Original Article

Comparison of the Effect of Recaldent and Xylitol on the Amounts of Salivary *Streptococcus Mutans*

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Abstract

Background: Dental caries is associated with oral pathogenes and *Streptococcus mutans* (*S. mutans*)is one of the primary cariogenic organisms. The aim of this clinical study was to evaluate the effect of sugar free chewing gum containing casein phosphopeptide-amorphous calcium phosphate(CPP-ACP) and Xylitol on salivary *Streptococcus mutan*.

Materials and Methods: 60 dental students, who volunteered after signing an informed consent, were randomly allocated to receive one of the following interventions: (A) Chewing gum containing CPP-ACP, (B) Chewing gum containing Xylitol. Subjects within the experimental groups chewed gum for 20 minutes, three times a day after meals for 3 weeks. Pre- and post-intervention unstimulated saliva samples were quantified for *Streptococcus mutans* count.

Results: A statistically significant reduction ($p<0.05$) of salivary *S. mutans* was displayed in both groups A and B after the intervention. When results compared with baseline, and group A shows more statistically significant reduction of salivary *S. mutans* than group B.

Conclusion: In conclusion, daily chewing gum containing CPP-ACP and xylitol reduce the level of salivary *S. mutans* in a significant way, but chewing gum containing CPP-ACP can reduce the level of salivary *S. mutans* in a significant way than Xylitol chewing gum.

Keywords: *Streptococcus mutans*, Xylitol, Casein Phosphopeptide, Amorphous Calcium Phosphate, caries, chewing gum

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Introduction

Bacterial plaque accumulated on teeth surfaces and composed of native oral flora. That is the primary etiological agent for periodontal disease and dental caries which may result in teeth loss if left untreated[1,2]. Dental caries is destruction of dental structures by acid production as a product of carbohydrate metabolism by cariogenic bacteria[3]. *S. mutans*, commonly found in human dental plaque, are the primary species associated with dental caries[4]. *S. mutans* is now considered to play an important role in the development of dental caries in animals and humans. Extensive research on this microorganism has been done during the last 10 years[5].

Chewing gum is known to be a useful adjunct to common oral hygiene. Chewing gum is a potent stimulant of salivary flow rate. It is effective on razing

of plaque PH. The chewing of sugar free gums after meals and snacks can promote remineralization of enamel and reduce *S. mutans* rate[6]. Xylitol, a five-carbon natural sugar alcohol, is widely used as a non cariogenic sweetener, which is not fermentable by most oral bacteria[7]. Several studies have shown that xylitol also reduce dental plaque as the number of *S. mutans* (*in vivo* and *in vitro*)[8].

In recent years Casein Phosphopeptide-Amorphous Calcium Phosphate (CPP-ACP) non complexes have also been demonstrated to have anticariogenic properties in both laboratory animals and humans insitu experiments[9,10]. Casein Phosphopeptide (CPP) containing the cluster sequence of Ser(p)-Ser(p)-Ser(p)-Glu-Glu have a remarkable ability to stabilize Amorphous Calcium Phosphate (ACP) in metastable solution[11]. When delivered in sugar free chewing gum, CPP-ACP has also been shown to remineralize enamel subsurface lesion and reduce *S. mutans in vivo*, independent of chewing frequency and duration[12,13].

To our knowledge, no studies hither to evaluated the effect of xylitol and CPP-ACP on level of salivary *S.mutans* and compare them. The aim of the present investigation was compare the effect of xylitol and CPP-ACP chewing gums, on the level of *S. mutans* in the saliva of young adults.

Methods

Study group: The material consisted of sixty healthy young adults (37 women, 23 men), 20-25 years old, who volunteered after receiving verbal and written information. Subjects with a history of systemic antibiotic or topical fluoride treatments within a four week period before baseline were not included nor individuals with a habitual use of dairy Xylitol or Recaldent chewing gums. The subjects had non compromised oral health, and none exhibited untreated caries lesions or clinical signs of either gingivitis or periodontal disease.

Study design: The study protocol was approved by the school of Dentistry Ethics Committee at the University of Shahid Beheshti, Tehran, Iran. In this study 60 of the Dental students of the Shahid Beheshti University between 20–25 years old have been selected. This prospective controlled, clinical trial had two parallel group (each size group=30). Each group chewed 3 gum pellets for 3 times/day with an experimental period of 3 week. Subjects were randomly assigned to groups by a block randomization procedure. Block randomization ensured similar proportion of participant in each group. Group A consumed three chewing gums with CPP-ACP, three times daily after each meal; group B was given three chewing gums with Xylitol three times daily after each meal, too. Use of the chewing gums was scheduled as shown in table 1. Salivary samples were collected at baseline and 1 day after the final gum use. During the experimental period, the subjects were strongly encouraged to reduce their carbohydrate diet and continue to brush their teeth twice a day with fluoride containing toothpaste.

Chewing Gum: Each Recaldent pellet (Trident Company, Thailand) contained 10% CPP-ACP plus gum base and the Xylitol chewing gum (Orion Company, Rasti Lar Company, Iran) contained 55.3668% Xylitol. The ingredients of the gums are

Table 1: Ingredients of the chewing gums according to the manufactures' declaration.

Gum Compounds	Recaldent	Xylitol
Therapeutic agents	10%	55.3%
Fat	0%	0%
Sugar	0%	0%
Sodium	0%	0%
Protein	0%	0%
Carbohydrate	1%	1%
Power supply	10%	12%
Flavor	Eucalyptus	Mint

listed in table 2. The participants were instructed to actively chew on the assigned gums during 20 minutes after the meals; in the morning, at noon and evening. A 1-week supply was handed out to the subjects at the time to continuously check the compliance.

Results

All subjects completed the trial, the compliance was excellent and no side effects were reported. The pre-intervention and post-intervention reports are shown in table 2. All subjects had detectable levels of *S. mutans* at baseline, and there were no statistically significant differences between the two groups concerning the distribution of scores. One day after the 3-week intervention period, significantly reduce levels ($p<0.05$) of *S. mutans* compared to baseline in both groups A and B. Group A shows more statistically significant reduction of salivary *S. mutans* than group B (Fig. 1).

Discussion

A significant part of studies has been focused on studying the effect various substances for preventing dental caries in the primary stages. *S. mutans* is the effective bacteria on the beginning process of enamel demineralization and consequently decays, hence using an appropriate solution for controlling or eliminating these effects can prevent the creation of decay.

In the study we tested the effectiveness of Xylitol and Casein Phosphopeptide-Amorphous Calcium Phosphate chewing gum in reducing load of *S. mutans*, as cariogenic agents.

Although the usefulness of Xylitol for preventing dental caries especially in patients with primary caries has been documents[14,15]. But since so far the effect of these two types of chewing gums on the *S. mutans* rate in saliva have not been compared with each other clinically, hence the present study has been developed and conducted.

In the research, considering the effect of caries on the number of bacteria's of saliva including *S. mutans*, so those individuals with active caries have been eliminated from the study. In addition, with matching the Health and nutrition programs such as do not using any other Xylitol and CPP–ACP products and mouth wash and Fluoride gel, it has been tried to eliminate the intervening variables as much as possible[17].

Table 2: Distribution of salivary *S. mutans* score at baseline and after 3-week consumption of different Chewing gum regimens (n=60)

Group		***mutans*. before**	***mutans*. after**
Xylitol	Mean	42000.00	21800.00
	N	30	30
	Std. Error of Mean	5909.276	3987.740
	Median	30000.00	10000.00
Recaldent	Mean	42000.00	10200.13
	N	30	30
	Std. Error of Mean	5909.276	2275.991
	Median	30000.00	5000.00
Total	Mean	42000.00	16000.07
	N	60	60
	Std. Error of Mean	4142.927	2398.203
	Median	30000.00	10000.00

In the study, the time of sampling has been performed at 9 AM when subjects were fast. This method of sampling is consistent with the sampling method in the study of Gaglar et al[17].

In this study the participants were asked to use the provided chewing gums were used for a time period of 3 weeks, three times a day after eating their main meal. Researchers believe that for evaluating the effects of each chewing gum on the counts of *S.mutans* in saliva, the chewing gums should be used immediately after taking the main meal for 3 weeks[18,19].

The individuals were asked to use the chew the chewing gums every time for 20 minutes. According to the studies of Harris et al., and Iigima et al., after 20 minutes of chewing, secretion rate of saliva becomes three times more than normal time. In addition, we will have increase in the level of PH and mineral deposition of calcium and phosphate ions present in saliva so enamel become reminerelized.

In this study the *S. mutans* rate in saliva after 3 weeks of using chewing gums that contained Xylitol has decreased significantly ($p<0.0011$). This finding was shown by Claudia et al[20].

The reason that Xylitol has reduced amounts of *S. mutans*, might be due to the inability in fermentation of 5-carbon sugar Xylitol by *S. mutans*. Furthermore, chewing stimulate salivary flow which improves the buffering of the PH drop that occurs after eating. It can cause reduce growth of this bacteria[20].

In many studies mentioned that Xylitol has caused the reduction of *S. mutans* in saliva like as present study[21-23].

In this study the rate of *S. mutans* in saliva, after 3 weeks of consumption of chewing gums containing CPP-ACP had a significant reduction ($p<0.001$). This finding is in agreement with the study of Sabraminian et al., and Vashisht et al[24,25].

In the present study although in both groups the rate of *S. mutans* in saliva after consumption of the chewing gums have shown a significant decrease; however, the rate of *S. mutans* in saliva in the group of Xylitol is significantly higher comparing to CPP-ACP group (figure 1). That can be due to the antibacterial properties and its buffering effect on plaque and prevention of growth and attachment of *Streptococcus* strains on the teeth. This study has

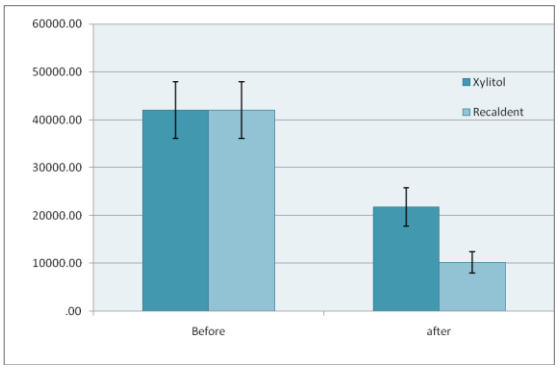

Figure 1. Transition of salivary *S. mutans* scores when post-intervention levels were compared with the baseline in the different experimental groups and when two groups compared together.

documented and demonstrated the clinical antibacterial effects of CPP-ACP and its effect as an anti-caries agent (in primary caries)[25].

All individuals, especially those who are in danger of the development of dental caries can use these substances; however, more clinical long-term studies in this regard are required.

Conclusion

In conclusion, chewing gum containing CPP-ACP and Xylitol reduce the level of salivary *S. mutans* significantly, but chewing gum containing CPP-ACP can reduce the level of salivary *S. mutans* in a significant way than Xylitol chewing gum, then daily chewing gum containing CPP-ACP suggested and all individuals, especially those who are in danger of the development of dental caries can use these substances; however, more clinical long-term studies in this regard are required.

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