Halitosis-A warning sign?

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Abstract

Most complex diseases often go undiagnosed under the shield of an unobjectionable sign/symptom. Halitosis or bad breath is one such very common sign seen in people of almost all age groups. It is usually physiological due to wrong eating habits, neglected oral hygiene but can also be one of the manifestations of pathology like periodontal and oral causes, systemic disorders, psychological alterations like halitophobia, suggesting medical intervention. Halitosis has multifactorial etiology and hence should not be ignored. The purpose of this review is to familiarize the physicians regarding the varied etiology, current methods of diagnosis and management of oral malodor. It is the duty of the physician to keep themselves updated and ask the patients to refrain from self medication for halitosis.

Keywords: bad breath, malodor, diagnosis, treatment

Introduction

Human body emits a variety of volatile and non-volatile compounds, odorous and non odorous. Halitosis is the general term used to describe any disagreeable odor in expired air, regardless of whether the odorous substances originate from oral or non-oral sources. “Halitosis” is derived from Latin - “Halitasia” - bad breath and the Greek word “Osis” - disease or condition. Other names used are fetor ex ore, fetor oris, bad or foul breath, breath malodor and oral malodor. The contribution from mouth is termed as “oral malodor”. This is very common and can affect people at all ages. Halitosis, where, on one hand could be an embarrassing situation for people, also can act as a caution tool indicating immediate medical attention. Oral malodor could be physiological in cases of morning breath and in children with mouth breathing. However, it can also be pathological in certain situations. Hence, it is extremely important for the practitioners to understand the etiology, classification and treatment of halitosis to be able to treat the patients successfully.

Genuine Halitosis should be differentiated from pseudo halitosis and halitophobia. Pseudohalitosis is the condition when there is no objective evidence of malodour, despite the patients complaint of oral malodour. In Halitophobia, the patient persists in believing they have halitosis despite firm evidence for the absence of objective evidence. Many classification systems have been proposed addressing the etiology and the treatment needs. The most common classification system based on patient criteria was proposed by Miyazaki et al, 1999.1

It is of paramount importance to understand the etiological factors leading to halitosis. The etiology could be classified into two categories. Intraoral: Poor oral hygiene, Tongue and tongue coatings, Periodontal disease, Open gangrenous pulp, Large unfilled cavity, Mouth breathing, ANUG, Dry mouth
and extra oral: Systemic diseases, Neurologic diseases, Drugs.

**Intraoral causes**

a. Tongue coatings: Tongue is considered as ideal niches for bacterial adhesion and growth due to its topographic distribution of papillae. The dorsal tongue mucosa (area - 25 cm$^2$) shows a very irregular surface topography, the posterior part is roughened by a no of oval cryptolymphatic units whereas the anterior part is even rougher because of the high number of papillae. In a study by Quirynen et al (2009)$^2$, halitosis due to oral causes comprised of 89.8%, non oral causes 5.7% and combination 4.3 %. In a population of 2000, tongue coating, periodontal disease or combinations of both were considered as major causative factors. The “Coating” of tongue consists of desquamated oral epithelial cells, microorganisms and leukocytes from periodontal pockets$^3$. Evirgen S and Kamburoglu K$^4$ conducted a study to determine the relation between tongue coating and halitosis. The study was conducted amongst 268 dental students and a relationship was found between halitosis and tongue scores (P < 0.001) and between halitosis and mean CPITN scores (P = 0.004). The most common source of bad breath in individuals with good oral hygiene and healthy periodontal tissues is from the posterior dorsum of the tongue$^5$, where the crypts are the favored sites for growth of the anaerobic bacteria responsible for halitosis. Several studies have implicated the dorsum of the tongue as the primary site of microflora putrefaction and the production of VSC$^6,7$.

b. Microbial etiology: A relationship between bacterial numbers on the tongue (as measured by determining the colony-forming units per square centimeter) and oral malodor, suggests that the load of microbes per mouth (i.e. the thickness or aerial density of biofilms) is the most important feature of chronic oral malodor, rather than the presence or absence of specific microbial agents$^8$. The most common micro organisms associated with oral malodor include Fusobacterium nucleatum, Prevotella intermedia, and Tannerella forsythensis. Prophyromonas gingivalis and Treponema denticola$^9$. Recent study by Vancauwenbergh F, 2013 suggests that Solobacterium. moorei, from both tongue and saliva have significant association with several breath parameters (OLS, H2S, CH3SH, (CH3)2S and total VSCs), tongue coating indices and periodontal indices (gingivitis, periodontitis and oral hygiene) implying a strong association between the presence of S. moorei and oral malodour$^{10}$. The substrates for these micro organisms are free amino acids cysteine, methionine, tryptophan, arginine and lysine from saliva and gingival crevicular fluid, salivary mucins, peptides like glutathione from desquamating epithelial cells and proteins from food or saliva$^{11}$.

c. Periodontal infections: Volatile sulfur compounds like Hydrogen sulphide ,Methyl mercaptan , Dimethyl sulphide and gases like Acetic acid, propionic acid, Indole, skatole, Cadaverin, putrescine are produced through putrefactive activities of bacteria. In particular methyl mercaptan, are capable of inducing deleterious changes in both the extracellular matrix and the local immune response of periodontal tissues to plaque antigens suggesting the role of these compounds in the pathogenesis of periodontitis$^{12}$. Pham TA, 2012 examined the associations between oral health status, the presence of N-benzoyl-DL-arginine-2-naphthylamide-positive bacteria, and oral malodor in periodontal patients in 137 periodontitis and 80 gingivitis patients. Dental plaque, bleeding on probing, tongue coating, and N-benzoyl-DL-arginine-
2-naphthylamide-positive bacteria were found as contributing factors to oral malodor, but with different degrees in periodontitis and gingivitis patients. The bleeding tendency of the periodontal tissues may provide essential substrates for odor production. The inflamed periodontal tissues provide more methionine, which is converted into methyl mercaptan at a higher rate than in healthy gingival tissues. Various other studies have suggested relationship between oral malodor and periodontitis.

d. Other factors like saliva, gingival crevicular fluid, acidic Ph, deep carious lesions with food impaction and putrefaction, extraction wounds filled with blood clot, crowding of teeth, Acrylic dentures favor food entrapment and accumulation of debris resulting in physiologic oral malodour.

Extra oral causes
There are multifold extraoral causes of bad breath:

- Respiratory : Acute pharyngitis, Purulent sinusitis, Post nasal drip, Foreign bodies in sinus or nasal cavity, Nasal polyps, Cleft palate, Carcinoma of oropharyngeal region, Chronic and purulent tonsillitis
- Gastrointestinal tract disorders: Zenker’s diverticulum (hernia in esophageal wall), Gastric hernia, Regurgitation esophagitis, Intestinal gas production, H. pylori infection.
- Liver insufficiency like cirrhosis, Chronic glomerulonephritis, Hereditary metabolic syndrome, diabetes mellitus,
- Medications that are taken for a long duration time contribute to bad breath and taste disorders like medications include antihistamines, tricyclic antidepressants, diuretics, anti-hypertensives and analgesics,
- Certain foods including garlic, onion and some spices are absorbed from the intestine, possibly metabolized in the liver released into the bloodstream and excreted via the lungs and other routes contributing to malodor.

Diagnosis
The first step in the treatment of halitosis is to determine and differentiate between genuine halitosis and pseudohalitosis/ halitophobia. A thorough assessment of oral health status, medical history, and patient’s habits should be performed. A multitude of tests are available for detection of bad breath.

Self assessments tests: Smelling a metallic or non odorous plastic spoon after scraping back of tongue, Smelling a toothpick/dental floss after introducing it to interdental area, Smelling saliva spit into a cup or spoon, Licking the wrist and allowing it to dry (wrist lick test).

Analytical tests: BANA test, Zinc oxide and Nitrogen chemiluminescence detectors, bacteriologic analysis, electronic nose, Spoon test, The dental floss odor test, The saliva odor test, the salivary incubation test, quantifying b-galactosidase activity, ammonia monitoring, the ninhydrin method and the polymerase chain reaction, diamond probe/ 2000 system. However the utility of these tests have yet to be fully established.

Principle methods of detection of halitosis are Organoleptic measurement, gas chromatography and sulfide monitoring.

- Organoleptic rating: The use of organoleptic measurement is suggested as the gold standard. The offensiveness of the odour can be measured on Rosenberg scale from 0 to
5, which is as follows: 0 = no odour; 1 = barely noticeable odour; 2 = slight but clearly noticeable odour; 3 = moderate odour; 4 = strong offensive odour; and 5 = extremely foul odour; with a score ≥ 2 equalling halitosis.53 Hedonic scale in which a score of +2 = like very much; +1 = like; 0 = do not like or dislike; -1 = dislike; and -2 = dislike very much20. Assessment is thus usually based upon organoleptic assessment of exhaled air, namely the clinician sniffs the air exhaled from the mouth and nose and subjectively defines the presence or absence of malodor21. However there are certain shortcomings. It is subjective method, less reliable and reproducible, difficult to understand and distinguish b/w the intermediate ranges, depends on many factors like the position of head, hunger, and experience of the judge, degree of attentiveness and expectation.

- Gas chromatography: It is the preferable objective method for precise measurements of specific gases and a method of choice for differentiating and quantifying the volatile sulfur compound. It was initially developed by Tonzetich and co-workers (1964). OralChromaTM- portable gas chromatome machine specifically designed to digitally measure molecular levels of the three major VSCs (H2S, methyl mercaptan, and dimethyl sulfide). It is extremely sensitive and produces visual results in graph form via computer interface22. The disadvantages are its High cost, Need of skilled personal and its time consuming.

- Sulfide meter / Halimeter/ BreathronTM: Sulfide monitors analyze total sulfur content of the subject's mouth air using an electrochemical, voltametric sensor, which generates a signal when it is exposed to sulfide and mercaptan gases, measuring the concentration of H2S gas in parts per billion23. The main disadvantages are that it is incapable of distinguishing among individual sulfide compounds, and that measurements are not reliable in the presence of alcohol or essential oils24.

A new portable monitor known as B/B Checker® has been developed by Tamaki et al, 201125. This device is capable of detecting several kinds of gases mixed with volatile sulfur compounds (VSC) in addition to other odorous gasses and is used for objective evaluation of malodor in oral, exhaled and nasal air and for screening subjects with halitosis.

Indices and screening tests to measure and detect oral malodor

Screening tests: Ueno M, 201326 has proposed turbidity of mouthrinsed water as a screening index for oral malodor. A study was conducted in 165 oral malodor patients. Gas chromatography and organoleptic test (OT) were used for oral malodor measurement. Oral examination along with collection of saliva and quantification of bacteria was conducted. Turbidity of mouthrinsed water was measured with turbidimeter. The analysis showed that turbidity had an ability to screen for presence or absence of oral malodor.

Indices to determine severity of oral malodor: Tongue coating has been associated with the severity of malodor. Indices by Gross et al (1975)27, Miyazaki et al (1995)28, Gomez et al (2001)29 have been developed to measure or classify the tongue coating.
Winkel tongue coating index divides the tongue into 6 sextants, 3 anterior and 3 posterior part of tongue. Scoring criteria is as follows, 0- no coating, 1 presence of light coating, 2 presence of distinct coating. Results are obtained by adding all the 6 scores\textsuperscript{30}.

**Management of halitosis**

Complex multifactorial problem like halitosis needs a step wise protocol to be followed, for the underlying etiology to be addressed. A thorough oral examination, medical, dental history will provide clues about the oral or the non oral causes, and will help to differentiate the genuine from the pseudo halitosis. Patients with extra oral /systemic background and pseudohalitosis should be referred to the physician for medical evaluation and counseling. The success of treatment of any oral malodor hinges on reduction of the microbial load and the volatile sulfur compounds. Mechanical interventions (brushing, flossing, tongue scraping, cleaning the dorsum of the tongue) are the tools to reduce microbial load on the personal front. Brushing the tongue significantly reduced concentrations of VSCs, such as methyl mercaptan, and to a lesser extent, hydrogen sulfide\textsuperscript{31}, toothbrush bristles sweep between papillae and remove microorganisms reducing malodor effectively\textsuperscript{32} and improves taste sensation by removing the thick layer of tongue coating\textsuperscript{33}. Use of either a toothbrush or scraper for tongue cleaning is debatable, however studies do suggest that tongue cleaning does not require an additional tool\textsuperscript{34,35}. Certain lozenges, chewing gums and mints, toothpastes, and breath strips have been reported to reduce tongue dorsum malodor. This lozenges increase salivary flow, enhance mechanical stimulation and also help in masking oral malodor, providing patient with psychological comfort. Patient also be asked to have ample amount of water especially before sleep as it occurs mainly when mouth gets dried out.

In office treatment by a physician should be aimed at eliminating the source of malodor by correcting overhanging restorations, treating periodontal pockets, thorough scaling and root planing and improved oral hygiene measures. One-stage, full-mouth disinfection programme, including scaling and root planning by Quirynen et al. 1998: reduced halitosis levels by up to 90\%\textsuperscript{36}. As an adjunct to mechanical therapy, chemical reduction of microbial load with mouthrinses has proved to be beneficial. Various chemical plaque control agents like chlorhexidine, essential oil, zinc containing mouthrinses, chlorine dioxide, triclosan, baking soda containing dentrifice are available in the market. A systematic review by Bloom et al, 2012 has suggested that chlorhexidine mouthwashes, and those that contained a combination of cetyl pyridinium chloride and zinc provide the best evidence profile on oral malodor\textsuperscript{37}.

Lately Probiotics have also been adopted as treatment strategy for halitosis. Kazor et al\textsuperscript{38} compared the bacterial populations on the dorsal surface of the tongue in healthy subjects and people with halitosis. Streptococcus salivarius was found to be the predominant species in healthy subjects, but was typically at low levels or absent in those subjects suffering from halitosis. Burton et al. (2005) showed that replacement of bacteria implicated in halitosis by colonization with competitive bacteria (probiotica) such as *S. salivarius* may provide an effective strategy to reduce the severity of halitosis\textsuperscript{39}.

**Conclusion**

Halitosis or oral malodor is a social/ psychological handicap. With over the counter medications and
various lozenges available, patients usually tend to bypass the clinician. This approach is wrong and the patients should be aware that halitosis is not only physiological but has varied systemic and intra oral cause which needs to be addressed. Dental physicians should take up the responsibility of ruling out the etiology and follow a multiphase approach and redirect the patient accordingly. The role of periodontist/physician in treating halitosis is insurmountable.

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