

EFFICACY OF A CHLORINE DIOXIDE-CONTAINING MOUTHRINSE IN ORAL MALODOR

Abstract: Studies have suggested that when chlorine dioxide is contained in a mouthrinse, it neutralizes volatile sulfur compounds in mouth air. The efficacy of a chlorine dioxide-containing mouthrinse in the reduction of oral malodor was evaluated in a randomized, controlled, double-blind, parallel group study of 31 men and women. Subjects with a maximum odor pleasantness score of <-1 (slightly unpleasant/stale) on a 7-point ordinal scale at both screening and baseline were randomized to treatment with the chlorine dioxide-containing rinse ($n=16$) or distilled water (negative control) ($n=15$). Oral malodor was evaluated at baseline (prerinse) and at 2, 4, 8, 24, 48, 72, and 96 hours postrinse by both a trained, previously calibrated panel of organoleptic judges and a factory-calibrated sulfide monitor. The sulfide monitor measured concentrations of volatile sulfur compounds in the subjects' mouth air 3 minutes after completion of the organoleptic assessment at each time point. The correlation between the organoleptic assessments and log-transformed sulfide monitor values was evaluated. With the chlorine dioxide mouthrinse, a statistically significant improvement in odor pleasantness, reduction in odor intensity, and reduction in oral volatile sulfur compound concentrations compared to the water control were evident at 2 hours post rinse and persisted through 8 hours postrinse. The mean (\pm SD) odor hours pleasantness improved from -1.25 ± 0.31 at baseline to -0.73 ± 0.33 at 2 hours postrinse in the chlorine dioxide group compared to -1.40 ± 0.38 at baseline to 1.31 ± 0.67 at 2 hours in the control group ($P < 0.001$). As measured by the sulfide monitor, the mean volatile sulfur compound concentration in the chlorine dioxide group reached its minimum level at 8 hours postrinse (change from baseline in the log-transformed Halimeter[®] measurement of -0.35 ± 0.31). Thus, this study demonstrates that a one-time use of a chlorine dioxide-containing mouthrinse significantly improves mouth odor pleasantness, reduces mouth odor intensity, and reduces volatile sulfur compound concentrations in mouth air for at least 8 hours after use.

The growing interest in halitosis (bad breath) is evidenced by the proliferation of diagnostic and treatment services offered in many dental offices and breath clinics. Bad breath is most often caused by oral conditions, including poor general oral hygiene, periodontal diseases, dry mouth (transient or chronic), food impaction, improper or faulty restorations, unclean dentures, excessive bacterial growth on the dorsum of the tongue, throat infections, and oral carcinomas; nonoral etiologies are rare.

The principal source of oral malodor is bacterial stagnation in grooves, fissures, and interpapillary areas of the dorsoposterior surface of the tongue. Mass spectrometric and gas chromatographic studies have shown that volatile sulfur compounds (VSCs), including hydrogen sulfide (H_2S) methyl mercaptan (CH_3SH) and, to a lesser extent, dimethyl sulfide (CH_3SCH_3), are the principal malodorants in bad breath. Hydrogen sulfide is produced primarily from the tongue dorsum, while methyl mercaptan and dimethyl disulfide enrich the malodor produced by periodontal tissues. In the mouth, VSCs originate from the anaerobic bacterial activity on sulfur-containing amino acids

derived from degraded proteins present in salivary filtrate. Although commonly associated with such conditions as chronic halitosis and periodontal disease, VSCs are detectable in the mouth air of normal (i.e., dentally healthy) individuals. Following the application of cysteine as a mouthrinse, VSCs have been produced in the mouths of healthy subjects with no history of halitosis.

Reliable and reproducible assessment of oral malodor has been difficult to achieve. Organoleptic or hedonic assessment, the simplest and most commonly used method of measuring oral malodor, involves the direct nasal sniffing of mouth air. Organoleptic assessment by a panel of sensory judges is considered a reference standard of oral malodor measurement because it closely approximates the way in which bad breath is detected. However, researchers have observed variation between judges on scoring the degree of unpleasantness of various odors. The reliability and reproducibility of measurement may be improved if the judges are trained to recognize and rate oral malodor. Although agreement among judges may be increased if they are previously instructed to assign specific scores to designated odor stimuli, reproducible olfactory standards do not exist. Attempts to create such standards have included the use of mass spectrographic and gas chromatographic techniques and, more recently, portable sulfide monitors adapted for use in oral malodor research.

Studies have suggested that when chlorine dioxide is contained in a mouthrinse, it neutralizes VSCs in mouth air. In experimental models, use of a mouthrinse containing a mixture of chlorine dioxide and chlorite anion has been shown to result oxidative consumption of the amino acids cysteine and methionine, which are precursors of VSCs. Thus, clinical use of a mouthrinse containing chlorine dioxide can be expected to reduce oral malodor by reducing concentrations of VSCs. In contrast, commercially available mouthwashes have no significant effect on oral malodor.

The objective of the present study was to investigate the efficacy of a chlorine dioxide mouthrinse in reducing oral malodor over a 96-hour period following a single 30-second rinse. The study used a double-blind, randomized, parallel group design, with distilled water serving as a negative control. Organoleptic assessment was used to characterize the pleasantness and intensity of the subjects' oral malodor, and a portable sulfide monitor was used to provide a quantitative measure of oral VSC concentrations for each time point that organoleptic evaluations were recorded.

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