

An update on halitosis

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Abstract

Halitosis is a symptom that has plagued man for centuries and remains an important problem till date. It is the third most common cause of dental consultation. Halitosis is multifactorial in origin, with causes ranging from intra-oral to systemic, as well as psychogenic factors. The most common cause of halitosis is bacterial activity on diseased periodontal tissues as well as on the debris on the dorsum of the tongue, followed by disorders of the respiratory tract. Gram-negative organisms have been implicated in the generation of malodorous compounds, of which hydrogen sulphide, dimethyl sulphide and methyl mercaptans, collectively known as volatile sulphur compounds (VSC), are the most important. There are diverse methods of assessing the presence and severity of malodour in affected individuals, including the subjective organoleptic method and more objective methods, such as the use of gas chromatography, halimeter, and enzyme assays such as the N-benzoyl, DL-arginine, 2-naphthylamide test. Various methods have been advanced for the treatment of this symptom. Such include the use of mouthwash, sugarless chewing gum, mint and oral spray. These methods tend to reduce the intensity of the odour perceived without addressing the cause of the malodour. Treatment of halitosis should be focused on the aetiology, as halitosis is not a disease but a symptom or sign of a disease condition. Thus, the management of halitosis spans various specialities in the field of dentistry and medicine, including clinical psychology.

Keywords: Halitosis, Halitophobia, Pseudo halitosis, VSC

Introduction

The word "halitosis" refers to offensive or unpleasant odour arising from the oral cavity or the nasal passages. Halitosis is a source of concern for millions of people all over the world; affecting both adults and children alike⁽¹⁾. The word is formed by merging the Latin word for breath "halitus" and the Greek suffix "osis" meaning condition⁽²⁾. Other names used for halitosis include fetor ex ore, bad breath, foul breath, and breath malodour⁽³⁾. The term fetor oris or oral malodour refers to halitosis of oral origin or foul smelling mouth which accounts for about 90% of all halitosis⁽⁴⁾.

Halitosis has impact on the medical, psychological and social aspects of the patient^(5,6). Fetor ex ore has been recorded in the literature for thousands of years; for example, in the Jewish Talmud, as well as by the Greeks and the Romans. Modern writings on bad breath date back to the 19th century, notable among which is the monograph written by Howe in 1898⁽⁷⁾. In addition, experimental studies were carried out at the University of British Columbia by Tonzetich and Richter in 1964, establishing that malodour is due to volatile sulphur compounds (VSCs) rather than amines and ammonia⁽⁸⁾. Halitosis has been a source of concern to the public for centuries and different substances and strategies have been employed over the ages to mask this social impediment⁽⁹⁾. Surprisingly, halitosis has not been approached with much interest by the dental profession until very recently⁽³⁾. This article aims at reviewing the present knowledge of the causes, methods of diagnosing and treating this intriguing symptom, that infrequently masquerades as a disease.

Prevalence

Halitosis has a significant impact on those who have it, or believe that they have it and at times their close relations⁽¹⁰⁾. It can be a very distressing condition for the patient and challenging for the dental practitioner. Oral malodour is the third most common cause of dental consultation, after caries and periodontal diseases⁽³⁾. The exact prevalence of this condition in most communities is unknown since epidemiological studies on the condition are yet to be carried out. However, an estimated one-quarter of the world population is affected by this condition⁽¹¹⁾.

Classification

A number of different classifications have been proposed for halitosis, such as that by Yaegaki and Coli, 2000⁽¹²⁾ where it was grouped into two broad classes; genuine halitosis and pseudo halitosis.

Lee et al⁽¹¹⁾, grouped halitosis into three

1. Exogenous (transient): this group is referred to as physiological halitosis in this review,
2. Endogenous (true oral halitosis), referred to as pathological halitosis here, and
3. Psychogenic halitosis, which encompasses pseudo halitosis and halitophobia.

In this review, halitosis is classified into three major groups.⁽⁵⁾

1. Genuine halitosis,
2. Pseudo halitosis, and
3. Halitophobia.

Genuine halitosis

Genuine halitosis is detectable by organoleptic and by physicochemical methods⁽⁵⁾ and can be sub classified into physiological and pathological halitosis.

Physiological halitosis

Physiological halitosis is also called transient halitosis because it is often self-limiting.

Morning breath is a very common type of physiological halitosis, often disappearing after eating or oral toileting. It is said to be due to enhanced microbial activities as a result of reduced salivary secretion during sleep which encourages stagnation and a micro environment that favours anaerobic bacteria proliferation. Morning breath does not usually interfere with patient's normal activities or social relations⁽⁹⁾. Other causes of transient halitosis are ingested foods such as garlic, ginger, onions, durian, fish, cheese, and coffee^(11,13).

Pathological halitosis

Pathological halitosis is multifactorial, with causes ranging from intra-oral to extra-oral disease conditions. It is also referred to as chronic or persistent halitosis, since the offensive odour persists until the disease condition responsible for it is treated. Disease conditions associated with bad breath are many and diverse and may be difficult to comprehensively discuss in this brief review.

Table I presents an outline of the major causes and predisposing factors to halitosis.

1. Intra-oral causes

About 90% of oral malodour is due to the production of foul smelling compounds by oral micro-organisms⁽¹⁴⁾. This could be engendered by the following intra-oral conditions.

Poor oral hygiene: Poor oral hygiene is a major contributor to the production of malodour of oral origin⁽¹⁵⁾.

Periodontal diseases

Periodontal diseases contribute greatly to oral malodour, by providing a conducive environment for the proliferation of anaerobic micro-organisms⁽⁵⁾. Also, periodontitis leads to the release of tissue fluid rich in protein, which oral microbes act on to release odiferous gases⁽¹⁵⁾. Several studies have demonstrated a positive correlation between the severity of periodontal disease and concentration of VSCs in the oral cavity. However, a few other studies failed to find this association^(3,5). In addition, oral diseases such as pericoronitis, periodontal abscess, necrotizing ulcerative gingivitis and other forms of periodontal disease have been associated with fetor oris⁽⁵⁾.

Xerostomia

Oral malodour may result from reduced salivation which may be drug induced, side effect of radiotherapy or a result of a primary disease of the salivary glands such as Sjögren syndrome, viral parotitis, suppurative parotitis and salivary gland aplasia^(16,17). Xerostomia compromises the lubricating, cleansing and buffering functions of saliva thus enhancing bacterial activity. Other causes of temporary xerostomia, and thus, halitosis include anxiety, stress, fasting and some drugs such as diuretics, tricyclic antidepressants and anti-psychotics⁽¹⁶⁾.

Malignancies of the oral cavity

Malignancies of the oral cavity are often associated with very offensive odour, which is due to tumour necrosis with or without bacterial super infection of the diseased tissue⁽¹⁸⁾.

Rare intra-oral causes of halitosis

Some other rare causes of oral malodour include oral myiasis, lichen planus and paraneoplastic pemphigus^(19,20). Paraneoplastic pemphigus, first described in 1990 is characterized by extensive mucocutaneous erosion, a distinct set of autoantibodies and an underlying neoplasm⁽²¹⁾.

2. Extra-oral causes

Upper and lower respiratory tract disorders:

This is the most common cause of extra-oral halitosis⁽⁹⁾. They include:

Chronic sinusitis: Patients with chronic sinusitis often have mucus rich in protein and bacteria draining unto the dorsal surface of the posterior third of the tongue; a region that is difficult to clean because of its anatomy, and is therefore a natural habitat for a great number of micro organisms. This is broken down by the bacteria in the oral cavity to produce the various odoriferous compounds⁽⁷⁾. Other causes are diseases of the tonsil such as tonsillitis and tonsilloliths^(7,18). Also, the open tonsillar fossa after a tonsillectomy may be colonized by organisms thus contributing to malodour⁽²²⁾. Other causes include malignancies of the respiratory tract, foreign bodies in the respiratory tract and lower respiratory tract diseases.

3. Other systemic causes

Trimethylaminuria:

This is a medical condition in which there is accumulation of a pungent smelling compound called trimethylamine in the circulation. It could result from a genetic defect leading to the absence of the enzyme flavine mono-oxidase which is essential in the metabolism of the foul smelling trimethylamine to the odourless trimethylamine N-oxide. This disease state is known as the "Fish odour syndrome", as the odour perceived is similar to that of rotten fish. Trimethylaminuria can also result from excessive production of trimethylamine in patients being treated with choline for Huntington's chorea or Alzheimer's disease.⁽¹³⁾

Diabetes mellitus:

Diabetic patients have a less competent immune response, reduced rate of salivation and a high level of glucose in their body fluids. All these predispose them to an increased risk of oral infection especially periodontal diseases of inflammatory origin, which results in oral malodour⁽²³⁾. In addition, poorly controlled diabetic patients have an acetone like smell due to the presence of ketone in their circulation as a result of deranged glucose metabolism⁽²⁴⁾. Other rare causes of halitosis reported include oesophageal reflux, chronic renal failure and chronic liver failure^(5,18,25).

Pseudo halitosis

This is often due to a psychological condition where patient believes he or she has a foul breath which cannot be verified by others⁽⁵⁾. Pseudo halitosis may also be experienced by some patients as a hallucinatory feature of schizophrenia, temporal lobe epilepsy or olfactory reference syndrome^(4,5). For the first two disease states, patients present with other clinical symptoms that help in establishing the appropriate diagnosis, while the

complaint of malodour is often the only problem in the olfactory reference syndrome cases. It is characterized by a constant preoccupation with body odour, which is accompanied by shame, embarrassment, social isolation and severe distress⁽⁶⁾.

Halitophobia

This is a condition in which the patient exhibits an excessive fear of ever having halitosis or dreads halitosis and wishes to stay free of malodour. These patients know they are free of halitosis but are obsessed with activities that tend to reduce intra oral debris accumulations such as repeated teeth and tongue cleaning as well as those aimed at masking malodour such as the frequent use of chewing gums, mints, mouthwashes and sprays⁽¹³⁾.

Aetiopathogenesis of malodour

New born babies have a sterile mouth at birth, but after a few hours, micro-organisms start colonising the oral cavity⁽²⁶⁾, such that by adulthood, about 600 different bacterial species reside in the oral cavity as commensal organisms. The most important group of these organisms that have been implicated in the production of odoriferous gases are the gram-negative microbes⁽¹⁴⁾. Many of these organisms are found in the subgingival region, such as *Treponema denticola*, *Porphyromonas gingivalis*, *Porphyromonas endodontalis*, *Tannerella forsythensis*, *Orphyromonas endodontalis* Centipeda spp., *Bacteroides* spp., *Peptostreptococcus* spp., *Eubacterium* spp., *Selenomonas* spp., and *Fusobacterium* spp.^(3,5,14).

Their main nutrient sources are proteins, peptides, or amino acids, which are derived mainly from food remnants, dead blood cells, saliva and desquamated oral epithelium⁽⁹⁾. The metabolites produced include VSCs (hydrogen sulphide, methyl mercaptan, and dimethyl sulphide), organic acids (acetic, valeric, butyric, propionic), volatile aromatic compounds (indole, skatole), and amines (cadaverine, putrescine)^(5,27). These organisms produce most metabolites at a neutral or alkaline pH and low oxygen tension. Many of the compounds have a foul odour, for example cadaverine smells like a decaying corpse, while hydrogen sulphide smells like rotten eggs (**Table 2**).

Management

All complaints of halitosis must be taken seriously and treatment should be tailored to the cause or causes^(7,28). To achieve this, the cause of the objectionable odour must be known, as halitosis is multifactorial in origin^(10,15).

Diagnosis

Due to the intriguing nature of the sense of smell, patients presenting with the primary complaint of halitosis range from those with no perceptible malodour to those with extremely foul breath⁽¹⁾. Only 25% of patients presenting with a primary complaint of foul breath have genuine halitosis⁽²⁹⁾.

History

The history of the presenting complaint described as “the cornerstone of medical diagnosis” is of great importance in identifying which group each patient belongs⁽³⁰⁾. A good history of the complaint must be taken to identify when the symptom was first noticed, when the odour is worse and how patient became aware of it. A medical and drug

history is also of utmost importance.^(11,30)

Clinical examination

Since the vast majority of halitosis cases have their origin within the oral cavity; a thorough oral examination must be carried out to identify any pathology within the oral cavity. This should include a thorough check for carious lesions, periodontal diseases, alveolar bone defects, oral ulcerations, pericoronitis over hanging restoration, oral hygiene and the state of the tongue, (e.g. check if the filiform papillae are long and dirty)⁽¹¹⁾. The nasal cavities must be examined for mucous secretions, deviated nasal septum, and swelling. The examination of the nasal cavities and sinuses is very essential as they are an important cause of bad breath of non oral origin⁽³⁰⁾.

Investigations

Investigations are also necessary to establish the presence or absence of a foul breath, the severity or intensity of the malodour as well as the site or sites from which the more intense odour is emanating. In addition, the intensity of the malodour should be noted at diagnosis so as to assess the effect of treatment⁽¹¹⁾.

The following are three main methods of assessing the presence or absence of malodour:- (a) organoleptic measurement, (b) gas chromatography (GC), and (c) sulphide assay. These methods are also of use in quantifying the severity of the halitosis and monitoring the effectiveness of treatment of the individual patient⁽⁵⁾. The organoleptic method is subjective, while GC and sulphide assay are objective methods⁽¹⁾.

1. Organoleptic assessment

This is the method most frequently used in clinics as the instrument is widely available. It may be used by trained or untrained examiners. It involves the sniffing of air being emitted from the oral cavity or nasal orifice by another person. The intensity of the malodour is scored according to the examiner's perception of the intensity of oral halitosis from the expelled air (**Table 3**). The advantage of this method is that it is simple to conduct and requires no specialist equipment. It however has a few set backs, which include low specificity and reproducibility as well as the potential risk of transmitting air borne diseases via the expelled air, especially the severe acute respiratory syndrome and bird flu infections of recent years⁽¹¹⁾.

2. Gas chromatography

This employs a machine that digitally measure the molecular levels of hydrogen sulphide, dimethyl sulphide and methyl mercaptans which are the three major gases responsible for halitosis. It is accurate and produces visual result in the form of a graph via computer interphase. However, the equipment is not compact and needs a skilful operator but the result is specific and reproducible^(5,11).

3. Halimeter

The halimeter is a portable sulphide monitor used to detect the level of volatile sulphur compound especially in the air within the oral cavity. It is compact and does not require a highly skilled operator but it loses sensitivity over time, therefore it requires periodic recalibration⁽¹¹⁾.

4. Other tests

There are a few other tests used in assessing halitosis,

however many of these are not of use in the routine clinical assessment of halitosis.

a) BANA test: This test can be done at the chair side; it detects the presence of arginine hydrolase; an enzyme that hydrolyze N-benzoyl DL-arginine 2-naphthylamide (BANA). There has been a strong association with BANA assay level and the presence of some bacteria whose presence reflects periodontal disease activity⁽¹⁰⁾.

b) Beta-galactosidase test: Measures the level of the enzyme β -galactosidase in the oral cavity. This enzyme plays an important role in the deglycosylation of oral mucin by the removal of O- and N-linked carbohydrate side-chains. This deglycosylation is essential for the oral microbes to break the protein down. High levels of this enzyme is associated with oral malodour⁽³²⁾. Additional tests include the use of chemical sensors, salivary incubation test, ammonia monitoring, ninhydrin method, and polymerase chain reaction. However, the scientific as well as the practical use of these methods in patient assessment is yet to be established⁽¹⁵⁾.

Treatment

Education plays a crucial role in the management of patients with all types of halitosis because the symptom can only be eliminated when the patient understands the cause of the malodour and is willing to cooperate fully with the dentist or physician. The patient should be enlightened on the aetiopathogenesis of his or her condition and must be motivated to maintain a good oral hygiene. This should include careful tongue brushing to remove debris and oral microbes in the fissures and crypts on the tongue⁽⁵⁾. Treatment/control of any underlying disease or predisposing condition is mandatory. Halitosis as a result of conditions such as trimethylaminuria with no treatment may be ameliorated by restricting patient's intake of food items rich in choline such as egg yolk, kidney, liver, peas and salt water fish⁽¹³⁾. Werner, 2007⁽³³⁾ advocated the use of desmopressin for this syndrome. For pseudoalhalitosis, education of the patient on the nature of this form of halitosis is essential. A demonstration of the reading of patient's exhaled gas on the halimeter may be helpful in patients with pseudo halitosis or halitophobia⁽¹¹⁾. Another option is to refer them to a psychiatrist or a clinical psychologist⁽³⁴⁾. However this option is often unacceptable to these patients because of the social stigma attached to visiting the psychiatrist and also because they are convinced they have a breath problem and find it difficult to relate bad breath with such specialists⁽³⁴⁾.

Complications

Reduced quality of life

Halitosis has a great influence on the social life of the patient. It is a cause of social embarrassment, emotional and psychological distress leading to a low self-esteem, poor self-image, and lack self-confidence⁽¹¹⁾. It is a constant source of unhappiness to the individual and may destroy communication amongst friends and reduces the pleasure of social contact⁽⁹⁾.

Promotion of periodontal disease

Halitosis is primarily considered a cosmetic problem by most patients and their relatives but VSCs, the family of gases primarily responsible for this condition have toxic

effects on oral tissues. For example methyl mercaptan affects the synthesis of collagen such that less collagen is synthesized, those formed are poorly cross linked, and more susceptible to proteolysis⁽³⁵⁾.

Suicide

Psychiatric disorders, notably, the olfactory reference syndrome, with progression to acute mania in some cases have been reported. In a few cases, affected patients have committed suicide^(7,31,36).

Conclusion

Halitosis is a symptom with diverse aetiology ranging from physiological to pathological and psychogenic. It has been a source of concern to man for centuries and it remains an important cause of dental consultation. The oral cavity is the site of origin of most cases of halitosis. Thus, a large percentage of halitosis will be taken care of by maintaining a good dentition and good oral hygiene. However, a class of patients may benefit from an assessment by a clinical psychologist or psychiatrist.

Acknowledgement

The author is greatly indebted to Prof EEU Akang of the Department of Pathology and Dr MO Arowojolu of the Department of Preventive Dentistry, University College Hospital, Ibadan, Nigeria for reading and editing this manuscript.

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