Oral Malodor

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ABSTRACT:

Halitosis or bad breath is an oral health condition characterized by unpleasant odours emanating consistently from the oral cavity. The origin of halitosis may be related both to systemic and oral conditions. It often results in psychological alterations and isolation of oneself from being social. This review projects the aetiology, diagnosis and treatment of oral malodor.

Key words: halitosis, tongue, periodontitis, Aetiology, diagnosis, therapy, therapeutics Cetylpyridinium, zinc.

Introduction

Halitosis is a general term used to define an unpleasant or offensive odour emanating from the breath regardless of whether the odour originates from oral or non-oral sources.^{1, 2} Other terms used are bad or foul breath, breath malodour, oral malodour, foetor ex-ore, and foetor oris. Halitosis should not be confused with the generally temporary oral odour caused by intake of certain foods, tobacco, or medications.

Halitosis can be classified into categories of genuine halitosis, pseudo-halitosis, and halitophobia.³ Halitosis may be an important factor in social communication and psychological alterations leading to social and personal isolation.

Aetiology of halitosis:

Genuine halitosis is multifactorial and may involve both oral and non-oral conditions. However, in approximately 80–90% of all cases it is caused by oral conditions, defined as oral malodour.^{1, 4}

Oral malodor

Oral malodour results from tongue coating, periodontal disease, peri-implant disease, deep carious lesions, exposed necrotic tooth pulps, pericoronitis, mucosal ulcerations, healing (mucosal) wounds, impacted food or debris, imperfect dental restorations, unclean dentures, and factors causing decreased salivary flow rate.^{5–8}

Oral malodour arises from microbial degradation of organic substrates, such as glucose,

mucins, peptides, and proteins present in saliva, crevicular fluid, oral soft tissues, and retained debris.^{2,9,10} Proteins containing the sulphurous amino acids cysteine and methionine, as well as tryptophan and lysine are causative substrates.^{11,12} Activity of the enzyme β -galactosidase in saliva is an associated cause.^{13,14}

Some microbial degradation products are volatile sulphur-containing compounds. Hydrogen sulphide (H_2S), methyl mercaptan (CH_3SH), and dimethyl sulphide ($(CH_3)_2S$) contribute to the malodour.^{2,12} In addition to volatile sulphur-containing compounds, a contribution has been demonstrated or suggested from short-chain fatty acids (butyrate, propionate, valerate), diamines (cadaverine, putrescine), alcohols, phenyl compounds (indole, skatole, pyridiene), alkenes, ketones, and nitrogen-containing compounds (urea, ammonia).¹⁵⁻¹⁷ Organisms responsible for the hydrolysis of peptides and proteins, and the production of volatile sulphur-containing compounds include proteolytic obligate anaerobes.

Bacteria known to produce volatile sulphur-containing compounds include *Aggregatibacter actinomycetemcomitans* (formerly *Actinobacillus actinomycetemcomitans*), *Actinomyces* species, *Atopobium parvulum*, *Campylobacter rectus*, *Desulfovibrio* species, *Eikenella corrodens*, *Eubacterium sulci*, *Fusobacterium* species, *Peptostreptococcus micros*, *Porphyromonas endodontalis*, *Porphyromonas gingivalis*, *Prevotella* species, *Solobacterium moorei*, *Tannerella forsythia* (formerly *Bacteriodes forsythus* or *Tannerella forsythensis*), *Treponema denticola*, *Veillonella* species, *Vibrio* species, a phylotype of *Dialister*, a phylotype of the uncultivated phylum, and a phylotype of *Streptococcus*, and as yet unidentified sulphur-reducing bacteria.^{15, 18-20}

However, no obvious association exists between halitosis and any specific bacterial infection, suggesting that bad breath reflects complex interactions between several oral bacterial species.

Diagnosis

The clinical assessment of oral malodour is usually subjective and is based on smelling the

exhaled air of the mouth and nose and comparing the two (organoleptic assessment). Odour detectable from the mouth but not from the nose is likely to be of oral or pharyngeal origin. Odour from the nose alone is likely to be coming from the nose or sinuses.

Diagnosis of malodor can be diagnosed by the following methods:

Organoleptic measurement

Organoleptic or hedonic measurement is a simple commonly used measurement method of halitosis by an examiner. A plastic tube is inserted into the patient's mouth, preventing the dilution of mouth air with room air. While the patient is exhaling slowly, the examiner judges the odour at the other end of the tube. A privacy screen with a hole for the straw or the tube can be used to separate the examiner from the patient. Nasal-breath odour can be measured with a tube inserted into one of the nostrils, while the other nostril is closed by a finger.⁶ Various scoring systems can be used for estimating the intensity of the odour. The most widely used scale is ranging from 0 to 5:²¹

- 0 = no odour,
- 1 = barely noticeable odour,
- 2 = slight but clearly noticeable odour,
- 3 = moderate odour,
- 4 = strong odour,
- 5 = extremely foul odour.

However, the reliability and reproducibility of the method are problematic and research projects are carried out attempting to improve the method.²² Measurement by a panel of judges is considered to improve the reliability.^{6, 23} Agreement among judges may be increased by standardisation of the sense of smell, using an odour solution kit for measuring the olfactory sense and previously assigned scores. For a good agreement between judges, patients must abstain from hygiene practises, smoking, antibiotics, and foods containing garlic, onion, and spices prior to the examination.⁶ Furthermore, the agreement between judges may be increased if they themselves avoid drinking coffee, tea, and juice, smoking, and

using scented cosmetics before the organoleptic measurements.⁶

Other methods to assess malodor are:

- Gas chromatography
- Sulphide monitoring
- BANA test
- Chemical sensors
- Quantifying b-galactosidase activity
- Salivary incubation test
- Ammonia monitoring
- Ninhydrin method
- Polymerase chain reaction

Therapeutic approach to manage oral halitosis

Successful treatment of halitosis depends on a correct diagnosis and the implementation of a cause-related therapy.³ After a positive diagnosis for oral halitosis has been made, the treatment plan is implemented, which comprises elimination of the causative agent and improvement of the oral health status.²⁴ Although the multiple possible aetiologies include oral and non-oral causes, the majority of breath malodor cases originate from the oral cavity. Briefly, the treatment of oral malodor can therefore be focused on the reduction of the intraoral bacterial load and/or the conversion of VSC to non-volatile substrates.

Miyazaki *et al.* (1999) established the recommended examination for halitosis and a classification of halitosis with corresponding treatment needs. Accordingly, different treatment needs (TN) have been described for the various diagnostic categories.

The responsibility for the treatment of physiologic halitosis (TN-1), oral pathologic halitosis (TN-1 and TN-2), and pseudo-halitosis (TN-1 and TN-4) resides on dental practitioners. However, extra-oral pathologic halitosis (TN-3) and halitophobia (TN- 5) should be managed by a physician or medical specialist and a psychiatrist or psychological specialist.

Table 1 describes the 5 different categories of treatment needs according to diagnosis (Miyazaki *et al.*²², 1999).

Category	DESCRIPTION
TN-1	Explanation of halitosis and instructions for oral hygiene (support and reinforcement of a patient's own self-care for further improvement of his/her oral hygiene).
TN-2	Oral prophylaxis, professional cleaning and treatment of oral diseases, especially periodontal diseases.
TN-3	Referral to a physician or medical specialist.
TN-4	Explanation of examination data, further professional instruction, education and reassurance.
TN-5	Referral to a clinical psychologist, psychiatrist or other psychological specialist.

The management of halitosis starts by taking a detailed history of the condition, duration, severity, and impact on the patient's everyday life. Special tests are performed to detect the foul-smelling VSCs along with the associated bacteria. Since malodor originating from the mouth is due to the metabolic degradation of available proteinaceous substrates to malodorous gases by certain oral microorganisms, oral malodor can be ameliorated through:

- (1) Reduction of bacterial load,
- (2) Reduction of nutrient availability,
- (3) Conversion of VSC to non-volatiles and
- (4) Masking the malodor.^{1, 3, 25}

Treatment of malodor

Mechanical approach

Several studies have implicated the dorsum of the tongue as the primary source of VSC, both in periodontally diseased and healthy individuals.^{1, 6, 26-28} Researchers have been able to find positive correlations between tongue coating status (amount and or presence) and the different parameters directly related with oral malodor. The morphology of the dorsum of the tongue provides additional

irregularities which serve as retention areas for harbouring bacteria.^{1, 29}

Numerous studies have found a relationship between the mechanical removal of tongue coating and the reduction of both organoleptic scores and VSC levels, including reduction in methyl mercaptan levels and the methyl mercaptan/hydrogen sulphide ratio, in both healthy and periodontitis patients, with or without halitosis. Mechanical reduction of malodor and of the intraoral bacterial count may be achieved by disrupting the tongue biofilm, thus decreasing the production of VSCs and other volatile organic compounds.^{28, 30, 31}

Various available instruments can be applied to the tongue, and by gentle pressure the majority of the tongue coating can be scraped off.³¹ Brushing the dorsum of the tongue with toothpaste was more effective than brushing the teeth. The duration of these effects varies from 15 to 100 min and depends on the device used to remove the coating over the tongue.

Other studies found a relationship between tongue cleaning and the reduction of both organoleptic scores and levels of volatile sulphur-containing compounds. In addition, mechanical cleaning of teeth, such as brushing the teeth and flossing reduced the amount of oral bacteria and substrates, thereby presumably reducing oral malodor.³² Interdental cleaning and tooth brushing are essential mechanical means of oral hygiene. This home care removes residual food particles and organisms that cause putrefaction.

Since periodontitis can be a factor in chronic oral malodour. Professional periodontal treatment is mandatory. Thus, initial periodontal therapy in moderate periodontitis patients can be expected to improve breath odour parameters by reducing the number of periodontopathogens.³³

Chemical approach

The goal of any antimicrobial treatment would be to reduce the proteolytic, anaerobic flora found on the tongue surface. Treatment procedure should include a debridement component, such as the use of a tongue scraper, possibly in combination with

an antimicrobial mouth-rinse. Mouth-rinses with antimicrobial properties can reduce oral malodor by reducing the number of microorganisms chemically.

Often used active ingredients in these products are:

- Chlorhexidine
- Essential oils
- Triclosan
- Cetylpyridinium chloride
- Zinc
- Chlorine dioxide

Combinations of some of the chemicals are also used successfully to reduce malodour. They are:

- Chlorhexidine and zinc
- Cetylpyridinium and zinc ions
- Chlorhexidine, cetylpyridinium chloride and zinc-lactate

All the above chemicals have been proved to reduce malodor effectively.

Conclusion

The present review described the etiological factors related, methods to assess and the mechanical and chemical therapeutic approaches towards halitosis. Tongue biofilm seems to be directly involved in the production of oral halitosis. It is clear that a successful treatment of halitosis involves an appropriate diagnosis, professional therapy, mechanical plaque control, including tooth brushing and tongue cleaning, possibly combined with the use of an effective antimicrobial mouth rinse.

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