

Dryness of Mouth: A More Valuable Predisposing Factor of Self-perceived Bad Breath than Mechanical Cleansing in Dental Students

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Purpose: This study was performed to investigate a correlation among oral hygiene habits, dryness of mouth, and self-perceived oral malodor and therefore to find out self-care methods which could be a help to reduce oral malodor.

Methods: A survey of 296 dental undergraduate students of School of Dentistry, Pusan National University, who wrote consents voluntarily and participated in this study, was conducted using a questionnaire consisting of 17 questions and analyzed to investigate a correlation among oral hygiene habits (frequency of tooth brushing, water gargling, and drinking water, etc.), dryness of mouth indicating the amount of salivary secretion, and self-perceived oral malodor.

Results: There was no significant correlation between mechanical cleaning factors and self-perceived oral malodor. The factor showing a strong correlation with severe self-perceived oral malodor was dryness of mouth ($p=0.000$).

Conclusions: There was no correlation between mechanical cleaning habits and self-perceived oral malodor. Participants who felt self-perceived oral malodor more tended to have rather good mechanical cleaning habits. The factor showing a strong correlation with severe self-perceived oral malodor was dryness of mouth. Therefore trying to increase salivary secretion is considered to be a help to reduce self-perceived halitosis.

Key Words: Halitosis; Health behavior; Oral hygiene; Self concept; Xerostomia

INTRODUCTION

Bad breath (halitosis, oral malodor) is a common condition. Halitosis affects a large proportion of the population and may cause a significant social or psychological handicap to those suffering from it.¹⁻⁴ Its etiology could be attributed to both intraoral or extraoral factors. However, in about 90% of the cases, the cause is intra oral, with the reason being deep carious lesions, periodontal disease, peri-implant disease, mucosal ulcers, food debris, reduced salivary flow rates, or tongue coating.^{5,6} The main compounds that lead to bad breath emanating from the oral cavity are the

volatile sulfide compounds, especially hydrogen sulfide (H_2S), methyl mercaptan (CH_3SH), and dimethylsulfide ($[(CH_3)_2S]$).^{7,8} These compounds are produced by the anaerobic Gram-negative microorganisms.⁹ The microorganisms interact with the sulfur-containing substances that are present in saliva, gingival crevicular fluid, blood, and cells leading to the production of odiferous products.¹⁰ Salivation is important for self-cleaning and antibacterial action. Dry mouth (xerostomia) might also promote oral malodor,^{1,11} although a correlation is not always observed.^{1,2}

A previous study reported that self-estimation of oral malodor has been reliable and correlated with the objective

assessment of the persons who were not concerned about oral malodor.¹³⁾ Also, patients' self-estimated oral malodor was significantly correlated with organoleptic test ($r=0.61$), H_2S ($r=0.50$) and CH_3SH ($r=0.46$). The significant predictors of patients' self-estimated and clinical oral malodor were bleeding on probing, tongue coating, BANA test and flow rate of saliva. Current findings suggest that self-estimation can be used to judge one's own oral malodor.¹⁴⁾

It is important to remove organic substrates and bacteria mechanically well to reduce oral malodor. Many desquamated cells and food debris can be washed away by water gargling after tooth brushing as shown in the study by Schaeken and van der Hoeven,¹⁵⁾ in 1990. Intraoral mechanical cleaning methods and the factors which may have influence on the cleaning effects are amount of salivation, tooth brushing, water gargling after tooth brushing, tongue brushing, water gargling, and drinking water etc. Hence this study aimed to verify a hypothesis that a person with good oral hygiene habits (frequent tooth brushing, water gargling, and drinking water etc.) and less dryness of the mouth, indicating proper salivation would feel less self-perceived oral malodor and to find out self-care methods which could be a help to reduce oral malodor.

MATERIALS AND METHODS

1. Study Population and Recruitment

This study involved 304 dental students of School of Dentistry, Pusan National University (Yongsan, Korea) from February to April 2015. This study was reviewed and approved by the institutional review board of Pusan National University Dental Hospital (PNUDH-2015-007). All the participants signed a written informed consent prior to the initiation of this study. The subjects with systemic diseases were excluded.

2. Structured Questionnaire

The questionnaire included seventeen questions (Appendix 1) which evaluated the presence, self-perception of halitosis, treatment (self or professional) for halitosis, perception of oral dryness. The oral hygiene habits of the subjects including frequency of tooth brushing, tongue brushing, mouth rinsing, drinking water and rinsing after having snacks

were also evaluated. The questionnaire was anonymous with no column for identification of the individual.

3. Data Analysis

SPSS version 15.0 was utilized for statistical analysis (SPSS Inc., Chicago, IL, USA). The Mann-Whitney test and Kruskal Wallis test were performed for comparison of responses obtained from participants. The level of statistical significance was set at a value less than 0.05.

RESULTS

The study population included 304 participants in the age range of 22 to 41 years. A total of 296 participants answered all the questions provided and were included for statistical analysis. Questionnaires that were incompletely filled were excluded from the final analysis. The overall response rate was 97%; 174 of the 296 participants (58.8%) were male and 122 participants (41.2%) were female (Table 1).

1. A Correlation with the Experience of Self-perceived Halitosis (Question 1)

The participants who have experienced self-perceived halitosis was 67.2%. The participants with the experience of self-perceived halitosis brushed their teeth significantly more after eating snacks ($p=0.014$) and had a higher chance of feeling dryness of mouth significantly ($p=0.001$) (Table 2).

2. A Correlation with Severe Self-perceived Halitosis (Question 2)

The participants who felt severe self-perceived halitosis had a higher chance of feeling dryness of mouth ($p=0.009$) and were less likely to snack 4 times or more a day ($p=0.000$) (Table 3).

3. A Correlation with the Frequency of Tooth Brushing (1 to 2 Times vs 3 Times or More; Question 6)

Among the participants brushing their teeth 1 to 2 times a day the number of male was significantly higher ($p=0.000$). The frequencies of water gargling after tooth brushing ($p=0.018$) and drinking water ($p=0.004$) was low in these participants. They had a higher chance of not brushing their teeth after eating snacks ($p=0.000$).

Table 1. Sex distribution and the rate of responses to each question (n=296)

Variable		Value
Sex	Male	174 (58.8)
	Female	122 (41.2)
Q1	Yes	199 (67.2)
	No	97 (32.8)
Q2	Yes	21 (7.1)
	No	275 (92.9)
Q3	Yes	4 (1.4)
	No	292 (98.6)
Q4	Yes	4 (1.4)
	No	292 (98.6)
Q5	Yes	7 (2.4)
	No	289 (97.6)
Q6	1 time	4 (1.4)
	2 times	37 (12.5)
	3 times	198 (66.9)
	≥4 times	57 (19.2)
Q7	1 time	21 (7.1)
	2 times	49 (16.6)
	3 times	112 (37.8)
	4-6 times	96 (32.4)
	≥7 times	18 (6.1)
Q8	Yes	127 (42.9)
	No	169 (57.1)
Q9 ^a	<3 times	52 (17.6)
	4-6 times	142 (48.0)
	7-10 times	72 (24.3)
	>10 times	29 (9.8)
Q10	No	43 (14.5)
	1 time	119 (40.2)
	2 times	83 (28.0)
	3 times	31 (10.5)
	≥4 times	20 (6.8)
Q11	Yes	117 (39.5)
	No	179 (60.5)
Q12	Yes	85 (28.7)
	No	211 (71.3)
Q13	Yes	88 (29.7)
	No	140 (47.3)
	Do not know	68 (23.0)
Q14	Yes	172 (58.1)
	No	117 (39.5)
	Do not know	7 (2.4)
Q15	Yes	52 (17.6)
	No	244 (82.4)
Q16	Yes	0 (0)
	No	280 (94.6)
	Do not know	16 (5.4)
Q17	Yes	246 (83.1)
	No	50 (16.9)

Q, question.

Values are presented as number (%).

^aSome data are error, and error values are not included.**Table 2.** Relationships according to Q1

Q1. Y/N	Q12. Y	p-value	Q15. Y	p-value
Y: 199 (67.2)	48 (24.1)	0.014	44 (22.1)	0.001
N: 97 (32.8)	37 (38.1)		8 (8.2)	

Q, question; Y, yes; N, no.

Values are presented as number (%).

By independent t-test.

Q1, have you ever felt that you had bad breath?; Q12, do you brush your teeth after eating snacks?; Q15, do you feel dryness of your mouth?

Table 3. Relationships according to Q2

Q2. Y/N	Q10. Y	p-value	Q15. Y	p-value
Y: 21 (7.1)	0 (0)	0.000	10 (47.6)	0.009
N: 275 (92.9)	19 (6.9)		42 (15.0)	

Q, question; Y, yes; N, no.

Values are presented as number (%).

By independent t-test.

Q1, have you ever felt that you had bad breath? Q12, do you brush your teeth after eating snacks? Q15, do you feel dryness of your mouth?

4. A Correlation with the Frequency of Water Gargling after Tooth Brushing (1 to 2 Times vs 3 Times or More; Question 7)

The participants gargling with water 1 to 2 times after tooth brushing showed significantly less frequencies of tooth brushing ($p=0.005$) and drinking water ($p=0.011$) and were less likely to brush their tongue ($p=0.024$).

5. A Correlation with Regular Mouth Washing Habits Usually Aside from Tooth Brushing (Question 8)

Among the participants with regular mouth washing habits usually the number of male was significantly higher ($p=0.022$). Many of these participants felt halitosis made their work or social life difficult ($p=0.039$). They drank water ($p=0.000$) and water gargling after eating snacks frequently ($p=0.000$) and haven't experienced gum bleeding ($p=0.039$).

6. A Correlation with the Frequency of Drinking Water per Day (6 Times or Less vs 7 Times or More per Day; Question 9)

There was no significant correlation between the frequency of drinking water per day and self-perceived halitosis. The frequency of drinking water was slightly low in female

($p=0.061$). The participants who drank water frequently had significantly a higher chance of frequent tooth brushing ($p=0.001$) and water gargling more after tooth brushing ($p=0.013$). They usually rinsed their mouth regularly aside from tooth brushing ($p=0.001$) and water gargled after having snacks ($p=0.011$).

7. A Correlation with Water Gargling after Eating Snacks (Question 11)

The number of male ($p=0.045$) was significantly higher in the participants who water gargled after having snacks. These participants brushed teeth many times ($p=0.048$), usually rinsed their mouth regularly aside from tooth brushing ($p=0.000$). The frequency of drinking water and eating snacks in between meals ($p=0.017$) were low.

8. A Correlation with Dryness of Mouth (Question 15)

Number of women ($p=0.011$) was significantly higher in the participants complaining dry mouth. These participants have felt self-perceived halitosis ($p=0.003$) and also severe self-perceived halitosis ($p=0.000$). They had visited a hospital for a consultation ($p=0.002$) and treatment ($p=0.002$) and halitosis made their social life difficult ($p=0.000$).

9. A Correlation with Tongue Brushing Habit (Question 17)

There was no significant correlation between tongue brushing habit and self-perceived halitosis. Among the participants doing tongue brushing the number of women ($p=0.037$) was significantly higher. They gargled with water many times after tooth brushing ($p=0.037$).

DISCUSSION

In 2013, Pham¹⁴ reported that patients' self-estimated oral malodor was found to correspond significantly with clinical oral malodor and self-estimation could be used to judge one's own oral malodor. There were studies about the factors which affect the self-perception of oral malodor, the comparison of the difference in oral hygiene techniques between sex and nations, and reduction in oral malodor using various tooth brushing techniques and mouth rinses. However there was no study about self-perceived oral malodor according to mechanical cleaning methods of each

individual or dryness of mouth which might affect intra-oral self-cleaning and antibacterial capability hence this research was conducted to find out self-care techniques which might help reduce oral malodor.

There was no significant correlation between previously mentioned mechanical cleaning factors and self-perceived oral malodor. The factor showing a strong correlation with severe self-perceived oral malodor was dryness of mouth. The more the participants felt dryness of mouth, the more they felt self-perceived oral malodor. Therefore there was no correlation between mechanical cleaning habits and self-perceived oral malodor. A person who felt self-perceived oral malodor more tended to have rather good mechanical cleaning habits. However it was difficult to conclude that whether frequent mechanical cleaning was the result of self-perceived oral malodor or it could be excluded from the contributing factors with the results of this research only.

According to the study by Almas et al.¹⁶ in 2003, the difference in oral hygiene habits of undergraduate students from King Saud University, College of Dentistry existed between male and female. The results showed female students had better oral hygiene habits and there was no difference in tongue coating among male and female students. This could be interpreted as meaning that oral hygiene habits didn't affect the presence of tongue coating and it corresponded with the result of this research that there was no correlation between mechanical cleaning habits and self-perceived oral malodor.

Saliva plays very important roles such as maintenance of oral health and protection of mucosa, lubricant, antibacterial action, blood coagulation, buffering capacity, and control of water metabolism etc. Salivation which is important for self-cleaning and antibacterial action is also an important factor for management of halitosis originated by intraoral causes. It seems that it is difficult to deodorize halitosis by mechanical cleaning or frequent water intake and reducing dryness of mouth is considered to be necessary to reduce self-perceived halitosis. Reduction in dryness of mouth means intensified intraoral self-cleaning action and it is considered to have much greater influence on reduction of halitosis than just doing mechanical cleaning from time to time.

Therefore trying to reduce stress, increase amount of

water intake, or chew gums to increase salivary secretion is considered to be a help to reduce self-perceived halitosis.

CONFLICT OF INTEREST

No potential conflict of interest relevant to this article was reported.

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Appendix 1. Questionnaires for the assessment of self-perceived halitosis and oral hygiene habits

No. _____ Date _____ Age _____ Sex: male/female

1. Have you ever felt that you had bad breath?
Yes () No ()
2. Do you feel that you have severe bad breath?
Yes () No ()
3. Have you ever visited a hospital for diagnosis or treatment of your bad breath?
Yes () No ()
4. Have you ever been treated for your bad breath?
Yes () No ()
5. Does your bad breath make your work or social life difficult?
Yes () No ()
6. How many times do you brush your teeth a day on average?
Once () Twice () 3 times () 4 times or more ()
7. How many times do you gargle with water after brushing your teeth?
Once () Twice () 3 times () 4-6 times () 7 times or more ()
8. Do you usually wash your mouth regularly aside from tooth brushing?
Yes () No ()
9. Do you drink water often?
3 times or less per day () 4-6 times per day () 7-10 times per day () More than 10 times per day ()
10. Do you often eat snacks (including coffees with sugar or drinks) between your meals?
No () Once () Twice () 3 times () 4 times or more ()
11. Do you gargle your mouth with water after eating snacks?
Yes () No ()
12. Do you brush your teeth after eating snacks?
Yes () No ()
13. Do you have dental caries in your mouth?
Yes () No () Do not know ()
14. Have you ever experienced gum bleeding?
Yes () No () Do not know ()
15. Do you feel dryness of your mouth?
Yes () No ()
16. Do you have any medical history?
Yes () _____ No () Do not know ()
17. Do you brush your tongue when you brush your teeth everyday?
Yes () No ()