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Correlation of using Tanita screening toolin Periodontitis and Diabetes Patients -A Clinical Study

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Abstract:

Aim of the study

The aim is to detect the halitosis grade in the exhaled breath using two distinct techniques and to compare the readings with different clinical indices to find out the best method of halitosis grading.

Materials & methods

A total of 30 patients with chronic periodontitis having Oral malodor were included in the study. The subjective assessment of the exhaled breath(Halitosis grading) was done by 2 different methods using:Organoleptic(sniff test) method and a handheld portable Tanita FitscanSulfide monitor. The following parameters were assessed probing depth, gingival bleeding index, and plaque index.

Statistical analysis

The descriptive data that included mean, standard deviation (SD), and percentage frequency were estimated for each category of halitosis grading. For all tests, a $P < 0.05$ was found to be statistically significant.

Results

The median value of halitosis grading as obtained by Tanita FitScan was 3.0 (95% confidence interval as 2 and 4) which was then compared with clinical indices (PI, GI, and PD) and the results were found to bestatistically significant ($P < 0.05$) in both the groups with Tanita scoring assessment being percentage increase compared to organoleptic scoring.

Conclusion

The results confirmed that the halitosis grading done using Tanita FitScanSulfide monitor is equally effective with respect to clinical indices when compared with organoleptic technique.

Keywords:

TanitaFitscan sulfide monitor, organoleptic rating, periodontitis, diabetes.

Introduction:

Bad breath or malodor is a condition that most people encounter on a regular basis. Oral malodor is the third most prevalent reason patients visit a dentist, after periodontal disorders and dental cavities.[1,2]Periodontal disorders, decreased salivary flow, overhanging restorations, dentures, and microbial colonisation of the tongue are the major causes of halitosis.[3,4]The amount of sulfur-containing volatile chemicals that cause halitosis is closely correlated with the density of Gram-negative anaerobes found in the subgingival plaque.[5]

Microbiological study of the organisms that produce toxins and volatile sulphur compounds (VSC) can confirm the link between halitosis and periodontitis. The malodorous substances found in the oral cavity combine with breath that is exhaled to cause oral malodor. The microorganisms found in saliva either ferment mucins or peptides to produce these volatile molecules that contain sulphur. The most frequent sulphur compounds that cause

halitosis are hydrogen sulphide, methyl mercaptan, and dimethyl sulphide, all of which are harmful to the tissues. The soft tissue's ground matrix and cellular components may interact with the thiol-containing substances, increasing the permeability of ions and bacterial endotoxins.[6]Extra-oral halitosis could be caused by disturbances in the upper and lower respiratory tract, metabolic diseases, medications, carcinoma, and other systemic diseases such as diabetes which gives rise to ketone bodies (ketoacidosis) in the breath.[7,8]

Patients with diabetes are more likely to experience long-term infections and oral tissue inflammation, particularly if their condition is inadequately managed. Diabetes's oral symptoms include dry mouth, oral candidiasis, and periodontal disorders.[9,10] Moreover, it has been demonstrated that periodontal disease deteriorates glycemic control.[11,12,13]
The diagnosis of halitosis is difficult and self-assessment is not always reliable due to misperception. Organoleptic measurement using the human nose is the gold standard in detecting oral halitosis.(14) Halimeter is an objective and quantitative method for the diagnosis of halitosis.[15,16]

Therefore, the aims of this study were to examine the relationship between the glycated hemoglobin level (HbA1c) in the blood and halitosis status among diabetic patients affected with periodontitis and to examine if there is a relationship between the severity of periodontal destruction and halitosis among the selected sample.

The etiology of halitosis is classified into real halitosis and pseudo halitosis (a misperception). Of the causes of real halitosis, oral pathologies make up 87% that 51% of cases originate from the tongue, 17% originate from gingivitis, 15% originate from periodontitis and 17% originate from a combination of these causes.[17,18]The diagnosis of halitosis is difficult and self-assessment is not always reliable due to misperception. Organoleptic measurement using the human nose is the gold standard in detecting oral halitosis, but it requires the examiner to sniff the bad odour, which means chemical/physical contact with the patient's breath. Furthermore, this method requires the examiner to distinguish smells precisely and grade them on a scale, which is a process that not only has a learning curve but is also not standardized among healthcare professionals. [19]

Materials and Methods:
A total of 30 patients with periodontitis having Oral malodor were included in the study. The subjective and objective assessment of the exhaled breath(Halitosis grading) was done in Periodontitis patients and periodontitis withDiabetes patients, by 2 different methods using -

- Organoleptic(sniff test) method
- A handheld portable Tanita Fitscansulfide monitor,

Clinical Parameters

- Plaque Index(PI)
- Gingival Index(GI)
- Probing depth(PD)

- The probing depth was measured with a UNC-15 periodontal probe. The probe was inserted parallel to the long axis of the tooth gently, till resistance was noted and readings were recorded to the nearest millimeters.

- The PI was calculated using Silness and Loe scale. The score of zero was given when no plaque was seen. A score of one was given when a film of plaque adhered to the gingival margin or to adjacent areas of the tooth. A score of two on the moderate accumulation of soft deposits within the gingival pocket which can be seen by the naked eyes. When there was an abundance of soft matter seen within the gingival pockets, a score of three was given.

- The GI was calculated using Loe and Silness scoring method. A periodontal probe was used to assess the bleeding potential of the tissues. The normal gingiva was rated as a score zero. The gingiva with mild inflammation but with no bleeding on probing (BOP) was scored as one. The gingiva with moderate inflammation with redness, edema, and BOP was scored as two and the gingiva with severe inflammation, marked redness, edema, and ulceration with a tendency for spontaneous bleeding was graded as three.

Organoleptic Method:

Based on Rosenberg & McCulloch, Category are as follows 0- Absence of Odor-170 ppm, 1- Questionable Odor-171–236ppm, 2- Slight malodor- 237–303 ppm, 3- Moderate malodor-304–369 ppm, 4- Strong malodor-370–436ppm.

The evaluation of halitosis grading was done by the organoleptic method (Sniff test), in which the patients were asked to close the mouth and nose simultaneously with their hand, then to exhale out gently by opening the mouth and the malodor was assessed by the clinician.Organoleptic scores were obtained by a single physician who was blinded to the halimeter results. The subjects were instructed to breathe in deeply through their nostrils and hold it for a while before breathing out through their mouths while the examiner sniffed the odour at a distance of 20 cmA detailed medical history was taken from the subjects to detect extra-oral causes of halitosis and understand dietary habits. Organoleptic assessment was performed after an otolaryngological examination and all measurements were repeated.

Organoleptic Scores are as follows: 0- No odor, 1- Slight odor, 2- Moderate odor, 4- Strong odor, 5- Intense odor, Er-Error.The VSC and hydrocarbons in the exhaled breath were detected using the Tanita FitScan breath checker (Tanita Corp., Japan). Patients were asked to keep their mouths closed for 3 min before testing while breathing through the nose. Then, the patients were asked to exhale from the mouth keeping the Tanita breath analyzer close to the mouth for 30 seconds. The procedure was repeated in three trials for each subject and the mean value was calculated.

Statistical Analysis:

The values of Tanita breath analyzer and organoleptic scorings were then compared with PI, GI, PD and HBA1C.The results were statistically analysed using Pearsons correlations and independent t-test using SPSS software version 26. found to be significant [$P < 0.05$], indicating that Tanita FitScan and organoleptic methods are reliable method for halitosis grading in patients with periodontitis and in diabetes patients.

Table 1 shows association between organoleptic scoring and plaque index, gingival index, probing depth and HBA1C levels in diabetes individuals. Table 2 shows association between Tanita scoring with plaque index, gingival index, probing depth and HBA1C levels in diabetes individuals. Both the groups are found to be equally significant with more percentage for organoleptic group.

Discussion:

Detection of oral malodor is a widespread problem that lacks scientific investigation into its cause and treatment. Kapoor *et al*. studied the current concept for diagnosis and management of halitosis, in which nasal sniffing is a commonly used approach to directly sample the expelled mouth air.[20]They defined the organoleptic assessment as the "gold standard" to diagnose halitosis in clinical settings as it was inexpensive, no equipment was needed, and a wide range of odors could be detected by a clinician.[21,22]However, such organoleptic measurement raised problems such as considerable variation between clinicians on the ranking of the same sample. [23,24]

Our findings differ from Kapoor *et al*., as the newly designed equipment like the Tanita FitScan breath analyzer gives comparable readings every time.Morita *et al*. conducted a study to compare the relationship between oral malodor and sulfide levels in the periodontal pockets.[25]They concluded that the clinical indices like the volume of tongue coating, extent of periodontal disease, periodontal pockets, and BOP were significantly associated with oral malodor. The volume of tongue coating and percent of sites BOP were significantly associated with oral malodor.[26]Our study also showed similar findings. The clinical indices (PI, GI, and PD) were directly related to halitosis grading as detected by Tanita breath analyzer. Many bacteria produce H2S but the production of methyl mercaptans is primarily restricted to periodontal pathogens such as *P. gingivalis*(26.6% of cases) and *Prevotella intermedia*

Direct exposure to either of these metabolites adversely affects protein synthesis by human gingival fibroblasts in culture. Studies have demonstrated that exposure of oral mucosa to either hydrogen sulfide or methyl mercaptan causes a marked increase in its permeability to ions and bacterial endotoxins.[27, 28] Kundu *et al*. reported that the hygiene status of the tongue may play an important role in malodor production as oral malodor was significantly associated with both the percentage of tongue coating and the presence of deep fissures on the dorsum of the tongue. [29]In our study, an attempt was made to isolate *Streptococcus*, *Bacteroides*, *Porphyromonas*, *Prevotella*, and *Fusobacterium* colonies from the subgingival plaque. Gram-positive bacteria contribute little to oral malodor production, whereas Gram-negative bacteria produce large amounts of VSCs.[30]In our study, we found that the Gram-negative bacteria, *P.s gingivalis*(26.6% of cases) and *P. intermedia* (33.3% of cases) were the major contributors of bacterial colonies in patients with halitosis.

Results

The mean value of halitosis grading as obtained by Tanita FitScan and organolepticgrading which was then compared with clinical indices (PI, GI, PD and HBA1C) and the results were statistically significant ($P < 0.05$),

Conclusion

The results confirmed that the halitosis grading done using *Tanita FitScanSulfide* monitor and organoleptic grading with respect to clinical indices are both found to be reliable methods .

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Fig 1: Tanita FitScan breath checker assessment

Table 1: Organoleptic scoring association with plaque index, gingival index, probing depth and HBA1C.

	EtA (ASSOCIATION)	P VALUE
PI	0.887	0.012*
GI	0.853	0.036*
PROBING DEPTH	0.720	0.033*
HBA1C	0.925	0.00*

*SIGNIFICANCE p<0.05

Table 2: Tanita scoring association with plaque index, gingival index, probing depth and HBA1C.

	EtA (ASSOCIATION)	P VALUE
PI	0.905	0.08*
GI	0.914	0.029*
PROBING DEPTH	0.940	0.00*
HBA1C	0.987	0.00*

*SIGNIFICANCE p<0.05

Figure 1: Organoleptic scoring assessment

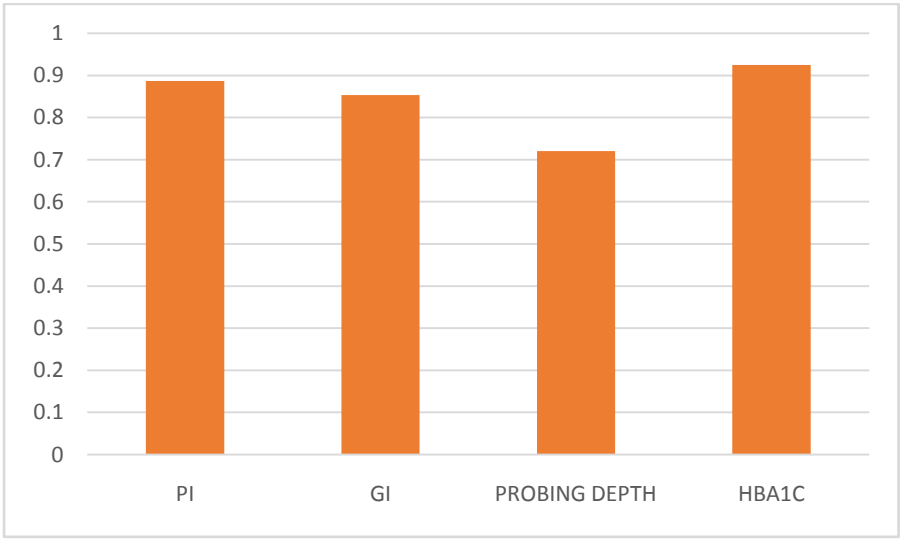
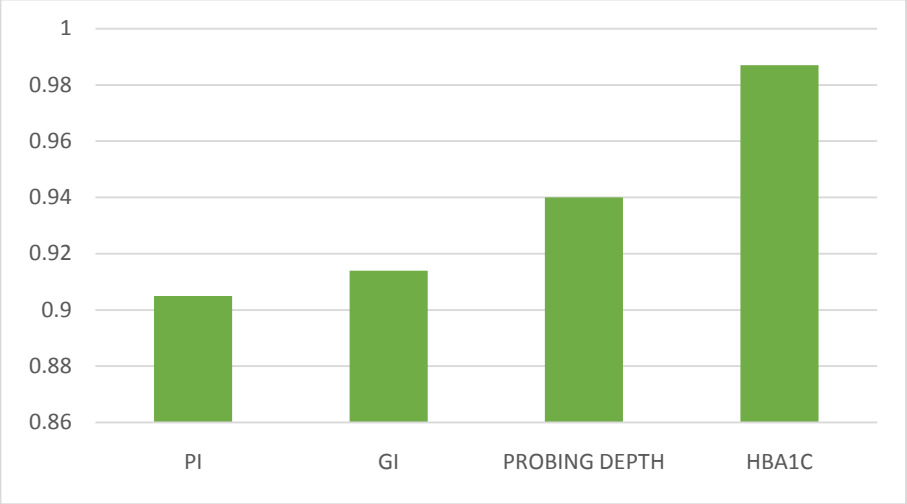


Figure 2: Tanita breath analyser scoring assessment


1
0.98
0.96
0.94
0.92
0.9
0.88
0.86
PI
GI
PROBING DEPTH
HBA1C