Effect of DioxiRinse™ Mouthwash on Oral Malodor

A Clinical and Microbiological Pilot Study

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INTRODUCTION

The sponsor, Frontier Pharmaceutical, Inc., claims that their new mouthwash eliminates bad breath in 3 ways:

1. Kills the bacteria
2. Oxidizes the protein precursor molecules
3. Oxidizes the volatile sulfur compounds (VSC)

The sponsor also claims the mouthwash neutralizes the odorous materials at the back of the tongue.

OBJECTIVE

The purpose of this study was to demonstrate the efficacy of a new mouthwash, DioxiRinse, in reducing oral malodor.

EXPERIMENTAL DESIGN

A total of 15 subjects with self proclaimed halitosis and oral malodor (OM) verified by an "organoleptic judge", were selected for evaluation.

Qualified subjects completed a demographic and a medical history survey and were assessed for degrees of oral malodor. The qualifying score of the subjects as evaluated by self-assessment and the organoleptic judges was a minimum of 3 or above on the 5 point malodor scale. Baseline examinations included: 1) oral soft tissue evaluation, 2) Halimeter assessment, 3) organoleptic test and 4) spoon test. The results of baseline and examinations after treatment were scored on the following 5-point malodor scale:

0= No odor present
1= Barely noticeable odor
2= Slight but clearly noticeable odor
3= Moderate odor
4= Strong offensive odor
5= Extremely foul odor

15 subjects were enrolled in the study and performed the assigned procedures for a period of one (1) week. Subjects were asked to keep a daily diary during the one-week period and record compliance to the instructions and procedures given. At the end of the study (one-week) period, the clinical examinations previously mentioned were performed again on each subject, *the day after the final rinse was performed.*

STUDY POPULATION

Fifteen adult male and female subjects were enrolled to complete the evaluation as required. Subjects were eligible to enter the study if they met the following criteria:

Inclusion Criteria:

1. In good general health over the age of 18 years.
2. Willing to sign the informed consent and comply with protocol procedures.
3. Oral malodor problem scoring $\geq$3 on the 5-point malodor scale.
4. Minimum of 16 natural teeth including at least 4 molars.
5. Availability of the subject to complete the 1-week study.

No demographic profile is specified by protocol, except that each subject must be 18 years of age or older. Subjects were removed from the study if they received emergency dental treatment, which could influence the plaque growth, or if loss of teeth placed them below the minimum teeth requirements. All the subjects completed the study. Any subject treated with antibiotics or antibacterial agents during this study would have been dropped.

Subjects were instructed to refrain from routine dental treatments (except for emergency) for the duration of the study. All emergency treatments would have been reported to the study investigator. No electrical toothbrushes or other mouthrinses were used during the study period.

EXPERIMENTAL PROCEDURE

Subjects were instructed to pour about 10 ml of A and 10 ml of B into a cup or glass and wait at least one minute. They were instructed to rinse twice in the morning and twice at night before bedtime. At the first rinse, subjects would concentrate the wash around the teeth, the second, around the back of the tongue. Each rinse was for 15 to 30 seconds.

Oral Malodor Diagnostic Tests:

Halimeter:

The short end of a flexible drinking straw was inserted approximately 1/2 inch into the subject's slightly parted lips, gently touching the straw. The subject was instructed to hold their breath for 5-10 seconds, until a peak of volatile sulfur compounds (VSCs) was reached. Readings for the VSC were then recorded from the Halimeter.

For the throat and posterior tongue assessments, the drinking straw was inserted approximately 3 inches into the subject's mouth, near the throat. Subjects were instructed to hold their breath for 5-10 seconds, until a volatile sulfur compound (VSC) peak level was reached. Reading for the VSCs were then recorded from the Halimeter.

Organoleptic Test:

Each subject was instructed to close his or her mouth for two minutes and not to swallow during that period. After two minutes the subject was instructed to breathe out gently, at a distance of 10 cm from the nose of the two organoleptic judges and the organoleptic odors were assessed according to the 5-point scale:

0= No odor present
1= Barely noticeable odor
2= Slight but clearly noticeable odor
3= Moderate odor
4= Strong offensive odor
5= Extremely foul odor

Spoon Test:

Scrapings from the posterior dorsum of the tongue were obtained with a small disposable spoon and the odor was assessed after five seconds at a distance of 10 cm by the organoleptic judges. The odors were assessed according to the 5-point scale:

0= No odor present
1= Barely noticeable odor
2= Slight but clearly noticeable odor
3= Moderate odor
4= Strong offensive odor
5= Extremely foul odor

Clinical Examinations

Oral Soft Tissue Assessment

The oral cavity was assessed for irregular tissue, canker sores, or cancer lesions at baseline and at the end of the study. Subjects with gross periodontal disease, calculus, bridges or dentures were excluded from the study.

Subject Daily Diary

All subjects completed a daily accounting of their assigned procedures in order to record compliance with the requirements of the protocol.

Microbiology:

A swab of the area between the teeth was taken before the mouthwash rinse. The mouthwash was allowed to sit for 1 ½- 2 minutes after mixing Part A & Part B. The subject was instructed to gargle for at least 30 seconds vigorously through the teeth, spit out and wait for 1 minute. The subject was then instructed to gargle at the back of the tongue for at least 30 seconds, spit out and wait for 10 minutes. The same area between the teeth was then swabbed to plate for bacteria after treatment. The swab was plated on a Brucella blood agar plate. Plates were incubated at 35 °C for 48 hours and colonies were counted. The number of total colony forming units was expressed in percentages.

ADVERSE EVENT DEFINITION

An adverse event was any unexpected or undesirable experience occurring to a subject during the evaluation, which may or may not have been related to the test product. All adverse event details were to be recorded including time of onset, severity, duration, any circumstances leading to the adverse event and other clinical findings. The Investigator or designee was to report all serious findings to the Sponsor within twenty-four hours when possible. If an adverse event occurred, the subject, under the direction of the Investigator (or designee), may be referred to the Investigator's consultant physician for treatment. UHRG staff monitored all adverse events until resolved.

RESULTS:

The study sample comprised of 15 subjects and the oral malodor related measurements are summarized in Table 1. At the end of the study period, the Organoleptic scores showed a 50 % reduction for the assessment of oral malodor. Halimeter readings for the mouth and the throat showed a reduction of 50%. Spoon test showed a reduction of 50%. Table II depicts the percentage of colony forming units. There was a reduction of 60% in the colony forming units for the total bacterial counts from baseline. No adverse events occurred.

Table I: Oral Malodor Parameters:

		Organoleptic		Halimeter		Spoon
		Judge 1	Judge 2	Mouth	Throat	
Averages	Baseline	3.3	3.3	142.2	138.6	3.4
	Day 7	1.6	1.7	76.6	84.2	1.5

Table II. **Microbiology – Colony Forming Units**

Time	Percentage of Colony Forming Units
O time	100 %
10 min	40 %

DISCUSSION:

Rinsing the mouth with DioxiRinse™ Mouthwash produced an appreciable reduction of odor. This improvement was especially noteworthy since the mouth rinsing took place the night before and not immediately prior to the odor test. It would normally be expected that the bacteria and the sulfur bearing amino acids would return to baseline within a day. The mouthwash likely killed facultative bacteria in the plaque coating on the dorsum of the tongue. The tested reduction of oral malodor would no doubt be more dramatic if the mouth were rinsed with the mouthrinse the same day or immediately before.

When utilizing the categorical scale of 0-5, the meaning of odor reduction from say, 3 to 1 (moderately to barely noticeable odor), is somewhat arbitrary. Considering that our other senses, for example hearing of sound and seeing of light, are logarithmic relationships (that is when sound pressure increases ten times, we perceive it as double), very likely we smell in the same way.

The log relationship is nature's way of crowding in a greater range of information, and also serves to protect our sense organs from overdose. If the smelling sense is similar to light and sound, and there were a perceived drop in the scale from 3 to 2, then there would be, by a good guess, an actual reduction of 50 % of the odor molecules, and if there were another perceived drop from 2 to 1, another quantitative drop of 50 %. The drop overall would then be a reduction to ¼ the original odor molecules. With this kind of log relationship, the drop in actual odor molecules is much higher from 3 to 2, than 2 to 1, although in both cases the odor is perceived as half.

CONCLUSIONS:

The Organoleptic scores and the halimeter readings decreased by 50 %, or by the putative method of scale described above, there was a 75% reduction in the number of odor molecules. The total number of colony forming units was reduced by 60%. There were no adverse events reported during the study. All the subjects that participated in the study stated that the mouthwash helped them to reduce oral malodor. The subject compliance was good and was not affected by the dual dispenser system. In this study, because of the length of time between mouth rinsing and odor assessment, the reduction of 50 % of the odor and 60 % of the bacterial load indicates clinical significance.