vs Control	Control vs PD
Indian ink	23.1	57.1	60	0.036	0.892	0.045
Wood	30.8	42.9	60	0.457	0.407	0.120
Perfume	15.4	57.1	80	0.007	0.250	0.000
Mentol	53.8	78.6	80	0.123	0.936	0.148
Orange	30.8	78.6	80	0.004	0.936	0.008
Curry	42.3	100.0	100	0.001	1.000	0.002
Cooking gas	23.1	57.1	80	0.031	0.242	0.002
Rose	11.5	42.9	60	0.023	0.408	0.003
Cypress wood	38.5	50.0	60	0.481	0.628	0.244
Sweaty smelling clothes/fermented soybeans	26.9	64.3	70	0.021	0.770	0.018
Condensed milk	23.1	50.0	70	0.083	0.327	0.009
Roasted garlic	50.0	71.4	100	0.191	0.114	0.006

PD: Parkinson's disease, OND: Other neurological diseases.