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The Impact of Chewing Gums on the Plaque Index in the Lack of Oral Hygiene Measures in Patients Referred to a Private Dental Clinic

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Author's contribution

The sole author designed, analysed, interpreted and prepared the manuscript.

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Case Study

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ABSTRACT

Introduction: Nowadays, Chewing Gum is one of the frequent habits among people. The purpose of this study was to compare the effect of two types of chewing gums (with and without sugar) on dental plaque accumulation in the lack of oral hygiene measures.
Materials and Methods: In this descriptive cross-sectional study, plaque accumulation during three 4-day periods (with two-week interval) was recorded (Sillness & LÖe Index) in a group of 20 patients in the absence of routine oral hygiene methods. The patients were asked to chew sugar-free Gum (Trident) during the first 4-day period and sugar-containing Gum (Dubble Bubble) during the second 4-day period and stop chewing during the third period. Participants were asked to chew five gum sticks daily after meals for about twenty minutes. The data were statistically analyzed using One Way ANOVA and LSD full form tests.
Results: The results showed that both sugar-free and sugar-containing gums reduced the amount of plaque ($P<0.001$). The comparison of the mean dental plaque accumulation between the two groups indicated that the effect of the sugar-free gum was more significant than that of the sugar-containing one ($P<0.001$).
Conclusion: Although sugar-free gum is more effective than sugared gum on reducing dental plaque accumulation, chewing sugar-containing gum also decreases the level of dental plaque.

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Keywords: Dental plaque; chewing gum; oral hygiene.

1. INTRODUCTION

The results of epidemiological studies of European and North American as industrialized countries in recent decades show a rapid decline in dental caries in children and youth in the mentioned countries [1-3]. On the other hand, there is a public agreement based on clinical, experimental, and epidemiological research that the prevalence of dental caries in children and young people in developing countries is increasing significantly. Also, the reasons for the decrease in the prevalence of caries in industrialized countries and particularly in children, could be derived from the implementation of primary prevention programs at the community level, including nutrition control. Diet is one of the most effective factors, and sugars such as sucrose are the most important nutritional and active factors in causing tooth decay. Due to the high interest of children in consuming products and snacks that contain sugar, plenty of researches has been conducted for alternative sweeteners, and scientists are attempting to find a proper solution. The results of this study showed that sucrose in products such as chewing gum, chocolate, so on, which is frequently used by children, can be replaced with other sweeteners such as Xylitol.

Xylitol is a sugar from the Polyol family that is not only not metabolized by streptococcus mutants but also has a bacteriostatic effect [4]. The results of many studies have proven that chewing Gum without harmful sugars could reduce the buildup of dental plaque, the amount of streptococcus in saliva and dental plaque, and the production of salivary acid. Moreover, in this condition, increase secretion of saliva and salivary PH lead to reducing dental caries [4-7]. Autio and Courts [8] found growing acceptance of Xylitol chewing gum as a daily habit and prevention of caries in students and their teachers.

Studies have proven that chewing gum, even with sugar, shows a positive effect on preventing plaque buildup and reducing the streptococcal mutants in saliva [5,6,9], which may be due to the mechanical cleansing of chewing gum or increase in salivary secretion.

Edgar found that chewing gum containing sucrose leads to dental caries, unlike gum containing Xylitol and Sorbitol [10]. The results of Pizzo et al. showed that chewing sugar-free gum, containing Lactoperoxidase or silicon dioxide or zinc Gluconate, has no deterrent effect on plaque buildup on the smooth surface [11].

Van Loveren and Stookey found that increasing saliva secretion from chewing gum containing Polyol sugars such as Xylitol and Sorbitol after having meals was more effective than its ingredients in preventing decay. It means that saliva secretion plays a vital role in decreasing dental caries [12,13].

With the rise of public awareness and the recommendation of dentists, despite the significant price difference between these products and similar products containing sucrose (even up to 5 times), parents are very willing for their children to use these products. Also, the use of these products has become very demanding. The present study is designed to compare the influences of chewing both gums (free sugar and containing sugar) with the control group to remove dental plaque in the lack of oral hygiene measures.

Based on findings in the ADA Council, The physical act of chewing increases salivary flow in the mouth; if chewed after eating, the increased salivary flow can help neutralize and wash away the acids that are produced when food is broken down by the bacteria in plaque on teeth. This study aims to investigate the effect of chewing gums on the plaque index in the lack of oral hygiene measures.

2. MATERIALS AND METHODS

The ethical considerations of this research have been confirmed, and the ethical approval has been obtained. The study was an experimental intervention (clinical trial) with a series of descriptors in Tehran. Twenty volunteer patients without any disease and progressive decay were selected. The study was conducted over three periods, which each period was four days with two-week intervals. In the first period, the volunteers were asked to chew five sugar-containing gums (Dubble Bubble)once a day for 20 minutes after the main meal and between meals.

During the second period, chewing free-sugar Gum (Trident) was used, and in the third period, no gum was given to people.

In order to unify the research conditions, one person was asked to put the sufficient number of each type of chewing Gum in the same container and identify it with a code, so the kind of chewing Gum was not precise.

Trident is a brand of sugar-free chewing gum, introduced by Cadbury in the United Kingdom. It is sweetened with Xylitol, a sugar alcohol that reduces plaque and protects teeth against decay associated with dental caries by helping to maintain a neutral pH balance in the mouth. It is also sweetened with sorbitol, Mannitol, Aspartame, Sucralose and Acesulfame potassium.

Dubble Bubble is a brand of pink-colored bubble gum invented by Walter Diemer, an accountant at Philadelphia-based Fleer Chewing Gum Company in 1928. The main ingredients in Dubble Bubble gum are Sugar, Dextrose, Corn Syrup, Gum Base, Tapioca Dextrin, Titanium Dioxide, Confectioner's Glaze, Carnauba Wax, Corn Starch, Artificial Flavors, Artificial Colors.

In all three phases, firstly, the scaling and root planing was conducted, and then the modified plaque index of Loe and Silness was measured. If the index were not zero, the dental cleaning would be repeated, and after the completion of each period, the plaque index was measured. During the three periods, patients should refrain from brushing, flossing, and consuming any other gum.

Four people were eliminated from the study because they did not avoid brushing and flossing. In the present study, the altered plaque index of Loe and Silness was used. In fact, instead of four surfaces, six surfaces such as Mesiobuccal, Mid-Buccal, Distobuccal, Mesiolingual, Distolingual of teeth [14,15,16] were considered as the dental plaque index [17]. The purpose of this feature is to diagnose the thickness of dental plaque in the Gingival area. Firstly, the teeth should be dried, and then they are examined by eye accompanied by sufficient light, dental probe, or explorer.

The scoring criteria: (Silness and Loe – 1964)

Zero: There are no plaques.

1. A layer of plaque adheres to the free gingival margin in adjacent dental areas and can be detected by using the probe on the tooth surface
2. The average volume of soft deposits in the Gingival pocket, which be recognized by the naked eye.
3. Abundance of soft materials in the Gingival envelope or dental and Gingival margin.

After collecting all the information, statistical analysis was conducted through statistical software (SPSS), one way ANOVA, and Least Significant Difference (LSD).

3. FINDINGS

ANOVA analysis showed a statistically significant difference between the studied groups ($P < 0.05$). The LSD test showed that chewing of five chewing gums, which are free sugar for 20 minutes after a meal and between main meals over four days and in the absence of oral hygiene measures, significantly reduced plaque accumulation in comparison with a controlled group ($P < 0.001$). Likely, chewing gum containing sucrose (Dubble Bubble) in the above conditions has a similar effect in reducing the accumulation of dental plaque compared to the control group ($P < 0.001$).

The mean and standard deviation of the plaque accumulation in three groups and comparing the results of the two groups are shown in the below charts. The results showed that chewing Gum containing sugar along with oral hygiene measures could reduce the plaque buildup by 74 percent. While in this case, sugar-free gum reduced 76 percent, and the effect of sugar-free gum was about 83 percent.

A Comparison of the mean plaque accumulation in two groups showed that chewing Gum without sucrose was significantly more effective in reducing the buildup of dental plaque than chewing Gum containing sucrose ($P < 0.001$).

4. DISCUSSION

Due to the direct relationship between sugar consumption in diet and tooth decay, many studies have been conducted to control the prevalence of dental caries. The results have shown that sugar compounds, such as Xylitol and Sorbitol, play a vital role in the control and prevention of caries. People who used toothpaste and chewing gums containing Xylitol and sorbitol showed fewer dental caries compared to the controlled group.

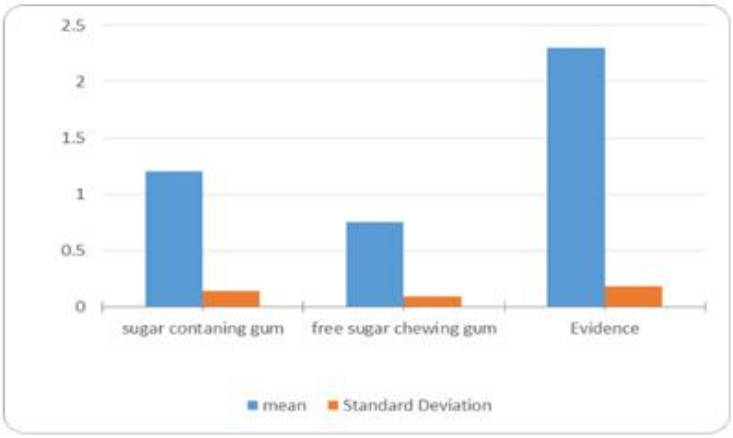

Fig. 1. The mean and standard deviation of the plaque accumulation in three groups (sugar-containing gum, free sugar chewing gum and controlled group)

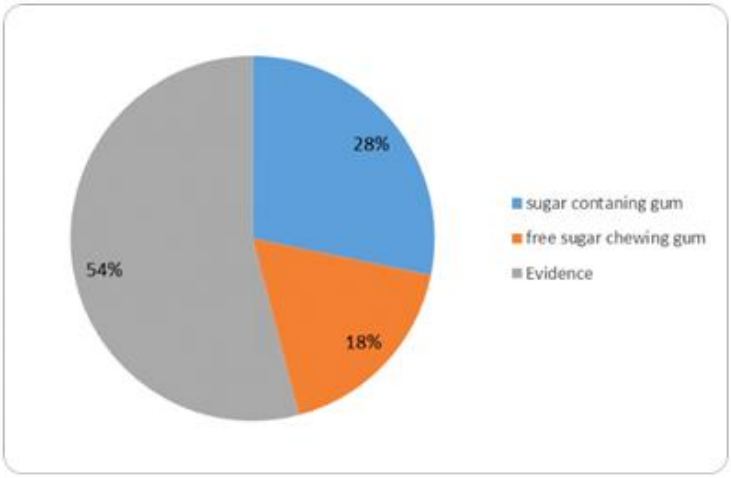

Fig. 2a.

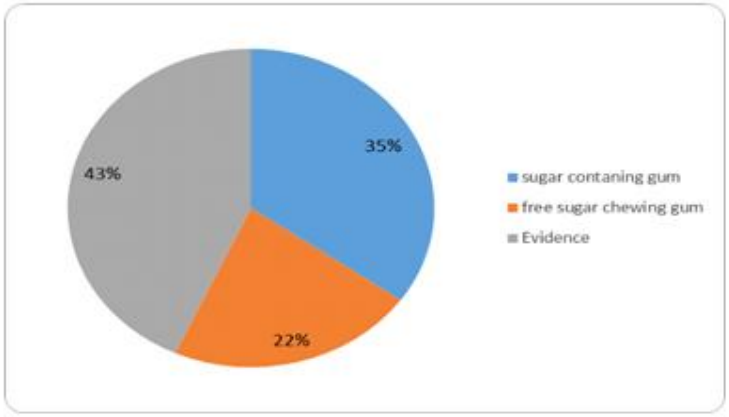

Fig. 2b.

Fig. 2(a,b). The Comparison of the mean and standard deviation of the plaque accumulation in three groups using LSD

Among the sugars used in these studies, Xylitol had the most significant effect on controlling and reducing caries.

Karami et al. found that during three weeks, chewing both gums immediately after a meal reduced the number of *Streptococcus mutants*, and this reduction after seven weeks would be more significant [5].

In another study (with a similar design), the results showed that chewing Gum containing sucrose along with oral hygiene could lead to reducing plaque buildup by 40%. However, this reduction for free sugar gum is 15% and its effect is about 81% higher than that of sucrose-containing gum [6].

Thaweboon et al. found that chewing gum containing Xylitol, sorbitol, and even sucrose-containing gums were effective in reducing caries, which is compliant with the results of the present study [9].

Besides, the results of the present study showed that daily chewing was five gums containing sugar (Dubble Bubble) in the above conditions as well (although less than sugar-free gum) significantly reduces plaque buildup compared to the control group. On the other hand, Edgar found that chewing Gum containing sucrose, unlike chewing Gum containing Xylitol and Sorbitol, leads to dental caries [10].

Stookey and Van Loveren found an increase in saliva secretion resulted from chewing sugar-free gum after a meal is more effective than its ingredients in preventing decay sent format [12,13].

Loesche stated that chewing Gum containing a small amount of Xylitol (5 mg in a day) for four weeks significantly reduced the plaque compared to the control group, which is similar to the results of the present study [14]. In the present study, the results show daily chewing of 5 free sugar gums (orbit) for 20 minutes after meals and main meals, during four days and in the absence of all oral hygiene measures, significantly reduces the accumulation of dental plaque compared to the controlled group. This finding is compliant with the results of studies by Wennerholm et al., Twetman et al. and Szoke et al.

Barnes et al. suggested that chewing gum as a proper means of oral hygiene in the absence of brushing [18]. The results of the present study also show that both chewing gums are effective in reducing the accumulation of microbial plaque on teeth.

Wennerholm et al. studied about four types of chewing Gum with different amounts of Xylitol and sorbitol (21 chewing gums per day for 25 minutes) showed that all chewing gum reduces plaque and increases pH [19]. This effect is also highlighted by increasing the percentage of Xylitol.

Isotupa et al. considered patients who had fixed orthodontic treatment and showed that continuously chewing gums in the Polyol group, mainly containing Xylitol, can have a significant effect on reducing caries [20].

The results of a study by Twetman et al. Showed that chewing Gum containing Xylitol and Gum containing sorbitol and mannitol reduced plaque buildup and salivary acid [21].

Beiswanger et al. evaluated the effect of consumption of sucrose-free chewing gum after meals on tooth decay in children, in fifth to seventh grade. The results show that chewing free sugar chewing Gum after meals in children, who are high risk regarding dental caries, significantly reduce the risk of developing tooth decay [22].

Szöke et al., in a two-year clinical study, from 547 students asked to chew the gum containing sorbitol three times a day after meals for 15 to 20 minutes, but no chewing gum was given to the students who were part of the control group. After two years, dental caries was 38.7% lower in students who chewed gum than in students who had chewed gum. If they Considered the white spots, this decrease would be 33.1%. These results suggest that even in societies with low and mild caries prevalence and communities with excellent oral and regular hygiene (which can prevent tooth decay), people using toothpaste containing fluoride [23].

Other research has shown that chewing sugar-free gum immediately after taking sucrose neutralizes the resulting acid and increases the pH of the plaque [24].

Similarly, the results of the present study showed the same finding between two gums, such as containing sorbitol and sucrose. In contrast, there

are significant differences between free sugar gum and chewing gum containing sucrose. Cosyn and Verslet stated that placebo chewing gum had a significant reduction in plaque buildup in the palatal and lingual areas, but did not affect plaque accumulation in the buccal region [16].

Hoerman et al. studied the effect of chewing gum containing sorbitol and sucrose on the growth of plaque accumulation in 91 students who had no prior prophylaxis, no oral hygiene measures during the period of study. The number of chewing gum chewed per day was based on students' demanding (average 3.8 per day). The result showed that both chewing gums reduced plaque buildup for five days [24].

Considering the results of the present study, chewing gum, in general, seems to be effective in reducing plaque accumulation, especially in the lack of oral hygiene measures, especially after meals and snacks. Since the free sugar chewing gum in this study showed a significant difference in terms of plaque accumulation compared with chewing gum containing sucrose, replacing sucrose with Xylitol had a considerable effect on reducing the impact of chewing gum.

5. CONCLUSION

Although the effect of free sugar gum is more significant than that of gum-containing sugar in reducing plaque accumulation. Chewing gum, even sugar-containing gum, in the lack of oral hygiene measures is effective in reducing the prevalence of dental caries. Based on the available evidence, the chewing of sugar-free gum after meals has been recommended as a way to prevent caries, even if no oral hygiene can be performed.

DISCLAIMER

The products used for this research are commonly and predominantly use products in our area of research and country. There is absolutely no conflict of interest between the authors and producers of the products because we do not intend to use these products as an avenue for any litigation but for the advancement of knowledge. Also, the research was not funded by the producing company rather it was funded by the personal efforts of the author.

CONSENT

As per international standard or university standard, patient's written consent has been collected and preserved by the author(s).

ETHICAL APPROVAL

As per international standard or university standard written ethical approval has been collected and preserved by the author(s).

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COMPETING INTERESTS

Author has declared that no competing interests exist.

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