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REVIEW ARTICLE

Halitosis- A Review

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INTRODUCTION

Breath Odor can be defined as the subjective perception after smelling someone's breath. It can be pleasant, unpleasant, or even disturbing, if not repulsive. If unpleasant, the terms *breath malodor, halitosis,* or *bad breath* can be applied.

Breath malodor should not be confused with the momentarily disturbing odor caused by food intake (e.g., garlic) or smoking because these odors do not reveal a health problem. The same is true for "morning" bad breath, as habitually experienced on awakening. This malodor is caused by decreased salivary flow during the night and spontaneously disappears after breakfast or oral hygiene. A persistent breath malodor, by definition, does reflect some pathology.[1]

EPIDEMIOLOGY

Breath malodor is a considerable social problem, and its incidence remains poorly documented in most countries. A large-scale Japanese study of more than 2500 subjects age 18 to 64 years reported that the volatile sulfur component (a measure for bad breath) increased with age, tongue coating, and periodontal inflammation.[2]

In a special patient category, subjects imagine they have breath malodor; this is called *imaginary breath odor* or *halitophobia*. Because of the complexity of this pathology, a malodor consultation preferably is multidisciplinary, combining the knowledge of a periodontist or dentist, an ENT specialist, eventually a gastroenterologist, and a psychologist or psychiatrist.[3]

ETIOLOGY

The unpleasant smell of breath mainly originates from *volatile sulfide compounds (VSCs),* especially hydrogen sulfide (H_2S), methylmercaptan (CH_3SH), and dimethylsulfide [$(CH_3)_2S$], as first discovered by, Tonzetich. However, other compounds in mouth air may also be offensive, such as diamines (e.g., putrescine, cadaverine), indole, skatole, and butyric or propionic acid. Most of these compounds result from the proteolytic degradation by oral microorganisms of peptides present in_ saliva sulfide-containing or non-sulfide-containingno acids, shed epithelium, food debris, gingival crevicular fluid (GCF), interdental plaque, poems nasal drip, and blood. In particular, gram-negative, anaerobic bacteria possess such proteolytic activity.[3] Thus, wherever the cause is localized, a common pathophysiology is tissue destruction and putrefaction of amino acids by bacteria)[2]

INTRAORAL CAUSES

DENTITION

Possible causes within the dentition are deep carious lesions with food impaction and putrefaction, extraction wounds filled with a blood clot, and purulent discharge leading to important putrefaction. Interdental food impaction in large interdental areas and crowding of teeth favor food entrapment and accumulation of debris.

PERIODONTAL INFECTIONS

It is understandable that the VSC levels in the mouth correlate positively with the depth of periodontal pockets (the deeper the pocket, the more bacteria, particularly anaerobic species) and that the amount of VSCs in breath increases with the number, depth, and bleeding tendency of the periodontal pockets.[3] However, not all patients with gingivitis or periodontitis complain about oral malodor, and vice versa. VSCs themselves aggravate the periodontitis process; they increase the permeability of the pocket and mucosal epithelium and therefore expose the underlying connective tissues of the periodontium to bacterial metabolites.

DRY MOUTH

Patients with xerostomia often present with large amounts of plaque on teeth, prostheses, and tongue dorsum. The increased microbial load and the escape of VSCs as gases when saliva is drying up explain the strong breath malodor.

TONGUE AND TONGUE COATING

The papillae in the tongue surface are ideal niches for bacterial adhesion and growth, sheltered from cleaning actions. Also, however, desquamated cells and food remnants remain trapped in these retention sites consequently can be, putrefied by the bacteria. The dorsum of the tongue has therefore long been considered as a primary source of oral malodor.[3]

DIAGNOSIS OF MALODOR

MEDICAL HISTORY

The proper diagnostic approach to a malodor patient starts with a thorough questioning about the medical history. Asking about all the relevant pathologies for breath malodor just discussed is not time-consuming; it may save time and expenses to achieve a proper differential diagnosis As often repeated, "Listen to the patient, and the patient will tell you the diagnosis."

The clinician should ask about the frequency (e.g., every month), time of appearance within the day (e.g., after meals can indicate a stomach hernia), whether others (nonconfidants) have identified the problem (excludes imaginary breath odor), what medications are taken, and whether the patient has dryness of the mouth or other symptoms.)[3]

CLINICAL AND LABORATORY EXAMINATION

1. SELF-EXAMINATION

It can be worthwhile to involve the patient in monitoring the results of therapy by self examination, especially when an intraoral cause has been identified. For example, this can motivate the patient to continue the oral hygiene instructions. The following self-testing can be used[4]:

- Smelling a metallic or nonodorous plastic spoon after scraping the back of the tongue.
- Smelling a toothpick after introducing it in an interdental area.
- Smelling saliva spit in a small cup or spoon (especially when allowed to dry for a few seconds so that putrefaction odors can escape from the liquid).
- Licking the wrist and allowing it to dry (reflects the saliva contribution to malodor).

1. **Organoleptic Rating:**
   Even though instruments are available, organoleptic assessment by a judge is still the "gold standard" in the examination of breath malodor. In organoleptic evaluation, a trained "judge" sniffs them expired air and assesses whether or not this is unpleasant of using an intensity rating, normally from 0 to 5, as proposed by Rosenberg and McCulloch." (It is solely based on the olfactory organs of the clinician: 0 = no odor present, 1 = barely noticeable odor, 2 = slight but clearly noticeable odor, 3 = moderate odor, 4 = strong offensive: odor, and S = extremely foul odor.[1,5]
   The use of any fragrance, shampoo, or body lotion; smoking; and consumption of alcohol or garlic are prohibited 12 hours before the organoleptic assessment is made; this applies to both the patient and the judge. The judge also should not wear rubber gloves. Assessments should be repeated because breath odor can fluctuate from day to day. The patient should be encouraged to bring a confidant to the consultations who can identify whether the perceived odor is the one previously noticed. The judge smells a series of different air samples.[6,7,8]
2. **Portable Volatile Sulfide Monitor**. This electronic device (Halimeter, Interscan, Chatsworth, Calif) analyzes the concentration of hydrogen sulfide and methylmercaptan, but without discriminating them.[9]
   The examination should preferably be done after at least 4 hours of fasting and after keeping the mouth closed for 3 minutes. The mouth air is aspirated by inserting a drinking straw fixed on the flexible tube of the instrument. The straw is kept about 2 cm behind the lips, without touching any surface and while the subject keeps the mouth slightly open and breathes normally. The sulfide meter uses a voltametric sensor that generates a signal when exposed to sulfur-containing gases, especially hydrogen sulfide. Absence of breath malodor leads to readings of 100 ppb or lower. Patients with elevated concentrations of VSCs easily reach 300 to 400 ppb.[8]
3. **Gas Chromatography.** This device can analyze air, (incubated) saliva, or crevicular fluid for any volatile component. About 100 compounds have been isolated from saliva and tongue coating, with most identified, from ketones to alkanes and sulfur-containing compounds to phenyl compounds. Recently a small, portable gas chromatograph (OralChroma, Abilit, Henderson, Nevada) has been introduced, which makes this technique available for periodontal clinics. It has the capacity to measure the concentration of the three key sulfides separately.[2]
4. **Electronic nose.** An artificial nose that has the same capaci ies as the human nose would be ideal. Currently, although significant improvements still need to be made, the first trials thus far with an electronic nose have been promising.[7]

TREATMENT OF ORAL MALODOR

The treatment of oral malodor (thus of intraoral origin) should preferably be cause related. Because oral malodor is caused by the metabolic degradation of available proteins to malodorous gases by certain oral microorganisms, the following general treatment strategies can be applied:

- Mechanical reduction of intraoral nutrients and microorganisms
- Chemical reduction of oral microbial load
- Rendering malodorous gases nonvolatile
- Masking the malodor

1. Mechanical Reduction of Intraoral Nutrients and Microorganisms

Because of the extensive accumulation of 'bacteria on the dorsum of the tongue, tongue cleaning has been emphasized. Previous investigations demonstrated that tongue cleaning

reduces both the amount of coating (and thus bacterial nutrients) and the number of organisms and thereby improves oral malodor effectively. Other reports indicated that the reduction in microbial load on the tongue after cleaning is negligible, and that the malodor reduction probably results from the reduction of the bacterial nutrients

Cleansing of the tongue can be carried out with a normal toothbrush, but preferably with a tongue scraper if a coating is established. This should be gentle cleaning to prevent soft tissue damage. It is best to clean as far backward as possible; the posterior portion of the tongue has the most coating."[5] Tongue cleaning should be repeated until almost no coating material can be removed. Gagging reflexes often are elicited, especially when using brushes; practice helps to prevent this." It can also be helpful to pull the tongue out with a gauze pad. Tongue cleaning has the additional benefit of improving taste sensation.[5]

Interdental cleaning and toothbrushing are essential mechanical means of dental plaque control. Both remove residual food particles and organisms that cause putrefaction. A combination of tooth and tongue brushing or toothbrushing alone has a beneficial effect on bad breath for up to 1 hour (73% and 30% reduction in VSCs, respectively).

Because periodontitis causes chronic oral malodor, professional periodontal therapy is needed. A one-stage full-mouth disinfection, combining scaling and root planing with the application of chlorhexidine, reduced the organoleptic malodor levels up to 90%.

2. Chemical Reduction of Oral Microbial Load

Mouth rinsing has become a common practice in patient ., with oral malodor. The active ingredients in oral rinses; are usually antimicrobial agents such as chlorhexidine, cetylpyridinium chloride (CPC), essential oils, chlorine dioxide, hydrogen peroxide, and triclosan. All these agents have only a temporary reducing effect on the total number of microorganisms in the oral cavity[1,2,8]

3. Conversion of Volatile Sulphide Compounds

Metal Salt Solutions. Metal ions with affinity for sulfur are rather efficient in capturing the sulfur containing gases. Zinc is an ion with two positive charges (Zn"), which will bind to the twice-negatively loaded sulfur radicals, and thus can reduce the expression of the VSCs. The same applies for other metal ions, such as mercury and copper. Clinically, the VSC inhibitory effect was $CuC1_2$ > SnF_2 > $ZnC1_2$. In vitro, the inhibitory effect was $HgCl_3$, = $CuC1_2$ = $CdC1_2$ > $ZnCl_2$ > SnF_2 > $SnC1_2$ > $PbC1_2$.[3,4]

Compared with other metal ions, Zn++ is relatively nontoxic and noncumulative and gives no visible discoloration. Zn++ has been one of the studied ingredients for the control of oral malodor. Schmidt and Tarbet[83] already reported that a rinse containing zinc chloride was remarkably more effective than a saline rinse (or no -treatment) in reducing the levels of both VSCs (±80% reduction) and organoleptic scores (±40% reduction) for 3 hours.

mentioned, Halita, a rinse containing 0.05% chlorhexidine, 0.05% CPC, and 0.14% zinc lactate, has been even more efficient than a 0.2% chlorhexidine formulation in reducing the VSC levels and organoleptic ratings. The special effect of Halita may result from the VSC conversion ability of zinc, besides its antimicrobial action. The combination Zn++ and chlorhexidine seems to act synergistically.

Tooth pastes. Baking soda dentifrices have been shown to be effective, with a 44% reduction of VSC levels 3 hours after toothbrushing versus a 31% reduction for a fluoride dentifrice. The mechanisms by which baking soda produces its inhibition of oral malodor might be related to its bactericidal effects and its transformation of VSCs to a nonvolatile state.

Gerlach et al." compare the antimalodor efficacy of three different toothpastes, 3 and 8 hours after use, and reported a slightly better outcome, especially for an SnF_2-containing paste (50% reduction), when compared to water (35% reduction). In a study of Hoshi and van

Steenberghe,[33] a zinc citrate/triclosan toothpaste applied to the tongue dorsum appeared to control morning breath malodor for 4 hours. If the flavor oil was removed, however, the antimalodor efficacy of the active ingredients decreased. (Another clinical study reported up to a 41% reduction in VSC levels after 7 days' use of a dentifrice containing triclosan and a copolymer, but the benefit compared with a placebo was relatively small (17% reduction).

Chewing Gum. Chewing gum can be formulated with antibacterial agents, such as fluoride or chlorhexidine, thus helping in reducing oral malodor through both mechanical and chemical approaches chewing gum and found that a 2-mg Zn acetate-containing chewing gum that remained in the mouth for 5 minutes resulted in an immediate reduction in the VSC levels of up to 45%, but the long-term effect was not mentioned.[4]

4. Masking the Malodor

Treatments with rinses, mouth sprays, and lozenges containing volatiles with a pleasant odor have only a short term effect. A typical example is mint-containing lozenges. Another pathway is to increase the solubility of malodorous compounds in the saliva by lowering the pH of the saliva low pH increases the solubility of VSC5) or simply increase the secretion of saliva; a larger volume allows the retention of larger volumes of soluble VSC. The latter can also be achieved by ensuring a proper liquid intake or by using a chewing gum; chewing triggers the periodontal-parotid reflex, at least when the lower premolars are still present. To lower the pH, an orange juice may be sufficient, but the effect is short term.

CONCLUSION

Breath malodor has important socioeconomic consequences and can reveal important diseases. A proper diagnosis and determination of the etiology allow initiation of the proper etiologic treatment. Although gingivitis, periodontitis, and tongue coating are by far the most common causes of malodor, a clinician cannot take the risk of overlooking other, more challenging diseases. This can be done by either a trial therapy to deal quickly with intraoral causes (the full- mouth one-stage disinfection, including the use of proper mouth rinses and toothpastes) or by a multidisciplinary consultation .

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