

Halitosis: A Short Overview

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Occurrence of halitosis, breath malodour or 'bad breath' may indicate certain medical problems (e.g. periodontitis) and may cause social problems. In only 10% of all cases halitosis is caused by an internal (e.g. diabetes mellitus, oesophagitis) or ear-nose-throat problem. For the remaining 85–90% quite a wide range of different oral causes (e.g. gingivitis, periodontitis, necrotising ulcerative gingivitis and periodontitis, caries lesions with food impaction, fissured tongue) exists. Halitosis may be assessed clinically (organoleptic) or by using instrumental devices. Together with patient history, careful examination provides information about the most likely cause of malodour. With a dental cause, an effective individual oral hygiene programme should be rendered. Therapy will be targeted at reduction of oral micro-organisms, reduction of bacterial nutrients, transformation of volatile sulphur compounds into non-volatile molecules and, if required, rinsing solutions to mask halitosis. Harboured approximately 60% of all oral bacteria, the tongue should be cleaned by the patient on a daily basis. If halitosis is caused by periodontitis, a systematic anti-infective periodontal programme eventually followed by periodontal surgery should solve the problem.

Key words: breath malodour, organoleptic assessment, volatile sulphur compounds

INTRODUCTION

Halitosis, breath malodour or what is colloquially known as 'bad breath' is a problem that can be subdivided into the following groups: real halitosis, pseudo-halitosis and halitophobia. Breath malodour may indicate certain medical conditions (e.g. periodontitis) and may cause social problems. Patients who suffer from pseudo-halitosis or halitophobia notice their own bad breath, although it does not exist clinically. These problems cannot be solved by a dentist and require psychological care. Real halitosis can be further subdivided into physiological halitosis and pathological halitosis (Yaegaki and Coil, 2000a, b).

The term oral malodour characterises malodour that has its origin in the oral cavity. Temporary bad breath that generally has no pathological significance should be carefully distinguished.

Temporary malodour may be caused by certain foods (e.g. garlic) or cigarette smoking and is a common experience, such as early morning bad breath due to reduced salivary flow during the night (Scully et al, 1997).

Aetiology

Temporary halitosis

Temporary bad breath may result from various causes, such as hot or spicy food as well as certain drinks, alcoholic beverages and coffee. The most common causes are garlic, onions, salty foods, spices and curry. Tobacco consumption may also leave a characteristically mouldy odour. However, bad breath is quite easy to treat by avoidance of the particular causes. Hyposalivation or xerostomia can also lead to bad breath, which can be considered temporary when associated with reduced salivary flow during the night (Kleinberg and Westbay, 1992).

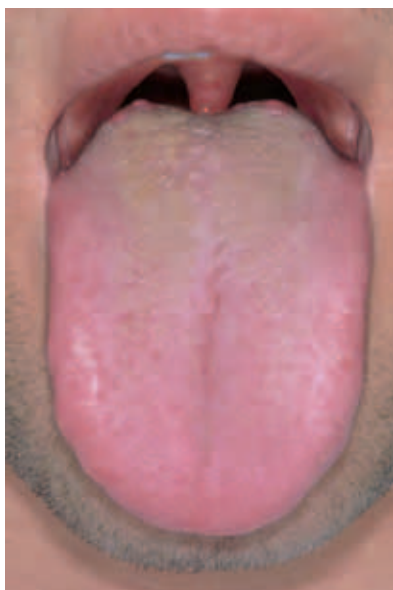


Fig 1 Tongue of a 28-year-old patient introducing with halitosis. Particularly the distal third of the tongue is coated (degree 2, Table 1).

Oral malodour

Contrary to popular belief, permanent bad breath does not predominantly result from gastric diseases but rather from bacteria of the oral cavity (Delanghe et al, 1997; Tonzetich 1978). The preferred habitats of these micro-organisms are the interproximal surfaces of teeth, defective marginal restorations, periodontal pockets (Tonzetich 1978; Yaegaki and Sanada, 1992a), and particularly the distal third of the tongue (Bosy et al, 1994; de Boever and Loesche, 1995; Yaegaki and Sanada, 1992a, b; Morita and Wang, 2001) (Fig 1). Gingivitis and periodontitis may be associated with supra and sub-gingival Gram-negative anaerobic bacteria (e.g. *Porphyromonas gingivalis*, *Prevotella intermedia*) and thus may also cause oral malodour. Gingival inflammation in particular is associated with oral malodour (Morita and Wang, 2001). Partially erupt-

ed third molars creating gingival pockets that after bacterial colonisation cause pericoronitis may also lead to bad breath. Further possible causes of oral malodour are deep caries lesions, particularly after food impaction, exposed pulps and open root canals, extraction wounds and interdental food impaction, particularly in patients with interproximal recessions (e.g. after severe periodontitis). Impacted food and debris (food constituents and exfoliated cells) in the oral cavity lead to putrefaction. Patients suffering from necrotising ulcerative gingivitis (NUG) or periodontitis (NUP) regularly exhibit oral malodour. Another possible cause of oral malodour is acrylic prostheses. The surfaces facing gingiva and oral mucosa are porous and facilitate penetration of micro-organisms, oral fluids and debris. The tongue may be another cause of halitosis. The presence and extent of coating indicates the load of micro-organisms and debris that are harboured by the tongue (Table 1). A fissurated tongue or lingua plicata is particularly likely to harbour bacteria and debris. Approximately 80 different kinds of bacteria, predominantly from the Gram-negative spectrum, are capable to cleave proteins of dead tissue or food residue by proteases and thus produce fetid substances (Bosy et al, 1994; de Boever and Loesche, 1995; de Boever et al, 1994; Goldberg et al, 1997; Tonzetich 1978; Tonzetich and Richter, 1964). In this context, volatile sulphur compounds (VSC: e.g. hydrogen sulfide, dimethyl sulphide and methyl mercaptan) have particular significance, which makes them seem adequate to act as a kind of marker substance (Tonzetich, 1971; Tonzetich and Richter, 1964; Tonzetich et al, 1991).

Malodour of extraoral origin

There exists quite a wide range of different oral causes of malodour. In only 10% of halitosis patients can the cause be traced back to an internal

degree 0	No visible coating
degree 1	< 1/3 covered by easily removable coating
degree 2	< 2/3 covered by easily removable coating and < 1/3 covered by not easily removable coating
degree 3	> 2/3 covered by easily removable coating
degree 4	> 2/3 covered by not easily removable plaque

Table 1 Classification of severity and extent of tongue coating (van Steenberghe, 2004)

Table 2 Possible causes for halitosis

Specialty	Cause/Basic disease	
Dentist	<ul style="list-style-type: none"> – Coating of the tongue – Sub- and/or supragingival biofilm – Gingivitis – Periodontitis – Candidiasis – Untended prosthesis – Abscesses 	<ul style="list-style-type: none"> – Open root canals – Overhanging restoration margins – Pemphigus – Morbus Behcet – Erythema exudativum multiforme – Ulcerating and decomposing tumours
ENT	<ul style="list-style-type: none"> – Tonsillitis – Sinusitis – Pharyngitis – Diphtheria – Pfeiffer's disease – Angina Plaut Vincent 	<ul style="list-style-type: none"> – Debris – Abscesses – Lues III – Chronic rhinitis – Postnasal Drip – Ulcerating and decomposing tumours
Internal medicine	<ul style="list-style-type: none"> – Putrid bronchitis – Pneumonia – Abscesses (lung) – Xenolith – Gangrene of the lung – Wegner's granulomatosis – Gastric and intestinal diseases – Precomatose condition and coma (uraemia, coma hepaticum) 	<ul style="list-style-type: none"> – Diabetes mellitus – Oesophagitis – Yellow fever – Pharmaceuticals – Trimethylaminuria – Ulcerating und decomposing tumours – Diverticle

(Lang and Filippi, 2005a) or ENT problem (Tonzetich, 1978). For the remaining 85–90% of halitosis cases the dentist may render appropriate care (Tonzetich and Richter, 1964; Tonzetich, 1978; Lang and Filippi, 2005a) (Table 2). However, in those cases where longstanding halitosis cannot be related to an oral cause patients should be referred to physicians to be examined for potential extraoral cases (Preti et al, 1992).

Diagnosis

Patient history plays a decisive role in identifying the cause of halitosis. The patient should be asked to describe the type of smell that is being noticed. Depending on the origin of breath malodour, different types of smell may be distinguished (Table 3). The start of complaints may coincide with other

symptoms or medications. A long list of drugs (e.g. antidepressants) cause hyposalivation or xerostomia and thus may contribute to or cause halitosis. Who noticed the bad breath? The patient himself or other people? If the patient is the only one to notice halitosis, then pseudo-halitosis and halitophobia should be considered. Under which circumstances was the bad breath experienced? Only in the morning (temporary bad breath), after meals (due to certain food or spices), or after lying down? Halitosis after meals or lying down may be indicative of regurgitation oesophagitis (van Steenberghe, 2004).

One of the major challenges in judging halitosis is that self-reported bad breath is quite subjective. Thus, it may be helpful if the patient is accompanied by a confidante who is able to give a more

Type of odour	Origin
Like rotten eggs	Indicates volatile sulphur compounds (VSC) which in most cases are associated with periodontitis or coated tongue
Sweet (like dead mice)	Cirrhosis of the liver: besides VSC aliphatic acids (butyric, propionic acid), methylmercaptan, ethanethiol, dimethyl sulfide accumulate
Like rotten apples	Not well-controlled insulin-dependent diabetes: accumulation of ketones
Like fish	Kidney insufficiency or trimethylaminuria (very rare metabolic disease): uraemia and accumulation of di- and trimethylamine

Table 3 Different types of breath malodor according to their most likely origin (Preti et al, 1992; van Steenberghe, 2004)

degree 0	From approximately 10cm distance, have the patient say "A". No unpleasant smell is perceived.
degree 1	From approximately 10cm distance, have the patient say "A". An unpleasant smell is perceived.
degree 2	From approximately 30cm distance an unpleasant smell is perceived during a conversation.
degree 3	From approximately 1m distance, i.e. during the anamnesis talk, an obvious bad breath is perceived.

Table 4 Classification of subjectively perceived halitosis (Seemann, 2002)

objective picture of halitosis – for example, a spouse, other family members, or a close friend (Rosenberg, 1996).

Organoleptic assessment

For clinical assessment of malodour, examiners use their own sense of smell. This so-called organoleptic measurement has its problems with reproducibility. Thus, examiners who intend to assess halitosis should be trained and calibrated. To assess and train the examiner’s differentiation ability, test kits with different scents may be used (Smell Identification Test, Sensonic Inc, USA). Further, test kits containing different dilutions of specific scents are available to assess and train differentiation of strength of scents (Lang and Filippi, 2005b). The examiner’s perception of smells may be impaired by their own halitosis or temporary deterioration of smelling (e.g. rhinitis). Furthermore, the thought of going to a dentist as a patient and then being asked to breathe in order for the clinician to clas-

sify the halitosis can be quite embarrassing. Thus, the organoleptic assessment of halitosis requires some prerequisites. The circumstance of the examination has to provide a high level of privacy. Patient and examiner have to abstain from causing temporary malodour (e.g. smoking, garlic, spicy food) 12 hours before the examination. Further, substances that may mask halitosis have to be avoided (e.g. shampoo, perfume, mouth rinses) (Rosenberg, 1996). In order to classify the organoleptic measurement of halitosis, the classification in four degrees of severity is recommended (Seemann, 2002) (Table 4). Further, the clinical examination should follow a certain sequence in order to distinguish the origin of malodour (Table 5) (van Steenberghe, 2004). The different information rendered by this sequence in combination with the type of smell (Table 3) and patient history may lead to particular conclusions: If the expired air causes malodour, whereas oral air and saliva do not, it may have its cause in the larynx, oe-

Table 5 Sequence of clinical examination (van Steenberghe, 2004)

Smelling	Perceived air originates from
– the air of the oral cavity while the patient holds his breath	– the oral cavity
– the air expired through the mouth	– the mouth or the lungs
– the air while the patient performs a forced expiration	– the bronchi and/or lungs
– the air while the patient counts from 1 to 20	– (most likely) the oral cavity; counting leads to drying of the mucosa setting free VSC that are solved in the saliva
– the anterior 2/3 of the tongue; patient licks his wrist at which the examiner smells after a while of drying	– the anterior part the tongue
– the coating from the posterior 1/3 of the tongue, that was scrapped by a scraper, periodontal probe or spoon	– the posterior part of the tongue
– the plaque and debris removed from some interdental spaces by a tooth pick, interdental brush or periodontal probe	– the interproximal spaces
– saliva spat into a small cup	– the saliva
– the air expired by the nose	– the nose or the sinuses
– the air from one and then the other nostril	– just the nose or sinus of one side

sophagus, bronchi, lungs or may be due to an internal medical problem. If the total expired air is positive for malodour, whereas the air expired by mouth is negative, a nasal origin is likely.

If the organoleptic assessment is positive, the patient should be examined for gingivitis or periodontitis. If the patient is periodontally healthy, then one should examine the patient for tongue coating, ulcerations/wounds and interdental debris. If tongue coating is not found, then xerostomia should be considered. If this is negative as well, then the pharynx should be examined as the possible cause (e.g. tonsillitis, pharyngitis, post-nasal drip).

Instrumental assessment

The gold standard for the apparative measurement of halitosis is gas chromatography. However, this method of measuring is very time-consuming, expensive and impracticable for everyday practice. Thus, gas chromatography is used primarily for scientific purposes. Since the beginning of the 1990s, a device has been commercially available, which provides the possibility to measure VSC directly at the dentist's chair. This so-called Halimeter® (Anysco, Karlsruhe, Germany; Fig 2) indicates the concentration of volatile sulphur compounds in ppb (parts per billion) on a display. Unfortunately, the results are based only on some of the various



Fig 2 Halimeter® to determine the VSC in breath. With kind permission of Anysco Inc., Karlsruhe, Germany.

different sulphur compounds - i.e. hydrogen sulphide, dimethyl sulphide and methyl mercaptan. Other substances that may contribute significantly to halitosis such as cadaverine (Goldberg et al, 1994), putrescine, indole, and skatole are not assessed by the sulphide monitor. Thus, a threshold value cannot be defined with this device (Rosenberg et al, 1991a, b). It is suitable for treatment follow-ups and for psychological support during the treatment. Many patients trust the result of a device rather than the dentist's nose (Seemann, 2002).

Electronic noses

Latest developments lead to the so-called electronic or 'artificial noses', which are supposed to provide quantification and classification of exact smells (Shimura et al, 1997). Originally these devices have been developed for quantitative assessments of smells in food or beverages. However, an application to diagnosis of halitosis appears reasonable.

Therapy

Consequent treatment of halitosis requires a definite clarification of its cause. The following sequence is recommended: dentist, ENT specialist, internal specialist (Seemann, 2002). Treatment of halitosis means mostly elimination of the cause. Therefore, if the cause is heavy cleft tonsils, then a referral to an ENT doctor is advisable. With a dental cause, the most likely aetiology of halitosis, an effective individual oral hygiene programme should be instigated (Seemann, 2002). Therapy will be targeted to the following: reduction of oral micro organisms, reduction of bacterial nutrients,

transformation of VSC into non-volatile molecules, and possibly rinsing solutions to mask halitosis (oral cosmetics) (Lang and Filippi, 2005b). Patients should be instructed to perform effective individual oral hygiene including daily cleaning of interproximal spaces, using individually adjusted interdental brushes or dental floss. Carious lesions should be treated and teeth with open root canals endodontically completed. Hopeless teeth which serve as niches for micro-organisms should be removed. Harbouring approximately 60% of all oral bacteria (de Boever and Loesche, 1995), the tongue should be cleaned by the patient on a daily basis. Regular tongue cleaning may be performed by intensive brushing using a toothbrush or scraping of the tongue with special tongue cleaners (e.g. One Drop Only®) (Seemann et al, 2001). Initially this may be supported by 1% chlorhexidine gel, but should soon be replaced by low-percentage rinse solutions, to avoid possible adverse effects (Rosenberg et al, 1992). In the majority of cases, halitosis may be eliminated by establishing an effective individual oral hygiene program followed by a professional tooth cleaning. If halitosis is caused by periodontitis then a systematic anti-infective periodontal program - e.g. 'full mouth disinfection' (Quirynen et al, 2001) eventually followed by periodontal surgery - should solve the problem.

Some metal ions have a high affinity to sulphur. Copper (Cu), stannous (Sn), and zinc (Zn) salts are capable to transform VSC into non-volatile molecules. Thus, the use of Sn-fluorid rinsing solutions is an option for the therapy of halitosis. Generally the use of antimicrobial rinsing solutions may support individual and professional oral hygiene by reducing oral bacteria. Many mouth rinses contain essential oils and/or alcohol, which can also mask bad breath.

CONCLUSION

Halitosis or breath malodour may be an indicator for a medical problem and in many cases may cause significant social problems. In 85–90% of cases, halitosis is of oral origin. Thus, the dentist, and in particular the periodontologist, should be aware of this issue and should be able to offer adequate treatment. Furthermore, by excluding an oral aetiology of halitosis, the dentist

may identify medical problems and refer the patient to the appropriate specialist (ENT, internal medicine).

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