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ORIGINAL ARTICLE

COMPARISON OF THE PERIODONTAL PROBING STATUS BETWEEN MOLAR BANDS AND BONDED MOLAR TUBES IN ORTHODONTIC PATIENTS

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ABSTRACT

It is generally accepted that periodontal pathogens are significantly more prevalent in orthodontic patients. The purpose of this study was to assess the periodontal health around orthodontic bands in comparison to the bonded teeth. 31 patients requiring orthodontic treatment were divided into two equal right and left side groups. In these patients (n=31) orthodontic molar bands were cemented on the right side maxillary permanent first molars. In the same group of patients (n=31) molar tubes were bonded to the left side maxillary permanent first molar with Transbond XT (3M Unitek, Monrovia) adhesive material. Circumferential periodontal probing depth was recorded in millimeters for both sides before starting orthodontic treatment and after six months into the treatment. Our study sample (n=31) comprised of 11 (35.5%) males and 20 (65.5%) females both in the bonded and banded sides. The post treatment mean value of PPD for banded and bonded sides (B2) and (T2) was 2.81 mm (±.437) and 1.36mm (±.191) respectively. Paired sample t-test was applied for intragroup comparison of pre and post treatment values. Both the banded and bonded sides showed a statistically significant values. Independent sample t-test was applied to compare the post treatment values of mean PPD for the banded (B2) and bonded (T2) sides, depicting a statistically significant value of 0.00. The banded molars showed a statistically higher post treatment value of periodontal probing depth as compared to the molars with bonded attachments.

Key Words: *Molar bands, Molar tubes, Periodontal Probing Depth.*

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INTRODUCTION

Preformed stainless steel bands of varying sizes are commonly placed around posterior teeth during fixed appliance treatment. The design of orthodontic bands and its attachments presents a significant potential for contamination by either blood or saliva during use. For example, capillary action can draw fluids into the buccal tubes used which are very poorly accessible to the cleaning process. These hide outs, then, may become the source of spreading infections between patients.[1]

The pioneer orthodontists of 1900s used clamp bands which were tightened around molar teeth by screw attachments. The current preformed steel bands came into use during 1960s.Teeth receiving heavy intermittent forces, needing both labial and lingual attachments and teeth with short clinical crowns are few indications for banding[2]. Unlike directly bonded attachments, where one size fits all, bands have to be customized according to the size of the tooth to which they are to be cemented.[2]

A greater plaque index, tendency for bleeding and increased pocket probing depth have been observed more frequently for molars with orthodontic bands as compared to bonded molar tubes. Inter proximal loss of attachment is also observed to a greater extent in patients with orthodontic bands. The probable explanation for this is difficulty in plaque removal from the gingival margins of the bands in addition to the me-

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chanical injury caused by the sub gingival placement of the bands.[3]

According to a study, the salivary Streptococcus Mutans proportions exceed the pretreatment levels on the banded teeth, as compared to non banded surfaces of the teeth. It was thus concluded that creation of new retentive areas favors the local growth of Streptococcus Mutans, which in turn increases the overall infection stage of the body.[4] Incidence of bacteremia has found to be 10% after banding and 3% after debanding.[5]

Bondable molar tubes have a meshed base and a buccal groove indicator to aid bonding. They have a higher clinical failure rate of 21% because of the difficulty in maintaining adequate moisture isolation during bonding, and the greater masticatory forces in the posterior region of the mouth.[3] Bonded attachments are however preferred in adult patients with already existing periodontal problems, particularly in immunocompromised or disabled patients or any disease hampering the ability to maintain good oral hygiene.[6,7]

Review studies indicate periodontal infection as a risk factor for cardiovascular diseases, pneumonia, and premature and low baby birth weight.[8] Orthodontic patients are more prone to develop periodontal problems particularly if oral hygiene is not properly maintained. Banding or bonding of molars in such high risk patients would be a critical decision on the part of the orthodontist.[9] Only few international; however, no local studies have been carried out to compare the periodontal status of the molars with bonded and banded attachments. This study would help the orthodontist to make an evidence based treatment plan foreseeing the periodontal status and other potential risk factors in mitigating it's adverse effects and to maximize the benefit to the patients.

MATERIALS AND METHODS

This is a split mouth prospective cross-sectional observational study conducted at the College of Dentistry, Rawal Institute of Health Sciences, Islamabad, from October 2019 to March 2020. Approval was obtained from Ethical Committee College of Dentistry, Rawal Institute of Health Sciences Islamabad. Non probability consecutive sampling was done and sample size was determined using WHO calculator. Level of significance was 5% and Power of study was 80%. The population Standard Deviation was 1.2, Test value of population mean was 2.4[10] and anticipated population mean was 3.2. Sample size came out to be 31 patients in this study.

Patients between thirteen to twenty years of age with fully erupted healthy permanent teeth and no previous history of orthodontic treatment were included. Circumferential probing depth was made sure to be between 1-2 mm before start of orthodontic treatment. Patients with any pathology like gingivitis, periodontitis and proximal caries were excluded from the study. Similarly patients with any systemic disease affecting oral hygiene or periodontal status were also not included.

A detailed history and thorough clinical examination of 31 patients requiring orthodontic treatment were registered according to the attached proforma. In this study split mouth technique is used and the same 31 patients were divided in right and left side molar groups. In right side maxillary permanent first molars were banded with 3M chemically cured glass ionomer cement while in left side molar tubes were bonded to micro-etched enamel of left maxillary permanent first molars with Transbond XT (3M Unitek, Monrovia) adhesive material. Separators were placed in all right side molars at least one week before the cementation of molar bands. Bonding of molar tubes in left side molars did not need separators.

Circumferential periodontal probing depth (PPD) was recorded in millimeters in both right and left side molars before starting the orthodontic treatment (T1), at three points (mesial, center and distal) on the buccal surface of each permanent maxillary first molar with a Michigan periodontal probe (Hu-Friedy, Chicago, III, USA). The probe was inserted in line with the vertical axis of the tooth and walked circumferentially on the buccal surface to record at least three readings. The mean of these readings was taken as the final circumferential probing depth. Clinically in the normal healthy periodontium gingival margin is 1-2 mm coronal to the cemento-enamel junction. As poor oral hygiene increases the probing depth, all patients were instructed and fully motivated for oral hygiene maintenance throughout treatment and those patients unable to maintain oral hygiene were dropped from the study to control the bias. Probing depth is influenced by the diameter of the probe tip and the force applied to measure the pocket depth so all measurements were taken with the same probe by the same operator to control the confounding variables.

Post treatment probing depth was measured using the same procedure in both the left and right sides at the time when the patient has **undergone at least 6 months** of orthodontic treatment (T2). According to the measurement in millimeters probing depth was divided in three categories:

- Normal probing depth 1-2 mm
- Mild periodontal recession 1-3mm
- Moderate periodontal recession 3.1-5mm
- Severe periodontal recession above 5mm.

Statistical package for the social sciences (SPSS for windows version 16) was used for the statistical analysis. Frequencies and percentages are presented for age and gender. The mean and standard deviation for the pre-treatment and post-treatment periodontal probing depth was calculated. The intragroup pre- treatment and post- treatment probing depth was compared in both groups separately by paired sample t test while the intergroup post treatment probing depth was analyzed by utilizing Independent sample t test. The level of statistical significance was kept at $p \leq 0.05$.

RESULTS

Our study sample (n=31) comprised of 11 (35.5%) males and 20 (65.5%) females in the banded and bonded sides respectively (Figure1). The age of these subjects ranged from 12 to 24 years with a mean age of 15.29 (±1.9) years. The pretreatment and post treatment measurements of the periodontal probing depths of the bonded and banded groups were recorded. The pretreatment mean value of PPD for banded side (B1) was 1.39mm (±.248), while the pretreatment mean value of PPD for bonded side (T1) was 1.25mm (±.198). The post treatment mean values of PPD for banded and bonded sides (B2) and (T2) were 2.81 mm (±.437) and 1.36mm (±.191) respectively (Table I). The most frequent value of PPD in banded side (B2) was found to be 2.5mm (35.5%) while in bonded side (T2) it was 1.5mm (61.3%.) Figure 2.

Paired sample t-test (Table II) was applied for the intra group comparison of pre and post treatment values. The banded side showed a statistically significant value of .000 while the bonded side value was found to be 0.007 which is also statistically significant.

Independent sample t-test Table III was applied to compare the post treatment values of mean PPD for the banded (B2) and bonded sides (T2). The significance value was found to be 0.00 (p-value <0.05).depicting that there was a statistically significant difference in the pre and post treatment PPD values of banded and bonded sides.

TABLE 1: MEAN PRE AND POST TREATMENT PPD IN BANDED AND BONDED SIDES

	N	Minimum	Maximum	Mean	Std. Deviation
B1	31	1.00	2.00	1.3952	.24811
T1	31	1.00	1.50	1.2581	.19879
B2	31	2.25	4.00	2.8145	.43764
T2	31	1.00	1.50	1.3629	.19191

TABLE 2: PAIRED SAMPLE T TEST. INTRAGROUP COMPARISON OF PPD

		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
					Lower	Upper			
Pair 1	B1 - B2	-1.41935	.50985	.09157	-1.60637	-1.23234	-15.500	30	.000
Pair 2	T1 - T2	-.10484	.20181	.03625	-.17886	-.03082	-2.892	30	.007

TABLE 3: INDEPENDENT SAMPLE T TEST FOR COMPARISON BETWEEN B2 AND T2

		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
B2	Equal variances assumed	9.26	.003	16.913	60	.000	1.45161	.08583	1.27993	1.62392
T2	Equal variances not assumed			16.913	41.126	.000	1.45161	.08583	1.27830	1.62493

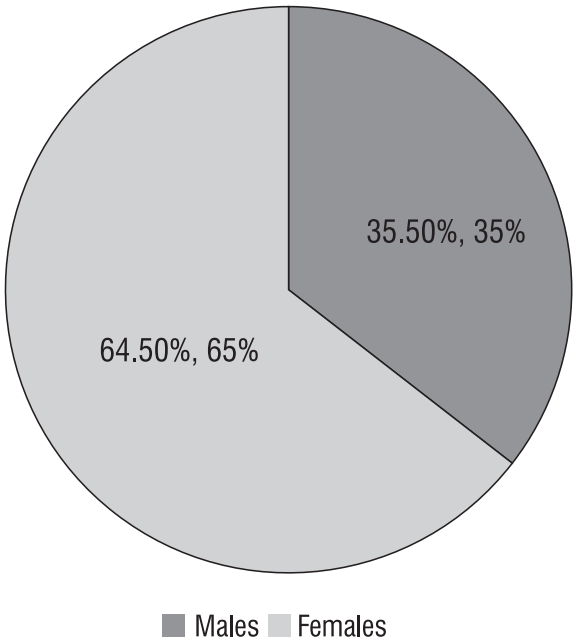

Fig 1: %Age of Males and Females in Study Group

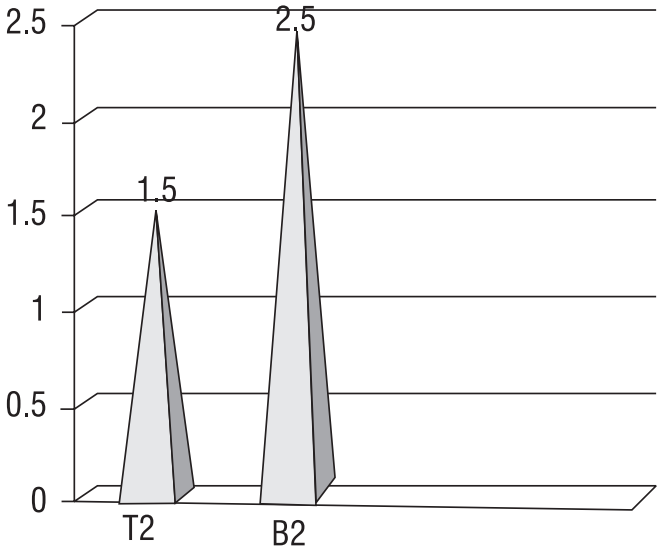

Fig 2: Most frequent value of ppd in t2 bonded and b2 banded attachments

DISCUSSION

During orthodontic treatment, an increased accumulation of plaque can be found around the bands and brackets because of the lack of proper oral hygiene maintenance, which is often the case in pubertal age people.[11] According to the literature, bands showed more gingival inflammation, gingival hyperplasia, and deeper pocket depths.[12] Furthermore, the posterior surfaces were more affected. Replacement with orthodontic tubes tended to give a transient decrease in Streptococcus mutans levels, in both plaque and saliva, possibly due to elimination of S.mutans reservoirs, mostly associated with the banding procedure. After 3 months into banding, the S.mutans proportions surpassed pretreatment levels in saliva on the banded teeth, whereas unbanded surfaces showed a mild increase. It reflected that creation of new retentive areas harber the local growth of S.mutans, which in turn increases the overall level of infection in the oral cavity.[13]

In our study we measured the PPD on banded and bonded molars in the same patient which helped to control the confounding variable of oral hygiene maintenance. Results clearly showed significantly increased probing depth in all these patients having bands as compared to ones with bonded tubes. The mean post treatment PPD value for banded side was 2.4mm and for the bonded side was 1.3mm. Only one banded case showed a maximum PPD of upto 4.0mm. This can be attributed to lack of oral hygiene maintenance, communication gap on part of the doctor, patients and parents. This particular patient was a female and her age was 13.0 years. Pubertal spurt, lesser clinical crown height or poor brushing technique could be the contributing factors for greater PPD in this particular patient.

Calniceanu et al[14] observed changes in the degree of plaque accumulation and gingival inflammation after tooth banding, thus the increase in plaque scores on banded teeth in our study is in agreement with the other studies, which have found plaque retention associated with orthodontic treatment. According to a local study by Ahmad and Haque have reported that increase in the duration of orthodontic treatment from six to twelve months significantly increases the periodontal probing depth in banded molars. These results are similar to our study as banded molars showed higher PPD values in our study also as compared to bonded molars.[15]

According to a recent study[16] the premolars bonded with brackets showed a higher plaque index. One possible explanation for this can be the difficulty to maintain oral hygiene there. In contrast to our study, **Guo** R et al[17] found no significant variations in plaque or gingival indices after initiation of orthodontic treatment. The discrepancy between the two studies may be related to differences in age or host-resistance factors in the patient populations. Our sample consisted of age range between 12 and 24. Host resistance factors plus their oral hygiene maintenance will definitely differ due to age diversity which can affect our results. These contradictory findings may further be explained by the different clinical assessment techniques used to evaluate the periodontal attachment level. In addition, age and gender of the patients might affect the results. Young adults are usually careless in maintaining oral hygiene or using mouth wash during orthodontic treatment. It will be appropriate to highlight that most of our patients in this study belonged to relatively younger age group.

In another study, *Actinomycetemcomitans* was present at 80% of sites studied. High counts of *Actinomycetemcomitans* might indicate a higher risk for the development of aggressive periodontitis.[18] Very little is known about the association of brackets and bands and the specific subgingival bacteria but these studies are not comparable to our study as we only focused on the post treatment PPD. Specific microorganisms are associated with specific periodontal diseases (e.g, . *Actinomycetemcomitans* is linked with localized juvenile periodontitis).[18] However, adult periodontitis is not caused by a single organism, and but is more likely that a consortium of bacteria is responsible.[19]

Results of several clinical studies indicate that orthodontic treatment may be associated with an insult to the periodontium, whereas other studies suggest that it has no long-term effect on periodontal health.[20,21] On the other hand, bacterial investigations, showed that placement of orthodontic bands is associated with the establishment of microorganisms usually found in periodontal disease.[22] The controversy still persists as the placement of fixed orthodontic appliances had a significant impact on microbial and clinical variables. The changes occurred faster at the bonded sites compared to the banded sites, probably because wire insertion caused difficulties in proximal cleaning. Over the long term, banding did not lead to more adverse microbial and periodontal effects than bonding. The important point is that in this study results were compared after band removal while in our study comparison was done during treatment. In our study, however we only looked for PPD so there is no comparison of our study with such studies which assessed gingival inflammation or bacterial change. However, these findings should draw attention to the importance of prophylactic programs for patients who are undergoing orthodontic treatment. Such programs are highly effective in maintaining the integrity of the periodontium, even in the presence of orthodontic appliances[23]. It is possible that in the future simple bacteriologic tests will help to modulate and personalize prophylactic programs or to identify risky patients well on time.

In literature, numerous studies investigated the most appropriate plaque elimination method for orthodontic patients.[24] Some of these studies compared the effectiveness of manual or electric toothbrushes on plaque elimination. Others evaluated the efficiency of toothpastes and mouthwashes with different ingredients, and oral irrigators on gingival health and plaque elimination. A study conducted by Ozlu FC et al [24] showed that standard education failed to maintain the plaque and gingival indices at the eighth week of the treatment. Although both video-assisted and hands-on training took a considerable amount of time, they served well in preserving both of the indices at the eighth week. The longer the educational intervention was, the better the preservation of the plaque and gingival indices were observed. In our study, all patients received oral hygiene instructions before treatment. All those patients who were not found capable in plaque elimination were excluded from the study. In our opinion, the most important advantage of the verbal technique is to have the opportunity to communicate with the patient and to gain his interest and confidence. The verbal technique in instructing the oral hygiene procedures was highly successful in our study sample, plus the parents were also given instructions in this regard who played a vital role in better oral hygiene.

A local study done by Jawaid and Qadeer showed that in orthodontic patients the most painful components at baseline were bands (Mean value=0.56) and after 24 hours were brackets (Mean value 6.25). Significant increase in pain was noted 24 hours after insertion of separators, bands and brackets.[25] Pain with orthodontic appliances is a frequent complaint which can definitely hamper the oral hygiene routine of the patient. Future studies should be designed keeping in mind the effect of pain on brushing routine thus indirectly affecting the periodontal health of orthodontic patients.

CONCLUSION

Based on the results, it was concluded that significantly greater periodontal probing depth was found in the banded molars as compared to the bonded molar tubes. The banded molars showed a statistically greater value of post treatment PPD as compared to the bonded molars sensitizing the orthodontists that as far as maintenance of the periodontal health is concerned bonding protocol provides better option than the conventional banding usually used during orthodontic treatment.

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