**ABSTRACT**

Background: Oral dryness is a critical health issue that can drastically reduce the quality of life in xerostomic patients. Aims and Objectives: To introduce an effective, non-invasive, and inexpensive method to address oral dryness among patients with xerostomia. Materials and Methods: Sixty volunteers with xerostomia were randomly allocated into two groups. The group A was instructed to massage their major salivary glands while the group B was instructed to chew sugar-free gum. The mean unstimulated and stimulated saliva flow rates, as well as the severity of xerostomia in both groups were measured at the beginning of the study and after three months. The mean flow rates of both groups showed statistically significant improvement. Results: Although, the amount of increase in the group A was meaningfully lower than group B, both groups were similar regarding to the severity of xerostomia at the end of the study. Conclusion: Massaging salivary gland can be employed as a safe, simple, and cost-effective method for improvement of oral dryness.

Key words: Chewing-gum; Hyposalivation; Massage; Xerostomia

**Introduction**

Xerostomia is a subjective feeling of oral dryness, usually associated with hypo-salivation, that may results in a range of mild and tolerable to dramatically severe and excruciating outcomes. Xerostomia, secondary to inadequate saliva, not only deteriorates the physical process of eating, but also secludes socially the affected patients due to difficulty in speaking. Inquiring the etiology of the so-called condition reveals diverse causative factors, which can be either local or systemic.iatrogenic interventions, such as radiation therapy or drug therapy, comprise a considerable distinct etiologic category. Studies on prevalence of xerostomia in general population showed that it can be detected in up to 46% of people. Nearly 30% of old adults experience some degrees of oral dryness. Age, gender, and medication have been generally underlined as the most common causes of xerostomia. Over 500 drugs have been introduced, till now, as having some xerogenic effects and, ironically, are mostly used by aged people. Management of oral dryness is mainly based on elimination of the underlying cause, if possible, as well as doing symptom-therapy by the use of supportive cares, saliva stimulating drugs, and saliva substitutive products. Depending on the etiology and severity of the problem a combination of those measures is applicable. However, in majority of xerostomia cases, who are old and medicated individuals, elimination of etiology is impossible and drug therapy has serious and intolerable side-effects. This study was conducted to introduce an effective, non-invasive and inexpensive method for treatment of xerostomia, specifically for patients who are not capable of applying other existing methods.

**Materials and Methods**

The ethic committee of Shahid Sadoughi University of Medical Sciences (SSU), Iran, approved the study protocol and it is registered by the code IRCT201211149103N2. Informed consent was obtained from each participant. In this clinical trial 60 adult volunteers who referred to SSU’s clinic of dentistry participated. Subjects whose oral dryness was shown by a questionnaire (Table 1) and confirmed by measuring their saliva flow rates entered the study. Normally, unstimulated and stimulated saliva flow rate should respectively be at least 0.1 ml/min and 0.7 ml/min. However, patients whose milking of salivary glands was non-productive were excluded from the study. Individuals with xerogenic habits such as mouth breathers or smokers were also excluded. Thereafter, participants were randomly allocated into two equal groups (Group A - Experimental and Group B - Control). The severity of oral dryness feeling of the two groups was assessed by Thomson’s score (Table 2), then each was assigned a distinct management protocol.

**Management protocols:** In control group, participants were asked to drink adequate water, 8 full glasses of water per day, and chew sugar-free mint-flavored gum (OrbitTM) 10 times a day, 5 minutes in each cycle. In case group, participants were instructed to drink the same daily amount of water but stimulate their salivary glands’ secretion by massaging the major glands 100 times for each pair glands in 10 divided cycles per day. Group A subjects were educated to massage their parotid glands by putting palms of both hands on sides of their faces, in front of ears, and gently rubbing them toward their nasal alnas. For sub-mandibular and sub-lingual glands they were told to put thumbs under their jaws and sweep toward their chins. All subjects were reviewed carefully to assess the performance of the massages correctly. Weekly recalls were set to closely follow the management of every participant. After three months of intervention, saliva flow rates of case and control groups as well as the severity of their oral dryness feeling were measured for the second time.

**Sample collection:** Saliva samples were obtained by spitting method, between 9am to 12noon. Subjects were advised to avoid food and drinks for 90 minutes. Stimulated saliva samples were collected following salivary glands stimulation by 60 seconds of chewing standard sized pieces of tasteless paraffin, for 5minutes. Unstimulated samples were collected for 5 minutes, when subjects were in relaxed position. Flow rates were calculated as gr/min which is approximately equivalent to ml/min. Thomson’s scores were recorded for all patients.
1. Does your mouth feel dry when eating a meal?
2. Do you have difficulties swallowing any foods?
3. Do you need to sip liquids to aid in swallowing dry foods?
4. Does the amount of saliva in your mouth seem to be reduced most of the time?
5. Does your mouth feel dry at night or on awakening?
6. Does your mouth feel dry during the daytime?
7. Do you chew gum or use candy to relieve oral dryness?
8. Do you usually wake up thirsty at night?
9. Do you have problems in tasting food?
10. Does your tongue burn?

Table 1. Questionnaire used for selection of subjects with xerostomia.
Response options: yes/no

I sip liquids to help swallow food
My mouth feels dry when eating a meal
I get up at night to drink
My mouth feels dry
I have difficulty in eating dry foods
I suck sweets or cough lollies to relieve dry mouth
I have difficulties swallowing certain foods
The skin of my face feels dry
My eyes feel dry
My lips feel dry
The inside of my nose feels dry

Table 2. Xerostomia Inventory (IX): Thomson’s score
Response options (Scores): Never (1), Hardly (2), Occasionally (3), Fairly often (4) and Very often (5)

<table>
<thead>
<tr>
<th>Symptom</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>I sip liquids to help swallow food</td>
<td>3</td>
</tr>
<tr>
<td>My mouth feels dry when eating a meal</td>
<td>3</td>
</tr>
<tr>
<td>I get up at night to drink</td>
<td>3</td>
</tr>
<tr>
<td>My mouth feels dry</td>
<td>3</td>
</tr>
<tr>
<td>I have difficulty in eating dry foods</td>
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<td>I suck sweets or cough lollies to relieve dry mouth</td>
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<tr>
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<td>3</td>
</tr>
<tr>
<td>The skin of my face feels dry</td>
<td>3</td>
</tr>
<tr>
<td>My eyes feel dry</td>
<td>3</td>
</tr>
<tr>
<td>My lips feel dry</td>
<td>3</td>
</tr>
<tr>
<td>The inside of my nose feels dry</td>
<td>3</td>
</tr>
</tbody>
</table>

Statistical analysis: Obtained data was presented as mean ± standard deviation. Values obtained from both groups were compared by means of Student’s t-test (CI 95%, P value<0.05), while changes in flow rates/ severity of dryness within each group were analyzed by Paired t-test (CI 95%, P value<0.05). The data analysis was performed by the SPSS 13.0 software.

Results
In the present study 26 males and 34 females with an age-range of 18 to 57 years and mean age of 36.76±8.1 years were participated. Both group A(Massage) and group B(Gum-chewing) were similar regarding to the baseline unstimulated and stimulated saliva flow rates as well as severity of the xerostomia (respectively, P value 0.433, P value 0.758, P value 0.217).

Table 3. Mean saliva flow rates before and after intervention for each group

<table>
<thead>
<tr>
<th>Saliva Sample</th>
<th>Group</th>
<th>Before</th>
<th>After</th>
<th>P_value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unstimulated</td>
<td>A</td>
<td>0.09±0.02</td>
<td>0.14±0.02</td>
<td>&lt;0.05</td>
</tr>
<tr>
<td></td>
<td>B</td>
<td>0.01±0.02</td>
<td>0.18±0.02</td>
<td>&lt;0.05</td>
</tr>
<tr>
<td>Stimulated</td>
<td>A</td>
<td>0.41±0.06</td>
<td>0.54±0.05</td>
<td>&lt;0.05</td>
</tr>
<tr>
<td></td>
<td>B</td>
<td>0.46±0.06</td>
<td>0.64±0.04</td>
<td>&lt;0.05</td>
</tr>
</tbody>
</table>

After intervention, the mean flow rates of group A and group B showed statistically meaningful increase (Table 3). However, the amount of increases among the subjects that used chewing-gums as stimulant were greater than those who employed gland massaging (P value <0.05). Data analysis also indicated significant relief of symptoms after the trial (Table 4), which showed no difference between both groups (P value 0.285).

Discussion
Despite a subjective problem, xerostomia is shown to be accompanied by variations in either quantity or quality of saliva production. The essence of medical literature on xerostomia and its consequences endorses that dry mouth feeling has dramatic effects on the patients’ general well-being, and oral health status, as well as their quality of life. Considering the prevalence of oral dryness feeling among general population, oral health care providers have a good chance to visit patients suffering from some degrees of xerostomia. A brief review of available studies on general population suggests that approximately 10% to 50% of people may complain of having saliva insufficiency symptoms. By increasing the age of sample populations, the prevalence of dry mouth feeling reaches higher figures.

In case of hyposalivation, treatments should alleviate the symptoms by targeting the underlying cause and/or providing the patients with supportive cares. Regarding the general population, the most documented etiology of hyposalivation is medication. Based on the fact that for the most of medically compromised individuals any interference with their drug regimens is not conceivable, supportive measures take the first priority in management of the patients with hyposalivation. Saliva stimulation is the most logical option for xerostomic patients whose salivary glands have some residual activity. Having natural cleansing, buffering, and antimicrobial properties make it unique and irreplaceable. Therefore, a sensible management of saliva insufficiency for the majority of affected individuals will be local saliva stimulations. Local saliva stimulants traditionally divide into gustatory and mechanical ones. Chewing, sucking and taste-stimulants can be employed with slightly different outcomes. For instance, while acid-
ic tastes may lead to increased output of watery secretions, sweet tastes and mint may lead to more viscous saliva. Thus, the choice of stimulation primarily depends on the patients’ conditions and compliance. Chewing gum is not favorable for denture wearer. Acidic tastes, such as lemon juice, accelerate the rate of demineralization and dental caries in at-risk xerostomic individuals. Mint and other strong flavors usually are caustic for those whose mucosa is already dry. Actually, there are situations that leave out the therapist with no solution to the problem except for saliva substitutes; Although, residual saliva output is still present. Let alone the inferior quality of saliva substitutes, comparing to the original fluid, they are not favorable for most of the patients.

On designing a new treatment plan to obviate the previously mentioned obstacles, massaging salivary glands seemed theoretically to be safe as well as effective. Considering the core idea of existing stimulating methods, rapid evacuation of saliva ducts induces the functional acini to secrete newly formed saliva into empty tubes. Therefore, regular milking of glands would fulfill the role of a local provocative measure. In the present study, the efficacy of massaging salivary gland in improving the xerostomia was verified, by comparing with a known effective local stimulant. Naturally, the strongest saliva secretion stimulators are those that mimic the intake of foods. Thus, chewing mint-flavored sugar-free gum, which combines mechanical provocation with the popular taste of sweetness and the powerful flavor of mint, was considered as the management option for the control group subjects. Referring to the result section, massaging the glands could significantly improve the secretory capacity of affected glands (P value <0.05). Approximately, the stimulated flow rate was 30 % and the unstimulated rate was 44% higher than the baseline-records, in the experimental group. Comparing to the control group, massaging was nearly half effective than chewing gum (P value <0.05). However, the interesting finding was that both methods had statistically equal effectiveness in reducing the severity of dry mouth feeling (P value 0.285).

A systematic review of 32 randomized controlled trials on supportive cares for management of dry mouth suggested that none of the available topical therapies, including gum chewing, have any clinical superiority to the others. Thus, it can be inferred that efficacy of massaging the salivary glands is clinically comparable to the other topical measure. It may not exceed the potency of systemic sialogogues, like Pilocarpine or Cevimeline. However, it is superior to any of currently available managements as it is rather simple and non-invasive. Massaging neither interferes with patients’ medications, nor has any unfavorable adverse drug reaction. While edentulous patients with hyposalivation can easily benefit from it, dentate xerostomic patients with temporomandibular joint dysfunctions can also take advantage of this method without any further damage to their affected joints. Furthermore, even those with particular disabilities, such as rheumatoid arthritis or scleroderma, as well as unconscious individuals may benefit from massages since a care provider can carry out the method for them.

Conclusion

The current study suggested that for xerostomic patients with compromised health status who cannot be the managed by current systemic or local treatment methods, salivary gland massage is a promising way to relief their suffering and discomfort. Massage can also be used as an effective adjunct to current remedies for xerostomia. The most significant aspect of massage is that it can easily be applied by care givers to the patients who are unable to execute the procedure themselves. It can be the treatment of choice for xerostomic patients with residual gland function whose compromised conditions deter them from benefiting any available management.

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