

Halitosis Patients at a Newly Established Satellite Dental Hospital: Analysis of Patients and the Role of Dental Hygienists

Masahiro Yoneda¹, Miwa Yamada², Nao Suzuki¹, Rie Uemura³, Akie Fujimoto¹, Yosuke Masuo¹, Hirofumi Fukuchi¹, Hiromitsu Morita¹, Kazuhiko Yamada¹, Tadayuki Matsuo⁴, Ayako Ishii⁴, Chihiro Koga⁵, Takao Hirofuji¹

¹Section of General Dentistry, Department of General Dentistry, Fukuoka Dental College, ²Postgraduate Course, Department of Dental Hygiene, Fukuoka College of Health Sciences, ³Dental Hygienists Division, Center for Oral Diseases, Fukuoka Dental College, ⁴Department of Dental Hygiene, Fukuoka College of Health Sciences, ⁵Center for Oral Diseases, Fukuoka Dental College, Fukuoka, Japan

Objective: Fukuoka Dental College established a satellite clinic, the Center for Oral Diseases (COD), in December 2011. In this study, we analyzed halitosis patients and the role of dental hygienists.

Methods: Approximately 70% of the patients were female and most were in their 40s. We analyzed the possible causes of halitosis.

Results: More than half of the patients exhibited a thick tongue coating. Low salivary flow was present in 23.6% of males and in 39.4% of females. Pocket depth ≥ 6 mm was found in 44.2% of males and in 16.7% of females. We also analyzed treatment provided after breath odor measurement. Most of the patients with physiological halitosis and pseudohalitosis did not receive further treatment, but some were treated at the COD with scaling and professional tooth cleaning. Many of the patients with genuine halitosis received dental treatment at the COD. We referred patients from other clinics and from distant locations to their local doctors for treatment.

Conclusion: Halitosis had various causes, and the role of dental hygienists, including scaling, root planing, and tooth brushing instruction, are important in decreasing breath odor. Dental hygienists play an important role in communication with halitosis patients.

Keywords: halitosis, dental hygienists, analysis, diagnosis

Corresponding author **Masahiro Yoneda**

Section of General Dentistry, Department of General Dentistry, Fukuoka Dental College, 2-15-1, Tamura, Sawara-ku, Fukuoka 814-0193, Japan. Tel: +81-92-801-0411, Fax: +81-92-801-4909, E-mail: yoneda@college.fdcnet.ac.jp

Received September 12, 2014, Revised February 23, 2015,

Accepted February 24, 2015

Introduction

Halitosis, or bad breath, is a common complaint among the general population and is primarily associated with conditions in the oral cavity, including oral hygiene status and periodontal condition [1,2]. Halitosis mainly results from microbial metabolism of amino acids in local debris [3,4]. Some cases of halitosis result from systemic disorders [5], and dentists must per-

Copyright © 2015. Korean Academy of Preventive Dentistry. All rights reserved.

This is an Open Access article distributed under the terms of the Creative Commons Attribution Non-Commercial License (<http://creativecommons.org/licenses/by-nc/3.0>) which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.

form careful examination to arrive at the proper diagnosis. Moreover, halitosis can play a role in social anxiety disorders [6], and dental professionals need to support patients by understanding their mental health conditions.

Dental hygienists are often the first to encounter halitosis patients at dental clinics, and they may spend more time with patients than dentists do. Therefore, dental hygienists are important in motivating halitosis patients. However, our recent study revealed that some dental hygienists lack knowledge about halitosis [7].

Fukuoka Dental College established a satellite clinic, the Center for Oral Diseases (COD), in December 2011. The COD has a halitosis clinic visited by many patients [8]. We analyzed patients with halitosis and the possible role of dental hygienists in treating this condition.

Materials and Methods

We evaluated 228 halitosis patients who visited the COD from December 14, 2011 to March 31, 2014. Patients provided

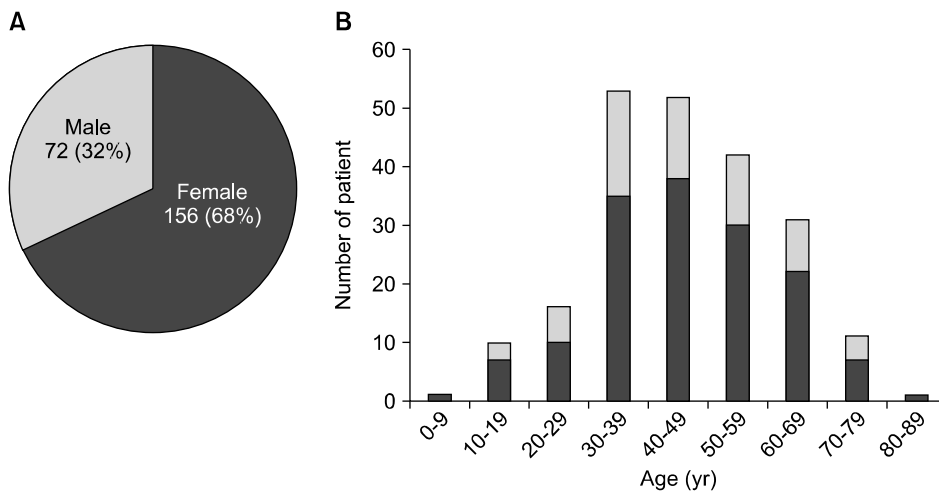


Figure 1. (A) Patient gender distribution. (B) Age distribution.

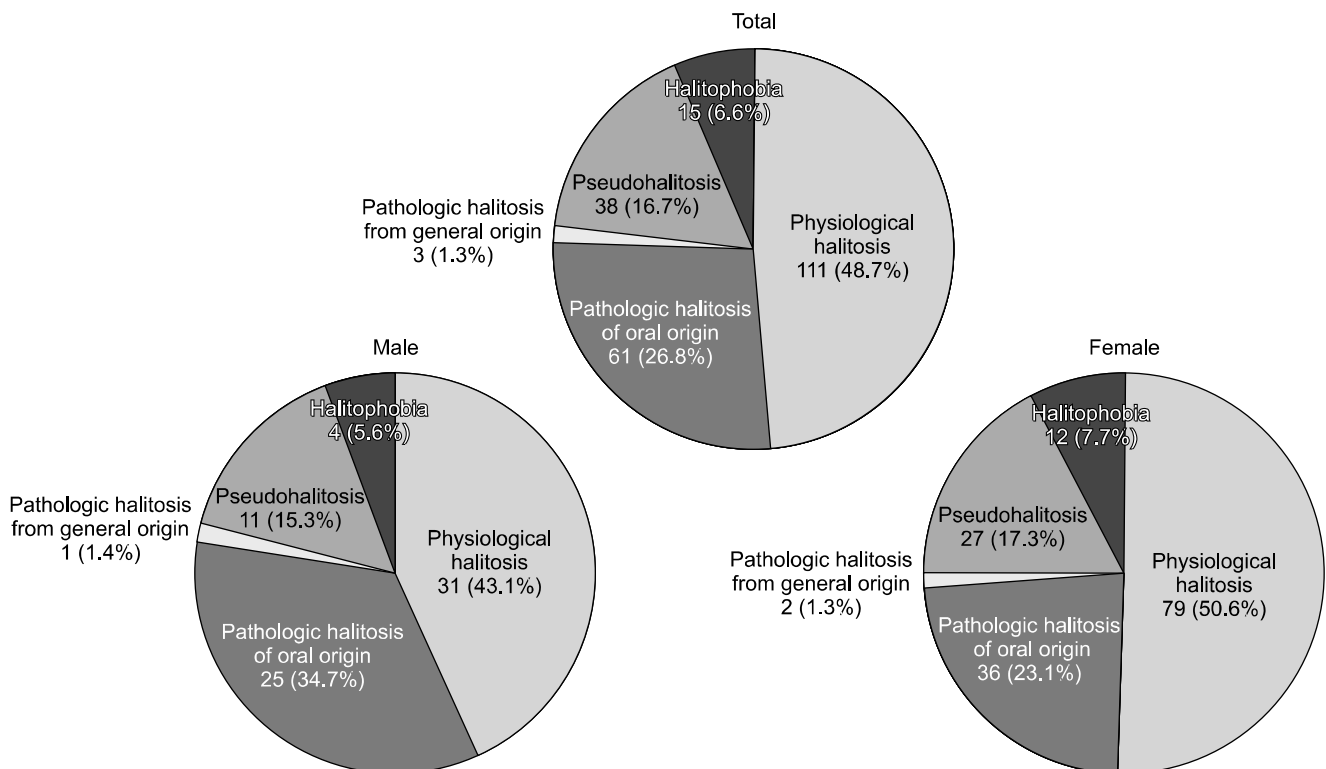


Figure 2. Halitosis diagnoses.

informed consent for participation in this study. Patient information, including age and gender, was obtained from the medical records. Halitosis was diagnosed according to international classification systems [2,8]. Tongue coating was evaluated by observation, scraping with gauze, and judged with Kojima's classification [9]. The tongue coating bacteria of some patients were counted with a bacterial counter (Panasonic Healthcare Co. Ltd, Tokyo, Japan). Statistical comparisons were performed using χ^2 tests. The SPSS statistical software package was used for all analyses (release 11.0J; SPSS Japan, Tokyo, Japan).

Results

1. Gender, age, and diagnosis of halitosis patients

Figure 1A shows the gender and age distribution of halitosis patients. Nearly 70% of halitosis patients were female; the number of male patients was less than half that of female patients. The peak age of male patients was in the 30s and that of female patients was in the 40s (Figure 1B). The youngest patient was 9-year-old, and the oldest was 82-year-old.

Figure 2 shows the halitosis diagnoses. Nearly half of patients were diagnosed with physiological halitosis; 26.8% had pathological halitosis of oral origin. The percentages of pseudo-halitosis and halitophobia were 16.7% and 26.8%, respectively.

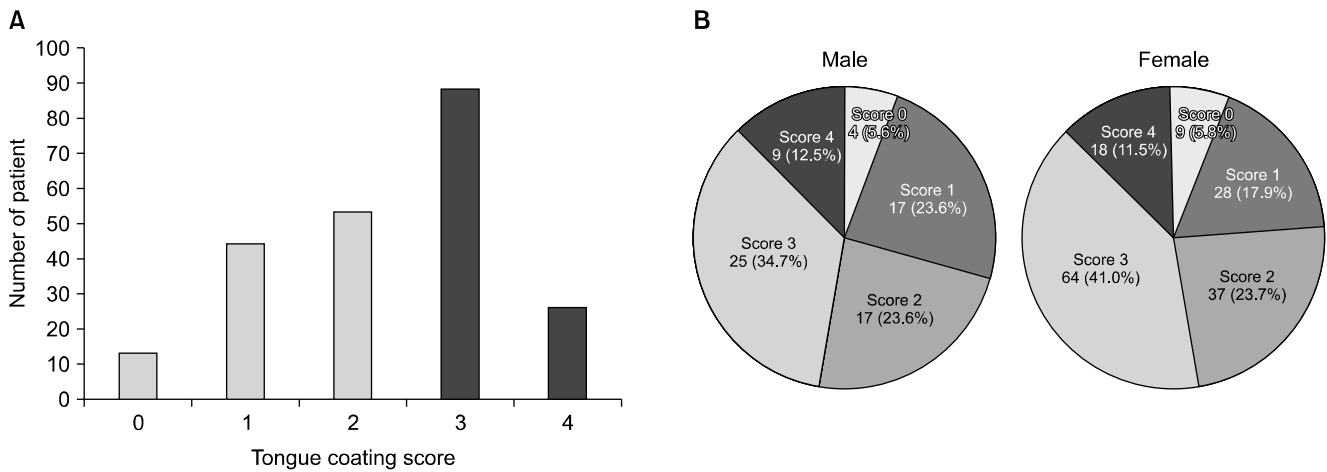


Figure 3. (A) Tongue coating classification of halitosis patients. (B) Tongue coating classification by gender. Kojima's scores are as follows. 0: no tongue coating. 1: thin tongue coating covering 1/3 area of tongue surface. 2: thick tongue coating covering 1/3 area of tongue surface or thin tongue coating covering 2/3 area of tongue surface. 3: thick tongue coating covering 2/3 area of tongue surface or thin tongue coating covering more than 2/3 area of tongue surface. 4: thick tongue coating covering more than 2/3 area of tongue surface.

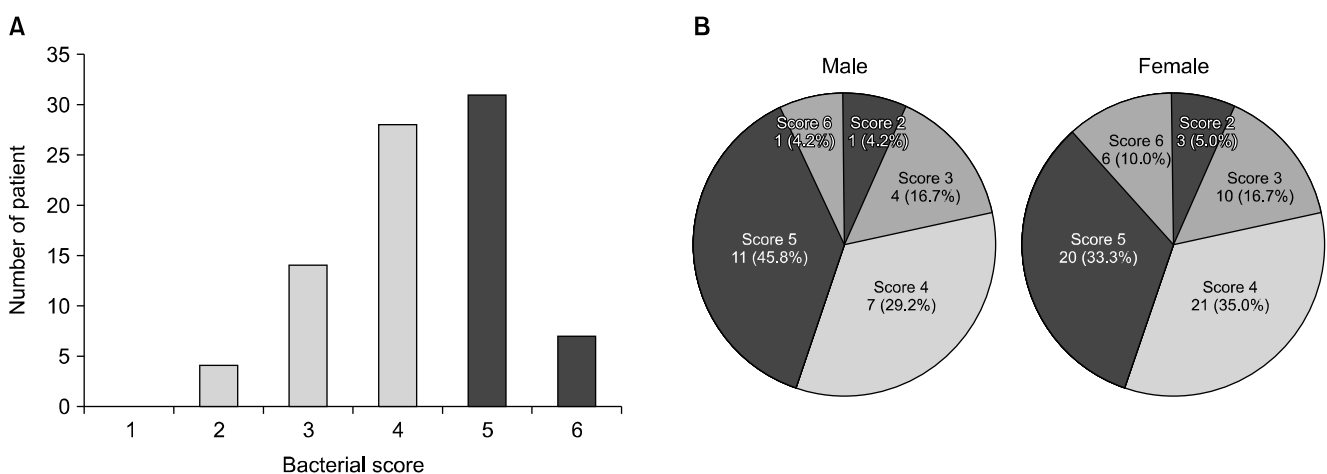


Figure 4. (A) Bacterial scores of tongue coating of examined patients. (B) Bacterial scores of tongue coating by gender. Black bar means "clinically many" bacteria reside in oral cavity. Numbers of bacteria in score 5 and 6 are 3.16 to 10 million and more than 10 million respectively.

Pathologic halitosis of systemic origin was found in 1.3% of patients, and was associated with internal medicine and otolaryngology. Pathologic halitosis of oral origin was more commonly found in males than in females. Physiological halitosis and pseudohalitosis were more common among females than males.

2. Tongue coating

Tongue coating classifications of all patients (Figure 3A) and classifications by gender (Figure 3B) are shown. More than half of patients had thick tongue coating (Kojima's class 3 and 4). A higher percentage of females than males had thick tongue coating. We also analyzed the tongue coating bacteria of some halitosis patients. Figure 4A shows the bacterial counts of these patients. Scores of 5 and higher indicate high bacterial count. Approximately 45% of patients had a score of 5 or higher. The

distribution of scores was more variable among female patients, but the percentage of patients scoring 5 or higher was not different between the sexes (Figure 4B).

3. Stimulated salivary flow

Stimulated salivary flow rates of all patients (Figure 5A) and by gender (Figure 5B) are shown. Stimulated salivary flow rates less than 5 ml/5 min were considered dry mouth. Dry mouth was diagnosed in 34.2% of all patients. Dry mouth was diagnosed in 39.1% of female patients and in 23.6% of male patients; a significantly higher percentage of female patients had dry mouth.

4. Probing depth

Figure 6A shows the probing depths of all patients. Pockets 6 mm or deeper were found in 26.8% of patients. Probing depths by gender are shown in Figure 6B. There were no differences

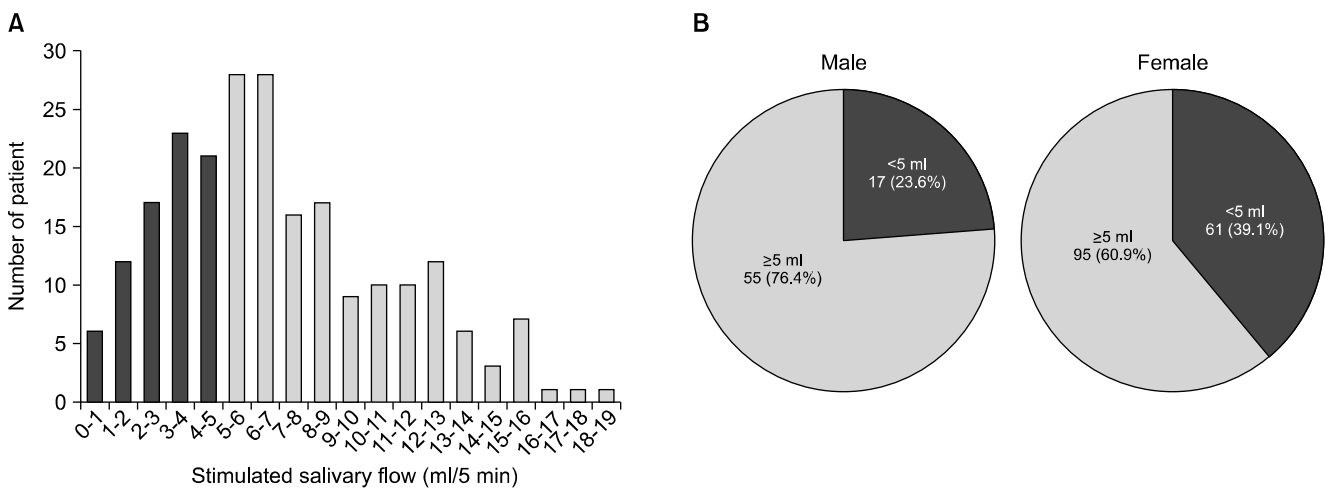


Figure 5. (A) Stimulated salivary flow rates of all patients. (B) Stimulated salivary flow rates by gender.

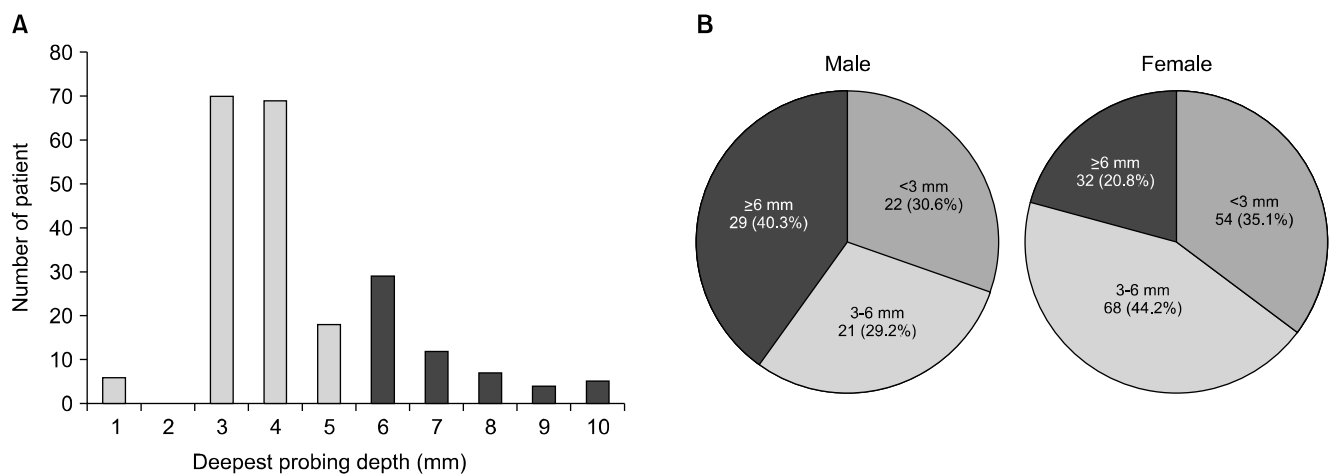


Figure 6. (A) Probing depths of all patients. (B) Probing depths by gender.

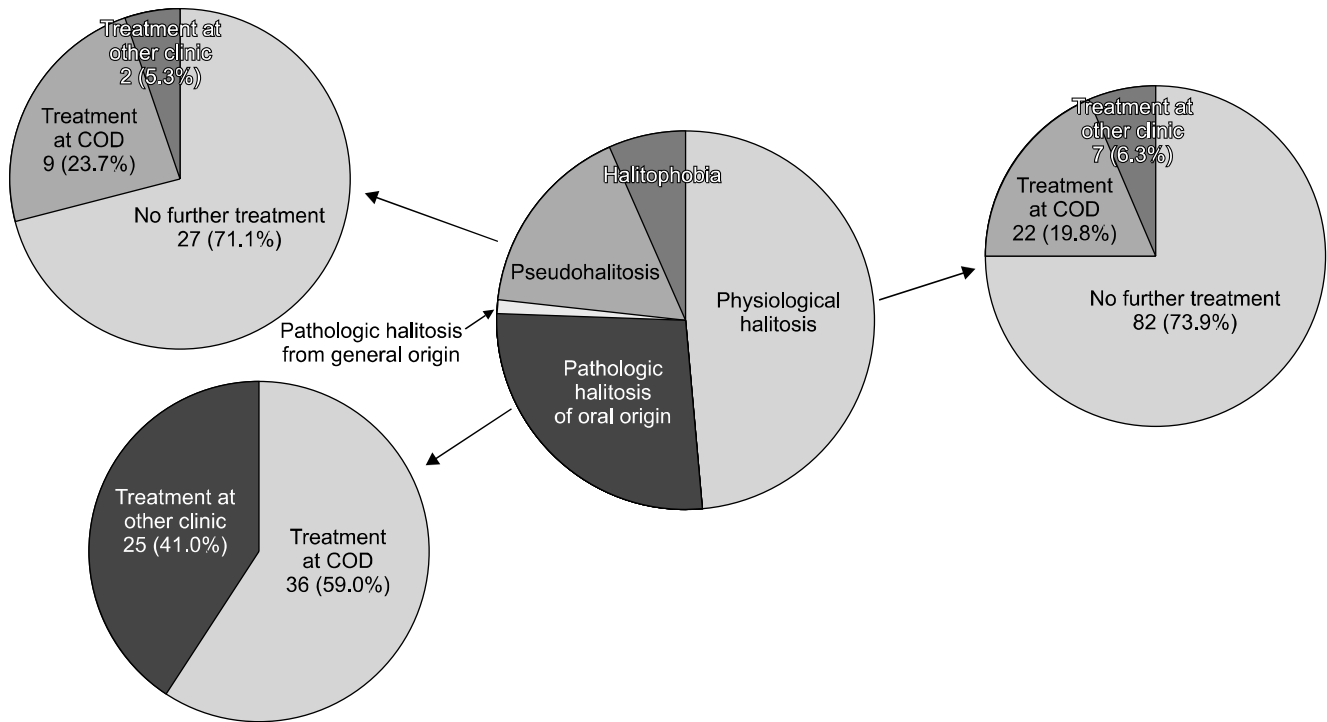


Figure 7. Diagnoses and subsequent treatments. COD: Center for Oral Diseases.

in the percentage of patients with pockets 3 mm or less between genders. Male patients had more deep pockets than female patients.

5. Treatment after diagnosis of halitosis

After diagnosis of halitosis, some patients received dental treatment and others did not (Figure 7). Many patients with physiological halitosis and pseudohalitosis did not need treatment, but some of these patients underwent scaling and professional tooth cleaning. All patients with genuine halitosis of oral origin required dental treatment. More than half of these received dental treatment at the COD; patients from other clinics or from distant locations were referred to their local doctors. Patients with systemic disorders were referred to internal medicine doctors or otolaryngologists. Patients with halitophobia were referred to mental health specialists (data not shown).

Discussion

We analyzed the gender, age, and diagnosis of 228 halitosis patients. We also examined the possible causes of halitosis, including tongue coating, tongue bacteria, probing depth, and stimulated salivary flow rate. Based on this data analysis, we evaluated the role of dental hygienists in the treatment of halitosis. About 70% of halitosis patients were female, a result similar to that of Kawaguchi et al. [10]. One possible reason for

the female predominance is that women are more conscious of halitosis than men. Another possibility is that female patients experience a transient halitosis associated with female hormones [11].

The peak ages for seeking halitosis treatment among men are the 30s, 40s, and 50s, in that order; peak ages among women are the 40s, 30s, and 50s. This order is different between genders, but the peak ages are from the 30s to 50s in both genders. It is speculated that salivary flow decreases and the use of prosthetics increases at these ages. Patients in this age range may also have more stress and feel anxious about their breath odor.

Clinically, some patients who complain of halitosis have actual malodor, whereas others have almost no malodor. Diagnosis and treatment of halitosis involves a simple classification into the categories of genuine halitosis, pseudohalitosis, and halitophobia [2,8]. The treatment of genuine halitosis primarily involves periodontal treatment, dental and oral care, oral hygiene instructions, and counseling. Treatment of pseudohalitosis involves counseling that includes education and explanations of examination results showing that the intensity of the patient's malodor is not beyond socially acceptable levels [2,8,10]. Halitophobia is characterized by a patient's persistent belief that he or she has halitosis despite reassurance, treatment, and counseling. Patients with halitophobia should be referred to medical specialists [2,8].

In this study, the percentage of patients with genuine halitosis

was 76.8%. Pathological halitosis of oral origin was most common among male patients, while physiological halitosis was most common among female patients. A higher percentage of patients who visited the clinic were female. These results indicate that women tend to seek care at an earlier stage of oral malodor than men, who seek care after they notice their bad breath caused by oral problems.

Physiological halitosis results from thick tongue coating and a large amount of dental plaque [1]. First we analyzed the tongue coating of halitosis patients. More than half of the halitosis patients had thick tongue coating (Kojima's score 3 and 4), and tongue coating was considered to be a main cause of oral malodor. Female patients had more tongue coating than male patients. We measured the bacteria in the tongue coating. Both male and female patients had scores of 4 and 5, corresponding to 3×10^6 to 10×10^6 bacteria and 1 to 3.16×10^7 bacteria, respectively. The tongue coating of halitosis patients contained large numbers of bacteria. Tongue coating causes oral malodor [12,13], but many people still do not understand the importance of tongue cleaning. Some patients were performing tongue cleaning, but on questioning, some of these revealed that they were cleaning with high pressure or with a hard tooth brush. Dental hygienists need to instruct patients on proper tongue cleaning technique.

Another cause of physiological halitosis is low salivary flow and dry mouth. More than one-third of patients were found to have dry mouth, which was more common among female patients than among males. Low salivary flow rates lead to increased numbers of tongue bacteria, resulting in oral malodor [14,15]. At our hospital, doctors and dental hygienists instruct patients on methods to improve salivary flow, with good results.

Approximately one-fourth of patients had deep pockets of 6 mm or more. Deep pockets were found in 44.2% of men and in 16.7% of women. Male patients had significantly deeper pockets than female patients. It is speculated that women visit halitosis clinics sooner than men when they notice physiological halitosis caused by tongue coating or dry mouth. In contrast, men visit dental clinics after they notice strong breath odor caused by periodontal disease.

Treatment provided after breath odor measurement was found to depend on the diagnosis. Approximately 70% of patients with physiological halitosis or pseudohalitosis only received breath odor measurement, because they had no oral problems. Approximately 20% of these patients received scaling and professional tooth cleaning by a dental hygienist. All patients with pathologic halitosis of oral origin received further dental treatment, because they had several oral problems. About 60% of these received scaling, scaling and root planing (SRP), and other treatments from dental hygienists at the COD.

The rest of the patients were referred to their local doctors, because they had been referred from other clinics or were from distant locations. Halitophobia patients were referred to mental health specialists, but some of these patients received scaling or tooth brushing instruction from dental hygienists.

To properly treat halitosis, it is important to find the cause [16]. Halitosis treatment varies according to the cause, and thus an accurate diagnosis is necessary. After diagnosis, we need to explain the condition to patients, relieve their anxiety, and provide proper treatment.

Dentists diagnose halitosis, but basic treatment is performed by dental hygienists [17]. For patients with physiological halitosis, dental hygienists will explain the condition and associated factors. They instruct patients on proper tongue cleaning. They also instruct on tooth brushing, and perform scaling. Patients with dry mouth receive instruction on improving salivary flow. For patients with pathologic halitosis caused by oral problems, dental hygienists will perform further treatments, including SRP, in addition to the above treatments. Dental hygienists may notice an improperly fitted restoration during scaling or SRP. Patients with pseudohalitosis usually do not have oral problems, but these patients often wish to receive scaling or professional tooth cleaning by dental hygienists to relieve their anxiety. Dental hygienists also play an important role in relaxing patients. Halitosis patients sometimes hesitate to talk with others because of anxiety. But these patients often talk with dental hygienists and confess their anxiety.

Many factors contribute to halitosis, including oral problems and mental health conditions [18]. Dental treatment and mental health management are necessary for halitosis patients. Knowledge about halitosis is important for dental hygienists, and improvement in this area is needed [7].

Conclusion

1. Approximately 70% of halitosis patients in this study were female, and many were older than 40 years.
2. Approximately 75% of patients were diagnosed with genuine halitosis.
3. More than half of patients had a thick tongue coating. A higher percentage of female patients had dry mouth, while a higher percentage of men had deep pockets.
4. After breath odor measurement, many patients with physiological halitosis and pseudohalitosis did not receive further treatment.
5. Dental treatment was performed for patients with pathologic halitosis of oral origin.
6. Dental hygienists play an important role in tooth brushing instruction, scaling, SRP, and relief of patient anxiety.

Acknowledgements

This study was supported in part by a Grant-in-Aid for Scientific Research (no. 26463176) and a Grant-in-Aid for Research in Control of Aging from the Ministry of Education, Culture, Sports, Science and Technology of Japan.

References

1. Tonzetich J. Production and origin of oral malodor: a review of mechanisms and methods of analysis. *J Periodontol* 1977;48:13-20.
2. Yaegaki K, Coil JM. Examination, classification, and treatment of halitosis; clinical perspectives. *J Can Dent Assoc* 2000;66:257-61.
3. Scully C, Porter S, Greenman J. What to do about halitosis. *BMJ* 1994;308:217-8.
4. Tanaka S, Yoshida M, Murakami Y, Ogiwara T, Shoji M, Kobayashi S, et al. The relationship of *Prevotella intermedia*, *Prevotella nigrescens* and *Prevotella melaninogenica* in the supragingival plaque of children, caries and oral malodor. *J Clin Pediatr Dent* 2008;32:195-200.
5. Tangerman A, Winkel EG. Extra-oral halitosis: an overview. *J Breath Res* 2010;4:017003.
6. Zaitu T, Ueno M, Shinada K, Wright FA, Kawaguchi Y. Relationship between social anxiety disorder and halitosis. *Int J Clin Prev Dent* 2011;7:25-32.
7. Yoneda M, Kashio N, Uchida H, Suzuki N, Matsuura H, Naito T, et al. Awareness among dental hygienists with regard to treatment options for halitosis. *Int J Clin Prev Dent* 2012;8:173-9.
8. Miyazaki H, Arai M, Okamura K, Kawaguchi Y, Toyofuku A, Hoshi K, et al. Tentative classification for halitosis patients and its treatment needs. *Niigata Dent J* 1999;29:11-5.
9. Kojima K. Clinical studies on the coated tongue. *Jpn J Oral Maxillofac Surg* 1985;31:1659-78.
10. Kawaguchi Y, Shimada K, Shimura N. Study on the clinical analysis of the "Questionnaire for halitosis". *Jpn J Psychosom Dent* 1992;7:134-40.
11. Kawamoto A, Sugano N, Motohashi M, Matsumoto S, Ito K. Relationship between oral malodor and the menstrual cycle. *J Periodontal Res* 2010;45:681-7.
12. Yoneda M, Naito T, Suzuki N, Yoshikane T, Hirofujii T. Oral malodor associated with internal resorption. *J Oral Sci* 2006;48:89-92.
13. Yaegaki K, Coil JM, Kamemizu T, Miyazaki H. Tongue brushing and mouth rinsing as basic treatment measures for halitosis. *Int Dent J* 2002;52 Suppl 3:192-6.
14. Kleinberg I, Wolff MS, Codipilly DM. Role of saliva in oral dryness, oral feel and oral malodour. *Int Dent J* 2002;52 Suppl 3:236-40.
15. Koshimune S, Awano S, Gohara K, Kurihara E, Ansai T, Takehara T. Low salivary flow and volatile sulfur compounds in mouth air. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod* 2003;96:38-41.
16. Armstrong BL, Sensat ML, Stoltenberg JL. Halitosis: a review of current literature. *J Dent Hyg* 2010;84:65-74.
17. Malcmacher LJ, Verburg J. The hygienist's role in oral malodor treatment. *Dent Today* 2001;20:38-41.
18. Suzuki N, Yoneda M, Hirofujii T. Evidence-based control of oral malodor. In: Mandeep V, eds. *Oral Health*. Croatia: In Tech; 2015: <http://dx.doi.org/10.5772/59229>.