The effect of Breezy candy on halitosis - A double-blind randomized study

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Abstract

Halitosis (bad breath) is a common condition socially crippling vast parts of the population that results mainly from the malodorous compounds volatile sulfur compounds, by products of oral bacteria.

In the present doubled blinded randomized study we have evaluated 75 subjects with halitosis. The participants were treated with or without abrasive microcapsules containing Zinc gluconate 0.5%, propolis 2% and a combination of both (Zinc 0.25%, propolis 1%).

The halitosis was assessed by an Halimeter at 4 different points of time.

Results: Breezy candy was found effective in treatment of halitosis for up to 4 hours. While treatment with regular candy (group 1 - candy without abrasive particles) showed reduction in malodor of 10%, Breezy's candy showed reduction of up to 60% in malodor.

Breezy candy with the Abrasive form and Zinc additive had the best potential to positively affect malodor when treating patients suffering from Halitosis.

The combined effect of abrasion by microcapsules with Zinc supplement represents a novel and successful approach for the treatment of halitosis.
**Introduction**

Bad breath (Halitosis) is a common condition symptom that affects significant parts of the population. It is a multifactorial condition which may result from many sources such as inflammatory processes of the upper respiratory system, GI tract and oral bacteria. Oral production of malodorous substances is associated with by-products of bacterial degradation and occurs on oral surfaces, in periodontal pockets, and the dorsal tongue surface (1).

The major malodorous compounds are termed volatile sulfur compounds (VSCs), with hydrogen sulfide, methyl mercaptan, and dimethyl sulfide accounting for the majority of the VSCs (32). Many oral bacteria, from subgingival plaque, produce a diverse array of malodorous compounds as by-products of their metabolism including VSCs and short-chain organic acids, manifested mainly at the posterior part of the tongue (Fig 1).

Species that produce such malodorous compounds include *Treponema denticola, Porphyromonas gingivalis, Prevotella intermedia, Tannerella forsythensis, Porphyromonas endodontalis,* and *Eubacterium* species (2). Halitosis has been correlated with the presence and severity of periodontal disease and by the amount of coating on the tongue (3, 4). Various methods of measuring halitosis have been suggested, including organoleptic odor rating schemes (smelling the breath) (4) and analytical techniques involving gas chromatography, mass spectrometry, and cryo-osmoscopy (4). The use of a portable sulfide monitor called a Halimeter to quantitate the levels of VSCs in mouth breath was introduced by Rosenberg and have shown that these levels significantly correlate with the measurements made by organoleptic odor rating schemes (5). Treatments of bad breath include removing bacteria and bacterial waste products by scraping the tongue and teeth with
fluoride toothpaste and daily tongue debridement with a toothbrush or other mechanical device, alone or in combination with the use of antimicrobial mouth rinses such as chlorhexidine. Few reports have also suggested a beneficial effect of zinc compounds in the form of chewing gums, rinses or adhesive tablets.

The purpose of the present study was to evaluate the combined effect generated by the scraping affect of candy manufactured in a microcapsules technology that releases chemical substances upon dissolving. Specifically we evaluated the combined effect of Zinc and propolis.

**Material and Methods**

The study was approved by the Institutional Review Board.

Randomization procedure: Each enrolled subject was given a sealed envelope containing the randomly chosen candy (one of 5 options). Each envelop was marked by a number randomly distributed according to a computerized random permutation system.

Blinding procedure: Both the participating subject and the investigator were blinded to the type of the candy chosen to the treatment. All documentations in the CRF relating to the treatment were designated by the envelope’s number only. Coding was not broken during the entire study.

A total of 75 subjects were enrolled to the study. Subjects who have met the selection criteria, and have signed the informed consent

*The inclusion criteria: 18 years and older, healthy who suffer from halitosis*
Subjects were asked to refrain from food, or using mouth wash or teeth brushing for 10 hours prior the first visit.

**The exclusion criteria:** Subjects who suffer from diabetes, renal disease, on chemotherapy, medications, smokers, had oral diseases for the last 3 months, pregnant or using dentures.

Patients were randomly divided into 5 study groups 15 subjects in a group as follows:

1. Control group: This group was treated by commercial lollipop Candy, without the abrasive capabilities and without any additional antibacterial substances.

2. Abrasive candy alone: This group was treated by the Breezy Candy, which is equipped by the abrasive vesicles only, without any additional anti bacterial substances.

3. Abrasive candy with Propolis 2%: This group was treated by the Breezy Candy, which is equipped by the abrasive vesicles as well as by the encapsulated Propolis.

4. Abrasive candy with Zinc gluconate 0.5%: This group was treated by the Breezy Candy, which was equipped by the abrasive vesicles as well as by the Zinc.

5. Active ingredients Propolis 1% and Zinc 0.25% with the abrasive candy. This group was treated by the candy consisting Propolis and Zink with the abrasive vesicles.

All groups were evaluated for halitosis during 4 different sessions at a one week interval.
Prior to the appointment for odor assessment, subjects were asked to refrain from oral activities, including eating, drinking, and chewing, for 10 hrs, and from brushing and mouth rinsing for the same period. They were remained quiet and maintained a closed mouth for a period of 30 sec.

**Malodor Assessment by Halimeter**

The subject was instructed to close his/her mouth and keep his/her lips sealed in preparation for sampling mouth air. Halimeter measurements were taken by a trained nurse 3 times for each visit, and the mean values of each visit were used for the analysis.

1. Results

   **Demographics and Other Baseline Characteristics**

   Overall 75 volunteers were enrolled in this study; these subjects suffered from halitosis. The subjects were randomly enrolled into one of the 5 following groups: G1-Control; G2-Abrasive; G3- Abrasive + Propolis; G4- Abrasive + Zinc; G5- Abrasive + Propolis + Zinc namely, 4 treatment groups and one control group. Each group included 15 participants. Mean age was 38 ±14 years and the sample consisted of 64% Male volunteers ( 
Halimeter baseline values were similar among all groups, Mean of 330± 260 ppb, with abrasive gr. Mean age 38 ±14 years of age and the sample consisted of 64% Male volunteers. Age as homogenous among the groups and according to ANOVA p=0.915, vs. the gender distribution was not even across all study groups.

### Table 1: Demographic Characteristics by Groups

<table>
<thead>
<tr>
<th>Group</th>
<th>Age (Mean, SD)</th>
<th>Min</th>
<th>Max</th>
<th># Male</th>
<th>% Male</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control (G1)</td>
<td>39.73, 15.064</td>
<td>19</td>
<td>59</td>
<td>10</td>
<td>66.7%</td>
</tr>
<tr>
<td>Abrasive (G2)</td>
<td>38.73, 11.732</td>
<td>21</td>
<td>63</td>
<td>5</td>
<td>33.3%</td>
</tr>
<tr>
<td>Abrasive+Propolis (G3)</td>
<td>37.8, 16.258</td>
<td>18</td>
<td>64</td>
<td>13</td>
<td>86.7%</td>
</tr>
<tr>
<td>Abrasive+Zinc (G4)</td>
<td>34.93, 15.397</td>
<td>18</td>
<td>60</td>
<td>9</td>
<td>60.0%</td>
</tr>
<tr>
<td>Abrasive+Propolis+Zinc (G5)</td>
<td>37.6, 11.783</td>
<td>27</td>
<td>58</td>
<td>11</td>
<td>73.3%</td>
</tr>
<tr>
<td>Total</td>
<td>37.76, 13.882</td>
<td>18</td>
<td>64</td>
<td>48</td>
<td>64.0%</td>
</tr>
</tbody>
</table>

*Mean age was not different according to ANOVA (p=0.915)

* Percent male was different among the groups according to CHI-SQ (p=0.037, df=4)

The vast majority of oral malodor originates with the anaerobic bacterial degradation of sulfur containing amino acids within the oral cavity, resulting in the emission volatile sulfur compounds (VSC). The Halimeter reads out in parts-per-billion (ppb) of volatile sulfur compounds. These Halimeter measurements are the key endpoint of this protocol.

The mean percent change of the 4 groups and control over time are presented on Fig 2
. The emerged pattern of group means over time shows that the percent change in the Control Group (G1) was lower throughout the trial. The Abrasive alone (G2) and the Abrasive+Propolis (G3) groups had the same response over time whereas the Abrasive + Prpolis + Zinc (G5) group had the intermediate response at first but at the last visit it coincided with the Abrasive alone (G2) group. The Abrasive + Zinc (G4) group had the highest response which continued throughout the repeated visits. Only G4 and G5 had significant response as compared to the control group (p<0.0001 and p=0.022 respectively). Namely only Abrasive + Zinc or Abrasive + Propolis + Zinc group reduced significantly the malodor and had a positive effect on Halitosis.

The mixed linear model was statistically significant with p<0.0001

Posthoc comparisons of treatment groups to the control group with Sidak correction for multiplicity . G2 vs. G1 Not Significant (NS); G3 vs. G1 Not Significant (NS); G4 vs. G1 P<0.0001; G5 vs. G1 p=0.016

Since it was found that groups G2&G3 coincide over time they were combined into one group and the data was analyzed.

Figure 3 shows that after controlling to baseline levels, the percent change reduction in all 4 treatment groups is statistically significant from control: (G2&G3 p=0.025, G5 p=0.064, G4 p<0.0001).  

Moreover, these results present a trend of dose response curve: control had the lowest effect over time, the Abrasive alone and the Propolis (G2 & G3) had intermediate response, the Abrasive+Prpolis+Zinc (G5) which represents half dose of Zinc, had higher intermediate response and the Abrasiv+Zinc (G4), which represents double dose of Zinc had the highest response.
Comparison of each group to control with Sidak adjustment for multiplicity.

G2&G3 vs. G1 p=0.025; G5 vs. G1 p=0.064; G4 vs. G1 p<0.0001.

Baseline p=0.054 (cofactor significance in the model)

Group p<0.0001 (group as fix effect in the model, indicating the overall group significance level).

Discussion

Halitosis can be a serious problem with detrimental social implication contacts that may affect up to 20% of the population. Although it may represent a significant burden for the patient, it is often overlooked or dismissed by health professionals.

VSC produced by oral bacteria are the major cause of this phenomenon and are known to be inhibited by Zinc (3).

Zinc is an essential mineral. It is a component of vital enzyme carbonic anhydrase, and other enzymes like several dehydrogenases (alcohol, glutamics, and certain pyridine nucleotide) and pancreatic carboxypeptidase's.

It is found in traces in all tissues, except the bones, teeth, and pancreas which have slightly more amount of zinc. A normal adult contains 1.4-2.5 gm of zinc. Zinc level for adults in plasma or serum is 0.1/100 ml, and in whole blood it is 0.7mg/100 ml. It exists in the body mostly in combination with other constituents. It is bluish-white, metallic element. It is excreted mainly in urine (9).
In the present study we have used a Halimeter( ) and have identified a significant reduction in halitosis as measured by in the Abrasive + Zinc (G4) group that had highest response which continued throughout the repeated visits. Since the abrasive group alone had a diminished halitosis compared to control we assume that the combination of abrasive and Zinc is at least additive if not synergistic. The abrasive effect in our study was achieved by the use of microcapsules congaing different ingredients.

The concentrations of Zinc used in the candy were 0.5% and did not result in any adverse reaction or side effects.

Microcapsules consist of a shell and a core, wherein the core contains the microencapsulated materials. The shell is formed from a hardened material and is produced using a microencapsulation technique as is well known to those skilled in the art of pharmaceutical compositions. The shell is sufficiently hardened to provide an abrading action, yet will not damage or cause pain to the tongue.

Zinc ions have been shown to inhibit VSC formation in the forms of rinses, chewing gums and pastes. Zinc seemed to be effective safe metal at concentration of at least 1%. Zinc has been shown to be effective in the treatment of halitosis in different compounds as paste, chewing gums and rinses, however it was not tried in a form that exerts a brushing impact of the tongue.

The general dental practitioner should be aware of the synergistic effect of abrasion effect on the tongue combined with the anti VSC effect of Zinc as a single treatment modality that combines both physical scrapping of the tongue with chemotherapeutic effect of Zinc.
A regiment that includes tongue scraping, mouth rinses containing antibacterial compounds have been proposed as the major line of treatment.

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References:
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