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Research Report

Comparison between probiotic lozenges and drinks towards periodontal status improvement of orthodontic patients

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ABSTRACT

Background: *Fixed orthodontic appliances may interfere with daily oral hygiene procedure, causing more abundant plaque accumulation, therefore increasing the risk of periodontal disease. Probiotic methods represent a breakthrough approach in maintaining oral health and preventing periodontal disease.* ***Purpose:*** *The aim of this study was to compare the effect between probiotic lozenges containing Lactobacillus reuteri and probiotic drinks containing Lactobacillus casei strain Shirota towards periodontal status of orthodontic patients.* ***Method:*** *Fixed orthodontic patients (n=30) from Faculty of Dentistry, Trisakti University Dental Hospital were included in this clinical trial. Periodontal status consisting of Plaque Index (PlI), Interdental Hygiene Index (HYG), and Papillary Bleeding Index (PBI) were then recorded from each patient. All patients received the phase one of periodontal treatment, as well as plaque control instruction. The subjects (n=10/gp) were randomly assigned to one of three groups; control group; probiotic lozenges group (Biogaia®); and probiotic drinks group (Yakult®). For 14 days, the probiotic groups were instructed to use the probiotic. Periodontal index improvement (PlI, HYG, and PBI) was found in all groups after 14 days research periode. These indices were then analyzed using Kruskal-Wallis analysis test.* ***Result:*** *It was found that L. reuteri and L. casei strain Shirota may improve periodontal status in fixed orthodontic patients. The best results were obtained from probiotic lozenges group. However, the results were not statistically significant (p>0.05).* ***Conclusion:*** *It was concluded that probiotics consumption containing L. reuteri and L. casei strain Shirota may slightly improve periodontal status in fixed orthodontic patients.*

Keywords: *probiotics; Lactobacillus reuteri; Lactobacillus casei strain Shirota; orthodontic*

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INTRODUCTION

Malocclusion is one of the most common oral health problems. Orthodontic treatment may correct malocclusion or prevent them from progressing, but it also holds some potential harm to teeth and periodontal tissues.[1] Orthodontic brackets and elastics may interfere daily oral hygiene procedure which may lead to plaque accumulation and gingival inflammation.[2] Plaque retention surrounding orthodontic appliances leads to enamel demineralization caused by organic acids produced by bacteria in the dental plaque.[3] This leads to oral cavity changing of orthodontic patients, such as pH reduction, developed larger number of sites available for *Streptococcus mutans* accumulation, and increased accumulation of food particles.[4] The changes in the microbial environment after the placement of fixed orthodontic appliances are accompanied by increased gingivitis.[5] To prevent harmful risks of orthodontic treatment on periodontal and gingival tissues, better oral hygiene programs during orthodontic treatment were strongly recommended.[3]

Recently, a new method in dentistry is found to preserve oral health, known as probiotics.[6] Probiotics are defined as living microorganisms which when administered in adequate amounts (in food or as a dietary supplement) confer a health benefit on the host.[7] Probiotics use in oral health is still a novel method.[8] Probiotic bacteria maintaining oral health by competing against oral pathogens

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for nutrients, growth factors and site of adhesion. Once adhered to the oral cavity, probiotic bacteria aggregate and inhibit the adhesion of the harmful microorganisms by producing bacteriocins or other antimicrobial compounds such as acids or peroxides. Consequently, probiotics help to prevent the inflammation of oral cavity and the oral tissue destruction by oral pathogens.[9]

Probiotic methods represent a breakthrough approach in maintaining oral health and preventing periodontal disease by using beneficial bacteria, specifically lactic acid bacteria, such as *Lactobacillus* and *Bifidobacterium*.[6] Probiotics are administered in some products, such as beverages and food, dairy products, or dietary supplements.[10] Probiotic lozenges containing *Lactobacillus reuteri* (*L. reuteri*) is one of the edible probiotic products. Krasse *et al.*[11] suggested that *L. reuteri* was effective in reducing both gingivitis and plaque in patients with moderate to severe gingivitis. Vivekananda *et al.*[12] reported about plaque inhibition, anti-inflammatory, and antimicrobial effects of probiotic lozenges containing *L. reuteri.* It can be recommended during non-surgical therapy and maintenance phase of periodontal treatment. The other product that also has the beneficial effect towards oral health is probiotic drink containing *Lactobacillus casei.* A recent study by Slawik *et al.*[13] showed that daily consumption of a probiotic milk drink containing *L. casei* strain *Shirota* (LcS) reduce the effects of plaque-induced gingival inflammation.

Either probiotic lozenges or probiotic drinks are known for their beneficial effect towards periodontal problems, including inhibition of plaque formation. However, there was no existing research that compares directly the effectiveness between both products. The aim of this study was to compare the effect between probiotic lozenges containing *L. reuteri* and probiotic drinks containing LcS towards periodontal status of fixed orthodontic patients.

MATERIALS AND METHODS

The subject of the research consists of 30 healthy non-medicating orthodontic patients, with the age range from 18-25 years, who had been undergoing orthodontic treatment used fixed orthodontic appliances for at least 1 year. The subjects volunteered after verbal and written information. All subjects were outpatients at Faculty of Dentistry Trisakti University Dental Hospital and had signed an informed consent form. Habitual consumers of xylitol chewing gums and mouthwash, smokers, pregnant women, and subjects with systemic antibiotic or topical fluoride treatments were excluded from this study.

This clinical trial was approved by the Ethics Committee of Trisakti University, Jakarta, Indonesia. All patients were received the first phase of periodontal treatment, including scaling and root planning, as well as plaque control instruction. The subjects (n=10/gp) were randomly assigned to one of three groups; (I) control group; (II) probiotic lozenges group (Biogaia®); and (III) probiotic drinks group (Yakult®). The periodontal status, such as plaque index (PlI), interdental hygiene index (HYG), and papillary bleeding index (PBI) was measured before and after consuming both probiotic products for 14 days.

The probiotic lozenges (Biogaia Prodentis®, Sweden) contained *L. reuteri* Prodentis. One lozenge consists of a minimum of 200 million live *L. reuteri* Prodentis. The subjects were instructed to consume 1 lozenge per day at least 1 hour after lunchtime. The other study product was the fermented milk probiotic drink (Yakult®, Japan), contained LcS. Each 65 ml bottle of the fermented milk drink contained a minimally of 6.5 million viable cells of LcS. Subjects were advised to consume a bottle per day, slowly taking small sips through a thin straw (3 mm in diameter) at least 1 hour after lunchtime. Moreover, the participants were advised to keep their supply refrigerated, in order to preserve the viability of the probiotic bacteria. A leaflet containing information to store the product correctly and how to brush their teeth regularly with Bass technique was also provided to the participants.

Pre- and post-treatment values are counted by consuming probiotic products within each parameter (PlI, HYG, PBI) were compared and analyzed with nonparametric test (Kruskal-Wallis Test). A value of ($p<0.05$) was considered statistically significant.

RESULTS

All clinical data were collected between October-December 2014 at Faculty of Dentistry Trisakti University Dental Hospital. Primary data collected from examination of the periodontal status of 30 fixed orthodontic patients.

As shown on Table 1, the mean PlI of control group were decreasing from 1.19 to 1.03 while the lozenges group were decreasing further from 1.22 to 0.91. Probiotic drinks group were also decreasing from 1.01 to 0.67. The mean HYG of control group were increasing from 0.69 to 0.77, probiotic lozenges group were increasing from 0.64 to 0.79, and probiotic drinks group were increasing from 0.69 to 0.83. The mean PBI of control group were decreasing from 0.82 to 0.58, probiotic lozenges group were decreasing from 1.01 to 0.67, and probiotic drinks group were also decreasing from 0.49 to 0.43. The best results were obtained from probiotic lozenges group.

Data was analyzed using SPSS Statistics. Kruskal-Wallis Test method was applied to the results, statistical analysis showed that there was no significant difference ($p>0.05$) between the study and control group.

DISCUSSION

Treatment with fixed orthodontics appliances usually related to alterations in the oral hygiene and periodontal health. It may increased plaque accumulation and interferes with effective daily oral hygiene procedure. Periodontal

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Table 1. Mean (± standard deviation) of plaque index, hygiene index, and bleeding index outcome measures at baseline and 14 days on 3 treatment groups (n=30)

Parameter	Time point	Treatment group			p-value
		Control	Biogaia®	Yakult®	
		SRP	SRP+P1	SRP+P2	
		Mean ± SD	Mean ± SD	Mean ± SD	
Plaque index	Baseline	1.19 ± 0.41	1.22 ± 0.46	1.01 ± 0.45	0.173
	14 days	1.03 ± 0.29	0.91 ± 0.42	0.76 ± 0.48	
HYG	Baseline	0.69 ± 0.17	0.64 ± 0.22	0.69 ± 0.24	0.196
	14 days	0.77 ± 0.14	0.79 ± 0.12	0.83 ± 0.13	
PBI	Baseline	0.82 ± 0.61	1.01 ± 0.62	0.49 ± 0.45	0.053
	14 days	0.58 ± 0.36	0.67 ± 0.77	0.43 ± 0.54	

Explanation: PlI= Plaque Index (Silness and Löe); HYG= Interdental Hygiene Index; PBI= Papillary Bleeding Index (Saxer and Mühlemann); SRP= scaling and root planning; SRP+P1= scaling and root planning + probiotic lozenges; SRP+P2= scaling and root planning + probiotic drinks; p-value= (p>0.05) : not significant.

complications, such as gingivitis and gingival enlargement, are reported to be one of the most collateral damage related to orthodontics.[14] Plaque considered to be the main aetiological factor in the initial, development, and reoccurrence phase of periodontal disease.[15]

Nowadays, a treatment method towards periodontal health such as probiotic has proposed to modify pathological plaque to biofilm of commensalisms. Probiotics defined as a living microorganisms administered in adequate amounts with beneficial health effects on the host.[16] Probiotics tend to create a biofilm, acting as a defensive lining for oral tissues against oral disease. The mechanisms of probiotic action in the oral cavity are by keeping bacterial pathogens off of oral tissues and compeeting with cariogenic bacteria and periodontal pathogens growth in biofilm.[17]

Fixed orthodontic appliance might render maintaining oral hygiene more difficult. Due to these, the patients need to be effectively trained and motivated to achieve an adequate oral hygiene. This is done by placing the patients for regular check ups, improving their oral health during and until orthodontic treatment is finished. Preventive procedures such as plaque control, motivation, compliance, and implementation could bring a great impact in maintaining gingival health during orthodontic treatment.[18]

Twetman *et al.*[19] concluded that short-term intake (14 days) of probiotics reduced the pro-inflammatory cytokines in gingival crevicular fluid and due to this reason it could decrease the inflammation in the oral cavity. In this study, both control and study group encounter improving on plaque index score, hygiene index, and bleeding index after 14 days. This may be due to effective plaque control that supports better oral hygiene and periodontal treatment, with or without probiotic consumption. It has been shown that orthodontic patients from the average age of 18-25 years had low risk on periodontal disease if the patients could perform effective plaque control and preserves their oral health optimally.

The best improvement of periodontal status was obtained from probiotic lozenges group containing *L. reuteri,* followed by probiotic drinks group containing LcS and control group. Probiotic lozenges showed better improvement among other groups probably because *L. reuteri* has 2 types of 2 bacteriocyn, such as reuterin and reutericyclin. It contains antibacterial substances that inhibit pathogens growth and anti-inflammatory that inhibit secretion of cytokine pro-inflammatory.[20]

Both probiotic lozenges and probiotic drinks showed better improvement in result than control group. Probiotic lozenges are known to reduce production of acid formation, prevent adhesion and invasion of pathogens, and furthermore inhibit the pathogen growth itself.[6] Probiotic drinks are considered to modulate immune system, lower local pH, inhibit pathogen bacteria, and could adhere on teeth surfaces.[21] Probiotics inhibit plaque accumulation through producing antioxidants. These antioxidants are able to utilize the free electron needed in mineralization process. This might be one of the probiotic mechanisms to prevent periodontal disease. *Lactobacillus* species may suppress periodontal disease bacteria population growth. The presence of *Lactobacillus* reduces plaque accumulation and gingival inflammation.[9]

This study requires consuming probiotic lozenges for 14 days based on a previous study by Krasse *et al.*[11] that reported 14 days of consuming probiotic chewing gum containing *L. reuteri* is significantly reduce plaque index and gingivitis severity level. In the present study the result shows reduction in plaque index score, improvement in HYG score, and reduction in PBI score, although not statistically significant. This might be due to the differences use of methods, subject quantity, and population. Their study included 59 patients from moderate to severe gingivitis.

Consumption of probiotic lozenges for 42 days has beneficial effect towards nonsurgical therapy and

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maintenance phase in periodontal treatment. Probiotic lozenges inhibit the population of periodontopathogen bacteria, such as *Aggregatibacter actinomycetemcomitans*, *Prevotella intermedia*, *Porphyromonas gingivalis*, reduce plaque formation, and have anti inflammation and antimicrobial effect. All subjects received scaling and root planning treatment and probiotic lozenges on 30 chronic periodontitis patients included in the trials. They stated that it gave an effective improvement towards plaque index, gingival index, and papillary bleeding index. The difference in this result might be due to the population and time limit during study. Twetman *et al.*[19] mentioned that probiotic chewing gum containing *L. reuteri* has a positive contribution towards bleeding on probing on gingivitis patients. The study was participated by 42 gingivitis patiens. The subjects were instructed to chew the gum for 10 minutes for 14 days.

Probiotic drink consumption containing LcS for 14 days can improve plaque index, hygiene index, and bleeding index in all groups but the result was not statistically significant ($p>0.05$). This study is similar to the previous study by Staab *et al.*[22] that indicate the effectiveness of LcS towards periodontal index, such as plaque index and papillary bleeding index in 50 gingivitis patients. LcS may improve towards gingival health by reducing gingivitis severity level though the result was not statistically significant. According to Sutula *et al.*[23] on their in vitro studies using probiotic LcS showed an inhibition on the population of periodontopathogens bacteria such as *P. gingivalis* and *Fusobacterium nucleatum*. It can be concluded that probiotic consumption containing *L.reuteri* and *L.casei* strain shirota may slighthy improve periodontal status in fixed orthodontic patients.

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