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HALITOSIS RAISING A STINK : A Review

BHAGYASHRI GUDADHE,*[1]DEEPTI GATTANI,[2] SNEHA MESHRAM,[3] AKHILESH SHEWALE[4] AND SAKSHI DUBEY[5]

[*1,3,4,5]Post Graduate student, Department of Periodontology,
Swargiya Dadasaheb Kalmegh Smruti Dental College And Hospital ,Nagpur ,India
[2]HOD, Professor, Guide Department of Periodontology,
Swargiya Dadasaheb Kalmegh Smruti Dental College And Hospital, Nagpur, India

ABSTRACT

Oral malodor one of the most common complaints with which patients approaches us thinking it can be detrimental to his self-image and confidence. Even though majority of oral malodor is of oral origin, there are multiple other systemic causes that have to be addressed while we diagnose and treat this condition. Most of these patients look up to oral care physicians for expert advice, it is critical for us to have the knowledge base and communication techniques to provide quality clinical assessment and implement effective intervention programs. This article reviews the various causes and the diagnostic modalities which will help us treat this multifaceted condition.

Key words: Halitosis, Oral malodor, Systemic diseases, Diagnosis

INTRODUCTION

The word halitosis is derived from the Latin word halitus, which means exhalation. Halitosis is a term used to refer to offensive or bad breath. Fetor ex ore, fetor oris and stomatodysodia (dysodia in Greek refers to stench) are other terms that have been used in literature to describe halitosis. Halitosis is a general term used to describe an offensive odor emanating from the oral cavity. Approximately 90% of all bad breath originates from the mouth itself. Oral halitosis is the specific term used to describe halitosis that originates within the oral cavity [1, 2].

CLASSIFICATION OF HALITOSIS

Psychosomatic halitosis
Patients having either true bad breath or no bad breath, and an accompanying psychological condition.

Delusional / imaginary / self-Halitosis
Patients with psychosomatic disease and without objectionable breath. (Uchida, 1969)

Halitophobia
Diagnostic term currently an acceptable term for psychosomatic halitosis.

ADA classification based on the etiological pathways involved (2003)

1. Extrinsic pathways - Tobacco, alcohol and foods like onions garlic and certain spices.
2. Intrinsic pathways –

a) Oral origin (90 %)
b) Systemic origin (10 %)

Classification based on the origin of halitosis (*Dominic 1982)*

1. Due to local factors of Pathological origin
2. Due to local factors of Non-pathological origin
3. Due to systemic factors of Pathological origin
4. Due to systemic factors of Non-pathological origin
5. Due to systemic administration of Drugs and
6. Due to Xerostomia.

Classification based on the Psychological condition of the patient
Miyazaki and others reported and was recognized at the International Workshop for Halitosis Treatment on March 13, 1999, in Vancouver, B.C., as well as the Fourth International Conference on Breath

Odor, August 19 to 21, 1999, in Los Angeles, California.

1. Genuine Halitosis
a. Physiological Halitosis
b. Pathological Halitosis
i. Oral
ii. Extraoral
2. Pseudohalitosis
3. Halitophobia.

Halitosis due to local factors of pathological origin

In general, up to 90% of the halitosis cases have an intraoral origin. In adults, chronic periodontal disease is a major cause of halitosis. Other causes include local conditions such as poor oral hygiene, extensive caries, gingivitis, open contacts allowing for food impaction, periodontitis, Vincent's disease, Hairy or coated tongue, fissured tongue, excessive smoking, healing extraction wounds and necrotic tissues from ulcerations. Periodontal pockets produce hydrogen sulfide, which give off an offensive odor; these pockets encourage trapping of food. Periodontal therapy may alleviate halitosis by reducing volatile sulfur compounds. Halitosis may also be related to an increase of gram-negative filamentous organisms, an increase in pH to 7.2 and the formation of indoles and amines in the oral cavity .Other conditions implicated as a cause of halitosis are chronic sinusitis with postnasal drip, rhinitis, pharyngitis, tonsillitis, syphilitic ulcers, cancrum oris, tumors of trachea and bronchi and infected malignant neoplasm of the oral and pharyngeal cavities.

Halitosis due to local factors of non-pathologic origin

Stagnation of saliva associated with food debris which causes the halitosis most often experienced in the morning is due, in part to lack of movement of the cheek and tongue and also to a decrease in the BMR during sleep which inhibits self-cleansing of the oral cavity. Sulser, 1939 reported that the intensity of bad breath increases with age.Excessive smoking, especially cigar, not only causes fetid odor but also encourages the hairy tongue condition, which traps food debris and tobacco odor. It also decreases the salivary flow and further increases the severity of the condition [3].Dentures can cause a type of halitosis known as "denture breath". Occasionally, endodontic patients will complain of bad breath due to leakage of eugenol placed in the tooth.Certain age groups present a characteristic specific mouth odor.

- Young children of 2-5 yrs have a sweet fetid mouth odor due to their tonsil crypts lodging food and bacteria.
- Vincent's disease and its odor are most frequently seen in teenagers
- Middle-aged men and women tend to suffer more severe morning breath odor and more periodontal problems.
- In older-age group, most halitosis is due to unclean dentures and putrefaction of stagnated saliva.

Halitosis due to Systemic factors of pathologic origin

Diabetes is well known example which has an acetone, sweet, fruity odor that could indicate diabetic acidosis or impending hyperglycemic coma due to the abnormal accumulation of ketones in the blood which are excreted through the respiratory system.The odor of ammonia and urine on the breath may well suggest uremia or kidney failure.In severe hepatic failure the breath, known as fetor hepaticus, produces a sweet, feculent, amine odor resembling a fresh cadaver.An acid sweet odor suggests acute rheumatic fever, and a foul putrefactive breath is indicative of lung abscess or bronchiectiasis.In almost all cases of acute and chronic scurvy, patients have the typical foul breath of persons with fusospirochetal stomatitis**.**Almost all cases of hemopoietic system diseases like agranulocytosis, polycythemia vera, hemophilia, aplastic anemia, thrombocytopenia have halitosis due to infection, necrosis and decomposed blood from spontaneous bleeding in the oral cavity.Trimethylaminuria (*Fish odor syndrome*) is a rare disease in which there is a deficiency of an enzyme that normally breaks down trimethylamine, a volatile tertiary amine with a fishlike odor is excreted in urine, saliva and sweat [4].

Halitosis due to systemic administration of drugs

A common antianginal drug, isosorbide dinitrate, is known to cause halitosis. Drugs with iodine or chloral hydrate can reach breath. Some anti-neoplastic agents, antihistamines, amphetamines, tranquilizers, diuretics, and atropine-like drugs used to reduce saliva production and therefore decrease the self-cleansing ability of oral cavity.Antineoplastic agents like methotrexate, flurouracil, adriamycin and bleomycin can cause leukopenia leading to candidiasis, gingival bleeding, and oral ulcerations in addition to xerostomia.

Halitosis due to xerostomia

Other conditions causing halitosis include mouth breathing, heavy smoking, aging, Sjogren's syndrome, salivary gland aplasia, Mikulicz's disease, radiation therapy exceeding 800 rads, macroglobulinemia with salivary gland involvement, diabetes, menopause, systemic and metabolic diseases with high fever and dehydration, emotional disturbances and poor oral hygiene.

Aetiopathogenesis

Oral halitosis is brought about by the action of bacteria on food debris and shed epithelial cells, which in turn releases volatile sulphur compounds. The commonly produced volatile sulphur compounds are hydrogen sulphide [H2S, rotten egg smell], dimethyl sulphide [(CH3)2S, rotten cabbage smell], and methyl mercaptan [CH3SH, faecal smell]. Methyl mercaptan is believed to be the most malodorous component. Sulphur-containing amino acids [cysteine] are broken down by the anaerobic bacteria to release volatile sulphur compounds. Certain non- sulphur containing substances like diamines [cadaverine (cadaver smell) and putrescine (rotting meat smell)], acetone and acetaldehyde also contribute to halitosis emanating from the oral cavity.Other potentially odor producing substances include indole (used in small quantities in perfumes, however large quantities can produce an offensive odor), skatole (faecal odor), short-chain carboxylic acids such as butyric and valeric acids (sweaty feet odor) and ammonia. The activity of bacteria is at its peak at a pH of 7.2 and inhibited at a pH of 6.5[5].

Microflora associated with halitosis

The principle bacteria that are implicated in the creation of oral malodor include *Fusobacterium nucleatum, Prevotella intermedia* and *Tannerella forsythensis*. Other bacteria that have been implicated in the production of volatile sulphur compounds include *Prophyromonas gingivalis*, *Porphyromonas endodontalis, Treponema denticola, Aggregatibacter actinomycetemcomitans* (earlier known as *Actinobacillus actinomycetemcomitans*), *Atopobium parvulum,Campylobacter rectus, Desulfovibrio species, Eikenella corrodens, Eubacterium sulci, Fusobacterium* species and *Peptostreptococcus micros*. Isolates of *Klebsiella* and *Enterobacter* are reported to have emitted foul odors in vitro which resembled bad breath in denture wearers. These gram-negative proteolytic anaerobes are located in the relatively stagnant areas of the mouth, such as periodontal pockets, posterior dorsal surface of the tongue, and interdental regions[6].

Intra oral and systemic predisposing factors of halitosis

Intra oral conditions

Coating of the tongue is an important factor for oral malodor (80-90%). Amir E et al (1999) and Poelmans J et al (2002) suggest that the individuals with history of oesophageal reflux disease and post nasal drip predispose to the build up of a substrate on the dorsal surface of the tongue[5]. The papillae of the tongue, crevices associated with mucous glands and lingual tonsils increase the accumulation of bacteria and exfoliated epithelial cells. Deposits on teeth and periodontal diseases like Acute Necrotising Ulcerative Gingivitis can also contribute to oral malodour [7,8].

Systemic conditions

Respiratory tract diseases (lung abscesses, necrotizing pneumonia and carcinomas of the respiratory tract) can cause the breakdown of tissue leading to the production of volatile sulphur compounds. Other associated respiratory diseases like tonsillitis and postnasal drip caused by nasal infections, sinusitis or nasal polyps and produce oral halitosis. Carcinomas of the upper respiratory tract, oral cavity and oropharynx , produce normal or branched organic acids, while lung carcinomas can produce acetone, methylethylketone , n-propanol , aniline and toluidine[9]. Liver disease can produce a variety of aromatic compounds, such as H2S, aliphatic acids, CH3SH, ethanethiol and (CH3)2S. Trimethylaminuria is a rare, odor producing metabolic disease with symptoms of dysgeusia and dysosmia, which are due to excess production of trimethylamine, or (CH3)3N. Hepatic cirrhosis will produce a characteristic musty or 'mousey' odor[9]. Uremia that is caused by kidney failure also produces (CH3)3N along with dimethylamine. These individuals present with a uremic breath (ammoniacal odor) [10, 11]. Patients with uncontrolled diabetes mellitus (diabetic ketoacidosis) can emit ketonic breath (also described as sweet 'fruity' smell or rotten apple breath), which is caused by a metabolic disturbance leading to the production of acetones and other ketones.

Diagnosis of Halitosis

Oral malodour can be assessed using direct and indirect methods.

Direct methods

A. Organoleptic method[12] (whole-mouth breath test, spoon test, floss odor test, salivary odor test and self perception of odor)
B. Gas chromatography
C. Sulphide monitors
D. "Electronic nose"[13]

Indirect methods

A. Bacterial culture and smear[14]
B. Enzyme assay

Direct Methods

Organoleptic Method

Organoleptic measurement can be carried out by sniffing the patient's breath and grading the level of halitosis .Though this technique is crude in nature, it is still the most reliable technique for assessing the level of oral halitosis. Assessment of oral halitosis should be carried out on two or three occasions for a reasonably accurate diagnosis.

Pre-procedural requirements

The patient is instructed to avoid taking antibiotics 3 weeks before procedure. They should also be instructed to refrain from ingesting garlic, onion and spicy foods for 48 hours before the assessment. Certain other requirements include avoiding use of perfumes, deodorants for 24 hours before the assessment and smoking and alcohol 12 hours before the procedure. They should also be discouraged from using breath fresheners and oral rinses 12 hours before assessment.

Examiner

The examiner conducting the test should have a normal sense of smell. He or she should avoid drinking coffee, tea or alcohol and abstain from smoking. Use of perfumes and scented cosmetics should be strictly avoided.

Whole mouth breath test

The patient and the examiner are seated on either side of a privacy screen. This screen will make the patient believe that he/she is undergoing a scientific test. A 50 – 70 cms long, 2.5cms diameter transparent tube is inserted through the privacy screen .The patient is asked to place one end of the tube into his mouth and exhale slowly as the examiner seated across the privacy screen will sniff the exhaled air on the other end and grade the halitosis .The organoleptic evaluation of oral malodour also includes other simple tests such as tongue odor test, dental floss odor test and saliva odor test.

Spoon test

The spoon test is used to assess halitosis originating from the posterior part of the dorsum of the tongue[15]. A sterile plastic spoon is used to scrape the dorsum of the tongue. After about 5 seconds, the odor from the contents of the spoon is assessed, holding the spoon about 5cms away from the nose.

Dental floss odor test

This test is used to assess the odor originating from the inter dental regions. The examiner passes a sufficient length of unwaxed floss through the inter dental regions of posterior teeth. The odor is assessed by holding the floss about 3 cms from the nose.

Saliva odor test

The patient is instructed to expectorate about 1-2ml of saliva into a glass tube. The tube is covered immediately and incubated at 37 C for five minutes. The glass tube is then held about 4cms away from the nose for assessing odor [14, 16].

Gas Chromatography

Gas chromatography[17] is a highly sensitive technique to assess breath malodor. Gas chromatography along with flame photometry is used to measure the most abundantly produced volatile sulphur compounds in the mouth (CH3SH, H2S, and (CH3)2S). Other substances that are associated with oral malodor such as cadaverine, putrescine and skatole can also be detected.The Oral Chroma™ portable gas chromatography device analyses individual concentrations of volatile sulphur compounds such as Hydrogen sulfide, Methyl mercaptan and Dimethyl sulfide and displays the concentrations on a display panel.The evaluation of halitosis can be performed in three basic steps using this unit.Step 1: A plastic syringe that comes with the product is placed deep into the mouth and held with the lips to form a seal with the barrel of the syringe. The plunger is gently pulled and then pushed back. For the second time the plunger is pulled back before the syringe is taken out of the mouth.Step 2: If the syringe is wet on the outer surface is wiped. The needle provided by the manufacturer is attached to the syringe and the plunger is pushed such that only 0.5 cc of the gaseous contents remain in the syringe.Step 3: The remaining gaseous contents in the syringe are injected into an inlet on the main unit of the OralChroma ™.

Advantages of Gas Chromatography

1. Identifies individual components of the gas sample
2. The system can detect minute quantities of the gas even when the patient has used halitosis inhibiting agents.

Disadvantages of Gas Chromatography

1. The technique requires highly trained personnel.
2. Expensive equipment and the machine is not portable

Sulphide Monitors

Sulphide monitor[18] is portable chair side equipment that can assess oral malodor, these monitors are cost effective and commercially marketed as Halimeter[R] (Interscan, Chatsworth, California.).The monitor is equipped with an electrochemical sensor.The patient is asked to exhale into a transparent tube that carries the breath to a suction pump which in turn carries the air to the monitor. These monitors analyze the total sulphur content of the individuals breath but cannot differentiate between various sulfides. The instrument measures parts per billion levels of hydrogen sulfide and, to a lesser extent, methyl mercaptan. This monitor may show erroneous results in the presence of high ethanol or essential oil levels in the breath. The monitor needs periodic recalibration in order to maintain its sensitivity.

Electronic nose

Electronic noses[19] are chemical sensors that have been in the recent times for a quantitative assessment of malodor associated with food and beverages. Mantini et al described various biomedical uses of these chemical sensors. Tanaka M et al used these electronic noses to clinically assess oral malodor and examined the association between oral malodor strength and oral health status.The FF-1 odor discrimination analyzer (electronic nose, Shimadzu Corporation) was used by Tanaka M et al. The set up comprised of a pre-concentrator, an array of 6 metal oxide semiconductor sensors selected for their different sensitivities and selectivity's to fragrant substances, and a pattern recognition software. The instrument can be set to various modes such as the "all note measurement mode" which is the standard setting used for measuring all volatile substances and the "top note measurement mode" which primarily measures volatile substances with a low boiling point. The results of their preliminary study showed that main compounds related to oral malodor were volatile substances with a low boiling point.

Indirect methods

Bacterial culture, smears and enzyme assays are indirect methods of assessing oral halitosis. These methods will help in the identification of organisms that produce oral malodor. One such technique is BANA test.

BANA (N-benzoyl-DL-arginine naphthylamide) test

BANA20 test is a chair side investigation that assesses the proteolytic activity of anaerobic bacteria. It is a rapid chair side test for evaluation of non-sulfurous malodorous compounds.

Test

To detect malodor, the tongue or inter dental regions are wiped with a cotton swab. The sample is placed on the BANA test strip, which is then inserted into a slot on a small toaster-sized incubator. The incubator automatically heats the sample to 55° for 5 minutes. If P. gingivalis, B. forsythus or T. denticola are present, the test strip turns blue. The bluer it turns, the higher the concentration and the greater the number of organisms. A color guide is printed on the container. It can also be used to evaluate the prognosis of the condition. Individuals who have been treated successfully for oral halitosis will reveal a BANA test that converts from a positive to a negative. The BANA Test is a modification of the BANA hydrolysis test developed by Dr. Walter Loesche and colleagues at the Univ. of Michigan School of Dentistry. It exploits an unusual enzyme found in Treponema denticola, Porphyromonas gingivalis and Bacteroides forsythus, three anaerobic bacteria highly associated with adult periodontitis. These three bacteria possess an enzyme capable of hydrolyzing the synthetic peptide benzoyl-DL-arginine-naphthylamide (BANA) present on BANA test strips. If any of the three species is present , they hydrolize the BANA enzyme producing B-naphthylamide which in turn reacts with imbedded diazo dye to produce a permanent blue color indicating a positive test.

Management of Oral Malodor

The first step towards effectively managing oral halitosis is to determine the cause for halitosis (oral or systemic) and the nature of halitosis. A good medical, dental and diet history will help in determining the origin for halitosis [21, 22].

General measures

1. Patients should be advised to drink plenty of water and rinse mouth thoroughly after every meal.
2. Patients should be encouraged to clean the dorsum of the tongue gently with a soft bristled tooth brush.
3. Patients should be encouraged to undergo periodic scaling procedure.
4. Proper brushing and flossing technique should be advised.
5. Patient can be encouraged to include fibrous vegetables in the diet.

Specific measures

Elimination of foci of infection

Oral prophylactic procedures such as supra and sub gingival scaling and elimination of periodontal pockets should be undertaken [23,24]. Carious teeth have to be restored16. Teeth with periapical pathology should be endodontically treated. Abscesses of acute nature should be managed using appropriate antibiotics.

Antiseptic mouth rinses[25]

Chlorhexidine gluconate mouth wash (0.2%) which is an effective anti plaque agent is used to manage oral malodor. Triclosan (2, 4, 4-trichloro-2-hydroxydiphenylether) is a broad spectrum non ionic antimicrobial agent. Literature review reveals that triclosan effectively minimizes oral malodor. A more effective mouth rinse against oral malodor is obtained when triclosan is used in combination with zinc .Mouth rinses containing alcohol are best avoided [26, 27]. Alcohol containing rinses will dry up the oral mucosa, thereby worsening the oral halitosis.

Zinc Rinses[28]

Zinc rinses (in chloride, citrate or acetate form) have been found to reduce concentration of volatile sulphur compounds. Zinc rinses are believed to inhibit the reduction of disulfide group to thiols. An independent study showed that zinc containing chewing gum reduced oral malodor significantly.

Miscellaneous products [29, 30]

Commercially available mints and breath freshners containing menthol have also been reported to reduce oral malodor, mainly by a masking effect. Spices such as Cardamom and cloves have been used since time immemorial to mask bad odor.

Recent innovations in the management of halitosis Anti Halitosis Mouth rinse

The first active ingredient of AHM is highly oxidizing sodium chlorite (600 ppm of chlorite ion) which oxidizes the sulfides of the VSCs to non-odorous sulfates and raises the oxidation/reduction ratio of the saliva toward the more oxidizing state. This also suppresses the overgrowth of the anaerobic bacteria on the tongue. The other active ingredient zinc acetate (300 ppm of zn ion)oxidizes the VSCs and creates a more oxygen rich oral environment, but also interferes with the proteolytic activities of the anaerobic bacteria. This combination provides a synergestic anti-halitosis effect for more than 6 hours. This material is still under clinical trials and not many definite studies are published so far.[31]

Chlorine dioxide mouth rinse

Chlorine dioxide as a mouth rinse neutralizes volatile sulfur compounds in mouth air. The efficacy of a chlorine dioxide-containing mouthrinse in the reduction of oral malodor has been evaluated in randomized, controlled, double-blind trials. One study demonstrates that a onetime use of a chlorine dioxide-containing mouthrinse significantly improves mouth odor pleasantness and reduces mouth odor intensity for at least 4 hours[32].

Cochrane review[33] on the various mouthrinses available

Cochrane review states, mouth rinses containing antibacterial agents such as chlorhexidine and cetylpyridinium chloride may play an important role in reducing the levels of halitosis-producing bacteria on the tongue, and chlorine dioxide and zinc containing mouth rinses can be effective in neutralisation of odouriferous sulphur compounds. Well designed randomised controlled trials with a larger sample size, a longer intervention and follow-up period are still needed.

Management of halitophobic individuals

These individuals can be reassured by using a simple 'air bag' technique, which is a self assessment organoleptic technique[32]. In this technique a food grade thin transparent plastic cover of 8x10 inches size is taken. The halitophobic individual is instructed to seal his/her mouth with the open end of plastic bag. He /She should inhale air through the nose and exhale through the mouth in short bursts. The procedure is continued till the plastic bag is fully inflated. The mouth of this plastic air filled bag is then held tight with finger pressure such that no air escapes out of the bag. Next, patient is seated comfortably in a well-ventilated odor free room. Air from the plastic bag

should be squeezed out in front of the patient's nose while he/she inhales slowly. As the air is odor free, patient will get convinced that he/she is not suffering from halitosis. To further strengthen the belief, odor free air samples can be collected from healthy (to prevent transmission of air borne diseases) volunteers/relatives and friends of the patient and having the patient blindly rate the odor quality of each sample, including his/her own.

CONCLUSION

This article highlights on the possible causes and the various management modalities of halitosis patients. This aspect is very useful for general practitioners, especially with regard to patients with pseudohalitosis, who may seek treatment from them. Evaluation of the psychological condition of patients with halitosis is important and needs multidisciplinary approach.

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