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Microbial Growth on Two Different Ligation Systems using Mouthwash - A Comparative Study

Abstract

Objectives: Fixed or removable orthodontic appliances impede the maintenance of oral hygiene and result in plaque accumulation. Many studies have evaluated the effects of fixed orthodontic appliances on microbial flora and periodontal status, but only a few have evaluated the microbial flora on different ligation system. The aim of the present study is to compare the microbial growth on two different ligation system using mouthwash. **Materials & Methods:** Twenty orthodontic patients undergoing treatment with fixed mechanotherapy were selected for this study and were assigned randomly into two groups of 10 each. Amount of microbial colonization was evaluated from both right and the left sides of the maxillary dental arch at day 1 (after undergoing oral prophylaxis). Then the arch wire was ligated with split mouth technique using stainless steel ligature wire and elastomeric ring. Group II patients were instructed to use mouth wash (0.12% chlorhexidine i.e., perioguard) 10 ml for 60 seconds, 30 minutes after breakfast and 10 ml for 60 seconds before bed time. The subjects were instructed not to take any liquid or food into the mouth for at least 30 minutes after using the prescribed mouth rinse .Second culture was done at day 21 (21 days after arch wire was ligated). The aerobic and anaerobic bacterial count was then compared. **Results:** Unpaired "t" test showed significant difference in bacterial count between the two groups. **Conclusion:** The teeth ligated with elastomeric rings exhibited significantly greater number of both the aerobic and anaerobic microorganisms than the teeth ligated with steel ligatures in both the groups. The increase in growth of microorganisms was less in group II pateints than group I .

Key Words

Microbial growth; mouthwash; ligation system

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INTRODUCTION

The human mouth provides a suitable habitat for numerous bacterial genera, aerobic as well as anaerobic. The mouth presents a series of different microenvironments, each of which may be colonized by different microorganisms.[1] The development of dental plaque is associated with several environmental and individual factors including diet composition, oral hygiene, fluoride exposure, the quality of saliva, the composition of the oral microflora , and immune factors. Fixed or removable orthodontic appliances also impede the maintenance of oral hygiene, resulting in plaque accumulation.[2] Various chemical agents are used during the active phase of orthodontic treatment to reduce the bacterial plaque accumulation and decrease the occurrence of periodontal disease in these patients. These chemical agents are used adjunctively for orthodontic patients who have difficulty maintaining plaque control by mechanical means alone. Some commonly used chemical plaque control agents are Chlorhexidine, Cetylpyridinium Chloride, Listerine, Triclosan etc. The earliest applications of chlorhexidine for the control of plaque and gingivitis go back to 1970, when Löe and Schiött reported that the use of

Table I: Comparison of anaerobic log bacterial count difference between Group I and Group II

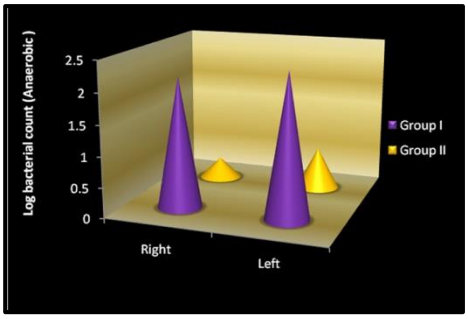
Log bacterial count	Group I	Group II	"p" value	Significance
Right	2.37±0.59	0.35±0.39	<0.001	S**
Left	2.16±0.62	0.69±0.34	<0.001	S**

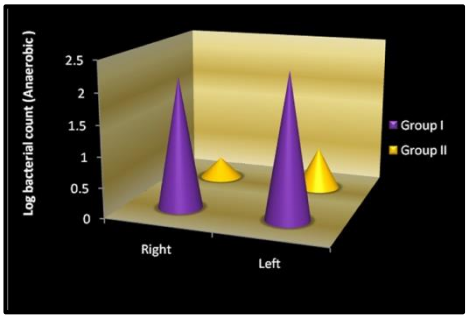
Table II: Comparison of aerobic log bacterial count difference between Group I and Group II

Log bacterial count	Group I	Group II	"p" value	Significance
Right	1.61±0.63	0.22±0.31	<0.001	S**
Left	2.47±0.71	0.12±0.34	<0.001	S**

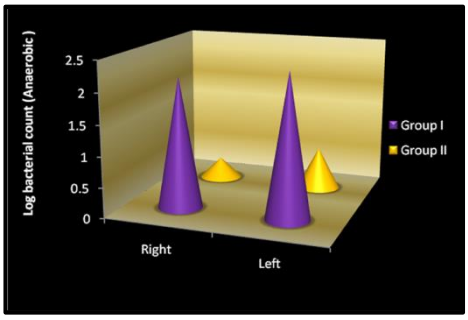
Fig. 1: Swab Collected From Buccal Surface of Maxillary Second Premolar Using Paper Point

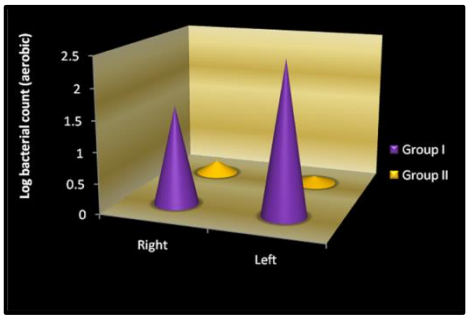
Fig. 1: Method of Collecting Elastomeric Ring and Stainless Steel wire





Graph 1: Comparison of anaerobic log bacterial count difference between Group I and Group II





Graph 2: Comparison of aerobic log bacterial count difference between Group I and Group II

0.2%Chlorhexidine Gluconate rinses, twice a day prevent plaque accumulation and subsequent gingivitis,[3] they reported development of hyperplastic gingivitis within 1 to 2 months after placement of appliances and even the detection of slight attachment loss 2 years after removal of the appliances, when patients have not been continually motivated regarding oral hygiene. However, if a thorough home care program is established, the inflammatory changes that may happen in the gingival tissues during orthodontic treatment can be reversed.[4] In a study by Fournier, Payantand Bouclin(1998)[5] adherence of streptococcus mutans to the orthodontic brackets, it was proved that saliva coating on bracket surface causes a decreased affinity for streptococcus mutans for all the products. A study for microbiological evaluation of elastomeric chain was done by Casaccia, Gomes, Alviano *et al*.[6] In this study the surface of elastomeric chains of different manufacturers were used to verify the presence of pathogenic microorganisms at the moment of unpacking and

analyse a possible inhibitory effect of the elastomeric chain when exposed to microorganisms of the oral cavity. It has been proved in various studies that different materials used in fixed mechanotherapy has different rate of microbial growth.[7-10] Among the different materials used in fixed mechanotherapy, two most commonly used materials for archwire ligation are stainless steel ligature wire and elastomeric rings. The purpose of this study is to evaluate the effect of mouthwash (0.12% chlorhexidine) on microbial colonization associated with two materials used for arch wire ligation.

MATERIALS AND METHOD

Twenty patients undergoing orthodontic treatment with following inclusive criteria were selected for this study.

The following inclusion criteria were used for patient selection:

a. Patients with age group of 11-25years.
b. Initial leveling and alignment completed.
c. Patient on round wires.
d. Patient undergoing fixed orthodontic treatment with brackets on their anterior teeth and bands on their molars.

The following exclusion criteria were used for patient selection:

a. Presence of decalcification of teeth.
b. Presence of anterior composites.
c. Presence of crowding.

The patients were instructed to brush once in the morning before breakfast and once in the evening before bed time. They were instructed to brush a minimum of three minutes to ensure thorough brushing. The patients were asked to thoroughly rinse with water after every meal and the group II patients were provided with one 500 ml bottle of o.12%Chlorhexidine gluconate (perioguard). These quantities were determined to be sufficient for a twenty one days investigation period.

METHOD OF COLLECTING SAMPLE

Samples were collected in two visits, labelled as day 1 and day 21.

1. On day 1 after the oral prophylaxis , the swab from the buccal surface of second premolar was collected from both the right and the left sides using sterile endodontic paper points placed on the surface of the tooth for 30 seconds (Fig 1). Immediately upon removing, the paper points were transferred to Robertson cooked meat media (RCM), used as the transport media.
2. After the swab was collected , the arch wire was ligated using split mouth technique i.e. on the right side from central incisor to second premolar one and a half inch long .009 steel ligature was used and grey conventional elastomeric modules were used on the left side from central incisor to second premolar.
3. On day 21 stainless steel ligature was collected from the right side and a module was collected from the left side of the dental arch (Fig 2), transferred to Robertson cooked meat media RCM, to be carried to microbiological lab.

RESULTS

The statistical analysis was carried out using SAS 9.2, SPSS15.0, Stata 10.1, MedCalc 9.0.1 and Systat 12.0. All bacterial counts were converted to log bacterial count for ease of statistical calculations. The mean and standard deviations of the bacterial counts values were calculated for both the groups. Aerobic and the anaerobic bacteria counts were recorded in the study and the data obtained at day 1 and day 21 ,between both the groups ,significant difference was found between day 1 and day 21(graph I and graph II) observations at 5% level of significance with respect to group I and group II (table I and table II). Unpaired “t” test for anaerobic log bacterial count between Group I and Group II (Table I) and for aerobic log bacterial count between Group I and Group II (Table II) showed significant difference between Group I and Group II observations at 5% level of significance with respect to right and left sides .

DISCUSSION

Primary dental care begins at home. Practicing satisfactory oral hygiene, such as adequate tooth brushing, mouth rinsing, and dental flossing, plays a vital role in maintaining healthy teeth, especially in the orthodontic patients.[11] It is a well known fact that the placement of fixed orthodontic appliances generally hinders good oral hygiene, and the appliance component can cause alteration in oral micro flora by reducing pH, increasing affinity of bacteria to the metallic surface because of electrostatic reactions, and causing retention areas for microorganisms. Thus they lead to plaque accumulation around the bracket base.[2,12,13] However, the contribution of ligation materials to this increase has only been evaluated in few studies. Forsberg et al14evaluated microbial colonization of 12 patients treated by fixed orthodontic appliances and reported that the lateral incisor attached to the arch wire with an elastomeric ring exhibited a

greater number of microorganisms in the plaque than teeth ligated with steel wire. They also reported a significant increase in the number of S. Mutans and Lactobacilli in the saliva after the insertion of fixed appliances. They recommended that the use of elastomeric ligation rings should be avoided in patients with inadequate oral hygiene because elastomeric ligation rings will significantly increase microbial accumulation on tooth surfaces adjacent to the brackets, leading to a predisposition for the development of dental caries and gingivitis. On the other hand, Sukontapatipark *et al*.,[4] and Turkkahraman[2]evaluated the microbial colonization of 20 patients. Upper second premolar was selected as the donor site, the sample was collected at three different time intervals. They found no significant difference between both materials regarding microbial contamination. The accumulation of supra gingival dental plaque on tooth surfaces is the major etiological component in the development of caries and periodontal disease. Numerous reports have documented that the flora change from primarily Gram-positive to Gram-negative bacteria in conditions leading to gingivitis. When mechanical plaque control is hampered, the chemical procedure remains the next best choice.

When it comes to chemical plaque control, there are various antimicrobial agents available and numerous studies have been done to evaluate the efficiency of these agents. In this study 0.12% chlorhexidine gluconate mouth rinse is used in orthodontic patients 11-25 year age group, during a 21 days period of twice daily use. All the subjects were evaluated on day 1 after thorough oral prophylaxis and oral hygiene instructions were given to them at the start of the study. The outcome of the current study indicate, that use of chemical mouth rinse as an adjunct to regular oral hygiene measures is effective in reducing the growth of anaerobic as well as aerobic microbial organisms thereby improving the oral health during the experimental period of 21 days . It is important to point out that the study population of both the groups was determined by random assignment. The result of the current study revealed that the teeth ligated with elastomeric rings exhibited greater number of aerobic as well as anaerobic microorganisms and the difference was found to statistically significant and mouth wash (0.12% chlorhexidine) had a significant role in reducing the microbial colonization . This result is in accordance with the study of Forsberg *et al*.,[14] evaluated microbial colonization of 12 patients but is in contrast with the study of Turkkahraman *et al*.,[2] evaluated the microbial colonization of 20 patients who found statistically not significant difference between elastomers and ligatures. A feasible explanation may be due to the difference in the study design i.e. in the present study at the 21 day the elastomeric ring and the ligature was cultured unlike the previous study were the swab from the labial surface of the tooth was taken and in this study anaerobic as well as aerobic culture was done whereas in previous study specifically the growth of streptococcus mutants and lactobacillus was evaluated. The present study was done to evaluate the amount of microbial colonization associated with two different materials used for arch wire ligation and the effect of mouth wash (0.12% chlorhexidine) in controlling the microbial colonization. Twenty subjects were selected for the study and were divided into two different groups randomly. All the subjects were brought to the baseline levels after receiving a thorough oral prophylaxis. Aerobic and anaerobic microbial culture was done of the swab collected from labial surface of upper second premolar from right and left sides after receiving through oral prophylaxis. On 21 day the stainless steel ligature wire was collected from second upper premolar of right side and elastomeric ring was collected from the second upper premolar of left side and aerobic and anaerobic microbial culture was carried out. The mean and standard deviation of both the groups were calculated and statistically analyzed. The teeth ligated with elastomeric rings exhibited significantly greater number of both the aerobic and anaerobic microorganisms than the teeth ligated with steel ligatures in both the groups.

CONCLUSION

The following conclusions were drawn from the study:

1. The anaerobic and aerobic bacterial count had increased significantly on day 21, in both the groups but, this increase was less in the group with 0.12% chlorhexidine digluconate mouth wash as compared to the control group without mouth wash.
2. The teeth ligated with elastomeric rings exhibited significantly greater number of both the aerobic and anaerobic microorganisms than the teeth ligated with steel ligatures in both the groups.

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