ORTHODONTIC WAVES XXX (2018) XXX–XXX

Available online at www.sciencedirect.com
ScienceDirect
journal homepage: www.elsevier.com/locate/odw

Original article

Influence of habitual mouth breathing on taste sensation

Kayo Kimura-Ueda [a,*], *Kazuo Shimazaki* [a], *Kumiko Sugimoto* [b], *Takashi Ono* [a]

[a] *Department of Orthodontic Science, Graduate School of Medical and Dental Sciences, Tokyo Medical and Dental University, Tokyo, Japan*
[b] *Department of Oral Prosthetic Engineering, Graduate School of Medical and Dental Sciences, Tokyo Medical and Dental University, Tokyo, Japan*

ARTICLE INFO

Article history:
Received 16 October 2017
Received in revised form
6 December 2017
Accepted 21 December 2017
Available online xxx

Keywords:
Mouth breathing
Nasal obstruction
Olfactory function
Salivation
Taste

ABSTRACT

Purpose: Although habitual mouth breathing is recognized to cause various disorders of orofacial growth and function, including taste sensation, the relationship between habitual mouth breathing and taste disorders has not been investigated sufficiently. This study aimed to examine the influence of habitual mouth breathing on taste sensitivity and relevant factors such as salivation, oral moisture, and olfactory function.

Materials and methods: Thirty volunteers (male, 18; female, 12) aged 22–35 years participated in this study. On the basis of their responses to a questionnaire regarding habitual breathing, 15 subjects each were assigned to the mouth-breathing (MB) and control groups. Recognition thresholds for sweet, salty, sour, bitter, and umami tastes at the tip and root of the tongue were measured using the filter-paper disk method. Salivary flow and spinnbarkeit (viscosity), oral moisture, and olfactory function were also measured as factors related to taste sensitivity. Additionally, a questionnaire about dry mouth, nasal obstruction, snoring, and olfaction was implemented.

Results: The MB group exhibited significantly higher recognition thresholds for sweetness and sourness at the tip and for bitterness and sourness at the root of the tongue compared with the control group. However, there was no significant intergroup difference in the threshold for salty or umami taste, salivary flow or spinnbarkeit, oral moisture, or olfactory function. The MB group exhibited a significantly higher subjective feeling of dry mouth, nasal obstruction, and snoring than the control group.

Conclusions: Mouth breathing habit poses a risk for taste deterioration without affecting salivary secretion and olfactory function.

* *Corresponding author at*: Department of Orthodontic Science, Graduate School of Medical and Dental Sciences, Tokyo Medical and Dental University, 1-5-45 Yushima, Bunkyo-ku, Tokyo 113-8549, Japan.
E-mail address: kkimura.orts@gmail.com (K. Kimura-Ueda).
https://doi.org/10.1016/j.odw.2017.12.003
1344-0241/

1. Introduction

Breathing is an essential function for sustenance of life. The physiologically normal form of breathing is conducted through the nasal cavity, pharynx, larynx, and trachea. However, when the nasal airway is obstructed because of rhinitis or incomplete lip closure caused by malocclusion, we are forced to breathe through the mouth [1]. Mouth breathing (MB) is defined as a habit of respiring through only the mouth or through both the mouth and nose for longer than 6 months [2]. It is associated with disorders such as abnormal orofacial development, dry mouth, malocclusion, tooth caries, periodontal diseases, and oral malodor [1,3]. Nasal obstruction is also a potential risk factor for obstructive sleep apnea syndrome [4,5]. In a previous study on evaluation of respiratory function using near-infrared spectroscopy (NIRS), relative to nasal breathing, experimental MB resulted in an increased oxygen load in the prefrontal cortex [6], and it was suggested that continual oxygen load in this area due to MB might induce central fatigue. It is also reported that, compared to nasal breathing, MB causes a decrease in peripheral oxygen tension [7]. Thus, MB might be a risk factor for dysfunction of the brain and peripheral organs such as sensory receptors.

Among sensory functions, olfaction and taste are essential for food selection and intake [8,9] for sustenance of life. Olfactory function can be directly disturbed by nasal obstruction—a major cause of MB—because accession of odor molecules to olfactory epithelium located in the posterior nasal cavity is interrupted. Taste sensitivity varies depending on several factors, including age, sex, stress, smoking habit, and alcohol consumption [10–14]. It is also influenced by olfactory deterioration [15], because information regarding taste and olfaction is integrated in the central nervous system when we savor foods. Ashida and Miyaoka reported that taste threshold is elevated when nasal breathing is obstructed by a cotton pad [16]. However, the influence of habitual MB on taste perception was scarcely examined, though one study investigated the influences of various factors including MB on taste thresholds and reported that MB was not an influential factor [17]. In addition, mouth-breathing-associated changes in relevant factors that possibly influence taste sensitivity have not been examined yet. Therefore, in order to elucidate the influence of habitual MB on taste perception and investigate the cause of this influence, we examined taste sensitivity and relevant factors such as salivation, oral moisture, and olfactory function in the present study.

2. Materials and methods

2.1. Subjects

Thirty healthy subjects (male, 18; female, 12) voluntarily participated in this study. The mean age of these subjects was 26.6±2.9 (SD) years (age range, 22–35 years). None of the subjects had any self-reported complaints of taste disorder or oral disease and were under any medication. The subjects were classified into two groups (15 subjects each)—the mouth-breathing (MB) and control groups—on the basis of their answers to the three questions shown in Table 1 which had been used to identify mouth breathers during daytime [18]. Subjects who chose 0–1 and 2–3 from among the underlined options were considered as nasal and mouth breathers, respectively. Additional questionnaire included questions regarding age, sex, smoking habits, drinking habits and taste preferences as well as problems such as dry mouth, nasal obstruction, snoring and olfaction (Table 3).

2.2. Measurement of recognition thresholds for five basic tastes

Subjects were asked to refrain from any food except water for 2 h before evaluation. On the assumption that the influence of MB might vary depending on the region of the tongue as well as taste quality, the focal stimulation method with the filter-paper disk (FPD) was selected for evaluation of gustatory function, rather than other methods such as whole-mouth method and electrogustometry. Since the correlation between the left and right thresholds measured by the FPD method is remarkably high [19], we measured recognition thresholds only on the right side of the tongue. A filter-paper disc of 5-mm diameter was soaked in a test solution and placed for about 3 s on the tongue region, approximately 2 cm from the midline at the tip and around the root, which are innervated by the chorda tympani and glossopharyngeal nerves, respectively. After the subjects pointed at an answer from among seven options on the chart, such as sweet, sour, salty, umami, bitter, feel some taste, and no taste, the tested filter-paper disc was removed.

Sucrose, citric acid, NaCl, monosodium glutamate (MSG), and quinine-HCl (quinine) solutions were each prepared at eight different concentrations (Table 2) for sweet, sour, salty, umami, and bitter stimuli, respectively. Recognition thresholds were measured with ascending concentrations of solutions for each taste quality; the lowest concentration at which the subject could correctly identify the taste quality was

Table 1 – Questionnaire for identification of mouth-breathing habit.

Questions	Choices			
How do you breathe usually?	Nose usually	Mouth usually	Mouth only	Nose and mouth
Is your mouth open?	Usually closed	Sometimes open	Often open	Always open
Is your mouth open when chewing?	Usually closed	Usually open	Both	

Note: subjects who chose 0–1 and 2–3 out of the underlined options were regarded as nasal and mouth breathers, respectively.

Please cite this article in press as: K. Kimura-Ueda, et al., Influence of habitual mouth breathing on taste sensation, Orthod Waves (2018), https://doi.org/10.1016/j.odw.2017.12.003