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Evaluation of periodontal parameters after the placement of fixed orthodontic appliance

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***Abstract*---**The results of this study confirms the fact that placement of fixed orthodontic brackets increases the accumulation of plaque in the oral cavity due to the presence of bands, brackets and wires in the oral cavity which acts as a hindrance for the tooth brush for proper removal of plaque from the oral cavity. So that we shout motivate the orthodontic patient for interdental aid and constant motivate for regular visit.

***Keywords*---**evaluation, periodontal parameters, placement fixed orthodontic appliance.

Introduction

The past decades have witnessed a steady increase in the number of patients undergoing orthodontic treatment with fixed appliances. Most of these patients wants to improve dentofacial esthetics. But very few of them require treatment from a medical or dental point of view. Periodontal disadvantages of orthodontic treatment with fixed appliances need to be characterized because the damage may be considerable.[1]

The region of the tooth surface around the brackets is prone to adhesion of oral bacteria and subsequent biofilm formation. Oral biofilm, or "dental plaque", is difficult to remove and regular brushing is often insufficient to remove plaque from retention sites, such as the vulnerable bracket-adhesive-enamel junction and the sensitive region between brackets and the gingiva.

Biofilms on dental hard and soft tissues, as well as on different biomaterials employed for restoration of function in the oral cavity, are the main cause of dental disease[2,3]. In orthodontics, the great variety of biomaterials used provides numerous additional surfaces to which microorganisms can adhere and form a biofilm. Moreover, orthodontic appliances severely hamper the efficacy of toothbrushing[4], reduce the self-clearance by saliva[5], change the composition of the oral flora[6], and increase the amount of oral biofilm formed[7] and the colonization of oral surfaces by cariogenic[8] and periodonto-pathogenic bacteria[9]. These factors strongly complicate orthodontic treatment, and illustrate that the need for oral biofilm control is even greater during orthodontic treatment than usual[5]. Despite current preventive measures to control biofilm formation during orthodontic treatment, the prevalence of biofilm-related problems has remained high.

Improper plaque control and undetected gingival inflammation might promote periodontal destruction that can be aggravated by orthodontic treatment.[10] It is well established that bacterial plaque is the primary etiological factor in the development of gingival inflammation and periodontitis.[11] The quantity and quality of plaque have long been known to be influenced by many factors, including surface characterstics.[12] Surface roughness and high surface free energies were positively correlated with plaque growth and maturation.[13] The placement of orthodontic brackets might influence biofilm formation and maturation as a result of all of the above mentioned factors.

The bacterial plaque initiates an inflammatory process in the periodontal structures. Hence the removal of plaque is an essential process for the health of periodontal tissues. Lack of adequate oral hygiene in conjunction with the placement of fixed orthodontic appliances is considered a major factor for an accentuated accumulation of bacterial plaque and the subsequent inflammatory response. Study[14] reporting on gingival changes after bracket placement noted only temporally reversible periodontal changes. However, another study[15] reported a significant loss of attachment during orthodontic treatment. The aim of this study is to assess clinical periodontal changes after placement of metal brackets and over time with short intervals and to compare these results with non- orthodontic group.

Materials and Methods

This study included 70 patients in the age range of 16-35 years from the outpatient Department of Orthodontics and Department of Periodontics, NIMS Dental College& Hospital, Jaipur. These were divided into two groups of 35 patients each, Group A patients were taken from the Department of Orthodontics and Group B patients were taken from the Department of Periodontics.
Group A- Patients with fixed orthodontic brackets
Group B- Patients without fixed orthodontic bracket

All the patients in the Group A and Group B were subjected to scaling and polishing. The patients in group A were placed fixed orthodontic brackets and baseline data was recorded and in group B also after scaling the baseline data was recorded. Both the groups were evaluated after 1 month and 3 months from the baseline. All the patients meeting the inclusion and exclusion criteria were enrolled in the study and written informed consent was obtained from those who agree to participate after detailed explanation was shared regarding the aims and objectives of the study.

Inclusion criteria

1. The patients in the age group of sixteen to thirty five years.
2. The patients who wanted to receive orthodontic treatment with fixed brackets.

Exclusion criteria

1. Patients who were having history of the use of antibiotics during the last 3 months prior to examination.
2. Patients who were younger than 16 or older than 35 years of age
3. Patients with previous history of periodontitis
4. Pregnancy or lactation
5. Patient who have undergone any periodontal surgery in a period of 1 year.
6. Patients who are currently smoking.

Clinical examination

All the patients from both the groups were clinically examined at baseline and after one month and three months duration

Periodontal parameters

PLAQUE INDEX (SILNESS &LOE) 1964

Fig. 5: Plaque Index

Fig. 6: Plaque Index

Fig. 7: Plaque Index in Orthodontic Patient

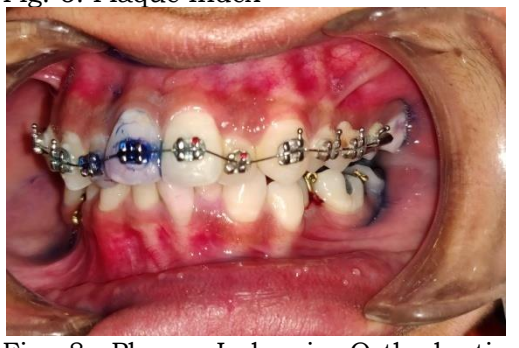


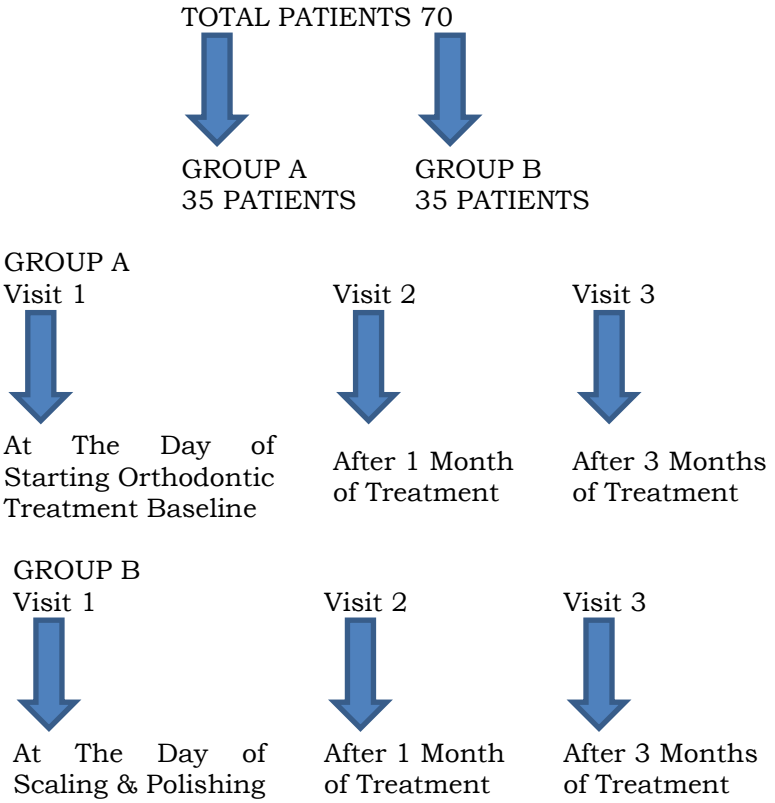
Fig. 8: Plaque Index in Orthodontic Patient

GINGIVAL INDEX (LOE &SILNESS) 1963

Fig. 9: Gingival Index (Loe &Silness)

Study design

1. The study included two groups of sample size 35 each. The group A comprised of patients undergoing orthodontic therapy. The group B comprised of healthy patient coming to Department of Periodontology. This study is a prospective longitudinal observational study
2. Experimental design was explained to all the participants. Plaque Index given by Silness and Loe and Gingival Index which was introduced by Loe and Silness (GI) was assessed



Results

A total of 70 patients in the age range of 16-35 years who were eligible and willing to participate were included in the study. The plaque Index (PI) and gingival index (GI) were measured and evaluated at baseline, 1 month and 3 months. The mean age group was 19 years in the present sample size. There were 13 females and 22 males in Group A and 16 females and 19 males in Group B. The table 1 shows the change in values of plaque index (PI) and gingival index (GI) with respect to different visits in the Group A.

Table 1: Comparison of within group change in values with respect to different visits in Group A

		N	Mean	Std. Deviation	Mean Difference	t-value	p-value
Pair 1	PI Visit 1	35	0.85	0.21	-0.171	4.861	<0.001
	PI Visit 2	35	1.02	0.06			
Pair 2	PI Visit 2	35	1.02	0.06	-0.121	4.211	<0.001
	PI Visit 3	35	1.14	0.19			
Pair 3	PI Visit 1	35	0.85	0.21	-0.292	7.062	<0.001
	PI Visit 3	35	1.14	0.19			
Pair 4	GI Visit 1	35	0.68	0.28	-0.310	6.748	<0.001

	GI Visit 2	35	0.99	0.04			
Pair 5	GI Visit 2	35	0.99	0.04	-0.048	4.466	<0.001
	GI Visit 3	35	1.04	0.06			
Pair 6	GI Visit 1	35	0.68	0.28	-0.357	7.273	<0.001
	GI Visit 3	35	1.04	0.06			

The mean value of plaque index in Group A at the baseline was 0.85, after 1 month 1.02 and after 3 months 1.14. The mean value of gingival index in Group A at the baseline was 0.68, after 1 month 0.99 and after 3 months 1.04. There is significant change in increasing direction in the mean values of plaque index as well as in gingival index with respect to different visits as depicted by P value <0.001. The table 2 shows the change in values of Plaque index (PI) and Gingival index (GI) with respect to different visits in group (B).

Table 2: Comparison of within group change in values with respect to different visits in Group B

		N	Mean	Std. Deviation	Mean difference	t-value	p-value
Pair 1	PI Visit 1	35	0.149	0.070	-0.846	66.40	<0.001
	PI Visit 2	35	0.995	0.018			
Pair 2	PI Visit 2	35	0.995	0.018	-0.043	5.61	<0.001
	PI Visit 3	35	1.038	0.045			
Pair 3	PI Visit 1	35	0.149	0.070	-0.889	63.91	<0.001
	PI Visit 3	35	1.038	0.045			
Pair 4	GI Visit 1	35	0.650	0.236	-0.332	7.95	<0.001
	GI Visit 2	35	0.981	0.071			
Pair 5	GI Visit 2	35	0.981	0.071	-0.044	3.29	0.002
	GI Visit 3	35	1.025	0.038			
Pair 6	GI Visit 1	35	0.650	0.236	-0.375	9.05	<0.001
	GI Visit 3	35	1.025	0.038			

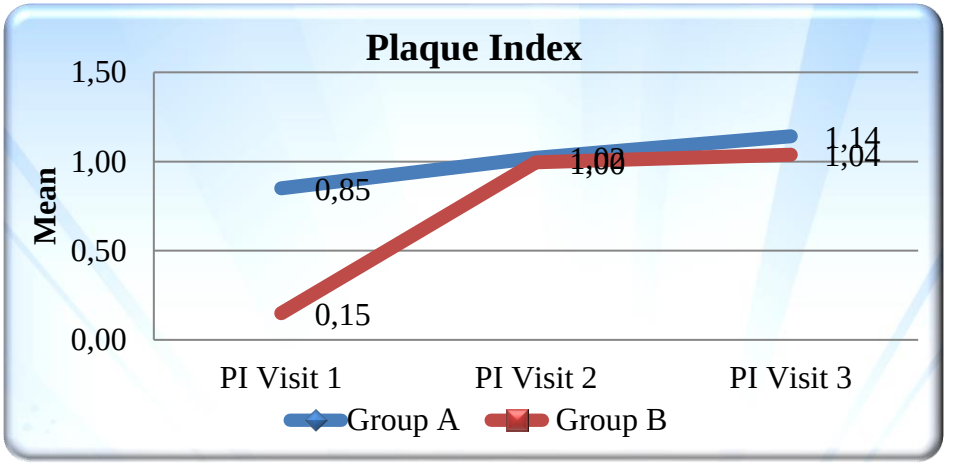
The mean value of plaque index in Group B at the baseline was 0.149, after 1 month 0.995 and after 3 months 1.038. The mean value of gingival index in Group B at the baseline was0.65, after 1 month 0.98 and after 3 months 1.025 The table 3 shows the comparison between the mean values of plaque index (PI) and gingival index (GI) between the group (A) and the group (B).

Table 3: Comparison of mean values between two groups (A) & (B) by using t-test

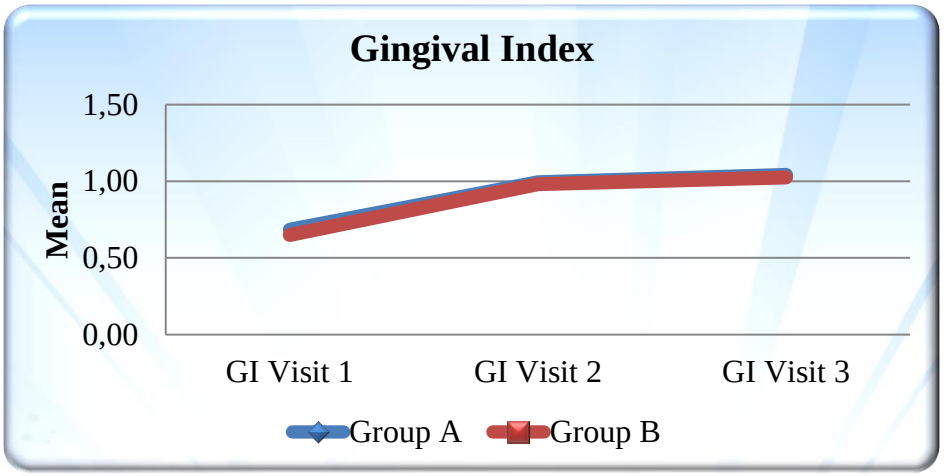
	Group	N	Mean	Std. Deviation	t-value	p-value
PI Visit 1	Group A	35	0.85	0.21	18.49	<0.001
	Group B	35	0.15	0.07		
PI Visit 2	Group A	35	1.02	0.06	2.47	0.016
	Group B	35	1.00	0.02		
PI Visit 3	Group A	35	1.14	0.19	3.131	0.003
	Group B	35	1.04	0.04		

GI Visit 1	Group A	35	0.68	0.28	0.555	0.58
	Group B	35	0.65	0.24		
GI Visit 2	Group A	35	0.99	0.04	0.939	0.351
	Group B	35	0.98	0.07		
GI Visit 3	Group A	35	1.04	0.06	1.435	0.156
	Group B	35	1.03	0.04		

Since p-value for plaque index is less than 0.05 in all the three visits, we can inference that there is significant difference between the two groups in case of plaque index. However, mean value of gingival index is not significant between the two groups at all the three visits. As p-value is more than 0.05.



Graph 5: Graph showing comparison of (PI) of both (A) & (B) group



Graph 6: Graph showing comparison of (GI) of both (A) & (B) group

Table 4: Overall comparison between Group A and Group B by using paired t test

		N	Mean	Std. Deviation	Mean Difference	t-value	p-value
Pair 1	PI Visit 1	70	0.50	0.39	-0.508	11.386	<0.001
	PI Visit 2	70	1.01	0.05			
Pair 2	PI Visit 2	70	1.01	0.05	-0.082	5.294	<0.001
	PI Visit 3	70	1.09	0.15			
Pair 3	PI Visit 1	70	0.50	0.39	-0.590	14.072	<0.001
	PI Visit 3	70	1.09	0.15			
Pair 4	GI Visit 1	70	0.67	0.26	-0.321	10.405	<0.001
	GI Visit 2	70	0.99	0.06			
Pair 5	GI Visit 2	70	0.99	0.06	-0.046	5.4	<0.001
	GI Visit 3	70	1.03	0.05			
Pair 6	GI Visit 1	70	0.67	0.26	-0.366	11.47	<0.001
	GI Visit 3	70	1.03	0.05			

The table 4 shows overall comparison of both group (A) & (B) by using paired t test. The results shows no significant difference in plaque index & gingival index between the group A and the group B as p-value is <0.001.

Discussion

Fixed orthodontic appliances create retention areas for plaque accumulation. The lack of adequate oral hygiene in these patients is presented as the main cause of bacterial plaque accumulation, increased number of bacterial colonies and consequent inflammatory response. During orthodontic therapy with fixed appliances, inflammatory reaction of gingival tissue can very often be observed. It seems that the main factor for an increased accumulation of dental plaque and inflammatory response is the appearance of new retentive places around the components of fixed appliances attached to the teeth.

The aim of this study is to investigate the influence of fixed orthodontic appliances on periodontal tissues, using periodontal indices like plaque index and gingival index. The assessment of plaque index and gingival index measured on six index teeth four molars and two incisors, showed an increase in the mean values from the baseline. The mean value of plaque index at the baseline in the patients with orthodontic brackets was 0.85 which was further increased to 1.02 and 1.14 in1and 3 months, this shows that after application of orthodontic brackets in the oral cavity there is more plaque accumulation.

As the values of all measured clinical indices increased to a maximum 3 months after fixed-appliance treatment for both indices in the patients with fixed brackets, it could be concluded that the presence of fixed appliances expresses its influence on periodontal health in this short period of time starting immediately after the placement of bands and brackets. This is in accordance to the studies done by Ristic[16] (2007), Zivkovic Sandic M[17] (2014).

The statistical analysis shows significant change in the values of plaque index and gingival index in the patients with orthodontic brackets from the baseline to 3 months. This shows that placement of orthodontic brackets and wire increases the accumulation of plaque in the oral cavity. The patients without orthodontic brackets also show increase in mean value of plaque index and gingival index in the statistical analysis.

On comparing the mean values of plaque index & gingival index in both the groups there is significant difference between the two groups in case of plaque index. However mean value of gingival index is not statistically significant between the two groups at all the three visits as p value is more than 0.05. Clinical studies on the influence of fixed appliances on the periodontal condition showed that fixed orthodontic treatment may worsen periodontal health, which improves again significantly after debonding. These studies also detected greater loss of clinical attachment level in the distal parts of the dental arches[18]. This was explained with worse oral hygiene in molar regions and with the presence of bands as bigger attachments. Similar to these results, Diamanti-Kipioti A[19] also points to the greater quantum of gingivitis around molars, measured by periodontal indices such as plaque index, gingival index and pocket probing depth, which could be explained with the fact that bonded attachments produce less gingival reaction compared with banded teeth. In this study the mean value of gingival index is not statistically significant between the two groups this is because of the fact that we have excluded the banded first molar instead had taken second molar in the index teeth examined for the periodontal indices as the presence of bands on first molar will automatically cover the entire tooth surface and there would be plaque accumulation leading to gingival inflammation as compare to the first molar in the patients without orthodontic brackets which is free from any bands and patient can use oral hygiene measure to remove plaque from the tooth surface.

This difference is usually attributed to the presence of uncultivable organisms, such as the various spirochetal species, which are not likely to be present in these young patients. The culturing technique relies on the detection of viable organisms and requires almost immediate processing of samples upon acquisition to maximize bacterial survival, in conjunction with essential, strict transport condition.[20] Lack of oral hygiene measures in conjunction with the placement of fixed appliances is considered a major factor in the accumulation of plaque and subsequent resultant inflammatory response. There is evidence that the prevention of plaque accumulation can control gingival inflammation[11]. It would seem obvious there is a need to maintain excellent physical plaque control throughout orthodontic treatment to ensure good gingival health.

Conclusion

The results of this study confirms the fact that placement of fixed orthodontic brackets increases the accumulation of plaque in the oral cavity due to the presence of bands, brackets and wires in the oral cavity which acts as a hindrance for the tooth brush for proper removal of plaque from the oral cavity. So that we shout motivate the orthodontic patient for interdental aid and constant motivate for regular visit.

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