

Research Report

The influence of xylitol containing toothpaste on plaque formation inhibition on fixed bridge

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ABSTRACT

Background: Plaque is the main cause of teeth and periodontal tissue damage, which usually accumulates on crown surfaces. To avoid this, plaque control is the best way that not only has a close connection to oral hygiene but also become important element in dental practice. Previously, xylitol was used as alternative sweetener for diabetic patients, but later it is used to maintain healthy teeth. Xylitol is capable to inhibit *Streptococcus mutans* growth which changes sugar and other carbohydrate into acid, because xylitol cannot be fermented. **Purpose:** This study was aimed to understand the inhibition capability of toothpaste containing xylitol to plaque formation on fixed bridge. **Methods:** This clinical experiment study was carried out in fifteen patients wearing fixed bridge at Prosthodontics Department, Faculty of Dentistry, Airlangga University in Surabaya from 2005 to 2008. Samples were based on selective random sampling technique. Plaque index was analyzed by Mann Whitney test. **Result:** This study showed that there was significant difference of plaque scores in patients who brush their teeth using xylitol containing toothpaste compared to the control group (placebo). **Conclusion:** Xylitol was capable to inhibit plaque formation on fixed bridge.

Key words: xylitol, fixed bridge, plaque

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INTRODUCTION

Tooth lost due to caries or other periodontal diseases must be replaced to maintain good oral health. One of many dental treatments to handle is the making of fixed bridge. This treatment is needed to improve aesthetic, mastication function, and maintain oral health after tooth loss.

The success of fixed bridge is determined from treatment planning, pontic design, abutment teeth preparation, cement choice which doesn't destroy tooth and gingiva, harmonious occlusion, aesthetic terms, and the ability of patient to maintain oral hygiene to avoid teeth and periodontal damage.¹ Restoration with fixed bridge must be able to reduce the plaque adherence while support periodontal tissue health.² Plaque accumulation under fixed denture pontic could inflame the underlying mucosa.³ Therefore the success and failure of fixed denture solely depend on the health of underlying tooth and bone structure.

The main cause of tooth and periodontal damage are plaque on tooth crowns. Plaque control is the best way and closely related to oral health as the main element in dental practice, because every patient is responsible for his or her own oral health.

Plaque consists of organic and inorganic material in solid form and about 20% of plaque is water. Almost 70% bacteria live in the solid form and the rest in intercellular matrix. Organic solid matter contains complex polysaccharide protein with main component of carbohydrate and protein 30%, lipid 15%, and the rest is still not known.³

According to Manson,⁴ there are two methods to eradicate dental plaque, chemically and mechanically. From both ways, the mechanical through brushing with tooth brush or other devices is more important. Mechanical cleaning with toothbrush and other devices is the most effective method in plaque control and calculus inhibition. Tooth brushing only will not inhibit new plaque

accumulation.⁴ Previous researches have been done on chemical substances which inhibit or reduce plaque and calculus formation.³

At first xylitol was used as alternative sweetener for diabetic patients.⁵ Presently this sweetener is used as alternative to maintain healthy teeth. Xylitol could inhibit *Streptococcus mutans*' growth while processing other sugar and other carbohydrates into acid. This could happen because xylitol is not fermented by the bacteria.⁶

Some superiority of xylitol compared to other sweetener are that xylitol is unable to be fermented by oral bacteria, capable of reducing caries, plaque, increasing saliva production, replacing fluoride in toothpaste, has acceptable taste without leaving unwanted aftertaste, and producing lower calories compared to sucrose or cane sugar. One gram of xylitol produce 2.4 calories. This number is lower than sucrose which produce 4 calories/gram energy. Consuming 5–10 grams of xylitol per day is still considered save.⁷ Xylitol inhibition could reach 90%. Xylitol effectiveness is optimal if contained more than 50% in a product. In Indonesia, xylitol is produced from agricultural waste like rice, corn, or cane waste.⁷

The purpose of this research was to know the influence of xylitol in toothpaste as fixed bridge plaque inhibitor.

MATERIALS AND METHODS

This research was clinical experimental study on fixed bridge patients who were treated in Prosthodontics Department Clinic, Faculty of Dentistry, Airlangga University, Surabaya, during 2005–2008 period, with selective random sampling method. The materials used in this research were xylitol containing toothpaste (Ciptadent) and placebo toothpaste. This xylitol toothpaste contains calcium carbonate, dicalcium phosphate, silica, sorbitol, propylene glycol, xanthan gum, sodium laurylsulphate, sodium saccharine, sodium monofluorophosphate, sodium fluoride, methyl paraben, flavor, vitamin A, vitamin C, vitamin E, xylitol, and aqua.

Placebo toothpaste contains cellulose 2%, sorbitol 40%, saccharine 0,2%, flavor 1%, surfact 2%, preservatives 0,2%, carbonate 15%, precipitate silicone 20%, titanium dioxide 0,2% and water ad 100%. Other materials were disclosing solution, polishing material, and cotton.

On the first day, fixed bridge were polished with rubber and brush therefore the plaque score = 0. At home, subjects were instructed to brush their teeth with placebo toothpaste 1 cm on toothbrush with roll method for 2 minutes, followed by 30 seconds gargle. Subjects were instructed not to eat but allowed to drink plain water after polishing and tooth brushing until after 4 hours (in Prosthodontics Department Clinic, Faculty of Dentistry, Airlangga University). The fixed bridges were given disclosing solution by gargling for 30 seconds, and then the plaques were scored. Subjects were not given any treatment for 1 week to condition the oral cavity to normal. After that, teeth brushing were done

with xylitol toothpaste according to above step and the plaques were scored.

RESULT

Sample's plaque score on 15 patients with 3 units fixed bridges in Prosthodontics Department Clinic, Faculty of Dentistry, Airlangga University, Surabaya during 2005–2008, according to sample category and after teeth brushing with placebo toothpaste and xylitol toothpaste was shown on Table 1. The plaque were scored using plaque index from Turesky-Gilmore-Glickman.

Table 1. Means and standard deviation of sample's plaque score after teeth brushing with placebo toothpaste and xylitol toothpaste after 4 hours

	Mean	SD
Placebo	0.80	0.13
Xylitol	0.22	0.18

Samples' plaque score after brushing with xylitol toothpaste is lower than with placebo toothpaste. Normality test with Kolmogorov-Smirnov test showed that all group has normal distribution ($p > 0.05$). To know the difference of patients' plaque score between patients who brushed their teeth with placebo toothpaste and xylitol toothpaste, Mann Whitney test was performed, the result was shown on Table 2.

Table 2. Mann Whitney test result on patients' plaque score between brushing with placebo toothpaste and xylitol toothpaste

	Toothpaste	Mean	SD	$p > 0.05$
Plaque score	Placebo	0.80	0.13	0.000
	Xylitol	0.22	0.18	

There was significant difference on patients' plaque score between brushing with placebo toothpaste and xylitol toothpaste. Hypothesis can be tested using hypothesis test. On hypothesis test, first the placebo and xylitol result must be counted and put into formula, finding $Z = 4.60$. Since counted $Z (4.60) > Z$ from table (1.96), H_0 was rejected. H_0 is zero hypothesis which means there was no difference between patients' plaque score which brushed with placebo toothpaste and xylitol toothpaste. Hypothesis test showed significant difference on patients' plaque score between brushing with placebo toothpaste and xylitol toothpaste.

DISCUSSION

In this research, the plaque was checked four hours after teeth brushing, because bacteria colony was formed on tooth surfaces within four hours.³ Before treatment,

the fixed bridges were polished to get plaque score = 0. Subjects were given the same toothpaste and were told the same brushing method (Roll technique). These were done to reduce heterogeneity. Subjects were asked not to consume food for four hours after brushing till examination.

This research showed difference in plaque formation between patients who brushed their teeth with placebo toothpaste and xylitol toothpaste. Plaque formation was less in patients who brushed their teeth with xylitol toothpaste. Statistic analysis using Mann Whitney Test showed $p = 0.000$. This result is smaller than half $\alpha = 0.025$. This is true according to Edgar⁶ who stated that xylitol was not fermented by many microorganisms, which cause plaque former microorganisms cannot live. Beside that, xylitol is artificial sweetener and grouped into sugar alcohol. Xylitol is more stable in chemical structure and enzymatic compared to other sweeteners. This made xylitol hard to be fermented by bacteria, therefore oral pH could be maintained.⁶

This research proved the use of xylitol containing toothpaste has effect on plaque decrease of patients with fixed bridge, this can also help avoid caries and plaque formation. Xylitol can also increase saliva production hence could remineralize tooth decay from bacterial demineralization. Xylitol cannot be fermented into cariogenic acid and showed caries decrease by inhibiting *Streptococcus mutans* growth.⁸ Other positive value of xylitol is the use as sucrose replacement sweetener since 1983 because xylitol has low calories, therefore it is save for diabetic mellitus patient consumption.⁷

There are some weaknesses in this research which can reduce research validity, such as how to make sure that the subject did not drink or eat during research, which must be controlled well. If patients eat or drink, they will influence the result. During plaque scoring, there might be different results between individuals, even though generally

bacteria colony formed after four hours, still there were variations.

From the observation after brushing with experiment toothpaste or placebo, it was seen that plaques were found most under pontic and metal part near gingival, while there are less found on the porcelain part. This is according to Hanoem⁹ which stated that plaque stick easier on metal than on porcelain.

Through observing this research and data analysis, it can be concluded that the use of xylitol containing toothpaste was effective to reduce the plaque index on fixed bridge.

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