

Evaluation of Influence in Halitosis of a Tooth and Tongue Brushing —Application of New Halitosis Sensor—

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Abstract There are many causes of halitosis (bad breath). It is well known that bacterial plaque and tongue coating are the main caused of physiologic halitosis due to oral hygiene. There are many people who care about halitosis. In dental clinics, there is the necessity to measure halitosis, by request of a patient at the time of treatment.

In this study, we examined the influence on the severity of halitosis of tooth and tongue brushing by measuring with a thick film semi conductor (absorption effect transistor) gas sensor, and evaluated the effectiveness of this gas sensor for use at chair-side in dental clinics.

At first, the change of halitosis during the day was measured every other hour after getting up in the morning until 5 p.m., without mouth cleaning. After that, the change of halitosis after tooth brushing with water for three minutes was measured. Measurements were started 2 hours after lunch. Five healthy young subjects (average age : 24.5 years old, 3 men and 2 women) and 7 healthy middle-age subjects (average age : 45.7 years old, 7 men) were measured for halitosis every 30 minutes after tooth brushing for two hours, including just before and after tooth brushing. Then, the change of halitosis after tooth and tongue brushing with water was measured. The schedule of measurements was the same as before but with the addition of tongue brushing for one minute.

In the results, the highest halitosis value was detected at the time of rising and 2-3 hours after breakfast and lunch. After tooth brushing, halitosis was reduced a little but there was not any major reduction of halitosis. After tooth and tongue brushing, halitosis was reduced immediately. Halitosis increased gradually every 30 minutes. Halitosis was also low after 120 minutes.

In this study, we investigated the effectiveness in maintaining low halitosis of tongue brushing used together with tooth brushing, measured by a thick film semiconductor gas sensor. All results indicated that tongue brushing is effective in maintaining halitosis. This means that the thick film semiconductor gas sensor is a useful and compact piece of equipment for measuring halitosis at chair-side in dental clinics.

Key words : Tooth brushing, Tongue brushing, Halitosis, Thick film semiconductor gas sensor

INTRODUCTION

Halitosis is a universally experienced condition that is most commonly attributed to bacteria. These offensive odors can originate from a multitude of anatomic areas or sources, such as the gastrointestinal tract, the pulmonary system, the nasal and sinus cavities of the upper airway or the oral cavity itself. The bacterial plaque that accumulates in the oral cavity, on tooth surfaces, gingiva, oral mucosa and tongue is thought to be the major source of offensive malodor.¹⁾ Many prophylactic remedies have been developed and marketed for the treatment of

halitosis. They are available in several formulations including but not limited to mints, sprays, chewing gum, dentifrices and mouth rinses. The therapeutic goal for most of these products is to mask the odors produced by bacteria. However, it is logical to predict that a reduction in the amount of odor-producing bacteria via oral hygiene would be advantageous in reducing halitosis.

The purpose of this study was to evaluate the influence of tooth brushing and tongue brushing on the severity of halitosis.

MATERIALS AND METHODS

Five healthy dental students (average age : 24.5 years old, 3 men and 2 women) and 7 healthy dentists (average age : 45.7 years old, 7 men) participated in this study. Halitosis was measured for each subject with and without oral hygiene procedures at specific time intervals throughout the day. Thus, each participant served as his or her own control.

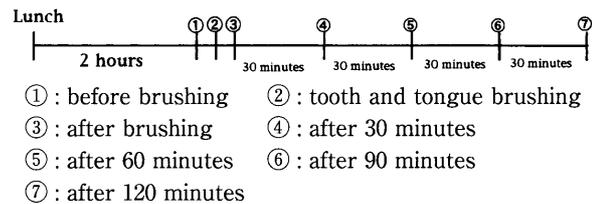
A thick film semiconductor (absorption effect transistor) gas sensor was used in this study to measure and compare the degree of halitosis (Fig. 1). The baseline halitosis levels were measured for a participant each hour throughout the day from getting up in the morning to 5 p.m. The average of three measurements was used for comparative data analysis.

The change of halitosis after tooth brushing was evaluated by taking measurements every 30 minutes for 120 minutes after tooth brushing. Subjects

were instructed to brush for 3 minutes with a soft toothbrush using the modified-Bass technique with water (Table 1). Measurements were started 2 hours after lunch. However, the subject's life proceeded as usual until lunch.

Subjects were measured for halitosis and data

Table 1. Time table of measurement.



were calculated with following expression to have $I_{③-⑦}$.

$$\frac{③ \sim ⑦}{①} = I_{③-⑦}$$

The change of halitosis after tooth and tongue brushing was evaluated by taking measurements

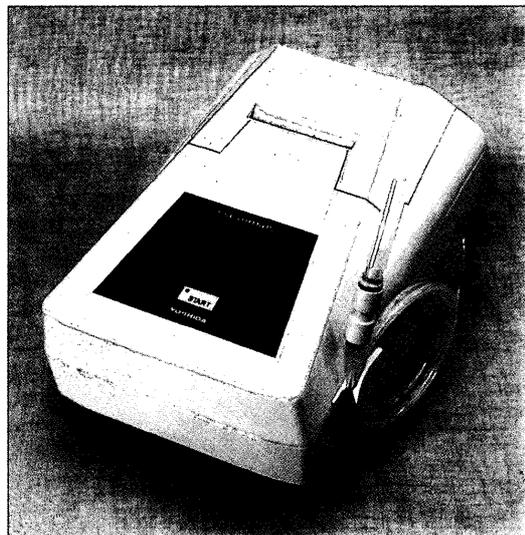
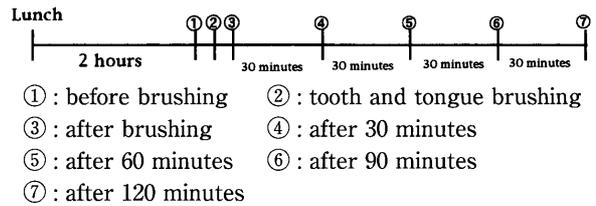


Fig. 1. A thick film semiconductor (absorption effect transistor) gas sensor.

every 30 minutes for 120 minutes after tooth and tongue brushing. Measurements were started 2 hours after lunch. The same subjects were instructed to brush with a soft toothbrush using the modified-Bass technique for 3 minutes with water only and to brush their tongue for 1 minute with a soft brush and water only (Table 2). Halitosis measurements were taken every 30 minutes at the beginning of 2 hours after lunch. However, the subject's life proceeded as usual until lunch.

Table 2. Time table of measurement.



Data were calculated to have $I_{③-⑦}$ similarly using the expression shown above.

RESULTS

The change of halitosis during a day without mouth cleaning (tooth brushing, tongue brushing, mouth rinse etc.) was used as the baseline for each participant. The greatest levels of halitosis throughout the day were detected at rising in the morning and about 2-3 hours following meals (breakfast and lunch) (Fig. 2).

brushing was more significant and immediate. Following tooth and tongue brushing, the values (I) were reduced by 60 percent (average). Halitosis slowly increased over time at each 30-minute measurement after tooth and tongue brushing. After 120 minutes, halitosis was still maintained at 90 percent (average) as a low level (Fig. 4).

Tooth brushing slightly reduced the severity of halitosis. The values (I) were diminished slightly but a low level of halitosis was not maintained for a long time (Fig. 3).

Differences between Fig. 3 and Fig. 4 were analyzed using the T-test. For the values of $I_{③}$, $I_{④}$ and $I_{⑦}$, P values less than .05 were considered significant.

The change of halitosis after tooth and tongue

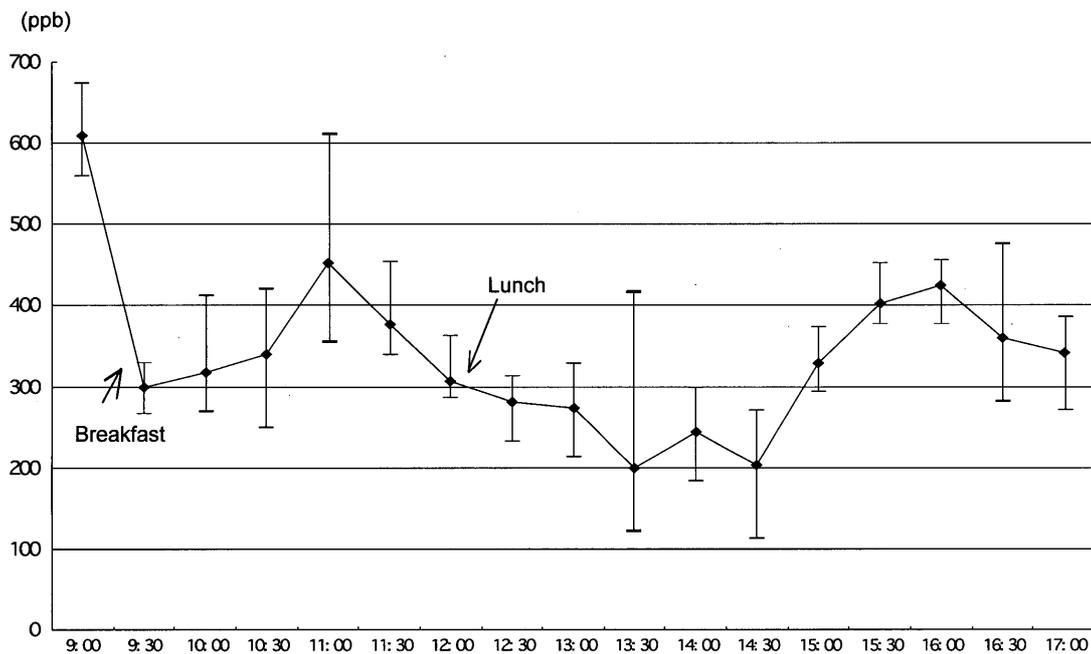


Fig. 2. The change of halitosis during a day without mouth cleaning. (mean, maximum and minimum value)

DISCUSSION

Halitosis, also known as bad breath or oral malodor, is an extremely common problem. Halitosis can arise from many sources in the body, but most fre-

quently halitosis is produced by bacteria in dentistry. It is well known that bacterial plaque and tongue coatings are the main sources of halitosis. The dorsal

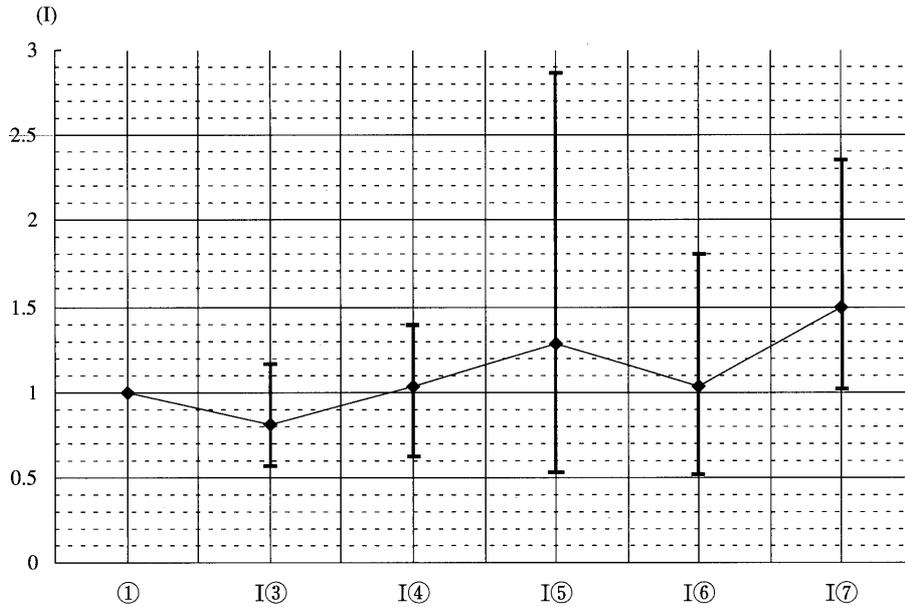


Fig. 3. The change of halitosis values (I) after tooth brushing with water. (mean, maximum and minimum value)

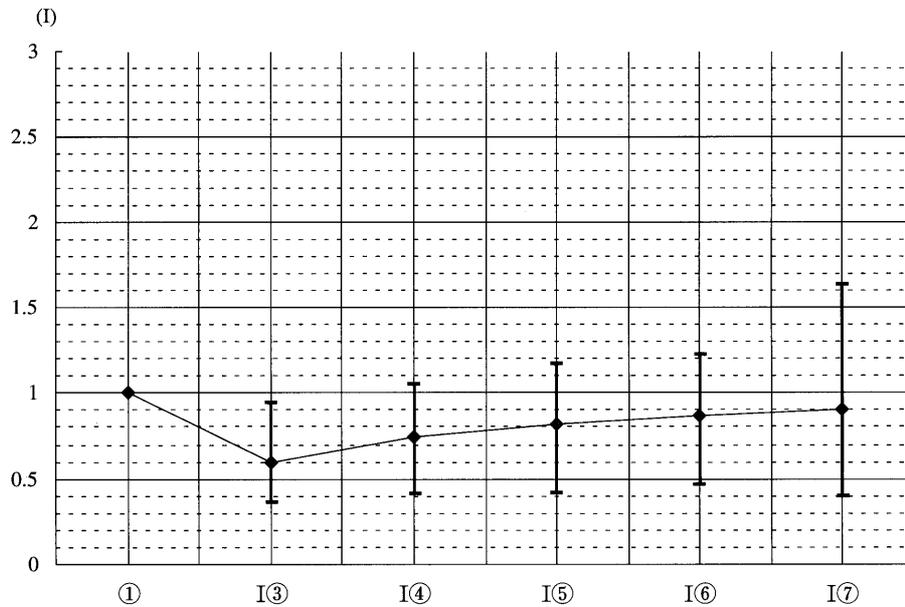


Fig. 4. The change of halitosis values (I) after tooth and tongue brushing with water (mean, maximum and minimum value)

surface of the tongue is thought to be the main location for the accumulation of odor-producing bacteria, thus, the main origin of halitosis.

The dorsal surface of the tongue is coated with desquamative epithelial cells, leukocytes, saburra and bacteria. It is well established that gram-negative anaerobic bacteria in tongue coatings produce volatile sulfur compounds (VSC) such as hydrogen sulfide and methylmercaptan, which is the cause of halitosis.²

Sensual examination (oral malodor judge), gas chromatography and examination by halitosis detector are the measuring methods for halitosis. Sensual

examination, by an experienced breath odor judge, is simple and reliable but not practical for most studies. Furthermore, inexperienced judges may not be calibrated well. Gas chromatography is a highly sensitive method but expensive and inconvenient to use in clinics.

In this study, the compact semiconductor gas sensor was used and measured VSC. This sensor provides an evaluation that shows a correlation between gas chromatography to analysis VSC³. At this time, it was the purpose of this study to evaluate the usefulness of this sensor in clinics, also.

In the results, the greatest levels of halitosis

throughout the day were detected at rising in the morning and about 2-3 hours following meals (breakfast and lunch). According to this result, the time of measurement for the evaluation of tooth brushing and tongue brushing's influence on halitosis started 2 hours after lunch. At this time of a day, halitosis is increasing. So, the effectiveness of tooth brushing or tooth and tongue brushing used to maintain a low halitosis level is easier to detect.

It is well known that oral hygiene has a big influence on halitosis. Specially, periodontal infection

often causes halitosis. Concerning the level of oral hygiene of the subjects for this study, we determined good oral hygiene through examination of gingival swelling and redness and the condition of bacterial plaque.

From the results of this study under such conditions, tongue brushing is effective in maintaining low halitosis. This result is in agreement with Yaegaki's results⁴⁾. It is also concluded that the compact semiconductor gas sensor is useful and convenient for clinics.

CONCLUSION

The results of this study support the conclusion that tongue brushing is effective in maintaining low halitosis in healthy patients. Also, the effectiveness

of the new compact gas sensor was confirmed in this study.

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歯および舌ブラシの口臭への影響の検索

—新しい口臭測定装置の応用—

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キーワード：歯ブラシ，舌ブラシ，口臭，半導体厚膜ガスセンサー

抄録 口臭の原因には多くの要因がある。そして、歯垢および舌苔は口腔に起因する生理的口臭の原因であることは良く知られている。また、多くの人々が口臭に関心を持っており、歯科医院においても患者からの要求で口臭測定を必要とすることが多くなっている。

本研究では、口臭を低く抑えるのに、歯ブラシと舌ブラシが影響するかを新しい小型のガスセンサーにより測定し検討し、そのガスセンサーを歯科の治療台にて使用することに対する評価を行った。

まず最初に、1日の口臭の変化を、口腔清掃を行わない状態で、起床時から就寝時まで測定した。その後で、歯ブラシ、舌ブラシを水のみを使用して行い、口臭の変化を計測した。この測定は、食後2時間経過した時点から始めた。5人の健康な若い被検者(平均年齢24.5歳、男性3人、女性2人)と7人の健康な中年被検者(平均年齢45.7歳、全て男性)の口臭を歯ブラシ直後を含め30分毎に計測した。また、水のみでの歯ブラシと舌ブラシ後の口臭の変化も計測した。計測時間は前の歯ブラシの場合と同じように、1分間の舌ブラシ直後より行った。

結果において、口臭は、起床時と食後2～3時間経過時に高値を示した。歯ブラシ後の口臭の変化は、一時的に低くなるものの口臭を低く維持する効果はなかった。歯ブラシと舌ブラシ後の口臭の変化では、直後から低値を示し、30分毎に徐々に上昇するものの、120分後においても低値を示していた。

本実験結果から、半導体厚膜(AET)ガスセンサーによる口臭の測定で、歯ブラシと舌ブラシを併用することが如何に有用であるかを突きとめた。また、半導体厚膜(AET)ガスセンサーの有用性も判明し、歯科の治療台での口臭の測定に応用できることが示唆された。