DIFFERENCE IN MICROFLORA BETWEEN BANDED AND BONDED ORTHODONTIC ATTACHMENT

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ABSTRACT

Objective: To evaluate the difference in microflora produced by banded and bonded orthodontic attachments.
Study Design: Comparative cross sectional study.
Place and Duration of Study: Orthodontics department, Armed Forces Institute of Dentistry, Rawalpindi, from May 2017 to Jul 2018.
Methodology: Bacterial samples from 162 sites (premolar brackets and bands) were collected in patients undergoing fixed orthodontic therapy at T1 and T2. These samples were evaluated for various periodonto pathogenic organisms.
Results: Eighty four patients (162 teeth) with 37 (44%) males and 47 (55.9%) females were inducted into the study. Bacterial growth (log CFU/mg) in plaque samples from first premolars with orthodontic bands and brackets was 6.60 (SD ± 6.3) and 6.98 (SD ± 7.0) (p=0.03). The proportion of facultative anaerobes from molars with orthodontic bands and brackets were 81.3% and 75.3%. There is a statistically significant (p=0.02) difference in microflora in plaque samples around different types of orthodontic attachments such as bands and brackets.
Conclusion: There was a significant difference of microbiota associated with different orthodontic armamentarium. Banded attachments showed more affinity for cariogenic bacteria whereas periodontal pathogens more frequently colonizes the plaque associated with orthodontic brackets.

Keywords: Microflora, Orthodontic attachments, Periodontopathogenic organisms.

INTRODUCTION

Preserving and improving aesthetics, function and periodontal health is the mainstay of orthodontic treatment[1]. The most overlooked aspect among these is the periodontal condition of patient which deteriorates in around 65%[2] of the patients. The main reason accounting for this high percentage is the formation of retentive areas which are difficult to access and clean[3].

Around 700 bacterial species or phylotypes have been detected in the oral cavity[4]. Oral microbial flora includes indigenous flora, supplemental flora and transient flora including streptococcus, lactobacillus, candida, actinomyces, porphyromonas, spirochetes, fusobacterial etc[5]. Orthodontic appliances have a role in changing the oral ecology and microflora by increasing the number of microorganisms and volume of plaque deposited. Microflora changes with time and conditions[6]. Various factors influence the quality and quantity of plaque which include type of appliance used, amount of time for which the appliance is worn in the oral cavity and oral hygiene practice of the patients[7].

Fixed Orthodontic armamentarium includes stainless steel bands and bonded attachments such as brackets and buttons. Bacterial adhesion is increased after fixed appliance therapy because of formation of inaccessible retentive areas which are difficult to clean which lead to increased risk of caries and deterioration of pre-existing periodontal health[8]. The consequence of these attachments and difficulty in maintaining oral hygiene may lead to hyperplastic gingivitis which will eventually progress to advanced stage periodontitis[9].

Various studies have been designed to determine the influence of orthodontic treatment and fixed appliances but there is a scarcity of

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literature on the comparison of microflora between different orthodontic armamentarium in our population. The purpose of this study was to compare the difference in microflora between banded and bonded orthodontic attachments.

METHODOLOGY

A protocol was drawn and approval from the ethics committee of Armed Forces Insttute of Dentistry (AFID) Rawalpindi was taken (Ref letter no: 905/Trg-ABP1K2). Sample size was calculated using G-power 3.1.9.2 soft-ware. This was a comparative study carried out from May 2017 to July 2018. Eighty-four patients within the age range of 12-22 years were included reporting to AFID orthodontic department requi-ring fixed orthodontic treatment. Patients having no genetic diseases, or habits (smoking), no signi-ficant medical history, taking no medication (antibiotics, anti-inflammatory drugs, immuno-suppressant), or radiation therapy 6 weeks before sampling, were included in the study.

Patients were evaluated prior to inclusion of study on periodontal grounds, normal sulcus depth of 2 to 3 mm was ensured. Patients having active gingival or periodontal disease were excluded from the trial as they may alter the microflora. After evaluation first premolar on one side of the arch was banded using stainless steel bands (group-1) and the contralateral side was bonded by regular orthodontic bracket (group-2). Which tooth is to be banded or bonded was decided randomly by lottery method. Proper oral hygiene instructions were given. Patient was instructed not to use any antibacterial mouthwash or toothpaste during this trial period. No dietary restriction was given and patients were instructed to take normal diet. Patients were evaluated after 1 month (T1) and then after three months (T2).

Sampling sites were identified of both groups (orthodontic bands and orthodontic brackets), buccal sites on the upper left and right first premolars were selected to take microbial samples. These sampling sites were isolated with cotton rolls. Supragingival plaque samples of both groups were collected with sterilized toothpicks from the tooth surface between the area above gingival margin and below the bands or brackets. Samples were transported to the laboratory in tightly screw capped tubes. In laboratory these samples were weighed and transferred to an anaerobic glove box containing 80% Nitrogen and 10% Carbon dioxide. Sample was dispersed using teflon homogenizer with sterilized 40 mM potassium phosphate buffer at a concentration of 1.0 mg/ml. CDC anaerobic 5% sheep blood agar plates were used as culture medium and serial 10 fold dilutions of the sample were spread onto the surface of culture plates, these CDC plates were then incubated in the anaerobic glove box at 37°C for 07 days. After 07 days of incubation, colony forming units on the culture plates were counted and colonies having lesser than 100 colonies were subcultured onto CDC plates. All plates, media, buffer solutions and experimental instruments were kept in the anaerobic glove box for at least 24 hours before use. Bacterial isolates now obtained were then cultured on fastidious anaerobe agar plates in the anaerobic glove box at 37°C for 2 days. After incubation acidogenic bacteria were identified by the yellow zones around their colonies whereas non acidogenic bacteria were having purple zones.

Data was analysed using IBM SPSS 21. Mean and SD were calculated for Qualitative variables. Proportion of acidogenic bacteria and Bacterial growth (log/CFU) was calculated using chi-square test. Difference in bacterial specie between the two groups was calculated using the independent sample t-test. Difference at T1 and T2 between the two groups will be calculated using paired sample t-test. A *p*-value of ≤0.05 was considered to be significant.

RESULTS

Eighty four patients (162 teeth) with 37 (44%) males and 47 (55.9%) females with an age range of 12-22 years, with a mean age of 15 ± 3 years were included.

On our plaque samples, bacterial growth (log CFU/mg) of group 1 was 6.60 ± 6.3 and group 2

was 6.98 ± 7.0 (p=0.04). The fraction of facultative anaerobes from premolars of group 1 and group 2 were 81.3% and 75.3%, respectively.

At T1, samples from group 1 showed predominant growth of streptococcus (15.7%), actinomyces (11.5%) and lactobacillus (14.3%) whereas the group 2 showed streptococcus (10.7%), actinomyces (12.7%), eubacterium (14.1%) and fusobacterium (11.6%) (p=0.02).

Table: Acidogenic bacterial proportions and growth in sites of orthodontic bands and brackets.

	Brackets n=84	Bands n=84	p-value
Proportions of acidogenic bacteria	75.5 % ± 1.1	69.3% ± 1.2	0.04
Bacterial growth (log CFU/mg)	6.98 ± 7.0	6.60 ± 6.3	0.03

At T2, the levels of organisms were altered. Group 1 showed an increase in Streptococcus (24.7%) and actinomyces (21.2%) levels. Group 2 showed an increase in the levels of gram negative fusobacterium (31.5%) and eubacterium (21.3%). The fraction of acidogenic bacteria was greater in group 1 (75.5% ± 1.1) as compared to group 2. (69.3% ± 1.2). Most of the acidogenic bacteria were facultative anaerobes, such as Streptococcus and Actinomyces (p=0.02) as shown in table.

Out of total 84 patients 13 (15.47%) patients showed presence of *E.coli* at T1 and its number was increased in samples taken at T2. Mean percentage of E.coli at T1 was (3.4% ± 2.1) and at T2 was (11.7% ± 1.4).

Results obtained showed that there is a statistically significant (p=0.02) difference in microflora in plaque samples around different types of orthodontic attachments that is bands and brackets.

DISCUSSION

Orthodontic therapy with fixed appliances may temporarily increase the growth of periodonto pathogenic bacteria altering the normal oral microflora which consequently leads to gingival inflammatory response which may further progress into advanced stage periodontal disease, if proper oral hygiene measures are not followed[10].

Papageorgiou *et al* in his systematic review demonstrated that fixed orthodontic treatment results in an increased microbial colonization in the first 6 months of the treatment, which later declines after removal of appliances[11]. All the orthodontic appliances increases the bacterial log in the oral cavity however it is observed that the removable appliances makes less changes in the microflora as compared to fixed appliances because they can be removed and cleaned thoroughly resulting in better oral hygiene and minimising the risk of periodontal disease.

After placement of fixed orthodontic armamentarium some studies have reported an increase in periodonto pathogens whereas some show no significant alterations in the levels of bacterial colonization. Our study revealed that Bacterial growth (log CFU/mg) in plaque samples from first premolars with orthodontic bands and brackets was 6.60 ± 6.3 and 6.98 ± 7.0 respectively (p=0.04).

Release of fluoride ions from ionomer cements especially the glass ionomer cements used for cementation of orthodontic stainless steel bands is thought to decline the bacterial growth and has a beneficial effect due to its anticariogenic properties[12]. As shown in our study, Bacterial growth (log CFU/mg) was much greater around orthodontic brackets than bands i.e. 6.98 ± 7.0 and 6.60 ± 6.63. It can be attributed to the release of fluorides and other elements[13] from the glass ionomer cements which alter the microflora of plaque adjacent to orthodontic bands.

Non mutans streptococci and actinomyces are the initial colonizers of plaque biofilm formation. In the current study, the proportion of acidogenic bacteria was greater with orthodontic bands (75.5%) than brackets (69.3%). Most of the acidogenic bacteria were facultative anaerobes, such as streptococcus and actinomyces[14]. Acidogenic potential of plaque microflora upon fixation of orthodontic bands was higher than brackets[15]. Periodontitis associated bacteria may be more

likely to colonize the plaque microflora after insertion of orthodontic appliances.

Two main organisms closely associated to enamel demineralization and development of dental caries are *Streptococcus mutans* and lactobacillus sp[16]. Their levels were significantly increased at the sites receiving orthodontic stainless steel bands resulting an increase in the levels of demineralized white spot lesions and caries progression. This was in consensus with the study performed by komori *et al*[15] and Gonzalez *et al*[17] which showed an increase in *streptococcus mutans* levels around orthodontic fixed attachments. Shukla *et al* also showed that orthodontic appliances increased the colonies of *streptococcus mutans* over a period of 3 months[18].

E.coli is not frequently found in the oral cavity of healthy individuals, but it was isolated in patients on cytoreductive therapies and in patients having chronic periodontitis[19]. The potential pathogenic role of these bacteria in the oral cavity of patients with fixed appliances is unknown. In a study performed by Poeta *et al E.coli* isolates were recovered from 9 of the 46 oral samples of patients with fixed appliances (19.5%) whereas not a single healthy volunteer (no fixed appliances) out of a sample of 55 was screened positive for *E coli*[20].

The correlation of oral microflora and orthodontics has always been a controversial issue. Evidence on one hand suggests that malocclusion[21] leads to gingivitis and other periodontal problems due to difficulty inmaintenance of oral hygiene, hence orthodontic treatment can diminish it[22]. However few studies in the literature contradicts the above mentioned facts. Orthodontic attachments during treatment make oral hygiene maintenance difficult[23] hence leading to periodontal breakdown[24] especially the transformation of supragingival plaque to sub gingival hence, worsening the condition[25]. To conclude, assimilating orthodontic treatment along with strict oral hygiene procedure is likely to preserve the health of oral tissues.

CONCLUSION

There was a significant difference of microbiota associated with different orthodontic armamen-tarium. Banded attachments showed more affinity for cariogenic bacteria whereas periodontal pathogens more frequently colonizes the plaque associated with orthodontic brackets.

CONFLICT OF INTEREST

This study has no conflict of interest to be declared by any author.

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