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EFFECT OF ORTHODONTIC TREATMENT USING FIXED MOLAR BANDS ON PERIODONTAL TISSUES– CLINICAL AND MICROBIOLOGICAL EVALUATION

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ABSTRACT

The Purpose of this clinical and microbiological study was to evaluate the clinical and microbiological changes occurring in mandibular first molar during fixed orthodontic treatment using molar bands.

A total of 30 young adults of age between 15 and 20 years were selected for the study. The experimental groups Gr-1 and Gr-2 consisted of 10 subjects in each, who were scheduled for fixed orthodontic treatment. They were seen one week before and just prior to fixation of molar bands oral hygiene instructions were given and oral prophylaxis done. Group II subjects were given instructions to use 0.2% chlorhexidine mouth rinse twice daily as an adjunct to plaque control measures. The control group involved 10 subjects without any orthodontic treatment. After baseline clinical and microbiological evaluation all individuals were examined at 1 – month, 3-month and 6-month intervals.

Following tooth – banding there was significant increase in plaque scores, gingival scores and pocket probing depths in experimental groups than in controls. Also in gr-I and gr-II, where as there was no change in, microbiota in controls. These results document the potential of orthodontic treatment. After baseline clinical and microbiological evaluation all individuals were examined at one month, three month and six month intervals. Following tooth – banding there was significant increase in plaque scores, gingival scores and pocket probing depths in experimental groups than in controls. Also a "Shift" in microbiota to more periodontopathogenic organisms is observed in Gr-1* and Gr-2**, where as there was no change in microbiota in controls.

KEY WORDS: Molar bands, Orthodontic treatment, Microbiological changes, Clinical changes.

INTRODUCTION

It is well known fact that proper alignment of teeth protects the periodontium from occlusal trauma and favors the maintenance of hygiene, which prevent infections. But during orthodontic treatment the response of the periodontium vary with type of treatment, materials used, duration of treatment and individual immune factors.

Plaque accumulation can be due to the bands placed which make plaque control difficult. Theoretically, therefore, controlling plaque could prevent gingivitis and periodontitis. Chemical antiplaque agents may provide adjunctive effect on plaque control. In this study, an attempt has been made to study the effects of orthodontic molar bands in patients who undergo orthodontic treatment. Clinical and microbiological effects on periodontal tissues were evaluated for a period of six months. Also the effect of chlorhexidine mouth rinses as an adjunct to plaque control measures has been studied.

Aims and objectives

1. To evaluate the clinical and microbiological changes on periodontal tissues due to fixed molar bands during orthodontic treatment.
2. To evaluate the effect of 0.2% chlorhexidine mouthwash as a an adjunct oral hygiene measure on periodontal tissues in patients with orthodontic treatement.

Materials and Methods

a. Patient selection

Thirty subjects for this study were selected from patients who attended college of Dental Surgery, Mangalore.

1. They were all in the age range of 15-20 years.
2. There was no evidence of decalcification on their teeth.
3. There were no known medical problems or evidence of antibiotic therapy or topical chemical agents during the previous six months of this study.

In this study twenty subjects were selected as experimental group and ten subjects as control.

Experimental groups : Included individuals who were selected for fixed orthodontic treatment using molar bands. They were divided into two groups, Group-1 and Group-2 (Gr-I and Gr-II). Group-1 subjects were given oral hygiene instructions and

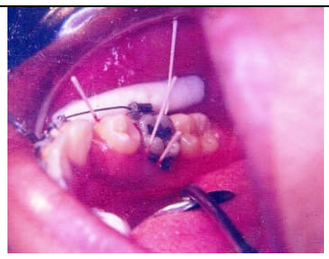

Fig. 1. Collection of Subgingival Plaque

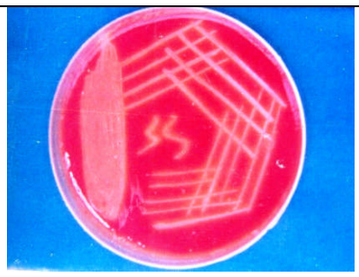

Fig.2. CulturePlate-*Streptococcus*

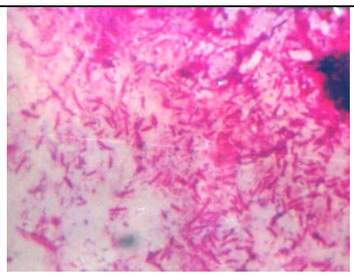

Fig.3. Glass smear--*Fusobacterium*

oral prophylaxis one week before fixing the molar bands for starting the orthodontic treatment. Group-2 subjects were given oral hygiene instructions and oral prophylaxis, also were instructed to use 0.2% chlorhexidine gluconate solution (chlorhexidine mouthwash) twice a day as an adjunct plaque control measure during the study period. One week after the prophylaxis orthodontic bands were fixed and treatment started.

Individuals in the control group (Gr-3^{+}) were given oral hygience instructions and oral prophylaxis and no orthodontic treatment.

b. Clinical examination

Plaque Index, Gingival Index and pocket probing depth were recorded for clinical evaluation. These baseline readings were taken one week after the oral prophylaxis and just before fixing the molar bands in experimental group; and one week after the oral prophylaxis in control group.

1) **Plaque scores :** In every individual, the supragingival plaque around the first mandibular molar was assessed according to the criteria of the plaque index system (PL 1) (Silness and Loe 1964).
2) **Gingival index scores :** Gingival health condition of right lower first molar was assessed using the criteria of Gingival Index system (GI) (Loe and Silness 1963).
3) **Pocket probing depth : (PPD)** Pocket probing depth was measured to the nearest millimeter using Williams calibrated periodontal probe. The distance from gingival margin to the base of the pocket is measured.

c. Microbiological Evaluation

Selected tooth (right lower first molar) was isolated with sterile cotton rolls. After removal of supragingival plaque with a sterile curette, 3-4 sterile paper points were inserted to the deepest part of the sulci and were kept for 20 seconds. (Fig.1). With the plaque that was collected onto the paper points, smear was prepared on glass slides. Later these paper points were transferred to a vial containing Robertson Cooked meat Medium (RCM). These samples were transported to the laboratory where they were incubated at 35^{0}C for not less than 24 hours.

Culturing The trypticase Soya blood agar was used here for culturing wide variety of aerobic and anerobic bacteria. (Fig.2).The total viable counts were expressed as colony forming units per ml (CFU/ml).

Grams stain The bacterial species were identified on the basis of distinct colony morphology and staining of smears prepared. (Fig.2). After clinical and microbiological evaluation wad done, at baseline, experimental group 1 and group 2 individuals were discharged for molar banding and orthodontic treatment. After one month, Three month and six month interval all the individuals were recalled, clinical and microbiological evaluation was done as explained above. After six months the result were statistically analyzed and compared.

Results

A) Clinical results :

Plaque scores (Table-1) When plaque scores were compared among three groups: Gr-1* and Gr-2** showed high plaque score than controls, which are statistically very highly significant.{(P< 0.001) (Mean = 1.6)} showed statistically significant high plaque scores than Gr-2**{ (Mean = 1.575) 9P = 0.0167}. In controls there was no change in plaque scores from baseline to one month and three month intervals. But at the end of six months plaque scores were increased which are statistically significant.

Gingival scores (Table -2) In Gr- 1* from baseline to one month gingival scores were increased to a statistically highly significant levels (P =0.0018) from baseline to three month and six month intervals gingival scores increased to a statistically very highly significant levels (P<0.0001). Between three month to six month intervals the gingival scores were not changed (P=1) significantly.In Gr-2** from baseline to one month there was not change in gingival scores. From baseline to three month and six month intervals gingivals scores increased to very highly statistically significant values (P>0.0001). There was no change in gingival scores from three month to six month readings. In Gr-3^+ there was no change in gingival scores from baseline to one month, three month or six month intervals.

Pocket probing depth (PPD) (Table-3) When pocket probing depths were compared among the groups at the end of 6-months. Gr-1* (mean=3.5) has more PPD scores than controls and Gr-2**, which are statistically very highly significant. Gr-2** has (mean = 3.3) more PPD than Gr-3^+ mean = 1.85) which are again statistically very highly significant.

When changes in PPD were compared from baseline to one month, three month and six month results. In Gr-1* and Gr-2** PPD were increased more from baseline to one month, three month and six month to statistically very highly significant levels. Between three month and six month intervals also PPD were increased to a statistically significant levels. When as in controls there was no change in PPD throughout the study period.

B) Microbiological results

Five main microorganisms were identified by anaerobic cultural and gram staining methods.
They are *S.mutans*(gram+ve,aerobie*);Pepto streptococcus* (gram +ve, obligate anaerobes); *Fusobacterium* (gram –ve, anaerobes); *Bacteroides* species (gram –ve, anaerobes) and *Actinomyces* species (gram +ve, anaerobes). Statistically all these organisms colony counts (CFU/ml) were compared using “Kruskal Wallis Anova” test.

***Streptococcus mutans*:** In Gr-1 CFU / ml were increased from baseline to one month, three month and six month intervals to statistically very highly significant levels. But from three months to six months there was no change in S. mutans counts.In Gr-2** CFU /ml from baseline to 1-month were increased to statistically significant levels. From one month to three month intervals bacterial counts increased which are statistically highly significant. Again from three months to six months there was no change in bacterial counts. When bacterial counts were compared baseline to six months there was slight increase in counts but to statistically non-significant levels. In Gr-3^+ there was no change in bacterial counts throughout the study period. Gr-1* showed more number of bacterial colonies than Gr-2** and Gr-3^+, which is statistically significant. When Gr-2** was compared with controls there is not much of change in colony counts and is statistically non-significant (P=0.5507).

Peptostreptococcus;:In Gr-1* from baseline to one month, three month and six month intervals bacterial colony counts were increased to a statistically significant levels. Between three month & six month Intervals there was no charge in bacterial counts.In Gr-2** from baseline to one month there was an increase in bacterial count which is statistically significant (P=0.0001). but from one month to three month intervals these counts were increased to statistically highly significant levels. (P=0.0091). When baseline counts were compared with three month intervals there was increase in colony counts. Between three month and three month intervals there was no change in CFU/ml. In Gr-3^+ there was no change in bacterial counts throughout the study period.

Among the three groups Gr-1* has more number off colony counts than Gr-2** and Gr-3^+ which are statistically very highly significant. When Gr-2** was compared with Gr-3^+ there was no change in bacterial counts.

Fusobacterium: In Gr-1* these bacterial counts were increasing gradually from baseline to one month, three month and six month intervals, which is statistically highly significant. In Gr-2**, their counts were less than Gr-1* individuals to statistically highly significant levels. From beseline to one month, three month and six month they increased more, which is statistically vary highly significant (P=0.0001). From three month to six month intervals bacterial counts increased but statistically not very significant. (P=0.0173). In controls there were very few colonies of Fusobacterium, when compared to Gr-1* and Gr-2** they were very less which is statistically very highly significant (P=0.0001). When Gr-1* and Gr-2** were compared Gr-1* showed more number of bacterial counts, which is statically highly significant. (P=0.0051).

Bacteroides species: In Gr-1* the colony counts of Bacteroides increased gradually from baseline to one month, three month and six month intervals,

which are statistically very significant (P<0.0001).In Gr-2** also they increased from baseline to one month and three month intervals to a statisfically very highly significant levels (P<0.0001). Between three month and six month intervals the counts were increased but to statistically significant levels (P<0.0008). In Gr-3^{+} there was no change in colony counts. Among the three groups Gr-1* showed more number of colony counts than Gr-2** which is statistically highly significant (P=0.0051). Both Gr-1* and Gr-2** showed more number of CFU/ml^{II} than Gr-3^{+}, which are statistically very highly significant. (P<0.0001)

TABLE NO.1
PLAQUE SCORES (Mean±S. D)

	MONTHS			
	0	1	3	6
GROUP-I	1.05+0.197	1.325+0.1208	1.6+0.129	1.6+0.129
GROUP-II	1.0+0.118	1.075+0.169	1.525+0.142	1.575+0.169
GROUP-III	1.0+0	1.0+0	1.0+0	1.2+0.258

TABLE NO.2
GINGIVAL SCORES (Mean±S. D)

	MONTHS			
	0	1	3	6
GROUP-I	1±0	1.4±0.516	2±0	2±0
GROUP-II	1±0	1±0	1.8±0.422	1.8±0.422
GROUP-III	1±0	1±0	1±0	1±0

TABLE NO.3
POCKET PROBING DEPTHS (Mean±S. D)

	MONTHS			
	0	1	3	6
GROUP-I	2±0	2.5±0	3.3±0.422	3.5±0.471
GROUP-II	1.85±0.242	2.1±0.211	3.05±0.158	3.3±0.35
GROUP-III	1.85±0.242	1.85±0.242	1.85±0.242	1.85±0.242

Actinomyces species: The changes in bacterial counts from baseline to one month, three month and six month intervals were same as that of *Bacteroides* colony counts in all three groups. Among the groups when compared Gr-I showed more colony counts than Gr-II which is statistically significant (P=0.0126). both Gr-1* and Gr-2** showed more *Actinomyces* colony counts than Gr-3^{+} which is very highly statistically significant. (P<0.0001).

Discussion

The results from this study indicated that plaque scores, gingival scores and pocket probing depths (PPD) were increased from baseline to one month, three months and six months period in both the experimental groups (Gr-1* & Gr-2**). Where as there was no change in Gr-3^{+}, except that in some individuals of Gr-3^{+} there was slight increase in plaque scores at the end of six months.

Alexander[1]; Boyd and Baumrind[2] also found more plaque accumulation and gingival inflammation around banded molars. In this study there was not much of change in plaque scores and gingival scores in between three month and six month readings even though there was increase upto three months. That means once the inflammation is established it did not vary considerably during treatment. By this observation we can say that once moderate gingivitis is caused during orthodontic treatment it is not progressing to periodontal disease[1]. Zechrisson et al observed some loss of attachment in-patients where molar bands were fixed violating the gingival sulcus.[3] In this study, gingival scores and PPD increase from baseline to three months. Huser et al also found significant increase in plaque index and bleeding scores form baseline to day 90.[4] From these findings it can be explained that the cementing of orthodontic bands on the tooth has the potential for evoking a local tissue response because of either 1) plaque accumulation or 2) close proximity to the gingival sulcus.

In patients with chlorhexidine mouthrines (Gr-2**) the plaque scores, gingival scores and pocket probing depths were significantly less than individuals without any mouthwash (Gr-1*). Zachrisson has shown that the use of chlorhexidine mouthrinses can be a useful adjunct in plaque control in-patients with fixed orthodontic treatment.[3] Brightman et al found that in patients who used 0.12% chlorhexidine mouthhrineses there was

significant reduction in plaque and gingival indices over the three month experimental period[5] . The present study also shows similar results.

The pocket probing depths increased from baseline to six months significantly in both Gr-1* & Gr-2**. In controls there was no change in pocket probing depths (PPD). Mean PPD in Gr-1* at baseline was 2 mm and 3.5 mm at the end of six months; and in Gr-2** it was 1.85 mm at baseline and 3.3 mm at the end of six months. There was no loss of attachment and this increase in PPD is due to pseudopocket formation by gingival enlargement. This gingival enlargement in patients with fixed orthodontic treatment can be due to mechanical irritation orthodontic bands, chemical irritation by the exposed cement at the gingival margin and inadequate oral hygiene maintenance leading to more plaque accumulation. Because of this gingival enlargement, initially supragingivally positioned molar band becomes subgingival and it further irritates the gingival leading to increase in gingival scores.

Baer and Coccaro observed gingival enlargement soon after placement of fixed appliance. [6] They also found that this gingival enlargement was resolved when the appliance was removed. Skillin found that the periodontal tissue damage caused during orthodontic treatment is almost reversible. [7] Our results differ from the observations by Diamanti-Kipioti et al[8] who, in a longitudinal study, found no significant variations in plaque or gingival scores after initiation of Orthodontic treatment. This discrepancy between the studies may be related to differences in age or host-resistance factors in the patient populations[4] Also, the time necessary for the development of gingival inflammation, when oral hygiene is abolished, varies from one person to another and depends on the rate of plaque formation[9,10]

When the microbial colony forming units per ml (CFU/ml[II]) were taken into account Gr-1* and Gr-2** showed significantly higher bacterial counts than Gr-3[+]. In controls aerobic cocci count was constant throughout the study period and very few colonies of anaerobes were round. The Group Gr-1* showed significantly more bacterial counts than Gr-2**. In the stages of fixed orthodontic treatment there were more aerobic, gram positive cocci. But at the end of six months there were more gram negative anaerobic bacilli than gram positive aerobic cocci. As the molar bands become subgingival they provide a favorable ecosystem for anaerobic organisms[11.] This is why at the end of six months with increasing PPD the number of anaerobic micro-organisms was increased significantly more than aerobic organisms. Flores De Jacoby & Muller (1982) also observed this “shift” in microorganisms from aerobes to anaerobes.

Bloom and Brown[12] observed a generalized increase in all bacterial counts after band placement, which is in accordance with this study. Leggott et al[13] found two to three fold increase in number of motile organisms six months after appliance placement. These results document the potential of subgingivally placed orthodontic bands (even though, they are supragingivally positioned initially, their borders become subgingival due to gingival enlargement) in changing the subgingival ecosystem favoring the dominance of periodontopathic microorganisms.These adverse changes in microflora are mirrored by increase in plaque scores, gingival scores and pocket probing depths[4] The effect of the altered bacterial ecosystem is unpredictable with gingivitis, which is not always progressing to periodontitis. In the subgingival region of the sulcus there exists equilibrium between the bacterial challenge and host’s defense system[14] The “host response” varies from individual to individual and depends on many factors like : age, genetics, hormones, immune status, and nutrition.[15] Despite chlorhexidine mouthrinses as adjunct to plaque control Gr-2** had changes in clinical and microbiological parameters in one to three months of band placement. This would seem to suggest factors other than supragingival plaque control might be involved. This includes mechanical irritation by the orthodontic molar band, subgingival plaque levels, and chemical irritation by the cements used for banding[3,16,17,18] It has also been speculated that the orthodontic appliances themselves may have cytotoxic effects. This cytotoxicity may contribute to the periodontal reaction[19]

In the present study the effect of molar banding in orthodontic treatment has shown increase in plaque index, gingival index and PPD; and increases and shifts in the microorganisms. It is in accordance with the various studies conducted by various authors. It also has shown that chlorhexidine reduces the formation of supragingval plaque to certain extent but it does not have much effect on subgingival plaque formation.

Summary

Individuals with orthodontic molar bands have more plaque accumulation, gingivitis and gingival

enlargement than individuals without any orthodontic treatment. In patients with orthodontic molar bands there was a shift in microorganisms from aerobic, gram +ve organisms to anaerobic, gram-ve organisms by the end of study period. Chlorhexidine could not completely prevent the occurrence of gingivitis in patients with orthodontic bands. So molar bands must have created some irritation, which caused gingivitis and gingival enlargement, which further produced more accumulation of plaque.

CONCLUSION

From this study we can conclude that strict oral hygiene instructions and frequent oral prophylaxis by professionals can reduce gingivitis and gingival enlargement in patients who is under fixed orthodontic treatment. Chlorhexidine mouthrinses can be used as an adjunct measure to other plaque control methods.

Key Message

Long-term studies are necessary to evaluate the effect off molar banding on periodontal tissues during orthodontic treatment and after their removal.

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References :

1. Alexander SA. Effects of orthodontic attachments on the gingival health of permanent second molars. Am J Orthod Dentofacial Orthop 1991; 100: 337-40.
2. Boyd RL, Baumrind S.Periodontal considerations in the use of bands or bonds on molars in adolescents
3. and adults. Angle Orthod. 1992; 62: 117-126.
4. Zachrisson BU. Cause and prevention of injuries to teeth and supporting structures during orthodontic treatment. Am J orthod 1976; 69:285-300. On BU. Longitudinal study of periodontal conditions associated with orthodontic treatment in adolescents. Am J Orthod 1979; 76:277-86.
5. Huser MC, Baehni PC, Lang R. Effects of orthodontic bands on microbiological and clinical parameters. Am J Orthod Dentofacial Orthop 1990; 97: 213-8.
6. Brightman L, Terezhalmy GT, Greenwell H, Jacobs M. the effect of a 0.12% chlorhexidine gluconate mouthrinse on orthodontic patients aged 11 through 17 with established gingivitis. Am J Orthod Dentofac Orthop 1991; 100 : 324-29.
7. Baer PN, Coccaro J.Gingival enlargement coincident with orthodontic therpy. J Periodontal 1964; 35: 436-439.
8. .Skillin WG. Tissue changes-the result of artificial stimuli and injury. J Am Dent Assoc 1940; 27:1544.
9. Diamante-Kipioti A, Gusberti FA,. Lang NP. Cliniccal and microbiological effects of fixed orthodontic appliances. J CLin Periodontol 1987' 14:326-33.
10. Loe H, Theilade E, Jensen SB. Experimental gingivitis in man. J Periodontol 1965; 36:177-87.
11. Theilade E, Wright WH, Jensen SB, Loe H. Experimental gingivitis in man. J Periodont res 1966; 1:1-13.
12. Kenney EB and Ash MM. Oxidation reduction potential of developing plaque, periodontal pockets and gingival sulci. J periodontal 1969; 40: 630-33.
13. Bloom RH, Brown LR. A study of the effects of orthodontic appliances on oral microbial flora. Oral Surg Oral Med Oral Pathol 1964; 17: 658-667.
14. Leggot PJ, Boyd RL, Quinn RS, Eakle WS, Chambers DW. Gingival disease patterns during fixed orthodontic therapy: Adolescents vs. adults. J Dent Res 1984; 63 (spec issue) : 309 (abstr.1245).
15. Attack NE, Sandy JR; Addy M.Periodontal and microbiologicalf changes associated with the placemetn of orthodontic appliances. A Review. J Periodontol 1996; 67:78-85.
16. Lang NP, Kiel RA and Anderhalden K.Clinicalf and microbiological effects of subgingival restorations with overhanging or clinically perfect margins. J Clin Periodontal 1983; 10:563-78.
17. Slots J. Listgarten MA. Bacteroides gingivalis, Bacteroides intermedius and Actinobacillus actinomycetemcomitans in human periodontal disease. J Clin Periodontal 1988; 15: 85-93.
18. Boyd RL. Longitiudinal evaluation of a system for self-monitoring plaque control effectiveness in orthodontic patients. J CL in Periodontal 1983; 10:380-388.
19. Kloehn JS, Pfeifer JJS. The effect of orthodontic treatment on the periodontium. Angle Ortthod 1974; 44:127-134.
20. Grimsdottier MR , Hensten-Pttersen A, Kullman A. Cytotoxic effect off orthodontic appliances. Eur J Orthod 1992; 14:47-50.

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