

Oral Malodour: From Detection to Definitive Management

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ABSTRACT

Many individuals have accessed the care of dentists on account of noticeable unpleasant odour that emanates from the mouth which is objectionable to others. Such persons have been known to suffer a wide range of negative consequences such as social isolation as well as psychosocial stigma. Managing such individuals can be challenging because of the many possible causes of oral malodour. Therefore, this review was done to emphasise the many steps dentists take, from the very basic ones to recent advances, in the management of oral malodour patients.

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INTRODUCTION

Oral malodour is defined as a noticeable unpleasant odour that emanates from the mouth which is objectionable to others (Aydin and Harvey-Woodworth, 2014). It is also referred to as Halitosis (Halitus, meaning Breath+ Osis, meaning Bad). Other terms used are bad breath, foul breath, breath malodour, fetor ex-oro and fetor oris (Tangerman, 2002). The question often asked is how much of a problem is oral malodour? Oral malodour is estimated to be the 3rd most frequent reason for seeking dental care after dental caries and periodontal disease (Aung et al., 2019). Its prevalence has been reported to be as high as 50% in some population (Teshome et al., 2021). It was considered to be one of the greatest taboos in

many societies and recently recognized as a psychosocial stigma (Kolo et al., 2015).

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Its negative impact makes it a huge problem. It makes its sufferers embarrassed and frustrated. They talk sideways, suspend important life events and avoid social contacts. In extreme cases, sufferers have obsessive compulsive disorders that make them brush too frequently, abuse oral health care products and antibiotics, chew candy or gum excessively, have all their teeth extracted and even contemplate suicide (Deolia et al., 2018). Oral malodour also has significant

Impact on the sufferers' marriage, schooling and career, employment and employability, religion and overall quality of life (Renvert et al., 2020). Therefore, every aspect of the management of oral malodour is important, from detection to definitive treatment.

Detection of oral malodour

Detection refers to all actions or processes involved in identifying the presence of malodour, even when concealed. This will involve asking certain questions such as Is oral malodour truly present? Who says oral malodour is present? What is the origin of this oral malodour? How can we be sure oral malodour is present? The answer to these questions will determine exact protocol to adopt in the management of oral malodour.

Is oral malodour truly present? If the answer to this question is yes, then the condition is referred to as genuine halitosis. Genuine halitosis is obvious malodour with intensity beyond socially acceptable level and with a detectable organic cause (Kayombo and Mumghamba EG, 2017). If the answer is no, then it means there is no organic cause of malodour. Such a condition can be referred to as pseudo-halitosis or halitophobia. Pseudo-halitosis is when obvious malodour is not perceived by others, except the patient who stubbornly complains of its existence, but improvement in the malodour is noticed by the patient after treatment (Seemann et al., 2014). Halitophobia on the other hand is when there is no objectively noticeable foul odour, but patient still believes that malodour is present even after treatment (Aylikci and Colak, 2013).

The next question to ask is who complains that oral malodour is present? Is it the sufferer or other people around them? It is possible that oral malodour may be present but only other people would perceive it. This may be because of the humans' ability to suppress odours, known as smell adaptation and habituation (Stevenson and Attuquayefio, 2013; Aylikci and Colak, 2013). It may also be because of the divergent pathways between the inhaled and exhaled air (Ashwath et al., 2014). Expelled air from the mouth travels horizontally while inhaled air travels vertically, lowering chances of the affected person to detect odour from the expelled air. In some other cases, those who have oral malodour are completely unaware of it but they claim that they can perceive odour emanating from other people e.g., spouse. Another possible scenario is when there is no noticeable odour but the patient insists that it is present. Such persons remain adamant that they have malodour even when there is no objective evidence. This phenomenon is referred to as the "malodour paradox" (Rosenberg et al., 1995). This phenomenon has a strong implication in the management of malodour because the person who

needs the management may not be the one presenting at the clinic.

Another question to ask in the detection of oral malodour is: what is the origin of this oral malodour? This is because oral malodour may arise from both physiologic and pathologic sources. Examples of physiologic sources are food containing lactose (dairy products like milk, cheese, yoghurt, ice-cream), food containing sulphur (onion, garlic), reduction in salivary flow during sleep, menstruation, smoking and alcoholic drinks (Aylikci and Colak, 2013).

Pathologic sources are mainly intra oral (90%) e.g., dental caries, dental plaque, gingivitis, periodontitis, fissured and hairy tongue, acute primary herpetic gingivostomatitis, oral carcinoma and pericoronitis (Aylikci and Colak, 2013). The intraoral causes are more common because oral conditions are usually characterised by pain, subsequently leading to inability to carry out plaque control optimally (Azodo and Umoh, 2013). Also, areas in the oral cavity low in oxygen tension, such as deep periodontal pockets, encourage decarboxylation of amino acids, leading to the production of odoriferous volatile organic compounds (Kapoor et al., 2016). Dental restorations, when present, can also serve as secondary plaque retentive factors and are invariably potential bacterial reservoirs (Aylikci and Colak, 2013). Furthermore, the porous surface of dental appliances can encourage adsorption of salivary proteins which results in bacterial adhesion, bacterial action on food substances in the oral cavity and eventually, odour generation (Aylikci and Colak, 2013; Kapoor et al., 2016).

Pathologic causes of oral malodour can also be extra oral. Disorders of the upper and lower respiratory tract, gastrointestinal conditions and disorders of lower gastrointestinal tract, neurologic disorders, systemic administration of drugs, functional disorders such as psychosis and depression as well as metabolic systemic disorders have been implicated (Aylikci and Colak, 2013; Kapoor et al., 2016). The malodour generated by systemic disorders are distinct and easily identifiable. Odour from hepatic failure is mousy or sweetish while the one from kidney failure is referred to as uremic or fishy. Diabetic ketoacidosis odour is fruity and referred to as acetone breath while chronic glomerulonephritis or lung abscess is foul and putrefactive (Aylikci and Colak, 2013; Kapoor et al., 2016).

Methods of determining the presence of oral malodour

The methods based on self-assessment are subjective while those based on clinical assessment are more objective. The different types of self-assessments employed are essentially the same because they all involve eliciting odour from different part of the oral cavity and grading the severity of the odour perceived. Spoon test is used to assess odour from the posterior

part of the dorsum of the tongue while dental floss odor test is used to assess the odour originating from the inter-dental regions. Saliva odor test, wrist-lick test, nasal odour test and prosthesis odour test involve perception of odour from expectorated saliva, licked wrist, air exhaled through the nose and removable denture respectively (Kabir et al., 2013). The scoring of the odour, irrespective of the type of test, is based on of the organoleptic assessment (Rosenberg and McCulloch, 1992).

Organoleptic assessment has a scoring system that grades the intensity of the oral malodour. These scores range from 0 to 5. (0= No odour perceived, 1= Barely noticeable, 2= Slight but noticeable, 3= Moderate, 4= Strong, 5= Extremely foul) (Rosenberg and McCulloch, 1992). Although organoleptic assessment is still the gold standard for quantifying self-assessment of oral malodour, it is highly subjective and may not be reproducible. Its accuracy depends on the examiner's olfaction accuracy and environment. Factors such as the examiner's health and state of mind can easily influence their ability to detect odours (Dayma et al., 2020). To minimise the effect of this possible limitation, more than one odour judge carries out the organoleptic assessment. Each of the judges will give a score which will be used to determine the average score for the patient.

The more objective methods of detecting oral malodour involve estimation of odouriferous gases present. Gas chromatography is used to quantify the level of gases in mouth air and the ability of gas chromatography to quantify the precise levels of various gases present in an individual's breath has made it the gold standard for assessing oral malodour. OralChroma® is a portable gas chromatograph that can measure the levels of the 3 key volatile sulphur compounds implicated in oral malodour (Hydrogen sulphide (H_2S), methyl mercaptan (CH_3SH) and dimethyl sulfide (C_2H_6S)). There are other portable sulphide monitors which are easy to use to detect oral malodour at the chairside. However, most of them are not able to distinguish among the VSC. Examples are the Halimeter® and Breathtron®

There are other objective methods of detecting Oral malodour. Chemiluminescence is a method of testing for the presence of VSC based on the principle of chemiluminescence. When a sample containing VSC is mixed with the test's mercury compound, the resulting reaction causes a fluorescence (Kapor et al., 2011). This provides a better selectivity and sensitivity when measuring low levels of VSC. Selected ion flow tube mass spectrometry is also a method used for quantification of trace gases in human breath for clinical diagnosis and therapeutic monitoring (Spaněl and Smith, 2007). This method makes use of chemical ionisation of sample trace gases. The FF-1 odour discrimination analyzer (Electronic nose) has also been

able to overcome the shortcomings of the human olfactory system (Farraia et al., 2019). It detects odouriferous substances by making use of a pre-concentrator, an array of 6 metal oxide semiconductor sensors selected for their different sensitivity and selectivity to these substances.

Another strategy to detect oral malodour is to determine the presence of certain microorganisms and their enzymes which can produce VSCs. The N-benzoyl-DL-arginine-2-naphthylamide-Enzymatic™ test (BANA test) is based on the principle that certain anaerobic bacteria contain enzymes that can hydrolyze peptides (Dhalla et al., 2015). The test therefore detects the presence of *Porphyromonas gingivalis*, *Treponema denticola* and *Bacteroides forsythus* which have been identified to possess significant amounts of this unique enzyme. The BANA-Zyme™ reagent strips are plastic cards to which separate reagent containing matrices are affixed. The lower matrix is impregnated with BANA and the upper reagent matrix contains a chromogenic diazo reagent (fast black K). When subgingival plaque sample is applied to the lower matrices, a positive chemical reaction gives a permanent blue colour while a negative result gives no blue colour observable on a pale red-brown background. A positive reaction indicates that > 10,000 colony-forming units (CFUs) of the BANA-anaerobes, capable of producing foul smelling compounds, are present in the sample (Aylikci and Colak, 2013; Kapoor et al., 2016).

Definitive management of oral malodour.

It should be noted that the management of this condition starts as soon as the patient enters the dental office. The dental team's non-verbal communication must not in any way aggravate the patient's condition. There is a common saying "Listen to the patient, and the patient will tell you the diagnosis." Thus, history of presenting complaint, past dental history, past medical history, drug history as well as family and social history will help to arrive at a proper diagnosis. History taking will help in the classification of the type of oral malodour, determination of its associating factors, determination of relevant pathologies, and past attempts at its management.

Treatment strategies

A treatment strategy for oral malodour based on patients' treatment need has been proposed. The treatment needs (TN) have been categorized into 5 classes in order to provide guidelines for clinicians in treating oral malodour patients (Seemann et al., 2014). Patients with physiologic halitosis will require TN-1, pathologic halitosis from oral sources TN-1 and TN-2, pathologic halitosis from extraoral sources TN-3, pseudohalitosis TN-1 and TN-4 and halitophobia TN-5. TN-1 TN-2 and TN-4 should be the responsibility of a

dentist while TN-3 should be undertaken by a physician, ENT surgeons and other medical specialist. TN-5 should be handled by the dentist in conjunction with specialists such as a psychiatrist or psychologist (Seemann et al., 2014).

Depending on the patient's treatment need, the oral health practitioner may have to carry out any of the following singly or in combination (Aylikci and Colak, 2013; Seemann et al., 2014; Kapoor et al., 2016):

1. Mechanical reduction of intraoral nutrients and microorganisms: This may involve scaling of tooth deposits, root planning, emphasizing oral hygiene instructions and tongue cleaning
2. Chemical reduction of oral microorganisms: Chlorhexidine, Listerine, Cetylpyridium chloride and Zinc chloride are common mouthwashes used in cases of oral malodour. Zinc is incorporated into various mouthrinses because of strong affinity of zinc ions to thiol groups present in volatile sulfur compound, which would convert volatile H₂S and CH₃SH to nonvolatile sulfides
3. Antimicrobials/antibiotics can be prescribed. Penicillins, Metronidazole, Tetracyclines, Ciprofloxacin and Tinidazole are commonly used.
4. Baking soda dentifrices and Zinc salt solutions can also be used to render malodorous gases nonvolatile.
5. Masking: The offensive odour can be masked with different substances undergoing chemical transformations. For example, ascorbate present in lozenge can undergo peroxide-mediated oxidation to produce dehydroascorbic acid which has an anti-malodour effect. Also, epigallocatechin gallate (EGCG) present in green tea can undergo a chemical reaction when in contact with CH₃SH, resulting in a nonvolatile product.
6. Dietary recommendations: Patients can be advised to drink plenty of liquids, eat fresh, fibrous vegetables and rinse their mouth after eating or consuming milk products, fish and meat. They can also be advised to avoid coffee, smoking, drugs and foods that might be responsible for halitosis.
7. Consultation with physician: Since oral malodour may indicate the presence of an underlying systemic condition, whenever local measures prove ineffective, the consultation with a physician is indicated for systemic causes. Pseudo-halitosis almost always requires referral to clinical psychologist for management.

CONCLUSION

Oral malodour is a major concern to many. The management of sufferers is usually multidisciplinary and dentists have major roles to play in the effective diagnosis, investigation and treatment of all types of oral malodour

Source of support

None

Conflict of Interest

None

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