ORIGINAL ARTICLE POJ 2022:14(1) 57-63

Plaque index in patients treated with bands compared to buccal tubes on first molars during the first six months of orthodontic treatment

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Abstract

Introduction: An increasing number of individuals have been prompted to go for orthodontic treatment due to the esthetic treatment options given. Consideration of various factors is important before the start of treatment since the entire periodontium, including the soft tissues and osseous components remodels with orthodontic tooth movement. Fixed orthodontic appliances have been shown to enhance plaque accumulation thus affecting the periodontal health. These orthodontic appliances induce transient periodontal changes without any permanent loss or there might be a greater periodontal loss than the general population. The most likely area for periodontal pathology is the interproximal areas of the molars.

Materials and methods: This was a comparative analytical study. 60 orthodontic patients were divided in two groups (A & B) by random sampling. Group A had bands cemented on their molars while patients in group B had buccal tubes bonded to their molars. The parameter of plaque Index was measured and recorded for analysis and comparison.

Results: The variable showed increased values when the Plaque index before treatment (denoted as T0) was compared with the status at 3 and 6 months (denoted as T1 and T2 respectively) in the banded group. However, in the bonded group the parameter recorded gave decreased values showing an advantage to cleaning for maintenance of oral hygiene when buccal tubes were used. Where as in the banded group increased value of plaque index indicated lesser surface area available for cleaning and more foreign body surface available for the accumulation of bacterial plaque.

Conclusions: Buccal tubes gave a better plaque index with time than bands when used during fixed orthodontic treatment, provided that the oral hygiene is maintained.

Keywords: Oral hygiene; orthodontic bands; orthodontic buccal tubes; periodontal parameters

Introduction

The primary function provided by the periodontal ligament is supportive; also serving a key remodeling function. The periodontal health of a patient is of utmost importance for proper functioning of teeth. Properly aligned teeth facilitate good oral hygiene; however, the whole fixed orthodontic process to straighten the teeth may have negative effects on the gingival health.[1] In addition to patients requiring orthodontic treatment for their misaligned teeth, a large number of adults are now undergoing fixed orthodontic treatment for esthetics concerns. When the supporting apparatus undergoes a deleterious attack, it

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loses its supportive function leading to adverse conditions on teeth.

Patients need to take proper care of their periodontal health in normal circumstances and more stress should be given when they are undergoing any dental treatment especially during fixed orthodontic therapy. Negligence on the patient's part or their lack of knowledge leads to poor preservation of oral hygiene.[2] On the other hand negligence on part of the dentist treating them is not giving proper instructions before start of the treatment and not emphasizing on proper oral hygiene regimes even after noticing deterioration in the periodontal health during the course of the treatment. This negligence may result in noncompliance on behalf of the patient.

Bands, brackets, elastics and ligature wires encourage the accumulation of food residues around them.[3] The risk of plaque accumulation is increased with these fixed orthodontic appliances, in view of the fact that it becomes difficult to remove the plaque completely, posing a possible harm to teeth, alveolar bone and gingiva.[4] This accumulation of plaque leads to plaque (biofilm) traps encouraging changes in the oral environment, such as a decrease in the pH, further increase in the accumulation of plaque, and thus eventually resulting in the rise of microbial counts in the biofilm and also the saliva.[5] In due course of time gingivitis appears, becoming quite profound in 21 days in the continued presence of poor oral environment,[6] and which ultimately progresses to periodontitis, if the oral hygiene measures are not taken at the appropriate time.

Adults undergoing orthodontic treatment should be extra careful especially with their oral hygiene although they may exhibit less gingival inflammation and build-up of plaque in certain situations. Periodontitis in adults usually manifests itself clinically with rotations, flaring of the anterior dentition, spacing and overeruption of the teeth. Passive eruption resulting in large sized crown of adult teeth may be one reason allowing further positioning of the band from the gingival margins.[7] The posterior areas of the oral cavity have a difficult access thus accessories used in orthodontics such as bands, brackets, springs etc. in these areas hinder hygiene and provide increased areas for retention of dental plaque. Fixed orthodontic appliances may hinder a good maintenance of oral hygiene resulting in an inflamed gingivae preceding plaque accumulation.[8] Gingival enlargement has been noted to occur after a fixed appliance is placed in the oral cavity. During the active phase of orthodontic therapy, if proper oral hygiene is maintained, clinically insignificant lesions occur in the supporting tissues of the teeth.[6]

The characteristics of patient's periodontal tissue is an extremely important determinant of the susceptibility of the periodontium. The presence of thin tissue is more prone to recession during fixed orthodontic treatment as compared to thick gingival tissue.[5] Such patients should take extreme exemplary measures to maintain the oral hygiene before, during and after placement of fixed appliances. The resulting effects on the tissues not only depend on the type of tissue present in a patient and the oral hygiene measures taken; nevertheless, on the type of tooth movement taking place also.

When orthodontic forces are applied on teeth, the entire periodontium remodels, and changes are seen in both the soft tissue as well as the osseous components. In teeth that are banded, gingivitis has been observed especially in the interdental papillae region.[3,6] The banded teeth have been associated with an increased incidence of plaque rate, gingival rates and probing depths as compared to the bonded teeth.[7] Bonding of buccal tubes might prove to be better in terms of maintenance of the periodontal status; although it is a less frequent practice. Bonded buccal tubes not only expose less retentive sites for plaque accumulation; rather does not cause enlargement of the gingival tissue also known as gingivitis around the molar tooth,

since it does not come into contact with the tooth's gingiva.

On the other hand, placement of bands results in a change in the oral environment of the tooth as soon as the band is cemented. Since an orthodontic band is in contact or close to the gingiva, and since it exposes a larger surface area for the accumulation of debris and plaque, vigorous measures are required to maintain the hygiene around a banded tooth.[9] Ajayi and Azodo in their study revealed the fact that not only tooth brushing but levels of patient's motivation and education, along with sustained reinforcement of oral home care regimes[10] determine the oral hygiene of patient with banded or bonded attachments. The aim of this study was to compare bonded attachments to bands on first molars in terms of plaque accumulation that would directly affect the periodontal status of the teeth involved.

Material and Methods

This comparative analytical study was carried out in the Orthodontic department of Islamabad dental hospital for a period of 2 years. Ethical approval was taken by the Institutional Review Board of Islamabad Dental Hospital (Ref.No.F.2/11/AS&RB-57/2019). A sample of 60 patients was calculated by using the WHO sample size calculator. The two groups A and B with 30 patients in each group were randomized by the Computerized Lottery Method. Patients with a good oral hygiene, having fully erupted maxillary and mandibular first and second molars were included in the study. Patients with a history of previous orthodontic treatment, presence of chronic medical disease or condition that could affect their periodontium (such as pregnancy, diabetes mellitus, juvenile periodontitis, congenital heart disease, blood dyscrasias, or history of rheumatic fever) were not included. Patients with Class II and V restorations or fixed prosthesis on second premolars, first and second molars, those with a traumatic bite and bruxism and those who required other orthodontic appliances (such as TPA, Nance, Lingual arch, implants) as part of the treatment plan were also excluded from this study.

Group A had patients in which orthodontic bands were cemented with glass ionomer cement on the four first molars. Group B had patients with buccal tubes cured on the four first molars after etching the buccal surface with 37% phosphoric acid and bonding. Patients in both groups were given guidelines with regards to oral hygiene maintenance and motivation.

The plaque index of each patient in both the groups was assessed for each tooth before being banded or bonded (T0) and later at 3 months (T1) and 6 months (T2) of orthodontic treatment. Plaque Index (PI) was measured on the basis of Löe and Silness scale and recorded in a proforma. All measurements were done by the researcher and all measurements were rounded off to the nearest millimeter. Mann Whitney U test was applied to compare plaque index in both groups at T0, T1 and T2. For the pre- and post-comparison within one group Paired sample T- test was used.

Results

The sample size of this study was 60 with 30 patients in group A and 30 patients in group B randomly distributed. Out of the total of 60 patients 63% were females and 37% were males as shown in Figure 1. Age wise distribution of the sample shown in Figure 2, gave a mean age of 18 years with minimum and maximum ages of 12 and 27 years respectively.

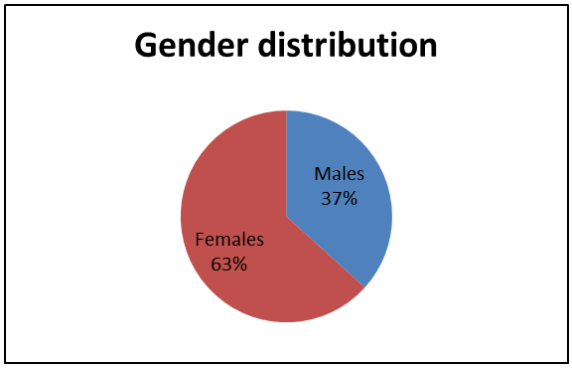

Figure 1: Gender wise distribution of both groups

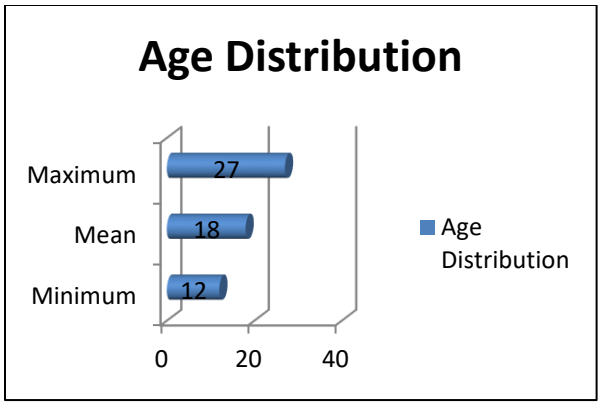

Figure 2: Age wise distribution in both groups

Table I gives an account on the plaque index of patients in group A and B using the Paired-sample T test. In group A significant P values were obtained at comparison between T0 and T1 and also between T0 and T2. The PI scores at 3 and 6 months gave significance of 0.000 with a mean and standard deviation of -0.467 ± 507 and -0.667 ±802 respectively. When the PI scores were compared between T0 and T1, there were no significant changes. Plaque index score comparison in the group B with buccal tubes after applying the Paired-sample T test gave significant p values from the start of the treatment to first 6 months of treatment time. The results show a significant decrease in the Plaque index scores from T0 to T1 and fromT1 to T2 and from T1 to T2 respectively for patients with buccal tubes as shown in Table I.

Table I: Plaque Index of Group A (Bands) and Group B (Buccal tubes) at T0, T1 and T2 separately

	Plaque Index (Bands)		Plaque Index (Buccal Tubes)	
N=30	Mean ±Std. Deviation	P value	Mean ±Std. Deviation	P value
Pair 1 T0 T1	-.200±.805	.184	1.30 ±.675	**.003**
Pair 2 T1 T2	-.467±.507	**.000**	.90 ±.504	**.000**
Pair 3 T0 T2	-.667±.802	**.000**	.47 ±.791	**.000**

The plaque index gave significant p values from the start of the treatment to first 6 months of treatment time. The results show significant decrease in the PI scores from T0 to T1 and fromT1 to T2 with standard deviation of 1.30 ±675, 0.90 ± 504 and 0.47 ± 791at T0, T1 and T2 respectively.

Table II: Comparison of PI between Group A and B before, at T0, T1 and T2

Plaque Index before treatment			
Groups	Mean ± SD	Mann-Whitney U	P value
Band	1.25 ± 0.773	419.500	0.627
Buccal Tube	1.50 ± 0.504		
Plaque Index after 3 months			
Groups	Mean ± SD	Mann-Whitney U	P value
Band	1.15 ± 0.606	267.000	0.002
Buccal Tube	1.50 ± 0.604		
Plaque Index after 6 months			
Groups	Mean ± SD	Mann-Whitney U	P value
Band	1.17± 0.867	42.500	0.000
Buccal Tube	1.50 ± 0.504		

Table II shows the comparison between both groups after applying Mann- Whitney U test. Comparison of plaque index scores between the two groups gave significant results at 6 months of treatment as shown in Table II. At T0 the patients of Group B presented with either no plaque or a thin film of plaque. Significant increase in results were seen when both groups were compared after 3 months of treatment and then after 6 months of treatment.

Discussion

Bonding of attachments to molars provides an added number of advantages when compared to molar bands. These advantages are greater time competence, no requirement for separation and thus the eradication of residual band spaces and pockets which appear after treatment. They also provide

better and easier placement in addition to patient comfort, and a decreased risk of caries and decalcification since they provide greater visibility for the detection of any accumulation on the enamel surface of the tooth.[11] Despite all these advantages provided by the buccal tubes it is a less common practice to use them, although they give an added benefit in terms of periodontal health considerations.[12] As stated earlier there is an increased risk of gingivitis in patients who have an increased plaque index.[11] Thus plaque index was seen to increase in patients after the start of the fixed orthodontic treatment in this study (Table I). As shown by other studies that orthodontic appliances such as bands, brackets, wires, ligatures etc[9,12] not only increase the sites for plaque retention but also provide a major hindrance on the maintenance of oral hygiene because patients find it difficult to clean their teeth with appliances on them.[1,5,7,11] Some patients become more indolent with regard to oral hygiene practices as the treatment progresses, although repeatedly emphasized. Others don't carry on with normal cleaning measures because of fear of dislodging a bracket or buccal tube as noted with the patients in the present study. The presence of bands provides a greater surface area for retention of plaque biofilm[11] thus making it extremely difficult to enhance the hygiene measures. The amount of plaque seen in the present study was from a mere absence to a thin film and reaching to a significant level by the T2. This pattern was seen more in the group of patients cemented with bands (Table I), because bands provide a larger area for retention of plaque all around the tooth and patients are not very good in cleaning posterior segments. Also noted in this study was the increase plaque on the lingual sides of banded teeth in some patients, as it was most difficult for them to clean there. Those who had no concept of flossing, showed an increase of plaque in the interproximal areas in the present study.

Although oral hygiene instructions were provided to the patients at the start of the treatment and also stressed upon at every subsequent visit, the increased plaque retention was a common finding in most of the patients. This fact can be owned to various factors on both the patients as well as on the hands of the orthodontist, as stated in other studies.[12,13] The obligation of an Orthodontist turns two-folds once starting the treatment, of giving full oral hygiene maintenance protocols for home and also checking if his/her instructions are being followed on each visit or not.[12] Also noted in this study was the fact that more plaque was seen between the proximal surfaces of teeth since the patients in our setting our not very keen on meticulous cleaning measures for oral hygiene and flossing is the least adhered method. In addition to the band being a foreign entity providing retentive site for plaque, it also increases the chances for the bacteria to adhere and increase in colonization at the proximal sites as seen in our study. This plaque retention over a period of time resulted in the development of gingivitis, especially in the interdental papillae, as shown by the increased gingival index in this study. This fact was also seen in other studies.[3,8,10-12] Cerroni et al. in their study also suggested this fact that in patients treated with fixed orthodontic appliances interdental areas are seen to be affected more.[14] The reason for this was later also given by Monica and de Melo in their study. They stated that improper placement of the band is an important factor in developing inflammation of the gingiva around that tooth. They also stated the fact that the position of the cervical margin of the band is an essential factor. It has been stated in various other studies that the cervical margin of the bands should not be allowed to impinge into the gingival sulcus, in view of the fact that if this invasion occurs the odds ratio for developing gingivitis increases.[1,3,6-8] Another important fact is that if the band becomes lose during the course of the

treatment the space created between the band and the tooth surface also gives a site for food accumulation and a retentive site for plaque.

When group A with bands was compared with group B with buccal tubes, the PI is seen to decrease slightly since a better compliance to oral hygiene measures were seen in patients with buccal tubes as it was comparatively easier for them to clean the greater tooth surface available (Table II). The pattern of index change was seen to move towards the lower values with time since more area is clinically visible for cleaning. This fact is supported by various studies[14-17] which compared bands and molar tubes in terms of periodontal health. The results of these investigations also show less accumulation of plaque on bonded teeth as compared to banded teeth since plaque adhered more on the band surface which is designed to surround the tooth from all sides in addition to the retentive sites present at their attached tube. Also, excess cement if not cleaned properly after placing the band, can further add to the plaque retentive sites making it more difficult for the patients to clean. Buccal tubes on the other hand occupy only a limited area on the buccal surface of the tooth and cleaning become much easier thereby eliminating or reducing the retentive sites with every tooth cleaning measure. Boyd also supported the result of the present study with regard to PI. His study also reported that banded molars had greater plaque retention and eventually greater values of gingivitis when they were compared with bonded.[18] Also in bonded teeth the plaque as well as gingival index showed increased values for the mandibular molars when compared to the maxillary molars. Studies have also indicated that clinical parameters such as plaque index and bleeding on probing were increased with increasing age after placement of fixed orthodontic appliance.[19]

Despite providing the patients with oral hygiene education and stressing upon the importance of maintaining good oral hygiene, the patients who are not compliant or have been externally motivated will not take interest with maintaining a good oral hygiene. The fact that oral hygiene protocols cannot be monitored for the patients is a limitation for this study.

Conclusions

It was concluded that Plaque Index (PI) scores increased for both the banded and bonded groups but more accumulation was found with bands after 6 months of treatment.

Conflict of Interest

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

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