

Evaluation of the Effects of Three Bracket Types on Periodontal Status

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ABSTRACT

Background: Fixed orthodontic appliances are associated with increased risk of plaque accumulation, bacterial colonization, and gingival inflammation. Oral-hygiene measures are hampered by fixed orthodontic appliances which consequently increases the accumulation of bacterial plaque as brackets, archwires, and other appliance components are both a focus for plaque accumulation and obstruction to plaque removal, thereby promoting gingivitis. The aim of this study was to evaluate the effects of three bracket types on periodontal status.

Material and Method: Periodontal status was compared among patients treated with MBT, Self-ligating and Lingual brackets. The periodontal parameters used in the study were plaque index, gingival index and bleeding on probing.

Results: The results of this study showed that periodontal status showed more deterioration in the MBT group followed by lingual group and it was found to be least in the self ligating group.

Conclusion: The use of MBT and lingual appliances promotes significant clinical alterations of the plaque index, gingival index and bleeding on probing compared to self ligating brackets. Self ligating brackets with a much lower amount of colonization of plaque is preferable over conventional and lingual brackets and they also reduced risk of deterioration of periodontal health.

Keywords: MBT, SLB, lingual orthodontic appliance.

INTRODUCTION

Fixed orthodontic appliances are associated with increased risk of plaque accumulation, bacterial colonization, and gingival inflammation. Furthermore, the correlation between plaque accumulation and halitosis is clearly demonstrated in the literature. The effects of orthodontic treatment on periodontal health have been investigated in several studies. This can be related to oral-hygiene measures hampered by fixed orthodontic appliances with consequent increases in the accumulation of bacterial plaque as brackets,

archwires, and other appliance components are both a focus for plaque accumulation and obstructions to plaque removal, thereby promoting gingivitis. The supragingival and sub gingival environment, are altered during fixed orthodontic treatment which leads to increase in amount of plaque around the teeth. Hence improper plaque control and gingival inflammation leads to periodontal destruction along with oral malodor. The relative side effects of fixed orthodontic treatment, such as the qualitative bacterial shift, are manifested as plaque-associated

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gingivitis, an increase in pocket probe depth (PPD), and bleeding on probing. To decrease these effects of conventional brackets, manufacturers introduced self-ligating brackets (SLBs), which have gained much popularity during the past few years. Some of the proposed favorable claims of SLBs are :-

- (1) the possibility of better oral hygiene because of the reduced complexity of the bracket, which has fewer retentive sites for microbial colonization; and
- (2) elimination of elastomeric or stainless steel ligature.

However there have not been many studies to validate the relationship between the brackets being used (conventional MBT, self ligating and lingual) on periodontal status. Hence, the need for the present study is to – Evaluate the effect of 3 different types of brackets (conventional MBT, self ligating and lingual) on periodontal status.

AIMS AND OBJECTIVES

The study was conducted with the following aims and objectives:

1. To determine the effect of 3 different bracket types on periodontal status.
2. To draw a clinical inference from the above results.
 - a) Does periodontal status deteriorate considerably for a particular system.
 - b) To educate patients to go for a particular system

MATERIALS AND METHODS

SOURCE OF DATA

The subjects selected were from patients reporting to the Department of Orthodontics and Dentofacial Orthopedics, Coorg Institute of Dental Sciences, Virajpet.

METHOD OF COLLECTION OF DATA

Purposive sampling technique was employed for patients who were seeking orthodontic therapy. Sample consisted of 21 subjects and were divided into three groups. The first group (Group A) consisted of 7 patients, who underwent treatment with conventional (MBT) brackets. The second group (Group B) consisted of 7

patients who underwent treatment with self ligating brackets. The third group (Group C) consisted of 7 patients who underwent treatment with lingual brackets.

Inclusion criteria:

Male and female patients between the age group of 15 and 35 years.

Patients who had no clinical signs of gingival inflammation.

Patients who had malaligned teeth and require fixed orthodontic therapy.

Exclusion criteria

Smokers

Pregnant or lactating women

Patients who had undergone periodontal treatment, within three months of baseline examination.

Systemic disorders that could influence periodontal conditions.

Patients who had taken antibiotics on or before a period of three months of the initial examination.

Materials used

1. Periodontal probe (WHO)
2. Camera (Nikon D5300)

Procedure

The study sample included twenty-one patients who underwent orthodontic treatment for a minimum period of 3 months. They were divided into three groups, each group consists of seven patients. Group A patients were treated using conventional brackets, group B patients using self-ligating brackets and group C using lingual brackets.

Categorization of samples.

Group	No. of patients
Group A (conventional labial bracket)	7
Group B (self ligating bracket)	7
Group C (lingual bracket)	7

The parameters used in this study were sillness and loe plaque index, Gingival index by Loe & Sillness(1963) and HR Muhlemann & S Son's sulcus bleeding index(1971), All the 3 indices were taken at 3 time intervals i.e. at baseline, after one month & after three months of appliance placement. For plaque index, six teeth were examined i.e 16, 12, 24, 36, 32 & 44. The four surfaces such as disto-facial, facial, mesiofacial & lingual surfaces were examined. The sum of the 4 scores was divided by 4. Then each score of the teeth were added and divided with the number of teeth examined.

The gingival index is used for the assessment of the gingival condition and records qualitative changes in the gingiva. It is measured on 4 surfaces i.e mesial, distal, labial & lingual of each tooth. The score of the 4 units were totalled & divided by 4 to obtain tooth gingival index, by totalling scores for individual teeth and dividing by number of teeth examined the gingival index is determined. An early sign of gingivitis is bleeding on probing measured by Muhlemann and Sons Sulcus Bleeding Index (SBI) which is measured on 4 surfaces ie mesial, distal, labial and lingual of each tooth. The score of the 4 units were totalled & divided by 4 to obtain sulcus bleeding index of one tooth and by totalling scores for individual teeth and dividing by the number of teeth examined the sulcus bleeding index is determined. The brackets were bonded on all the teeth except second and third molar teeth. The elastomeric rings or steel ligatures and arch wires were changed on monthly basis.

Timing for taking records

T0	T1	T2
Baseline	1 month after bracket placement	3 months after bracket placement

The subjects underwent a professional teeth cleaning prior to start of treatment, i.e. on their first appointment. No professional cleaning was carried out in the duration of the study and oral hygiene instructions were imparted to the subjects at each appointment.

Statistical methods used :

SPSS (version 20.0) for Windows was used for statistical analysis

- 1) Descriptive statistics
- 2) Multiple comparisons Bonferroni test
- 3) Repeated measure ANOVA test

COLOUR PLATE - 1

Patient treated with conventional MBT bracket



Fig 1: Showing one month before placement of bracket.



Fig 2: Showing one month after placement of bracket

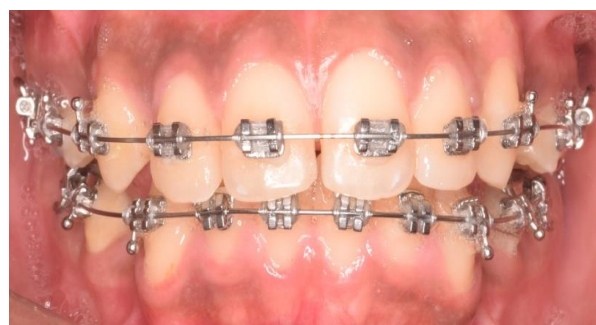


Fig 3: Showing two months after placement of bracket.

COLOUR PLATE 2

Patient treated with Self ligating brackets



Fig 4: Showing before placement of bracket.



Fig 5: Showing one month after placement of bracket.



Fig 6: Showing two months after placement of bracket.

COLOUR PLATE 3

Patient treated with Lingual brackets



Fig 7: Showing before placement of bracket.



Fig 8: Showing one month after placement of bracket.



Fig 9: Showing two months after placement of bracket.

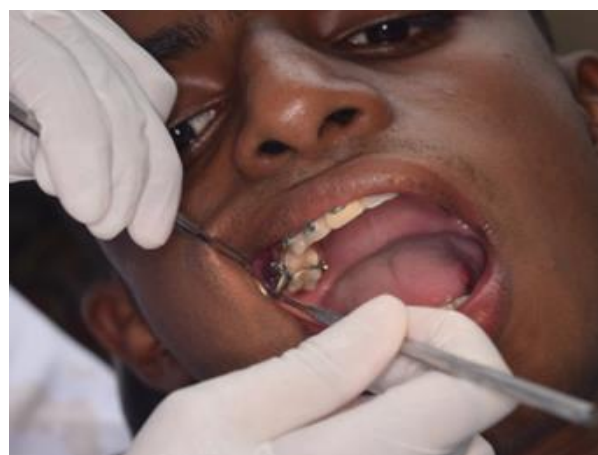


Fig 10: Assessment of Indices.

RESULTS

The present study was conducted to evaluate the effect of three bracket types on periodontal status. The sample size was of 21 subjects, which included 7 patients being treated using fixed conventional orthodontic appliance (MBT) and 7 patients being treated using fixed self ligating orthodontic appliance and the remaining 7 being treated using fixed lingual orthodontic appliance. The subjects were within the age group 12-35 years of age and were taken at T0 (baseline

examination, before bonding brackets), T1 (4 weeks after initial wire placement) and T2 (12 weeks after initial wire placement). The oral hygiene status was

assessed using Plaque Index, Gingival index and Bleeding on Probing.

The results of the study were as follows:

Table 1: Comparison of different brackets for clinical parameters at Baseline.

	Brackets	Mean	Std. Deviation	95% Confidence Interval for Mean		Statistics
				Lower Bound	Upper Bound	
PI	MBT	0.42	0.02	0.40	0.43	F = 1.763 P = 0.200 NS
	SLB	0.44	0.01	0.42	0.45	
	Lingual	0.42	0.02	0.40	0.44	
GI	MBT	0.37	0.01	0.36	0.38	F = 0.184 P = 0.834 NS
	SLB	0.36	0.02	0.34	0.39	
	Lingual	0.36	0.02	0.34	0.39	
BOP	MBT	0.11	0.02	0.09	0.14	F = 0.272 P = 0.765 NS
	SLB	0.11	0.01	0.10	0.12	
	Lingual	0.11	0.01	0.09	0.12	

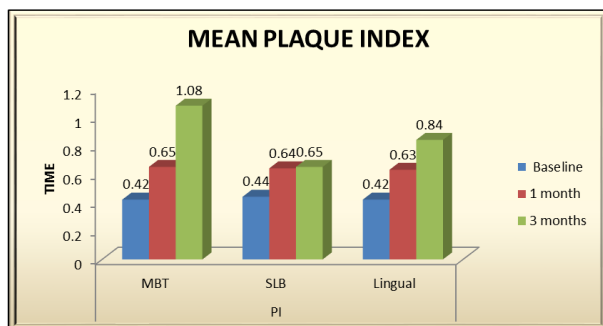
Table 2: Comparison of different brackets for clinical parameters at 1 month

	Brackets	Mean	Std. Deviation	95% Confidence Interval for Mean		Statistics
				Lower Bound	Upper Bound	
PI	MBT	0.65	.02340	.6369	.6802	F = 1.626 P = 0.224 NS
	SLB	0.64	.02673	.6239	.6733	
	Lingual	0.63	.02573	.6105	.6581	
GI	MBT	0.75	.03039	.7247	.7810	F = 196.417 P < 0.001 HS
	SLB	0.47	.02769	.4444	.4956	
	Lingual	0.55	.02340	.5369	.5802	
BOP	MBT	0.18	.01496	.1690	.1967	F = 4.227 P = 0.030 S
	SLB	0.16	.01134	.1552	.1762	
	Lingual	0.16	.01134	.1552	.1762	

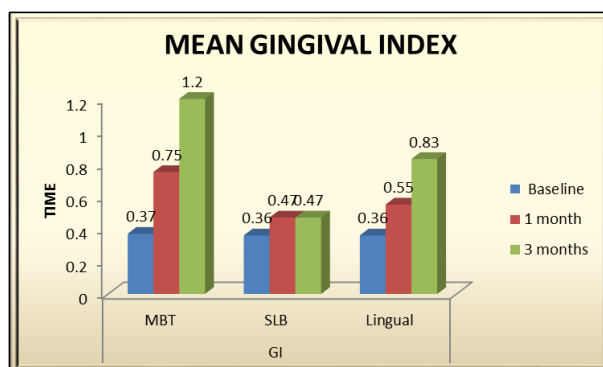
Table 3: Comparison of different brackets for clinical parameters at 3 months.

	Brackets	Mean	Std. Deviation	95% Confidence Interval for Mean		Statistics
				Lower Bound	Upper Bound	
PI	MBT	1.08	0.08	1.0043	1.1700	F = 105.228 P < 0.001 HS
	SLB	0.65	.02289	.6360	.6783	
	Lingual	0.84	.02673	.8239	.8733	
GI	MBT	1.20	.07345	1.1378	1.2736	F = 418.506 P < 0.001 HS
	SLB	0.47	.02699	.4508	.5007	
	Lingual	0.83	.02370	.8124	.8562	
BOP	MBT	0.25	.01574	.2369	.2660	F = 76.907 P < 0.001 HS
	SLB	0.17	.01291	.1581	.1819	
	Lingual	0.18	.00976	.1767	.1947	

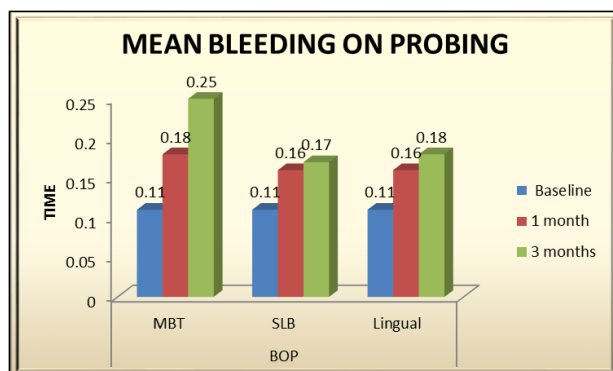
GRAPHS



Graph 1: Illustrates the increase in Plaque index in MBT, SLB and lingual brackets across time intervals T₀, T₁ and T₂.



Graph 2: Illustrates the increase in Gingival index in MBT, SLB and lingual brackets across time intervals T₀, T₁ and T₂.



Graph 3: Illustrates the increase in Bleeding on probing in MBT, SLB and lingual brackets across time intervals T₀, T₁ and T₂.

The result of the study were as follows:

1. Statistically significant results were found for all 3 bracket types between time interval T₁ & T₂ for plaque index, gingival index and bleeding on probing.

2. MBT group showed significant increase in (PI, GI and BOP) at T₃ followed by the lingual group and least in the self ligating group.
3. In the self ligating group the results were almost stable when comparing time interval T₂ with T₃.

DISCUSSION

The correlation between plaque accumulation and halitosis is clearly demonstrated in the literature. Fixed orthodontic appliances are associated with increased risk of plaque accumulation, bacterial colonization, and gingival inflammation. Hence Good plaque control is an important factor in the maintenance of dental health during fixed appliance therapy in orthodontics. Many researchers have observed inflammation of gingival tissues during fixed orthodontic therapy. Brackets, archwires, and other appliance components are both a focus for plaque accumulation and obstructions to plaque removal, thereby promoting gingivitis.

In a healthy oral cavity, the microorganisms coexist in a balanced state with their host. When changes occur in normal oral environment, the balanced flora alters. The introduction of orthodontic brackets is one such change. The brackets and ligatures have a negative effect on natural cleaning by creating retention areas for plaques, making the mechanical cleaning of the teeth and gingiva by the tongue and lips more difficult, and increasing the viscosity of the saliva.

Self-ligating brackets have been introduced to Orthodontics several decades ago. One of the most favorable aspects with the use of self-ligating brackets, according to the literature, would be elimination of the elastomers and steel ligature wires. The different accessory components of fixed orthodontic appliances contribute to the change in the equilibrium of oral ecology. The presence of brackets and ligatures has been shown to be related to in gingival inflammation and increased risk of tooth surface decalcification. The absence of ligatures in these brackets favor less bacterial adhesion and growth.

The conventional brackets have extra component i.e elastomeric ring for binding the archwire, which causes increase in the surface area which leads to increase the wettability of the brackets. Subsequently increasing the extent of salivary coating, leads to more number of association of microorganisms. Which is not possible in case of self-ligating bracket system since it doesn't contain elastomeric ring instead of that it has its own locking device for binding the archwire. In the conventional brackets, the elastomeric rings gives a retentive area for growing of the microcrystalline deposits which are mainly composed of potassium, sodium, chlorine, phosphorus and sulphur. The development of these deposits is associated with growth of crystal. Which helps in biofilm formation, leads to formation of plaque, and results in more number of association of microorganisms.

Since the advent of lingual orthodontic appliances in the 1970s, the recent years have witnessed a marked increase in the demand for lingual orthodontic appliances among orthodontic patients seeking esthetic improvement. "Invisible" orthodontic treatment can be provided by using fixed lingual bracket systems. Several seminal studies indicated that lingual appliances can provide treatment outcomes comparable to those achieved with labial appliances. Lingual orthodontic appliances enjoy esthetic advantages over conventional labial orthodontic however the bacterial adhesion is considered the same.

Determining the bracket system that causes a minimal destructive biologic effect has gained importance today. There are very few studies comparing SLBs with conventional brackets (CBs) on periodontal status.¹⁻² However, there have been no studies comparing 3 bracket types i.e conventional, self ligating and lingual brackets on periodontal status. In the present study it was seen that when considering the periodontal status i.e: plaque index, gingival index and bleeding on probing, there was a considerable increase after 3 months of bracket placement in both the MBT and lingual group. However the plaque index was relatively lesser in SLB brackets with no further increase after 1 month of bracket placement. This can be attributed to the fact that the SLB brackets accumulate lesser amount of plaque because of the

absence of elastic component. MBT brackets had a higher increase in all the periodontal parameters probably due to the presence of elastomeric modules which causes more adhesion of biofilm and plaque. Among the three bracket types the lingual bracket also showed a deteriorating effect on periodontal status but when compared to MBT group it was found to be lesser and when compared to the SLB brackets it was found to be higher.

CONCLUSION

The use of fixed conventional and lingual appliances promotes significant clinical alterations of the plaque index, gingival index and bleeding on probing compared to self ligating brackets. Self ligating brackets with a much lower amount of periodontal deterioration is preferable over conventional and lingual brackets as long term use of these brackets during the period of orthodontic treatment can affect periodontal health. If the inflammatory changes leads to periodontal diseases, then periodontal treatment is needed to be done after the orthodontic treatment, so special care should be taken by patients opting for conventional and lingual appliance toward their oral hygiene. Professional scaling should be carried out either at every, or every alternate, appointment. Use of interdental cleaning devices and mouth rinses should be prescribed for the patient to use at home.

CONFLICT OF INTEREST

No potential conflict of interest relevant to this article was reported.

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