Auris Nasus Larynx 41 (2014) 523–527

Contents lists available at ScienceDirect

Auris Nasus Larynx

journal homepage: www.elsevier.com/locate/anl

Combinations of two odorants of smell identification test for screening of olfactory impairment

Hideaki Shiga [a,*], Junpei Yamamoto [a], Miwa Kitamura [a], Hideaki Nakagawa [b,c], Tomoko Matsubasa [d], Atsuko Seo [d], Takaki Miwa [a]

[a] Department of Otorhinolaryngology, Kanazawa Medical University, Ishikawa 920-0293, Japan
[b] Department of Epidemiology and Public Health, Kanazawa Medical University, Ishikawa 920-0293, Japan
[c] Health Control Center, Kanazawa Medical University Hospital, Ishikawa 920-0293, Japan
[d] Tokyo Gas Corporation Ltd., Tokyo 105-8527, Japan

ARTICLE INFO

Article history:
Received 13 March 2014
Accepted 13 August 2014
Available online 2 September 2014

Keywords:
Odorant
Open Essence
Screening for olfactory impairment
Smell identification test card

ABSTRACT

Objective: To determine whether combinations of two odorants of the Open Essence smell identification test can be used to screen for olfactory impairment in Japanese people.
Methods: A total of 243 Japanese subjects (142 males, 101 females; mean age, 37.5 years; age range, 20–62 years) were enrolled in the study. The main outcome measures were the results of olfactory testing by using the full 12 odorants (condensed milk, cooking gas, curry, cypress wood (Japanese cypress, *hinoki*), India ink, Japanese orange (*mikan*), menthol, perfume, roasted garlic, rose, sweaty-smelling clothes, and wood) of the Open Essence test as well as combinations of two odorants of the Open Essence test, and the results of self-reported questionnaires addressing awareness of a smell disorder, history of sinunasal disease, self-reported nasal obstruction, and history of smoking.
Results: In screening with combinations of two odorants, the highest positive likelihood ratio (19.1) was obtained with the cypress wood and India ink odorants. All subjects correctly identified the curry odorant. Combinations of other odorants also had high positive likelihood ratios (India ink and sweaty-smelling clothes, 17.6; perfume and sweaty-smelling clothes, 14.7; cypress wood and roasted garlic, 14.1; cypress wood and rose, 13.2; cypress wood and perfume, 11.0; cypress wood and wood, 10.7).
Conclusion: The combination of cypress wood and India ink odorants may be useful for detecting individuals with olfactory impairment among subjects who can correctly identify the curry odorant.

1. Introduction

Impaired olfaction significantly increases the risk of serious accident or disease [1]. Simple odor presentation devices have been developed for the screening of olfactory impairment in Japan. The Odor Stick Identification Test for the Japanese (OSIT-J; Daiichi Yakuhin Sangyo, Tokyo, Japan) [2] has proven useful for identifying patients with olfactory impairment in otorhinolaryngological clinics [3,4]. The OSIT-J consists of 12 odorants that are familiar for Japanese people [2]. Miwa et al. [5,6] have shown that correct identification of the rose, curry, or sweaty-smelling clothes odorants in the OSIT-J has a statistically significant relationship with assessments made using the T&T olfactometer threshold test, which is the standard olfactory function test used in Japan. Furthermore, the curry odorant in the OSIT-J is more effective than the rose or sweaty-smelling clothes odorants, or a combination of these two odorants, for the detection of olfactory impairment in Japanese people [7]. However, screening for olfactory impairment is not widely conducted in Japan because the OSIT-J could hardly be applied for the self-reported test.

The Open Essence smell identification test (Wako, Japan) was developed to address the deficiencies of the OSIT-J [8,9]. Both the Open Essence test and the OSIT-J use the same 12 odorants and a four-plus alternative forced-choice paradigm; however, the Open Essence test is suitable for self-reporting because the odorants are contained within simple, sealed test cards rather than in sticks (Fig. 1). Subjects and experimenters reported the Open Essence test to be easier, shorter, more interesting, and more convenient to conduct than the OSIT-J [9]. In Japanese subjects, the scores from

* Corresponding author at: Department of Otorhinolaryngology, Kanazawa Medical University, 1-1 Daigaku, Uchinadamachi, Kahokugun, Ishikawa 920-0293, Japan. Tel.: +81 76 218 8147; fax: +81 76 286 5566.
E-mail address: shigah@kanazawa-med.ac.jp (H. Shiga).

http://dx.doi.org/10.1016/j.anl.2014.08.011
0385-8146/

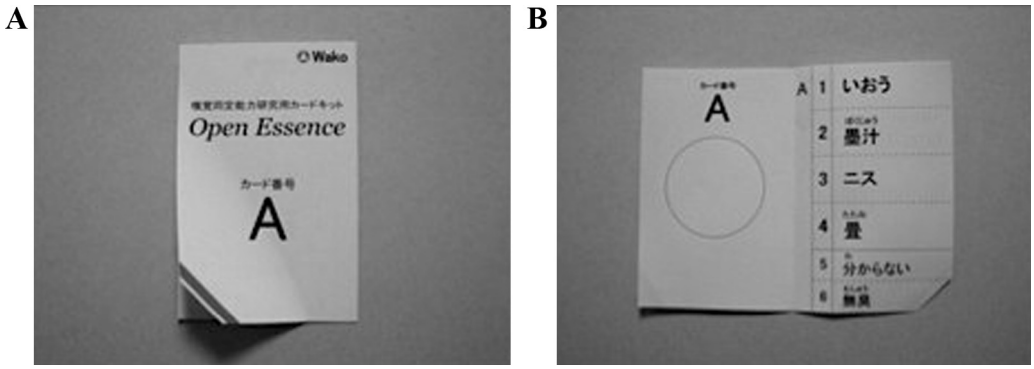

Fig. 1. Photographs of an Open Essence smell identification test card. (A) Front and (B) inside: left, the area within the printed circle is impregnated with the odorant; right, four odor name choices as well as "do not know" and "no smell detected" are listed in Japanese.

the Open Essence test are significantly correlated with the odor recognition threshold obtained by using the T&T olfactometer threshold test [8,9].

Here, we assess the odorants used in the Open Essence test for their usefulness in screening for olfactory impairment in Japanese subjects. We show that screening with the combination of cypress wood and India ink odorants of the Open Essence test is the most effective combination for identifying olfactory impairment in Japanese subjects who can correctly identify the curry odorant.

2. Subjects and methods

2.1. Subjects

A total of 243 Japanese subjects (142 males, 101 females; 74 recipients of an executive check-up at Kanazawa Medical University Hospital, 110 medical workers employed at Kanazawa Medical University Hospital, and 59 medical students enrolled at Kanazawa Medical University; mean age, 37.5 years; age range, 20–62 years) participated in this study. The protocol for this study was reviewed and approved by the clinical research ethics committee of Kanazawa Medical University Hospital. Informed consent was obtained from all subjects prior to the study.

2.2. Open Essence

The Open Essence test (Fig. 1) uses 12 odorants that are familiar to Japanese people [8,9]. These odorants are described as condensed milk, cooking gas, curry, cypress wood (Japanese cypress, *hinoki*), India ink, Japanese orange (*mikan*), menthol, perfume, roasted garlic, rose, sweaty-smelling clothes, and wood. Subjects received the odor cards from the experimenter, opened them, and then sniffed and identified the odorant in a four-plus alternative forced-choice paradigm. The order in which the odorants were presented was randomized.

2.3. Self-reported questionnaires

The subjects were asked to complete questionnaires addressing awareness of a smell disorder, history of sinunasal disease, self-reported nasal obstruction, and history of smoking.

2.4. Statistical analysis

Fisher's exact test (two-tailed) (Prism 4; GraphPad, San Diego, CA, USA) was used to determine the differences between scores for each odorant, screening with combinations of two odorants, and scores for the full 12 odorants. Fisher's exact test (two-tailed) was also used to compare the results of the identification of cypress wood and India ink odorants with the results of the self-reported questionnaires. A P value less than 0.05 was considered statistically significant.

Positive likelihood ratios (Prism 4, GraphPad) were calculated to determine how many times more likely subjects who could not correctly identify one odorant or a combination of two odorants of the Open Essence test are to have scores of 7 correct answers or less for the full 12 odors of the Open Essence test compared with subjects who could correctly identify the odorant or the combination of two odorants.

3. Results

3.1. Distribution of the total number of correct answers in the full Open Essence screening

The distribution of the total number of correct answers in the full Open Essence screening of 243 subjects is shown in Fig. 2 (mean ± SD, 8.97 ± 1.63). It was previously reported that the mean total score for the full 12 odors of the Open Essence test in Japanese subjects with normal olfactory function was greater than 7 correct answers, whereas that in Japanese subjects with slight, moderate, or severe hyposmia, or anosmia was 7 correct answers or less than 7 correct answers [8]. Furthermore, Fujio et al. [10] have suggested that scores of 8 or higher on the Open Essence test should be judged as normal. Therefore, subjects with 7 correct answers or less were classified as having olfactory impairment and subjects with 8 correct answers or more were classified as having normal olfaction.

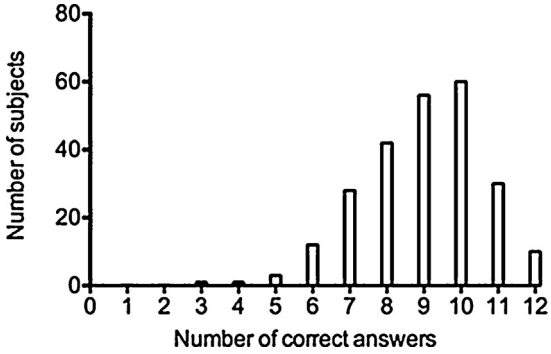

Fig. 2. Distribution of correct answers in the Open Essence screening. Subjects with 7 of 12 correct answers or less were classified as having olfactory impairment. Patients with 8 of 12 correct answers or more were classified as having normal olfaction.