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RESEARCH ARTICLE

HALITOSIS: A REVIEW ARTICLE

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ABSTRACT

Halitosis or bad breath is an oral health condition characterized by unpleasant odors emanating consistently from the oral cavity. For the majority of patients with halitosis, it causes embarrassment and affects their social communication and life. Moreover, halitosis can be indicative of underlying diseases. In general, intraoral conditions, like poor dental hygiene, periodontitis or tongue coating are considered to be the most important cause (85%) for halitosis. In addition, ear-nose-throat-associated (10%) or gastrointestinal/endocrinological (5%) disorders may contribute to the problem. 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. Therefore, dentists/ periodontists are the first-line professionals to be confronted with this problem. Proteolytic activity by microorganisms residing on the tongue and teeth results in foul-smelling compounds, and is the most common cause of oral malodor. The mouth air of chronic malodor sufferers is tainted with compounds such as hydrogen sulphide, methyl mercaptan and organic acids, which produce a stream of foul air that is gravely offensive to the people in their vicinity. Management may include simple measures such as scaling and planing, good oral hygiene, tongue cleaning, and mouth rinsing.

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INTRODUCTION

Halitosis is a general term denoting unpleasant breath arising from physiological and pathological causes from oral and systematic sources. The term is derived from the Latin "Halitus" meaning breath and Greek suffix "osis" meaning abnormal (Prinz in 1930). The other terms, which are used, as synonyms for Halitosis are, oral malodour, Fetor-oris, Fetor ex-ore, Bromopnea or more commonly used by common man is "Bad breath". Some authorities make a distinction between the term Halitosis and Fetor oris. Bad breath not arising in the mouth is Halitosis, whereas Odours that are caused orally are Fetor Ex oris. According to Grant this distinction does not seem to be important and the term Halitosis is used for any kind of bad breath. Under normal conditions our breath is free of offensive Odours but it does have a characteristic slightly, sweetish odour, sometimes termed the "Human odour". In the young the breath is usually not only sweet but also pleasant, however with advancing age it becomes more intense and definite but not unpleasant. Jenkins (Crispian Scully and John Greenman, 2008) Halitosis is one of society's oldest and most troublesome social maladies. It has been recorded in literature for thousands of years. It has been mentioned in the Bible and was also described by the Jews, Romans, Greeks, Chinese, Arabs etc., but modern literature was published only in 19th century by Home.

At least 50% of the population suffers from chronic halitosis and approximately half of these individuals experience a severe problem that creates a personal discomfort and social embarrassment. An important clinical feature of Halitosis is that patients are unaware of their own bad breath. Inability to smell own oral malodour has been attributed to a sensory phenomenon known as Adaptation (Miyozaki *et al.*, 1995). Decreased ability to smell unpleasant odour can be related to specialized olfactory bipolar neurons being constantly occupied with an otherwise offensive substance, making the patients insensitive to odour.

Conversely many others suffer from Halitophobia, a highly exaggerated fear that they suffer from bad breath. In extreme cases people with Halitophobia are driven to social isolation, may have their teeth extracted and occasionally commit suicide. Fear of offending by bad breath is a powerful motivating force driving people to seek dental attention, perhaps third in importance after cosmetic consideration and pain. Since bad breath usually comes from the mouth itself, the dentists should be the first professional whom individuals turn for help. Patients with complain of Halitosis may present a diverse range of oral, systematic and psychiatric disorders and may be of diagnostic importance (Miyozaki *et al.*, 1995). Halitosis has a multi factorial etiology. Diseases which cause Halitosis may produce distinctly different smells. The distinct smell, which each disease produces, may offer some help in differentiating the etiology of various factors causing this conditions. Halitosis may result from oral, local or systematic

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conditions and can be either psychological or pathological. An accurate diagnosis of Halitosis depends on analysis of data collected from patient's history, physical examination and interpretation of lab tests. Self-diagnosis of bad breath is a subject of considerable public interest. Many methods are described by which people can attempt to diagnose their own malodor. In most cases bad breath can be ameliorated by proper dental care, oral hygiene, deep tongue cleaning and if necessary rinsing with an effective mouth wash. If the problem persists, the patients should be referred promptly for appropriate medical care. With the growing interest of dental practitioner in bad breath, diagnosis and treatment, there has been associated increase in research activity in this field.

Table 1. Classification of halitosis

Classification	Treatment need	Descriptive
Genuine halitosis		Obvious malodour with intensity beyond socially acceptable level, is perceived.
Physiologic halitosis oral	TN-1	Malodour arise through putrefactive process within the oral cavity. Neither specific diseases nor pathologic condition that could cause halitosis is found. origin is mainly the doroposterior region of the tongue. Temporary halitosis due to dietary factors (e.g garlic) should be excluded.
Pathologic halitosis Oral	TN-1 and TN-2	Halitosis caused by disease, pathologic conditions or malfunction of oral tissue. Halitosis is derived from tongue coating modified by pathologic conditions (e.g periodontal diseases xerostomia) is included in this subdivision.
Pathological halitosis Extra-oral	TN-1 and TN-3	Malodor originates from nasal, paranasal and/or laryngeal regions. Malodour originates from pulmonary tract or upper digestive tract. Malodour originates from disorders anywhere in the body where by the odour is blood borne and emitted via the lungs (e.g diabibetes, hepatic cirrhosis, uremia, internal bleeding.
pseudohalitosis	TN-1 and TN-4	Obvious malodour is not perceived by other although the patient having complains of halitosis. condition is improved by counselling (using literature support, education and explanation of examination results) and simple oral hygiene measures.
Halitophobia	TN-1 and TN- 5	After treatment for genuine halitosis or pseudohalitosis, the patients persists in believing that he/she has halitosis.

Classification of Halitosis

- 1) Glickman 1894
 - i) Local causes (pathologic, non-pathologic)
 - ii) Systematic causes

- 2) DOMINIC *et al.* 1982: Based on etiology
 - i) Local factors of pathological origin
 - ii) Local factors of non-pathological origin
 - iii) Systematic factors of non-pathological origin
 - iv) Systematic factors of pathological origin.

- 3) Dayan *et al.* 1982

- i) Odour emanating with oral cavity
- ii) Odour emanating from regions immediately adjacent to oral cavity (Odour emanating from lungs)

- 4) BOGDASARIAN 1986 based on causes

- I) Normal breath and physiologic mouth odour
- ii) Odours from oral conditions
- iii) Odours from nasopharynx, pharynx and lungs Odours excreted via the lungs.

- 5) Iwakura *et al.* 1994 classified the patients with halitosis with primary and secondary halitosis.

- i) Primary Halitosis: Patients do not actually have halitosis but suffer from imaginary halitosis
- ii) Secondary Halitosis: Patients have actual halitosis

- 6) Classification of Halitosis with corresponding treatment needs (Miyazaki *et al.*, 1999)

Measurement of Halitosis

Measurement of oral malodour is complicated by variety of parameters including complexity of gaseous molecular species, sampling difficulties, temperature variation, and choice of suitable subject population and lack of agreement on reference standards. Since oral malodour is a perceived olfactory stimulus, direct sampling and assessment by human judges may be the most logical measurement approach. Some shortcomings in this method have lead several investigators to propose quantitative approaches based on measurements of volatile sulphur compounds.

Direct measurement of oral malodour

Subjective measurement of oral malodour (Rosenberg, 1996): The most simple and commonly used approach to sample and measure oral malodour is direct nasal sniffing of expelled mouth air. This is often referred to as organoleptic or hedonic assessment (Dae-Jung Kim *et al.*, 2009; Hideo Miyazaki *et al.*, 1995). Taking a short, rapid sniff as patient breathes out, nasal air should be organoleptically measured. For performing organoleptic assessment odour judges are selected with the help of general olfactory tests available on how judges should be selected. To reduce inter examination variation a panel consisting of several judges is employed and level of malodour is based on mean score. The intensity of oral malodour observed by human judges is usually graded on scale (organoleptic scoring scales (Rosenberg, 1996)) category description by Rosenberg (1991) o: Absence of odor1: questionable odor3: slight malodor4: strong malodor5: severe malodor

Instrumental analysis of oral malodour (quantitative method): Importance of quantitative parameters to measure level of bad breath

- a) It provides the dentist with an initial level, against which he/she can judge any subsequent improvement.

b) It expresses upon patient that the dentists' assessment is not an ambiguous one, but rather based on an objective scientific measurement.

c) It can also provide useful information to the dental practitioner concerning his own oral emission levels

GAS CHROMATOGRAPHY Two methods are commonly employed⁷

Gas chromatography employing Flame Ionization Detection (FID): This method identifies methanol, ethanol and acetone, but none of these emanate a putrescent odour.

Gas chromatography coupled with flame photometric detection: This method was developed by Tonzetich and co-workers. This system was very sensitive and capable of detecting sub nanogram levels of sulphur and hence was used to quantify volatile sulphur compounds of mouth air. The method established the presence of 3 sulphur containing compounds i.e, methyl mercaptan, hydrogen sulphide and dimethyl sulphur.

Advantages: Separation and quantitative measurement of individual gases, Ability to measure extremely low concentration of gases. **Disadvantages:** Relatively high cost, Need for skilled personnel, Cumbersome and lack of portability, Time required for detection and measurement

Mass spectrometry: It suggests a possible presence of sulphur compounds, but the concentration was too low to permit positive identification.

Industrial sulfide monitor also called Halimeter given by Mel Rosenberg *et al.* (1991), Lee *et al.*, 2007; Lee and Kho 2003.

Measurement using the monitor has been shown to be more reproducible than organoleptic measurements and more sensitive to reduction in oral malodour brought about by rinsing.

Advantage: Lower cost, Can be operated by non-skilled personnel, Portability, Rapid turnaround time between measurements, Simplicity in collecting samples, Noninvasive with no likelihood of cross infection.

Disadvantages: Inability to distinguish between individual sulphides, Measurements can't be made in presence of high levels of ethanol, essential oils, precluding assessment of mouth wash efficacy until these components have dissipated, Instrument may show a slight loss of sensitivity with time and necessitates periodic recalibrations, Compounds other than volatile sulphur compounds which causes halitosis cannot be measured.

Zinc oxide thin film semi-conductor sensor: Shimura and company in 1996 devised this device, which is used to diagnose halitosis in the clinics. The results obtained by this device correlated with the values of total volatile sulphur compounds measured by gas chromatography and also with the organoleptic scores given by the judges (Smirnoff *et al.*, 1977).

Advantages: Small size, Simple to handle, Responds specifically to several volatile sulfides and volatile sulphur

compounds in mouth air, Highly sensitive, Can measure halitosis due to non-volatile sulphur compounds, Could be used for diagnosis of diabetes as measures acetone in mouth.

Ora test: This test was developed by Rosenberg *et al.* (1989) It provides a quantitative assessment on the level of microbial activity in the oral cavity. The test involves oral rinsing with a sterile milk sample, followed by expectoration into a test tube containing an oxidation: reduction indicator (methylene blue). The higher the level of microorganisms, faster the colour changes from the blue (aerobic condition) to white (anaerobic condition) at the bottom of test tube. In addition to correlation with microbial counts, the oratest exhibits significant correlation with plaque and gingival indices

Indirect Measurement of oral malodour

Due to the variability of oral malodour measurements and difficulties in assessing oral malodour directly from oral cavity, investigators have employed indirect methods.

a) The approach, which has been most widely exploited, is the measurement of malodour and volatile sulphide in putrefying saliva samples where as some extrapolations between the odour of putrefied saliva and oral malodour may be acceptable, caution should be exercised since odour of Putrefied saliva usually differs appreciably from directly sampled oral malodour.

b) BANA test: It is an enzyme based assay. It is helpful in detecting halitosis by detecting the bacteria viz. Porphyromonas gingivalis, Treponema denticola and bacteria producers in forsythus which are considered active hydrogen sulphide producers in vitro (Smirnoff *et al.*, 1977). In this technique detecting trypsin like protease, which is produced mainly by these bacteria, identifies bacteria. This protease hydrolyses Benzyl DL. Arginina 2 Naphthylamine (BANA) substrate. Commercially available chair side test kit system is perioscan (oral B laboratories) (Kozlovsky *et al.*, 1996).

Advantages: Rapid and inexpensive, Provides visual results, which can be shown to patients and related to the site from which they were obtained.

Disadvantages: Lack of quantitative data, Inability to determine which of the three bacteria are responsible for enzyme production, Does not include inhibitor of host protease, which could contaminate the plaque sample from saliva, GCF that also, cleanses substrate. (c) less frequently employed method is the measurement of sulphide and malodour from bacterial isolates and pure cultures

Treatment of Halitosis

The best way to treat bad breath is to motivate patients to practice good oral hygiene and to ensure that their dentition is properly maintained.

Oral hygiene maintenance include (Rosenberg, 1994): (1) Periodic professional oral hygiene maintenance: With particular attention to potential foci of microbial colonization. Since periodontal diseases are the major cause of bad breath, prompt diagnosis and treatment is essential (Lee *et al.*, 2007). (2) Mechanical methods:

Tooth brushing

Brushing with toothpaste may reduce malodour for as long as 2 hours. Sodium bicarbonate dentifrice appears to be superior to fluoride dentifrice for the reduction of volatile sulphur compound levels (Lee *et al.*, 2007; Goldberg *et al.*, 1994).

Flossing

It is one of the most effective day to day home treatments that do not involve antimicrobial agents. However the level of patient compliance in daily flossing is low but once the connection is made between flossing and fresh breath, compliance improves having patient smell the floss after each use is a good way to illustrate the importance of regular flossing in improving breath odour.

Tongue cleaning

Gentle but effective deep tongue cleaning should become a part of the daily hygiene routine. To prevent tongue odour, the tongue should be cleaned in a gentle thorough manner. The posterior portion of the tongue is the least accessible but usually smells the worst (Goldberg *et al.*, 1994; Rnbergos *et al.*, 1991) (3). CHEMICAL METHODS –MOUTH RINSING Mouth rinses may be indicated in those patients who even after maintaining good oral hygiene continue to have malodour. Many commercially available mouth rinses claim to effectively eliminate malodour, but most of them use a masking approach. Other products have antibacterial mechanisms, but many of these rinses have insufficient strength to control odour for longer than several hours.

Effectiveness of rinses used for the reduction of oral malodou (Roldens and Herra, 2005; Yaegaki and suetaka, 1989).

Table 2. Effectiveness of rinses used for the reduction of oral malodour

METHOD	EFFECTIVENES IN REDUCTION OF ORAL MALODOUR
Rinsing with water	Effectiveness in reduction of oral malodour effective for 15 days
Use of sanguinarine rinses	No detectable decreases have been reported.
Essential phenolic oils	Low substantivity and only transient antibacterial effects, but measurable reduction.
Zinc chloride rinses	Marked reduction of volatile sulphur compounds levels over time, Ionic zinc inhibits volatile sulphur compounds for 10 hours, reduced odour by 71 percent.
Two phase mouth wash	Oil, water and cetylperdinium chloride, found very effective at full strength.
Chlorine dioxide	No research to show efficacy or long term effects
Chlorhexidine	Substantive anti-microbial agent, effective against both gram negative and gram positive bacteria.
Cetylpyridinium chloride	Shown to reduce volatile sulphur compounds production for three hours

Miyazakiet (1988) has given classification of treatment needs for halitosis according to corresponding types of halitosis (Rosenberg, 1992).

Treatment of Genuine Halitosis (Rosenberg *et al.*, 1991; Rosenberg *et al.*, 1992)

Table 3. Treatment need for Halitosis

Category	Description
TN1	Explanation of halitosis and instruction of oral hygiene
TN2	Oral prophylaxis, professional cleaning and treatment for oral diseases
TN3	Referral to a physician or medical specialist
TN4	Explanation of examination data, further professional instruction and reassurance
TN5	Referral to a clinical psychologist, a psychiatrist or other psychology specialist

A). Physiologic halitosis (TN1):

1. Patient education: Take regular meals, Eat fibrous vegetables, Avoidance of odoriferous foods, habits, health (e.g smoking), Drink ample amount of water
2. Oral hygiene instructions: Brushing and flossing, Mouthwash and toothpaste, Periodical dental examination and scaling

B) Oral pathological halitosis (TN1 & TN2): Periodontal treatment, Dental treatment (root canal, restoration), Oral surgical and medical treatment extraction, ulcer treatment and xerostomia.

C) Others (Extra pathologic halitosis (TN1 & TN3): If some underlying systematic condition is present, patient is referred to a medical practitioner.

D) Pseudo-halitosis and Halitophobia (TN1 & TN4): Counseling, Referral to a clinical psychologist, a psychiatrist or other psychology specialist.

A new 2-phase oil: Water mouth wash (Yaegaki and Sanada, 1992) has been developed. A large proportion of oral microorganisms adhere to the oil droplets formed during the rinsing procedure and are subsequently expectorated from the mouth. This in turn, enhances the ability of the mouthwash to physically remove oral microorganism in addition to inhibiting those that remain behind

DISCUSSION

Oral malodour also known as bad breath is a general complaint among general population. Recently this area has witnessed growing technology for its diagnosis and treatment; this in turn has raised the level of information and misinformation about bad breath among the general population. Early scientific research assessed the effect of microorganisms and conditions within the mouth, nose and sinuses on the production of breath odour. Gibbons *et al* in 1960 found that some periodontally pathogenic strains cause halitosis. Tonzetich *et al* in 1969 observed that the production of Volatile Sulphur Compounds (VSCs) is significantly increased by the presence of pooled blood. During 70,s studies revealed sufficient information to determine that the major cause of bad breath is oral microflora that produces volatile odiferous molecules, including sulphur compounds and organic acids among others (McNamara and Alexander, 1972; Yaegaki and Sanada, 1992). Yaegaki *et al* in 1992 reported that Volatile Sulphur Compounds (VCS) concentration increases with the bleeding index and that some blood components in the oral cavity or periodontal pocket may accelerate Volatile Sulphur Compound (VCS) production and

Morita M *et al* in 2001 observed that both organoleptic rating and Volatile Sulphur Compounds (VCS) significantly correlated with the bleeding index. Oral malodour may provide a window for diagnosis of periodontal diseases. An accurate diagnosis of Halitosis depends on analysis of data collected from patient's history, physical examination and interpretation of lab tests. Oral malodour measurement by organoleptic method has been inferred to be "gold standard" for bad breath measurement. The nasal sniffing is the most simple and commonly used approach to directly sample expelled mouth air. On the other hand quantitative measurement of gas chromatography has advantage in that it offers consistent results.

A Simple and rapid technique for measurement of halitosis related sulphide using a portable industrial sulphide monitor with objective reading is highly effective in clinical use (Shimura *et al.*, 1996). However these detectors are found to be unreliable in comparison with the results obtained by gas chromatography (Yaegaki and Sanada, 1992). Recently a small hand held monitor (Tanita, Japan) was introduced for the measurement of volatile sulphur compound in mouthair. The portable monitor provided a subjective reading which favours the organoleptic assessment. There are various treatment modalities for halitosis; the best way to treat is to motivate patients to practice good oral hygiene and to ensure that their dentition is properly maintained. Oral hygiene maintenance includes. Periodic professional oral hygiene maintenance, Mechanical methods like Tooth brushing, Flossing Tongue cleaning and Chemical methods comprising of various mouth rinses like Rinsing with water, Use of sanguinarine rinses, Essential phenolic oils, Zinc chloride rinses, chlorhexidine etc. Breath mints, lozenges, drops, sprays, chewing gums etc. On their own are typically not the most effective means by which to improve one's breath.

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