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Oral Malodour: New Directions

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Chronic oral malodour affects approximately 50% of the population. Given this, we can safely estimate that 140 to 150 million North Americans have this worrisome problem and probably 35 to 40 million of these individuals suffer from a severely strong and unpleasant mouth odour. Documented studies show that excluding the possibility that the odour may be caused by underlying systemic or upper respiratory diseases, the greatest proportion of oral malodour must be perceived as originating primarily in the oral cavity. Of all possible oral causes, periodontal diseases have been targeted as the most likely cause of offensive breath. These various factors are discussed and new approaches for assessment and treatment of oral malodour are explored in this article.

Systemic Diseases

If not controlled, many systemic diseases have their own characteristic breath odour. The fruity odour of diabetes, fishy odour of renal failure, aliphatic acids and volatile sulfurs found in liver cirrhosis indicate serious systemic pathology. Although the true prevalence of the metabolic disorder, trimethylaminuria is undetermined, excess production results in a foul, fishy odour. Breath concentration of volatile sulphide compounds increases in cases of hiatus hernia. Calcified material in tonsils called tonsilloliths might also lead to oral malodour. Contrary to popular belief, an upset stomach does not contribute to oral malodour unless it is accompanied by belching or vomiting. It has been demonstrated that constipation is not a contributing factor.

Bad breath may be of systemic origin without infection or pathology. The most common lung borne odours may be attributed to metabolites from ingested foods such as onions and garlic, choline, meat and fats. The objectionable odour of ketosis is most noticeable in those who eat infrequently. Hormonal changes during ovulation and menstruation may contribute a mousy odour to breath. Systemic intake of certain drugs such as tranquilizers and antihistamines, alcohol and dimethyl sulfoxide can taint the mouth air or may cause oral dryness thus predisposing the individual to oral malodour.

Hyposalivation

The flow of saliva is a continuous stream during waking hours and flows readily during meals. Swallowing acts as an automatic cleanser of the mouth. Reduction of salivary flow directly reduces the cleansing activity in the oral cavity. When this reduction is combined with incomplete oral hygiene it is likely to produce an unpleasant taste and odour. Decreased flow of saliva results in less frequent swallowing which, in turn, increases the density of microbes and increases contact of nutrients with tongue bacteria. The combination of these two factors results in an increase of mouth odour.

Mechanism of Production of Oral Malodour

Components of oral malodour have been established as primarily hydrogen sulphide and methyl mercaptan and to a lesser extent, dimethyl sulfide and dimethyl disulfide. Collectively they are called volatile sulphur compounds or VSC's. Other compounds suspected of contributing to the foul odour of mouth air are acetic, propionic, valerio and buteric acids, indole, skatole, putrescine and cadaverine. Eighty-two species of anaerobic bacteria isolated from the oral cavity have been shown to be capable of hydrogen sulphide production

through the breakdown of cysteine. Twenty-five species are known to produce mercaptan from the breakdown of methionine. Anaerobic species such as T. denticola and P. gingivitis are capable of producing both types of VSC's. These putrid odours produced by oral pathogens taint the mouth air.

Periodontal Diseases

In the oral cavity, dental caries and periodontal diseases have been strongly associated with oral malodour production. The intensity of odour was found to increase with the severity of the disease. In a study to examine the relationship between oral malodour and periodontal diseases all subjects were classified into four groups based on the presence of periodontitis (defined as the clinical detection of 1 or more pockets ≥ 5mm) and oral malodour (defined in this study as an organoleptic measurement of 3). Twenty-three subjects exhibited both periodontitis and oral malodour and only 37 out of the 127 cases had periodontal pockets ≥ 5mm (Table 1).

Table 1 Dichotomous Analysis of Subjects Based on Halitosis and Periodontitis

	Periodontitis	No periodontitis	Total
Halitosis	23 (18.1%)	52 (40.9%)	75 (59.0%)
No Halitosis	14 (11.1%)	38 (29.9%)	52 (41.0%)
Total	37 (29.1%)	90 (70.9%)	127

Number of subjects in groups with and without halitosis and periodontitis. Subjects were part of the study group attending the Halitosis Assessment Clinic, University of Toronto.

The results of this study indicated that moderate to severe odour was detected organoleptically in individuals with and without periodontal disease. Although the mean VSC measurement of healthy individuals was not as high as the group with periodontitis, the difference was not statistically significant (Table 2). The organoleptic measurement of mouth odour indicated no difference between the two groups with halitosis. For both groups, tongue odour and tongue pH readings were the same. There was a significant difference in the ages of the groups that had periodontal disease and those that did not. Clearly, there is evidence that both periodontally healthy and diseased individuals can exhibit significant malodour levels and that malodour and volatile sulfide levels are not reliable assessment tests for the presence of periodontitis.

Table 2: Malodour and Periodontitis Parameters for Groups With and Without Periodontitis

Variable	Perio/Halitosis	No Perio/Halitosis	Perio/No Halitosis	No Perio/No Halitosis
Age (years)	50.5	40.8	49.6	39.6
VSC Peak ppb	135.6	110.4	73.9	69.1
Oral score	3.5	3.4	1.3	1.7
Tongue Odour	2.7	2.7	1.7	1.7
Tongue PH	6.9	6.9	6.9	6.9
Pockets (5mm)	3.1	00	2.0	00
Gingival Index	1.5	1.2	1.4	1.0
Plaque Index	1.9	1.8	1.6	1.5

Measurements of malodour and periodontitis (mean, only) for each of the four groups identified in Table 1

Since VSC levels may be high in the presence of periodontitis, it is essential to determine sites of odour production. The tongue and tooth surfaces create numerous "micro-niches" facilitating the colonization of oral pathogens on teeth, tongue or gingival crevice. Putrid odour indicates the presence of an anaerobic infection. The rough surface of the tongue, subgingival plaque and mature plaque on proximal sites may exhibit high levels of anaerobic bacteria, many of which are capable of producing copious amount of VSC's through the putrefaction of sulphur-containing protein substrates such as cysteine, cystine and methionine.

Psychogenic Malodour

Psychogenic malodour or haliphobia has been attributed to those individuals who greatly fear that they displease others by their bad breath although there is no apparent odour upon examination. These individuals' chief complaint is classed as imaginary and often ignored. Erosion of self-image is proportional to the length of time the problem exists.

New Directions For Research

A diagnosis of oral malodour is confirmed only if there is a measurable odour. When odour is not obvious and there are no systemic or oral indicators, the

complaint is often labelled as psychogenic. Since oral malodour has been identified as episodic, not unlike periodontal diseases, the taste that the patient experiences may indicate a low level of bacterial byproducts below organoleptic or other measurements. Further, byproducts of yeasts such as candida are not readily detectable organoleptically but cause an excruciatingly unpleasant taste. Often physical evidence of anaerobic or yeast infection is absent but appropriate tests show an overgrowth of these microorganisms. Tongue taste, used by sufferers as a yardstick for their problem, is an unexplored predictor of oral malodour. It may be a key factor in determining a psychogenic or infection based state of complaint.

The underlying immunoligical host mechanisms if compromised, may contribute to the imbalance in the oral microflora and these mechanisms need to be explored. Immunoglobulin A is one of the factors that maintains the balance of oral microflora and contributes to the resistance of oral infections. Bacterial enzymes interfere with IgA defence mechanisms and may compromise host immunity by a variety of methods. Although selective IgA deficiency is hereditary in 0.1% of the population, there is evidence that IgA deficiency can be acquired. Further, it has been established that stress impairs immunologic functioning and a stressed individual is more likely to develop an unhealthy condition. Further exploration of this concept may establish a definite link between a compromised immune system and oral malodour. Treatment could then be aimed at controlling the secondary immune dysfunctions as well as eliminating the microbial infection. The end result would be more effective and long lasting.

Methods of Control of Oral Malodour

Presently, the treatment of oral malodour consists of the utilization of rinse products with a variety of active agents which help to control unpleasant oral emissions. Methods of oral malodour reduction using mechanical debridement of the tongue dorsum combined with chemical intervention vary greatly in effectiveness. Many commercial products use a masking approach. Other products have antibacterial mechanisms but many rinses have insufficient strength to control mouth odour for periods of time longer then several hours. Presently there are no reliable methods to eliminate the problem of mouth odour completely. Personal concern over body odours, especially oral odour continues to be a major concern to many and becomes an intimate and a highly emotional problem to those that are afflicted by this condition.

(references available upon request)