

Reduction of oral levels of volatile sulfur compounds (VSC) by professional toothcleaning and oral hygiene instruction in non-halitosis patients.

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PURPOSE: The aim of the study was to determine the longitudinal effect of an oral hygiene program on oral levels of volatile sulfur compounds (VSC). **MATERIALS AND METHODS:** The study subjects were randomly selected from patients attending a student course in operative dentistry and from staff members of our dental clinic. The test group (n = 30) received an oral hygiene training including professional toothcleaning (PTC), oral hygiene instruction, and motivation. The control group (n = 10) received no particular treatment. None of the subjects suffered from bad breath nor performed regular tongue cleaning. At baseline, immediately after PTC, one week, and four weeks thereafter we measured the oral hygiene status by means of the papillary bleeding index (PBI) and the oral concentrations of VSC by using a portable sulfide monitor (Halimeter). **RESULTS:** Immediately after PTC, as well as one week, and four weeks after entering the program the PBI and the VSC-levels were significantly decreased as compared to the baseline values and the control group. VSCs were decreased by 34.9% (+/- 6.3) after PTC, 33.2% (+/- 7.1) one week, and 27.9% (+/- 5.8) four weeks thereafter. **CONCLUSION:** The present study shows that in a group of patients without bad breath, an oral hygiene training program including professional toothcleaning, motivation and instruction of self-applied oral hygiene procedures is capable of reducing both papillary bleeding and oral levels of VSC Halimeter readings over the observation period of four weeks.

Halitosis manifestation and prevention means for patients with fixed teeth dentures.

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The objective of this research is to analyse the causal relationship between construction of fixed bridge dentures and the intensity of halitosis manifestations, as well as to establish basic hygiene requirements for construction of fixed dentures which would completely exclude retention of food particles and avoid

bad breath. 48 patients (36 men and 12 women), who use fixed dentures for 2-10 years, have been involved in this research. 26 patients wore fixed bridge dentures made of punched tooth crowns, the other 22 patients wore cast fixed dentures. The obtained measurements of halitosis magnitude point to the close connection between bad breath and the construction of fixed dentures. Fixed dentures with tooth crown laps, saddle intermediate parts, as well as denture constructions, which impede complex of mouth hygiene measures, cause bad breath. In this research, the condition of patients' teeth, periodontium, and oral cavity hygiene have been evaluated as satisfactory; the tongue is not perceptibly coated, and patients etiologically have not experienced problems caused by respiratory or gastrointestinal diseases. The examined patients have not complained of xerostomia problems. In conclusion, it should be admitted that fixed dentures, which make difficult or even completely impede the complex of oral cavity hygiene measures, intensify the development of halitosis.

[J Periodontol.](#) 2005 Oct;76(10):1751-7.

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Oral health impacts on daily living related to four different treatment protocols for chronic periodontitis.

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BACKGROUND: The aims of this study were to evaluate the oral health impacts perceived by patients submitted to different treatments of chronic periodontitis and their association with clinical parameters. **METHODS:** Sixty patients were assigned to one of the following therapeutic groups: control, treated with full-mouth scaling and root planing (SRP); test 1, treated with SRP and 400 mg systemically administered metronidazole (MET) three times per day for 10 days; test 2, treated with SRP and professional supragingival plaque removal (PP) every week for 3 months; and test 3, treated with SRP and MET plus PP. Clinical periodontal measurements and data regarding patients' oral health impacts (perceived impacts on bleeding gums, gingival recession, sensitivity to cold, packing foods, aesthetics, bad breath, and tooth mobility) were collected at baseline and 3 months after therapy. **RESULTS:** All groups presented significant improvement in oral health perceived impacts. There was no statistically significant difference in the improvement of oral health impacts among groups subjected to different treatments. The clinical data of percentage of deep probing depth, deep clinical attachment level, and bleeding on probing were found to be correlated significantly with oral health impacts. **CONCLUSIONS:** Periodontal treatment leads to a significant reduction of self-perceived impacts regardless of the non-surgical treatment protocol employed. Most of the clinical data were associated with oral health impacts.

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Hydrogen sulfide-producing bacteria in tongue biofilm and their relationship with oral malodour.

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The aims of this study were to identify hydrogen sulfide (H₂S)-producing bacteria among tongue biofilm microflora and to investigate the relationship between bacterial flora and H₂S levels in mouth air. Oral malodour levels in 10 subjects (age 21-56 years) were assessed by gas chromatography, and Breathron and organoleptic scores. Based on these assessments, subjects were divided into two groups: an odour group and a no/low odour group. Tongue coatings were sampled and spread onto Fastidious Anaerobe Agar plates containing 0.05% cysteine, 0.12% glutathione and 0.02% lead acetate, and were then incubated anaerobically at 37 degrees C for 2 weeks. Bacteria forming black or grey colonies were selected as H₂S-producing phenotypes. The numbers of total bacteria (P<0.005) and H₂S-producing bacteria (P<0.05) in the odour group were significantly larger than those in the no/low odour group. Bacteria forming black or grey colonies (126 isolates from the odour group; 242 isolates from the no/low odour group) were subcultured, confirmed as producing H₂S and identified according to 16S rRNA gene sequencing. Species of Veillonella (38.1% in odour group; 46.3% in no/low odour group), Actinomyces (25.4%; 17.7%) and Prevotella (10.3%; 7.8%) were the predominant H₂S-producing bacteria in both the odour and no/low odour groups. These results suggest that an increase in the number of H₂S-producing bacteria in the tongue biofilm is responsible for oral malodour, although the bacterial composition of tongue biofilm was similar between the two groups.

Assessing the relationship between concentrations of malodor compounds and odor scores from judges.

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BACKGROUND: The purpose of this review was to assess the relationship

between mean organoleptic scores (using a 0-to-5 scale) and concentrations of putative odorants representative of those thought to be important in oral malodor, as well as to propose a simple model that explains the dose-response curves obtained from a group of odor judges. **METHODS:** The model assumes that the scale is rooted at the detection threshold (0), the maximum score (5) is fully saturating and the brain and olfactory nervous system can act as a faithful transducer of the state of binding (occupancy) of the smell receptors in the nose. The authors predicted that the response would be exponential or sigmoidal in nature. They tested this using published empirical data based on seven odor judges and eight odor compounds. **RESULTS:** Analysis of the data by different plotting methods showed the odorants to be significantly different from each other ($P < .01$ by regression analysis) with regard to thresholds and slopes. The lower the threshold, the stronger the inherent odor of the compound. The greater the slope, the greater the odor power. Volatile sulfur compounds had low smell thresholds and high odor power and were highly volatile, while indole was less volatile but had a very low threshold. Both compounds may be significant in human oral malodor. **CONCLUSIONS:** The authors found that the organoleptic scale was exponential in practice. These findings imply that when inhibitory agents are tested against odor-generating bacteria, a given percentage inhibition of the volatile compound production rate by a treatment (such as an antimicrobial mouthwash) will result in an equal incremental reduction on the scale, regardless of the starting position on the scale. Understanding the scale enables dental professionals to develop better ways of training, calibrating and standardizing odor judges, along with better ways of designing clinical trials and interpreting data regarding the efficacy of antiodor treatments.

[J Periodontol.](#) 2005 Jun;76(6):1025-33.

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A combined therapeutic approach to manage oral halitosis: a 3-month prospective case series.

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BACKGROUND: Clinical research assessing different therapeutic protocols aimed at treating oral halitosis is scarce. The aim of this study was to evaluate the effects of a combined mechanical and pharmacological approach to treat oral halitosis on clinical and microbiological outcomes on patients followed for 3 months. **METHODS:** Nineteen subjects with oral malodor participated. At baseline, all subjects completed a questionnaire and carried out an examination including full-mouth organoleptic and volatile sulfur compound (VSC) levels and the Winkel tongue coating index. Standard periodontal outcome variables were assessed at six teeth. Standardized microbiological samples of subgingival plaque,

unstimulated saliva, and tongue coating were obtained for culture analysis. The treatment protocol included supragingival prophylaxis; instructions in oral hygiene (toothbrushing, interproximal cleaning, and tongue scraping); and gargling with a mouthrinse containing chlorhexidine, cetylpyridinium chloride, and zinc lactate. The same outcome variables were registered 1 and 3 months after baseline. RESULTS: Statistically significant reductions in organoleptic scores ($P < 0.001$), VSC levels ($P < 0.05$), and tongue coating index ($P < 0.05$) were observed after 1 and 3 months. Mean probing depth and plaque levels also demonstrated significant reductions after 3 months ($P < 0.05$). Total anaerobic counts were significantly reduced at all three locations after 1 month ($P < 0.05$), and in samples from tongue coating and subgingival plaque at 3 months ($P < 0.05$). Aerobic counts were significantly reduced in saliva at 1 month ($P < 0.05$), and the anaerobic/aerobic ratio significantly increased in the tongue samples. Among the selected pathogens evaluated, Porphyromonas gingivalis was the most affected of the three microflora evaluated. CONCLUSIONS: The evaluated therapeutic approach demonstrated its efficacy in the management of oral halitosis, demonstrating statistically significant improvements in both organoleptic and VSC values at 1 and 3 months. The proposed clinical protocol significantly affected the microbial composition in tongue coating, saliva, and subgingival microflora.

[J Periodontol](#). 2005 May;76(5):705-12.

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The impact of periodontal therapy and the adjunctive effect of antiseptics on breath odor-related outcome variables: a double-blind randomized study.

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BACKGROUND: Bad breath is often caused by periodontitis and/or tongue coating. This study followed the impact of initial periodontal therapy on several halitosis-related outcome variables over a 6-month period. Organoleptic ratings are often uncomfortable for the patient and have several disadvantages. They are, for instance, influenced by external parameters (e.g., food intake and cosmetics) and need to be calibrated among researchers worldwide. A second aim was to evaluate the reliability of saliva incubation as an in vitro indirect test for breath recording. METHODS: In this double-blind, randomized, medium-term, parallel study 45 moderate periodontitis patients without obvious tongue coating were enrolled. Besides a one-stage, full-mouth disinfection and oral hygiene improvement (including daily tongue scraping), patients were instructed to rinse

daily for 6 months with one of the following products (randomly allocated): chlorhexidine (CHX) 0.2% + alcohol, CHX 0.05% + cetyl pyridinium chloride (CPC) 0.05% without alcohol (a new formulation), or a placebo solution. At baseline and 3 and 6 months, a series of parameters were recorded including: concentration of volatile sulfide compounds (VSC), tongue coating, and an estimation of the microbial load (at anterior and posterior parts of the tongue, saliva, dental plaque). The intraoral VSC ratings were compared to in vitro VSC recordings and organoleptic evaluations of the headspace air from 1 and 2 hours incubated saliva (0.5 ml, 37 degrees C, anaerobic chamber). RESULTS: Even though the initial VSC values were not high (+/-90 ppb with only 18 patients revealing more than 100 ppb), significant ($P < 0.05$) reductions could be achieved in the CHX and CHX + CPC group, and to a lower extent in the placebo group ($P = 0.10$). Tongue scraping resulted in a significant reduction ($P < \text{or} = 0.05$) of the tongue coating up to month 6 in the placebo and CHX + CPC group, but not in the CHX group (confusion due to staining). The CHX and CHX + CPC group showed, in comparison to baseline, significant ($P < 0.001$) reductions in the number of anaerobic species in the supragingival plaque, in the saliva, and on the anterior part of the tongue. For the posterior part of the tongue the microbial changes remained $< \text{or} = 0.3$ log values ($P > 0.05$). For the placebo group, the microbial changes never reached a level of significance ($< \text{or} = 0.3$ log values). A strong correlation was found between the intraoral VSC ratings and the 1-hour ($r = 0.48$, $P < 0.0001$; $r = 0.54$, $P = 0.0003$ for baseline data only) and 2-hour ($r = 0.43$, $P < 0.0001$) VSC production of incubated saliva. The latter also correlated very strongly ($r = 0.71$) with the number of anaerobic species in the saliva. The VSC values and organoleptic ratings of the incubated saliva also correlated strongly with each other ($r = 0.64$ for 1-hour and 0.73 for 2-hour incubation). CONCLUSIONS: The results of this study indicate that in patients with moderate periodontitis, initial periodontal therapy including tongue scraping did not have a significant effect on the microbial load of the tongue and had only a weak impact on the VSC level, except when combined with a mouthrinse. Saliva incubation can be used as an indirect way to score breath odor. It offers simplicity, objectivity, and is less invasive.

[J Clin Dent.](#) 2004;15(4):98-104.

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Use of a novel group of oral malodor measurements to evaluate an anti-oral malodor mouthrinse (TriOral™) in humans.

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OBJECTIVE: This study compared the ability of a test mouthwash containing zinc chloride and sodium chlorite (TriOral) to reduce intrinsic oral malodor, to

that of two other mouthrinses, one with zinc chloride only and the other with no zinc chloride/no sodium chlorite, using a novel group of oral malodor parameter measurements. METHODOLOGY: Forty-eight subjects completed the study; 16 in the test group, 17 in the zinc only group, and 15 in the no zinc chloride/ no sodium chlorite group. At baseline and after two and four weeks, parameters assessed were 1) malodorants in the headspace of and in solution in resting whole saliva determined organoleptically, 2) breath volatile sulfur compounds (VSC) measured with a sulfide monitor (Halimeter), 3) fresh and incubated saliva oxidation-reduction potential (E(h)) measured with a platinum electrode, and 4) level of saliva indolic compounds (IC), indole and skatole, determined colorimetrically with Kovac's reagent. The VSC, E(h), and IC data for the three mouthrinses were analyzed statistically by repeated measures ANOVA between groups, and by 2-way ANOVA within groups. Corresponding organoleptic data were analyzed by Kruskal-Wallis and Friedman non-parametric tests. RESULTS: Organoleptic, VSC, and E(h) evaluations clearly showed the zinc chloride/sodium chlorite test mouthrinse to be more effective than the other two rinses. In all cases, the level of significance was $p < 0.001$ between the test mouthrinse and its no zinc chloride/no sodium chlorite control; between test mouthrinse and the zinc chloride only product, significance was $p < 0.05$, < 0.001 and < 0.01 for the organoleptic, VSC, and E(h) tests, respectively. Noteworthy was the observation that the mean organoleptic saliva headspace score with the test mouthrinse was reduced to zero, and VSC levels fell below 50 ppb S by the end of the study, a level where the breath is usually non-odorous. The test mouthwash also appeared more effective in reducing the salivary IC levels, but the results did not reach significance at $p < 0.05$ unless IC levels were amplified in the saliva by incubation overnight at 37 degrees C. Correlations between the various procedures were highly significant, achieving in almost all cases a probability level of $p < 0.001$. CONCLUSION: The results supported the conclusion that the zinc chloride plus sodium chlorite mouthrinse (TriOral) is more effective in reducing oral malodor than a zinc chloride alone mouthrinse, and even more effective than its no zinc chloride/no sodium chlorite mouthrinse control. The methods used in this study were consistent with one another, and highly effective in measuring various parameters that characterize oral malodor.