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Evaluation of Halitosis Using Different Malodor Measurement Methods and Subjective Patients' Opinion Related Own Malodor

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Abstract **Objectives:** The goal of this investigation was to evaluate halitosis using the different malodor measurement methods and to determine alignment between the measurements and subjective patients' opinion. **Materials and Methods:** Totally 198 patients (122 females 61.6% and 76 males 38.4%, aged 13-65 years ,average 29.78 years) were completed a questionnaire. Each individual was recorded for both organoleptic score and measure odor scores (volatile sulfur compounds) using breath checker (Tanita Corporation, Tokyo, Japan). For the determination of halitosis, ordinal scales were used for breath checker and organoleptic evaluation ranging from0 to 5 respectively. If the mean grade of measurements were ≥ 2 described as halitosis. Chi-square test, descriptive statistics and Spearman correlation test was performed by using SPSS statistical software for analysis. **Results:** There was a moderate agreement (r: 0.404) between organoleptic scores and breath checker scores .There was a significant correlation between years of smoking habit (r: 0.356), frequency of the relative's complaints about malodor (r: 0.329), tongue coating (r: 0.350). No significant correlation between organoleptic scores and patients own feelings about bad breath were found. Age and gender had no significant effect on malodor. **Conclusions:** Breath checker tool may be used for determination of halitosis. Since there was a moderate agreement between organoleptic scores which is accepted as gold standard and breath checker scores. It was surprisingly found that patients own feelings didn't correlate with both measurements.

Keywords: *halitosis, malodor, breath checker*

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1. Introduction

Halitosis is a common situation that has health and social effects. The exact prevalence of malodor is unknown but it is thought to range from 15% to 50% in populations [1,2]. In USA, authors stated that 50% of the population are complaining about halitosis [3] in a group of Japan population 47% of patient suffered from malodor [4].

The cause of 80–85% of halitosis cases are intraoral reasons [5]. Intraoral halitosis is generally caused by gingivitis, periodontitis, tongue coating, dental cavities, food and xerostomia. The causes of 10% of halitosis are extra oral reasons. Extra oral halitosis is commonly caused by diabetes mellitus, tonsil infections, nasal cavity and sinus infections (sinusitis), liver failure, kidney failure, nasal obstruction, dry mouth, gastro esophageal reflux, stomach infections (gastritis) or ulcers, certain cancers, lung diseases, drugs and medical problems that reduce salivary flow, pseudohalitosis [6].

Breath malodor can be a significant determinant in social communication [7]. Anaerobic gram-negative oral microorganisms produce various compounds as volatile sulfur compounds (VSC), organic acids, nitrogen and other chemicals arising from oral cavity are known as causes of halitosis [8-13].

The other origins of bad breath are gastrointestinal disorders, respiratory tract infections and systemic disorders [14,15]. Xserostomia, consumption of alcohol, tobacco, spicy food, garlic etc. may also lead to malodor. Halitosis is categorized into 3 groups as halitosis, pseudo-halitosis and halitophobia. It is accepted as genius halitosis if socially appreciable malodor is noticed [16]. If there is not an exact malodor realized by other people it is accepted as pseudo halitosis. If the patients, who has objectively diagnosed that they have no halitosis, claim that they have malodor it is described as halitophobia [16].

Self-assessment of malodor and awareness are important but always not so reliable because of its subjective nature [17]. Regarding to this concern portable devices are used to determine chemical levels objectively [18,19]. Researches stated that portable devices have good concordance with organoleptic measurements [20,21]. However there are few studies in the literature investigating the reliability of these devices and agreement of results with self-assessment

of individuals. In the present study a portable device was used to evaluate the consistency of organoleptic scores with Breath Checker and also self-reports of patients.

2. Materials and Methods

This research was approved by the Ethic Committee of Gaziantep University Faculty of Dentistry (2014/323). Patients who referred department of dentomaxillofacial radiology with complaint of halitosis were evaluated. Patients selected randomly from the individuals who referred to Gaziantep University Faculty of Dentistry. The patients were scored by three methods using a questionnaire filled by patients, organoleptic scoring, and breath checker (Tanita Corporation, Tokyo, Japan). Patients were selected who has no systemic problems, don't use any drug or take a treatment in last three months. Totally 198 patients (122 females 61, 6% and 76 males 38,4%, aged 13-65 years, average 29.78 years) were completed a questionnaire scoring their subjective opinion including 40 questions detail examining; bad taste in mouth, mouth breathing, dryness of mouth, daily fluid consumption of water tea and coffee, type of food that they consume, smoking habits, oral hygiene status, frequency of visits to the dentist, patients and their relatives options about malodor. Tongue coating was evaluated by the clinicians. The exclusion criteria were identificated as, patients who had any other systemic problems, which may cause halitosis, who use any drug regularly, pregnant and lactating patients. Patients were informed that they should not brush their teeth, smoke, eat or drink something before 2 hours of examination.

Each individual's organoleptic score and measure odor scores (volatile sulfur compounds) using breath checker were recorded by one examiner. For the determination of halitosis, ordinal scales were used for breath checker and organoleptic evaluation ranging from 1 to 5 respectively. Organoleptic scores noted as 0 – absence of odor, 1 – questionable odor, 2 – slight odor, 3 – moderate odor, 4 – strong odor, 5 – severe odor [16]. Breath checker scores recorded according to user's manual as 0 – no odor, 1 – slight odor, 2 – moderate odor, 3 – heavy odor, 4 – strong odor, 5 – intense odor. Tongue coating was also determined. Visual examination used to evaluate the tongue coated area and a score as; 0 – Not existent; 1 – smaller than 1/3rd of tongue surface; 2 – smaller than 2/3rd of tongue dorsum; 3 – More than 2/3rd of dorsum; was used for classification [22].

If the mean grade of measurements were ≥ 2 described as halitosis. A questionnaire consisting questions about nourishment habits, smoking periods, oral hygiene, commentaries by relatives about malodor, self-reports of malodor was used. Patient's ages were ranged (18-24, 25-34, 35-44, 45-54, 55-64, 65-74) to examine the relationship between malodor and age groups [23]. Practitioners who evaluated malodor and questionnaire were blinded. Correlations with self-reports and scores were evaluated and agreement between organoleptic scores and measure odor scores were recorded. Statistical analysis was performed using SPSS software descriptive statistics, student t test, and chi-square test and Spearman correlation. Confidence interval was accepted as 95%.

3. Results

Out of 198 individuals were incorporated to the investigation. 122 (61, 6%) of patients were female and 76 (38, 4%) were male. Mean age was 29, 78 standard deviation was = 0,769 minimum age was 13 and maximum age was 65. The results of the study indicated a moderate concordance between organoleptic and breath checker scores (r=0,404). Table 3 and Table 4 shows the distribution of patients breath checker scores and organoleptic scores. Organoleptic and breath checker scores were not affected by gender (P > 0.05). Ages were grouped as 13-17, 18-24, and 25-34…65-74. Age group of 13-17 and 18-24 organoleptic scores were significantly different (smaller) from 25-34 age group (P=0,020-P=0,030) (Table 1). Patients were asked to smoking habits. Clinical tests showed weak concordance between organoleptic score with smoking period (year), (r=0,356).

Table 1. Organoleptic score changes according to age category

Age Category	N	Mean	Std. Deviation	P
13-17	17	1,53	,717	0.346
18-24	64	1,70	,790	
25-34	57	2,07	,923	
35-44	36	1,94	,860	
45-54	20	1,95	,826	
55-64	3	1,67	,577	
65-74	1	2,00	.	
Total	198	1,86	,847	

The patients who complain of bad breath wanted to score their subjective opinion about the taste in the mouth. Some patients complain of bad taste although no correlation was found between bad taste in the mouth and organoleptic scores. Tongue coating evaluated clinically and weak agreement was found between organoleptic scores and tongue coating (r=0,350). Patient's relative's frequency of warning about bad breath had a weak correlation with organoleptic scores (r=0.329). Some of these patients were also stated that they have an intensity of breath but the estimation did not comply with bad breath complaints. Table 2 shows the Correlation of organoleptic scores with different conditions.

Table 2. Correlation of organoleptic scores with different conditions

	N	R	P
Bad taste in mouth	198	,212	0,003
How many days ago warned about bad breath	198	-,396	0,002
How many times warned about bad breath	198	,329	0,028
Tongue coating	198	,350	0
Self-estimate of breath intensity	198	,247	0,032
Years of smoking habit	198	0,356	0,018
Breath checker score	198	,404**	0

Table 3. The distribution of patients Breath checker scores

Score	N	Percent	Mean	Std.deviation	p
1	132	66,7			
2	55	27,8			
3	9	4,5	1,40	0,045	0.001
4	2	1			
Total	198	100			

Table 4. The distribution of patients organoleptic scores

Score	N	Percent	Mean	Std.deviation	P
1	78	39,4	1,87	0,061	0.001
2	77	38,9			
3	35	17,7			
4	7	3,5			
5	1	0,5			
Total	198	100			

4. Discussion

Halitosis is a common unpleasant situation that affects individual's life. Halitosis affects a wide range of age including children and adults. Although there was no acceptable correlation between age groups and organoleptic scores the smallest halitosis values were obtained from smallest age group (13-17). However the highest values obtained from 25- 34 ages in the present study group. Some authors stated an effect of gender on halitosis [2,3,4,24]. In Switzerland, researchers found that females generally used dental floss, interdental brush, mouthwash and also they brushed their teeth and cleaned their tongue more frequently than males. However they reported that the reasons of halitosis were generally same factors [25]. In present study, the results of organoleptic and breath checker scores did not differ by gender (P> 0.05).

The dental plaque and insufficient oral hygiene are commonly causes of halitosis [26].Miyazaki et al. determined the main reason of halitosis might be tongue coating and detected a significant correlation between periodontal conditions and the VSC value and tongue coating conditions [27]. In the current study, there was a correlation between tonque coating and organoleptic scores, however the correlation was weak (r=0,350) comparing to the literature [27].

Smoking for long period also effected degree of halitosis with a weak concordance (r=0,356) in our study group. Chemicals in tobacco irritates oral tissue, causes inflammation and leads to periodontal problems [28].

It is important to be aware of dental problems and malodor for early treatment. Authors focused on the self-reported oral health attitudes and behavior among a group of dental students on their study and stressed that the oral health attitudes and behavior of dental students improved with increasing levels of education [29]. Patients in research group had bad scores for reliability analyses (r=-0,092) with self-reports and organoleptic scores. On the other hand patients relatives frequency of warning correlated with real odor scores (r=0,329). This situation may be related to their status of education and social behavior. Because of this subjective nature of patients self-reports, a breath checker device was used in this investigation to compare scores. Although there were several devices that detect malodor in the literature [23], the breath checker used in the present study was used in few studies [23]. Odor scores achieved from that breath checker were in accordance with the previous studies [23]. In addition, the results of the present study showed that while patients opinion for malodor had no concordance with real odor scores, breath checker correlated moderately (r=0,404) with organoleptic scores.

5. Conclusion

The conducted study showed moderate correlation between clinical organoleptic and breath checker scores. Tongue coating and long smoking period affected range of malodor. Patients self-reports about malodor were not in concordance with real odor scores. However patients' relatives' frequency of warning about bad breath may be a sign for early detection of halitosis.

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