

Section Five

Management of oral malodour

M. Quirynen

Catholic University Leuven, Faculty of
Medicine, Leuven, Belgium

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Abstract

Halitosis is a common problem. Its aetiology is multifactorial, but oral malodour is usually caused by microbial metabolism from the tongue, saliva or dental plaque. Mouthwashes are only effective against halitosis caused by intraoral factors. The principal causative agents of oral malodour are volatile sulphide compounds (VSCs), including hydrogen sulphide, methyl mercaptan and dimethyl sulphide. Data suggest that oral VSC levels correlate with the depth of periodontal pockets. Trials have shown that both mechanical oral care and mouthwash use can reduce halitosis levels. The majority of studies involving mouthwashes have investigated chlorhexidine and essential oil mouthwashes, although comparative studies are sparse.

Key words: halitosis; oral malodour; volatile sulphide compounds; chlorhexidine mouthwash; essential oil mouthwash

Halitosis (bad breath) is estimated to affect up to 50% of the population, with varying degrees of intensity and aetiology (Bosy et al. 1994, Meskin 1996, Miyazaki et al. 1995).

Halitosis is caused by several intra- and extra-oral factors, including systemic diseases, and disorders of the gastrointestinal and/or upper respiratory tracts (Quirynen et al. 2002a). If halitosis originates from the oral cavity it is known as oral malodour (Delanghe et al. 1997). This is usually caused by microbial metabolism from the tongue, saliva or dental plaque.

Mouthwashes can only affect halitosis from intraoral sources. This article therefore concentrates on this pathogenesis.

The prominent elements of oral malodour are volatile sulphide compounds (VSCs), and in particular, hydrogen sulphide, methyl mercaptan and dimethyl sulphide. Various other compounds in mouth air may also be offensive, such as butyric or propionic acid, diamines such as putrescine, and cadaverine, indole and skatole. Most of these compounds are metabolized from the proteolytic degradation by

oral micro-organisms of sulphur-containing peptides and amino acids in saliva, shed epithelium, food debris, gingival crevicular fluid, interdental plaque, postnasal drip and blood (Quirynen et al. 2002a). Anaerobic Gram-negative bacteria that reside on tooth or tongue surfaces or periodontal pockets are particular odour-inducing, as are bacterial species associated with gingivitis (Tonzetich et al. 1977). These periodontal disease-related bacterial species include: *Porphyromonas gingivalis*, *Prevotella intermedia/nigrescens*, *Actinobacillus actinomyces-temcomitans*, *Campylobacter rectus*, *Fusobacterium nucleatum*, *Peptostreptococcus micros*, *Tannerella forsythensis*, *Eubacterium* species and spirochetes (Quirynen et al. 2002a). There also appears to be a number of related, but considerably less well-studied, species inhabiting the tongue that play a substantial role in the production of VSCs and other odiferous molecules.

A study has demonstrated that VSC levels in the mouth correlate with the depth of periodontal pockets, and that

the amount of VSCs in the breath increase with the number, depth and bleeding tendency of the periodontal pockets (Quirynen et al. 2002a). However, not every case of malodour is associated with symptoms of gingivitis and/or periodontitis. In particular, the dorsum of the tongue has long been considered a primary source of oral malodour, as its irregular and deeply fissured surface provides an excellent site for the entrapment and growth of micro-organisms. Therefore, the most effective malodour amelioration strategies focus on reducing the tongue coating and the prevention and/or reduction of gingivitis, periodontitis and associated plaque (Quirynen et al. 2002a).

As mechanical approaches are the most commonly used method of reducing plaque build-up, various studies have investigated its effect on malodour. A recent study showed that a one-stage, full-mouth, professionally administered periodontal disinfection programme, including scaling and root planing, reduced halitosis levels by up to 90% (Quirynen et al. 1998).

Similarly, mouthwashes have become a common hygiene practice in patients suffering from oral malodour (Gagari & Kabani 1995). Their antimicrobial agents temporarily reduce the number of micro-organisms in the oral cavity (Quirynen et al. 2002a).

Rosenberg and coworkers showed that a 0.2% chlorhexidine (CHX) mouthwash regimen produced a 43% reduction in peak VSC values, and lowered organoleptic mouth odour ratings by 50% (Rosenberg et al. 1991). A study by De Boever & Loesche (1995) found that a 1-week rinsing regimen with 0.12% CHX gluconate in combination with a mechanical approach significantly reduced VSC levels and mouth and tongue odour by 73.3%, 68.6% and 77.8%, respectively. Morning halitosis could even be reduced by up to 90% (Quirynen et al. 2002b, van Steenberghe et al. 2001).

The malodour efficacy of CHX mouthwash can be enhanced by the addition of the zinc cation. One study demonstrated that an additive effect was found when zinc was added to a mouthrinse containing CHX, and that after 1 week of rinsing twice-a-day VSC levels were reduced by 40%, organoleptic expired air ratings by 80% and tongue coating by 70% (Quirynen et al. 2002b). This enhanced effect is the result of sulphur binding to zinc.

The *in vivo* antimicrobial effects of essential oil (EO) mouthwashes have also been demonstrated. In a study of odour-producing crevicular flora, 30 healthy adults with no obvious oral pathology were randomized to a supervised, single 30-s rinse with an EO mouthwash (Listerine[®], Pfizer Consumer Healthcare, Morris Plains, NJ, USA), placebo rinse (a hydro-alcohol vehicle) or a control rinse (plain distilled water). The placebo and control rinses were used to distinguish the effects of alcohol from those of the EOs (Pitts et al. 1983). Chlorhexidine was not included in this study.

Seven samples of crevicular bacteria were collected by paper points before and 15 min after rinsing, and then every 30 min up to 2.75 h. The samples were then analysed for bacterial quantity. Subjects repeated the

procedure with the alternate rinses on separate days (Pitts et al. 1983).

The EO mouthwash significantly depressed crevicular odourgenic micro-organisms at all post-treatment sampling times, and was highly effective in depressing all determinants of oral malodour (Pitts et al. 1983). In a separate study evaluating the effects of CHX on determinants of oral malodour, the percent reductions were even more impressive, with studies reporting reductions of up to 90% (for review see Quirynen et al. 2002a). Comparative studies of both products on reduction of oral malodour would therefore be of value.

It was also demonstrated that the EO mouthwash effectively kills bacteria in the hard-to-reach interproximal space (Pitts et al. 1983). The crevicular odourgenic micro-organism count was significantly reduced by Listerine at all post-treatment sampling times ($P \leq 0.05$) (Pitts et al. 1983).

A recent study by Kozlovsky et al. (1996) showed that an EO mouthwash reduced the level of odour-inducing bacteria and organoleptic scores for periods of 2 h.

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Address:

M. Quirynen
Catholic University Leuven
Faculty of Medicine
School of Dentistry Oral Pathology
and Maxillofacial Surgery
Department of Periodontology
UZ. St Raphael, Capucijnenvoer 7
B-3000 Leuven, Belgium