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Comparison of Efficacy of Probiotic Toothpaste and Chlorhexidine Mouthwash to Reduce Streptococcus Mutans In Plaque Around Orthodontic Brackets

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ABSTRACT

Background: When basic oral hygiene is poor, orthodontic appliances create areas of plaque stagnation, especially around brackets, bands, wires, and other attachments; this facilitates the development of white spot lesions. Probiotics act by competitively inhibiting the pathogenic bacteria because they have greater adhesion to the tissues. Chlorhexidine is often used as an active ingredient in mouthwash designed to reduce dental plaque and oral bacteria**.**

Aim & Objective: The objectives of the study is to evaluate and compare the effects of the topical application of probiotic toothpaste and chlorhexidine mouthwash on the Streptococcus Mutans levels in the plaque of orthodontic patients hence improving the oral micro-flora of oral cavity by competitive inhibition of Streptococcus Mutans in plaque present around brackets.

Material & Method: The study consists of thirty randomly selected patients having orthodontic treatment. The study was initiated on a selected sample of 30 patients who were undergoing fixed orthodontic treatment. The patients were divided into three groups - Control Group, Probiotic Toothpaste Group & Chlorhexidine Mouthwash Group. Samples were collected at two times: before the study began (Phase 1) and after thirty days (Phase 2).

Conclusion: Chlorhexidine Mouthwash and Probiotic Toothpaste both were efficient in reducing Streptococcus Mutans in plaque around orthodontic brackets when compared to control group

Keywords: White Spot Lesion, Probiotics, Chlorhexidine, Streptococcus Mutans.

INTRODUCTION

Orthodontic appliance causes increase in plaque accumulation, especially around brackets, wires and attachments. Advances in orthodontics in recent time have led to improved quality of appliance and treatment procedures ultimately resulting in improvised standard of patient care [1], still, the problem of white spot lesion still presents as a common orthodontic challenge. Levels of acidogenic bacteria, present in the plaque, notably Streptococcus mutans, are higher in orthodontic

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patients as compare to non-orthodontic patients.[1] These bacteria metabolize different kind of carbohydrates accumulated around orthodontic appliances and create acidic environment in the oral cavity leading to enamel demineralization around the brackets and white spot lesions. The World Health Organization defined **Probiotics** as "live micro-organisms which, when administered in suitable amounts, render a health benefit on the host. [2,3] Probiotics are microorganisms that have claimed health benefits when consumed. Lactic acid bacteria (LAB) and bifidobacteria are the most common types of microbes used as probiotics. Their primary mode of action involves lowering gut pH thereby limiting the proliferation of pathogenic bacteria, competing for pathogen binding on receptor sites, and modulation of the local and systemic inflammatory immune response. Probiotics are commonly consumed as part of fermented foods with specially added active live cultures, such as in yogurt, soy yogurt, or as dietary supplements. **Chlorhexidine** is the most common anti-plaque agent used in dentistry and has been advocated to prevent the occurrence of white spot lesions among orthodontic patients. This study was carried out to evaluate and compare the efficacy of probiotic toothpaste and chlorhexidine mouthwash in patients undergoing orthodontic treatment with individuals who are not using them.

AIM & OBJECTIVES

The objectives of the study are to evaluate and compare the effects of the topical application of probiotic toothpaste and chlorhexidine mouthwash on the Streptococcus Mutans levels in the plaque around the brackets of orthodontic patients.

MATERIAL & METHOD

Thirty patients undergoing orthodontic treatment with Pre-adjusted orthodontic appliance (0.022 MBT; 3M Unitek, Monro- Via, Calif) were selected randomly. These patients were divided into three groups of ten patients each; Group 1: - Control Group; Group 2: - Probiotic Toothpaste; Group 3: - Chlorhexidine Mouthwash.

Samples were collected at two different occasions: A) Before the study began (Phase 1); B) After thirty days (Phase 2). The patients in the study were instructed to avoid chewing gums, any other mouthwashes and antibiotics during the study. Plaque specimens were collected from the labial surfaces immediately surrounding the orthodontic brackets of the maxillary lateral incisors using a 4-pass technique **(Fig 1)** [4]. Patients in Group 1**(Fig 2)** followed the regular oral hygiene protocol (brushing twice daily with a regular toothpaste). They were not given probiotic toothpaste or chlorhexidine mouthwash. These patients were instructed not to use any medicated toothpaste or mouthwash during that one-month period of study. Group 2 (*Probiotic toothpaste Group*) **(Fig 3)** patients were asked to brush twice daily with given probiotic toothpaste. Group 3 (*Chlorhexidine mouthwash Group)* **(Fig 4)** patients were asked to rinse daily with chlorhexidine mouthwash of 10ml without dilution for three times a day after meals (Breakfast, Lunch Dinner) for 3-4 minutes and were asked not to eat or drink anything for half-an-hour. These patients were asked to use their regular toothpaste along with the given mouthwash.

RESULT

Comparisons of the reduction in S mutans in the samples before the study and after 30 days, and comparisons among the 3 groups, were done using a 2-tailed chi-square test for categorical data. $P < 0.05$ was considered statistically significant. The data analysis in the current study showed, that before treatment in all the three groups there was an increase in bacterial load. After the treatment, there is a decrease in the bacterial load in the Probiotic toothpaste group (Group 2) and CHX treated group (Group 3). The proposed study shows that the probiotic toothpaste & chlorhexidine mouthwash causes a significant decrease in the S mutans levels in the plaque around brackets in orthodontic patients. (Graph 1) **(Fig 5)** [Interpretation of chart is given in **Fig 6**].

DISCUSSION

The specialty of orthodontics has seen a sea of changes in recent decades with advancements in biomaterials and increase understanding of biomechanics but the challenge of white spot lesions continues. It is an established fact that fixed appliances increase bacterial plaque accumulation and the risk for white spot lesions. [5,6,7,8] Enamel demineralization or white spot lesions could be a

common esthetic problem associated with the orthodontic treatment and the risk increases when

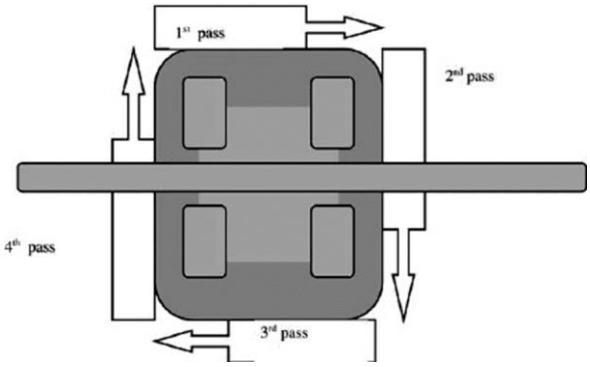

Fig 1: Four Pass Technique.

Fig 2: Control Group.

Fig 3: Probiotic Toothpaste Group.

Fig 4: Chlorhexidine Mouthwash.

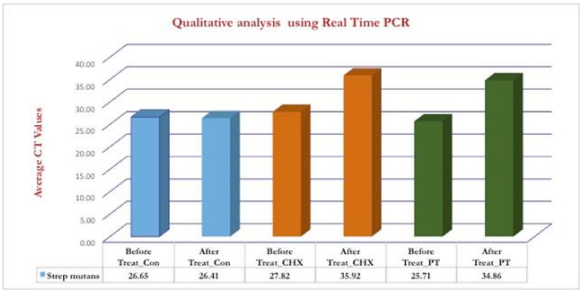

Fig 5: Result Graph.

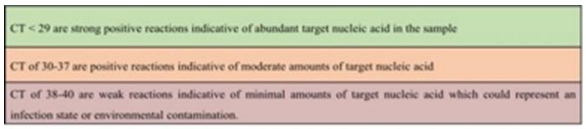

Fig 6: Result Interpretation

the patient's oral hygiene is poor. The organic acids produced by cariogenic microorganisms in the oral cavity are mainly responsible for enamel demineralization and the development of white spot lesions. The prevalence of white spot lesions was reported to be as high as 50% in some patients. [9]

Several methods have been employed to reduce the plaque formation, such as toothbrush technique, various forms of fluoride toothpastes and mouthwashes, varnish, gels, sprays. Countless measures have been advocated to achieve continuous fluoride release during orthodontic treatment; fluoride-releasing elastomeric chains, ligature ties, glass ionomer cement and composites but their efficacy is questionable. Many other methods, including antimicrobial and antibiotic therapies, have been tried, but their efficiency lasts only as long as they are supplied at regular intervals. The importance of fluoride in the prevention of development of white spot lesions has been well documented in the literature [10]

Chlorhexidine is a known antiplaque agent amongst dentists, which reduces plaque formation ultimately leading to decrease in white spot lesions. They function by inducing bacteriostatic action as a result of adsorption to the pellicle coated enamel surface. [11]. It is a potent antimicrobial agent particularly against mutans streptococci; sodium fluoride along with its anti-microbial property has remineralization potential and super added effect in adjunct to chlorhexidine for combating mutans streptococci. Efficacy of antimicrobial agents not

only depends on the potency of active ingredients but also on many other factors such as residual salivary anti-bacterial activity, time duration for re-colonization and return to the pre-rinse levels of mutans streptococci.

The probiotics can be considered an efficient alternative that could be available in regular dietary supplements without causing major side effects. [12] Probiotics mainly contain the Lactobacillus, These Lactobacillus genus has over 125 species and is a major part of the lactic acid bacteria group, named as such because most of the strains convert lactose into lactic acid. Their primary mode of action involves lowering gut pH thereby limiting the proliferation of pathogenic bacteria, competing for pathogen binding and receptor sites, and modulation of the local and systemic inflammatory immune response

This study was primarily conducted to compare the efficacy of probiotic toothpaste and to compare it with chlorhexidine mouthwash in orthodontic patients. The data was collected by running polymerase chain reaction on the plaque samples collected, and were compared by their Cycle Threshold (CT) values. Cycle Threshold Value was important in our study, as it was used to quantify the Streptococcus Mutans colonies in the sample by polymerase chain reaction test. CT value < 29 indicated abundant target nuclei i.e. increase number of Streptococcus Mutans colonies in the plaque sample; CT of 30 – 37 indicated moderate amount of target nuclei and CT of 38 – 40 indicated minimal amount of target nuclei i.e. lessen number of Streptococcus Mutans in plaque sample.

Krasse *et al.* [13] conducted a study which resulted in significantly reduced gingival index and bacterial plaque amount in patients which were treated with doses of Probiotic Formulation containing L. reuteri than in a placebo group and concluded that probiotic was effective to reduce gingivitis and bacterial plaque deposition in patients with moderate-to-severe gingivitis. **Twetman *et al.*** [14] assessed its effects on crevicular fluid volume, cytokine levels, and bleeding on probing by using L. reuteri-containing chewing gum in 42 healthy patients and concluded "Crevicular fluid volume and bleeding were significantly reduced". **Shimazaki and colleagues** [15] used epidemiological data to appraise the relationship between periodontal health and the consumption of dairy products such as cheese, milk and yoghurt and concluded that "individuals who consumed yoghurt and beverages high in lactic acid showed lower probing depths and less loss of clinical attachment than those individuals who consumed few of these dairy products". The findings in these studies suggested that probiotics and the bacteria associated with it significantly improve the periodontal health, results of which were similar to our study. In our study mean Cycle Threshold value for probiotic group after use of probiotic for 30 days was 34.86 which was increased significantly (Baseline Value 26.65 – 27.82), P = 0.05 (P < 0.05 was statistically significant) indicating reduction in streptococcus mutans level.

Chlorhexidine has shown highly significant reduction in the mutans streptococci count in orthodontic patients. [16,17,18]. When compared between sodium fluoride mouth rinse and chlorhexidine mouthrinse, CHX was found to be more effective. [16,17] The similar results were seen in our study where cycle threshold value after 30 days was 35.92 (Baseline Value was 26.65 – 27.82), which was suggestive of statistically significant decrease in streptococcus mutans level.

This study was conducted to compare and evaluate the efficacy of Probiotic Toothpaste and Chlorhexidine Mouthwash. The results were almost similar in Probiotic Toothpaste Group and Chlorhexidine Mouthwash Group, with Probiotic Toothpaste being more efficient when compared to Chlorhexidine Mouthwash. It will be correct to say that both the groups were equally efficient in reducing the streptococcus mutans level in plaque around orthodontic brackets. Although the results were almost similar, the pros and cons of both Probiotic Toothpaste and Chlorhexidine Mouthwash cannot be overlooked. Probiotic Toothpaste being is the latest product in market and not easily available in toothpaste form. Moreover, the they do not provide a cost-effective solution to the problem. Although it can be found effortlessly in dietary supplements and do not exhibit any disadvantages. Chlorhexidine Mouthwash, in spite of the fact that they are easily available and are more economic. They have been known for few disadvantages such

as discoloration of teeth and metallic taste in prolong use. [19]

Our study revealed that Probiotic Toothpaste and Chlorhexidine Mouthwashes efficiently reduce the Streptococcus Mutans level in dental plaque during orthodontic treatment, which ultimately results in reduction in white spot lesion as well as dental caries as compared to control. Group 2 (Probiotics) showed marginally more efficacy than Group 3 (Chlorhexidine) but not significant clinically.

SUMMARY AND CONCLUSION

This clinical study was conducted to compare and evaluate the efficacy of Probiotic Toothpaste and Chlorhexidine Mouthwash in decreasing the Streptococcus Mutans levels in the plaque around the brackets of patients undergoing fixed orthodontic treatment. The CT Value of Group 2 and Group 3 were 34.86 and 35.92 respectively, indicating that there was an indistinguishable effect in reducing the Streptococcus Mutans count in both the groups.

To conclude, judicial use of Probiotic Toothpaste and Chlorhexidine Mouthwash will reduce the plaque accumulation around the bracket resulting into decrease in levels of Streptococcus Mutans thus decreasing chances of dental caries and white spot lesion.

CONFLICTS OF INTEREST

The authors declare they have no potential conflict of interests regarding this article.

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