



Oral malodour (halitosis)

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BMJ 2006;333:632-635
doi:10.1136/bmj.38954.631968.AE

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Clinical review

Oral malodour (halitosis)

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BMJ 2006;333:632-5

Oral malodour (halitosis) is common; most people have some element of transient unpleasant oral odour at some time.^{1 w1} In the developed world, 8-50% of people perceive that they have persistent recurrent episodes of oral malodour. This article provides a succinct review of oral malodour relevant to medical practitioners.

Who gets halitosis?

Oral malodour is common and can affect people of all ages. When severe or longstanding, it may decrease self confidence and social interactions.^{w2}

What is the most likely cause of halitosis?

Oral malodour on awakening is common and generally not regarded as halitosis. Longstanding oral malodour is usually caused by oral, or sometimes nasopharyngeal, disease (box 1). The most likely cause of oral malodour is the accumulation of food debris and dental bacterial plaque on the teeth and tongue, resulting from poor oral hygiene and resultant gingival (gingivitis) and periodontal (gingivitis/periodontitis) inflammation. Although most types of gingivitis and periodontitis can give rise to malodour, acute necrotising ulcerative gingivitis (Vincent's disease, trench mouth) causes the most notable halitosis. Adult periodontitis, characterised by gradual plaque related loss of periodontal attachment, can cause variable degrees of oral malodour.² Aggressive periodontitis, typified by rapid loss of periodontal bone and resultant tooth mobility, can cause intense oral malodour.

Lack of oral cleansing because of xerostomia (dryness of the mouth) also has the potential to cause or enhance malodour,^{w3} and some evidence indicates that wearing dentures may sometimes cause oral malodour, possibly by virtue of increased tongue coat deposits.^{w4}

What other causes of halitosis exist?

Mild transient oral malodour often arises after sleep and is sometimes termed "morning halitosis." This may be more likely in people with nasal obstruction—for example, due to upper respiratory tract infection—or when people sleep in a hot, dry atmosphere. Transient oral malodour can also arise after someone has eaten volatile foods such as garlic, onions, or spices (durian is reputed to be the worst); the breath takes on a different odour that may last several hours. Likewise, tobacco

Summary points

Oral malodour (halitosis) is common in people of all ages

Poor oral hygiene is the most common cause

The oral source of halitosis reflects local bacterial production of odiferous sulphides and amines

A range of systemic disorders may rarely cause the problem

Improving oral hygiene, and perhaps tongue cleaning, is usually effective

Patients with symptoms of halitosis in the absence of objective oral malodour may warrant psychological investigation or support

and alcohol may give rise to distinct oral odours that can last a few hours, and the odour of betel nut products can be almost continuous if the person has a persistent habit.

Respiratory tract infections can cause oral malodour as a consequence of nasal or sinus secretions passing into the oropharynx or in people who breathe predominantly through their mouth. Tonsillitis and tonsilliths may also be causes of halitosis. Foreign bodies in the nose can likewise produce a striking odour to the breath.¹ Bronchiectasis and other lung infections, such as in cancer, may also cause halitosis.

A range of systemic disorders may rarely cause oral malodour (box 2). The halitosis of such disorders is unlikely to be an early feature of such disease (including undiagnosed type 1 diabetes mellitus) and is an incidental finding during clinical examination. Of interest, *Helicobacter pylori* infection has been suggested to cause a subjective change in oral odour.³ A range of drugs may rarely cause oral malodour (box 3).

Trimethylaminuria ("fish odour syndrome") is a rare disorder characterised by longstanding oral and body malodour caused by an excess of trimethylamine that produces a pungent ammoniacal odour similar to that of rotten fish. This disorder reflects either defective flavin mono-oxygenase activity (often genetically

References w1-w18 are on bmj.com



Box 1: Common causes of the symptom of oral malodour (halitosis)**Oral disease**

- Food impaction
- Acute necrotising ulcerative gingivitis
- Acute gingivitis
- Adult and aggressive periodontitis
- Pericoronitis
- Dry socket
- Xerostomia
- Oral ulceration
- Oral malignancy

Respiratory disease

- Foreign body
- Sinusitis
- Tonsillitis
- Malignancy
- Bronchiectasis

Volatile foodstuffs

- Garlic
- Onions
- Spiced foods

Box 2: Possible systemic causes of oral malodour

- Acute febrile illness
- Respiratory tract infection (usually upper)
- *Helicobacter pylori* infection (?)
- Pharyngo-oesophageal diverticulum
- Gastro-oesophageal reflux disease
- Pyloric stenosis or duodenal obstruction
- Hepatic failure (fetor hepaticus)
- Renal failure (end stage)
- Diabetic ketoacidosis
- Leukaemias
- Trimethylaminuria
- Hypermethioninaemia
- Menstruation (menstrual breath)

determined) or an overload of precursors of flavin mono-oxygenase—for example, after choline treatment for Huntington's chorea or Alzheimer's disease.⁴ Hypermethioninaemia is another rare metabolic disorder that can lead to oral malodour.⁵

More importantly, some patients complain of oral malodour yet do not have confirmable halitosis, even with objective testing. This symptom may be attributable to a form of delusion or monosymptomatic hypochondriasis (self oral malodour, halitophobia). Such people often wrongly interpret the actions of others as an indication that their breath is offensive, and with time these patients can adopt a variety of behaviours to minimise their perceived problem (such as covering the mouth when talking, avoiding or keeping a distance from other people, or avoiding social interactions). People with halitophobia often become fixated with teeth cleaning and tongue cleaning and frequently use chewing gums, mints,

mouthwashes, and sprays in the hope of reducing their distress.^{1,6}

What is the oral source of halitosis?

Malodour that arises from the mouth is the consequence of microbial putrefaction of food debris, cells, saliva, and blood. The oral microbes most likely to cause the oral malodour are Gram negative bacteria and include *Prevotella (Bacteroides) melaninogenica*, *Treponema denticola*, *Porphyromonas gingivalis*, *Porphyromonas endodontalis*, *Prevotella intermedia*, *Bacteroides loeschei*, Enterobacteriaceae, *Tannerella forsythensis (Bacteroides forsythus)*, *Centipeda periodontii*, *Eikenella corrodens*, *Fusobacterium nucleatum vincentii*, *Fusobacterium nucleatum nucleatum*, *Fusobacterium nucleatum polymorphum*, and *Fusobacterium periodonticum*.^{2,7} However, no obvious association exists between oral malodour and any specific bacterial infection, suggesting that halitosis reflects complex interactions between several oral bacterial species. The agents that give rise to oral malodour include especially the volatile sulphur compounds, diamines, and short chain fatty acids (box 4).

These bacterial interactions are most likely to occur in the gingival crevices and periodontal pockets, but oral malodour can also arise from the posterior dorsal tongue (and this explains why oral malodour may sometimes occur in people with good oral hygiene). As a consequence of its large and papillary surface area, the dorsum of the tongue can retain

Box 3: Examples of drugs that may cause oral malodour

- Alcohol
- Tobacco
- Betel
- Solvent misuse
- Chloral hydrate
- Nitrites and nitrates
- Dimethyl sulphoxide
- Disulphiram
- Some cytotoxic agents
- Phenothiazines
- Amphetamines

Box 4: Odoriferous components that give rise to oral malodour**Volatile sulphur compounds**

- Methyl mercaptan
- Hydrogen sulphide
- Dimethyl sulphide

Diamines

- Putrescine
- Cadaverine

Short chain fatty acids

- Butyric acid
- Valeric acid
- Propionic acid

Box 5: Clinical assessment of oral malodour**Subjective**

- Intensity—the organoleptic method
 - Smelling expelled air of mouth and nose separately
 - Easy to do, requires no clinical training
- Quality—the hedonic method
 - Rarely clinically applicable
 - Requires well trained clinical judges

Objective

- Detection of sulphides with appropriate monitor—simple, but may fail to detect oral malodour caused by non-sulphide components
- Gas chromatography—not applicable for routine clinical practice
- Bacterial detection (such as benzoyl-arginine-naphthylamide test, polymerase chain reaction, dark field microscopy)—not applicable for routine clinical practice

large amounts of desquamated cells, leucocytes, and micro-organisms (and presumably salivary constituents). The microbial content on the tongue may be greater,^{8 9} but not necessarily different,^{w5} in people with periodontal disease than in others.

How is halitosis diagnosed and assessed?

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.¹⁰ In rare instances when the odour from the nose and mouth are of similar intensity, a systemic cause of the malodour may be likely (box 5). Assessment of the quality of the odour (the hedonic method) relies on the use of trained clinical judges.^{11 12}

Objective measurement of the breath components is rarely used in routine clinical practice, as it is expensive and time consuming. Volatile sulphur compounds can be measured by using a portable sulphide monitor, but as oral malodour may comprise agents other than volatile sulphur compounds this may provide an inaccurate assessment of the source and intensity of oral malodour. Gas chromatography of oral breath is a potential method of determining the components of oral malodour, but this is not of practical clinical application.^{w6} Likewise, the detection of trypsin-like activities of bacteria (the benzoyl-arginine-naphthylamide test, dark field microscopy, and real time quantitative polymerase chain reaction detection of likely causative oral microbes^{w7}) falls outside the routine clinical assessment of oral malodour.

What is the treatment of halitosis?

Box 6 sets out the treatment of halitosis. Treatment is primarily directed towards educating the patient as to the cause and prevention and lessening the accumula-

tion of oral bacteria. Effective teeth cleaning, including brushing and interdental flossing, can significantly reduce oral malodour, particularly in people with poor oral hygiene and related gingival and periodontal disease.^{2 13}

If oral hygiene is already good, or improves and yet oral malodour persists, the tongue may be the likely source of odour and hence tongue cleaning may be indicated. A recent systematic review concluded that tongue scraping may have a limited benefit in reducing oral malodour in the long term.¹⁴ Nevertheless, provided tongue cleaning is done gently and regularly, no harm is likely and patients may find benefit in the short term at least. Chewing gum seems to lead to only transient reduction in oral malodour.¹⁵

The range of mouthwashes suggested for the treatment of oral malodour act by reducing either the bacterial load or the associated odoriferous compounds.¹⁶ Unfortunately, few randomised controlled trials have looked at the effectiveness of these. Chlorhexidine gluconate produces a fall in bacteria that produce volatile sulphur compounds,^{w8} and the mouthwash or spray can be more effective at reducing oral malodour for several hours than is improving oral hygiene alone.¹⁷ A mouthwash of chlorhexidine/cetylpyridinium chloride and zinc lactate also reduces oral malodour.^{w9} Patients may, however, be reluctant to use chlorhexidine long term as it has an unpleasant taste, can give rise to a burning sensation of the oral mucosa if used too frequently, and can cause (reversible) staining of the teeth. A two phase oil-water mouthwash can reduce oral malodour for several hours, without adverse effects.^{18 19} Other mouthwashes that can reduce oral malodour for several hours include cetylpyridinium chloride,^{w10} chlorine dioxide,^{w11} and zinc chloride.^{21 w12}

Triclosan has both a direct action against volatile sulphur compounds and an antibacterial effect; used in mouthwashes and toothpastes, it may reduce oral malodour. The action of triclosan against volatile sulphur compounds, however, seems to depend mainly on the solubilising agent with which it is delivered.^{w13} A formulation of triclosan/co-polymer/sodium fluoride seems to be particularly effective in reducing volatile sulphur compounds, oral bacteria, and oral malodour.^{22 23 w14}

Box 6: Treatment of oral malodour

- Investigate and manage possible systemic (non-oral) source if organoleptic method detects malodour from both mouth and nose
- Improve oral hygiene by professional and patient administered tooth cleaning
- Regular atraumatic tongue cleaning
- Regular use of antimicrobial toothpastes and mouthwashes, such as
 - Chlorhexidine gluconate
 - Cetylpyridinium (not available in UK)
 - Oil-water rinse
 - Triclosan/co-polymer/sodium fluoride toothpaste
- Regular clinical review to ensure maintenance of effective oral hygiene
- Halitophobia warrants referral to clinical psychologist

Experimental methods of reducing oral malodour include the use of glycosylation inhibitors (such as D-galactosamine),^{w15} probiotic placement of bacteria (such as *Streptococcus salivarius*) that replace the bacteria causing oral malodour,^{w16 w17} light exposure that directly inhibits bacteria that produce volatile sulphur compounds,²⁴ or lethal photosensitisation.^{w18}

Studies of the treatment of oral malodour have tended to report only short term data (weeks to a few months). Clearly, however, patients must continue to maintain an effective oral hygiene regimen. Patients are often unable to accurately assess the severity of their own oral odour, so that they may be unable to perceive any significant reduction in objective malodour.²⁵ Long term support and encouragement thus needs to be provided by the patient's primary healthcare clinician, family, and friends. Certainly, those patients who are aware of their good clinical response do have an improvement in their quality of life.

Patients with halitophobia require referral for clinical psychology investigation and treatment. Unfortunately, few of these people are willing to follow this course of treatment.

Contributors: Both authors contributed equally to the preparation and writing of this review.

Competing interests: SRP and CS assisted in the organisation of the 6th International Conference on Breath Odour, 20-22 April 2004. Fees for time for this work were transferred to the Eastman Dental Institute.

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(Accepted 21 August 2006)

doi 10.1136/bmj.38954.631968.AE

A perfect job

A precise and methodical man whose depression had lasted nearly 10 years, returned to see me in the psychiatric clinic with his wife. When we had last met I had encouraged him to take up hobbies that he previously enjoyed, and he now reported that he was doing some painting.

"The trouble is," his wife added, "every job has to be done so perfectly. He inspects every flaw and so never finishes anything—like the painting. It makes him even more frustrated and depressed."

I tried to engage him in a conversation about unattainable goals and low mood. "To be successful at some things might not always require every detail to be perfect," I suggested. "Take the French impressionist painter Monet, for example."

"Not that sort of painting, doctor," he replied. "House decoration, DIY."

"I see. Well, try thinking of high standards as being like the stars: good to look up to as a guide, although you are never actually going to reach them."

He showed little enthusiasm for this approach. "But I was always admired in my work before I took early retirement," he retorted.

As we said goodbye, I thought of one last analogy to help convey the main message: "There aren't many jobs where getting everything precisely right is essential. Perhaps if you had worked as a bomb disposal expert, then the highest standards would be needed. Being a perfectionist would be a real asset. People's lives, including your own, would depend on every detail of the task in hand. Even a single error would need to be avoided at all cost."

For the first time, he readily agreed with me: "I was a bomb disposal expert." He was smiling as he left the room.

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