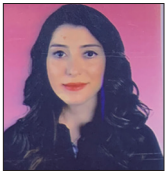


Original Article

Comparison of effects of bracket types and treatment duration on periodontal health of adult patients

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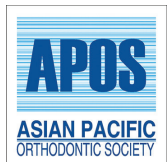
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ABSTRACT

Objective: The aim of this study was to assess the effect of fixed orthodontic treatments with steel-ligated conventional brackets and self-ligating brackets (SLBs) on periodontal clinical parameters.

Materials and Methods: Seventy-seven patients (24 male and 53 female) aged between 18 and 30 years were enrolled in the study. Periodontal parameters including plaque index (PI), gingival index (GI), and bleeding on probing (BOP) index were obtained from all the bonded teeth.

Results: When the effect of bracket type and duration of treatment on gingival tissues was examined, there was no statistically significant difference between the treatment times ($P = 0.670$) and bracket types ($P = 0.596$) in terms of PI. The GI was significantly different between the different treatment durations ($P = 0.045$); it was higher in patients with a treatment duration of 18–36 months. However, the GI did not change according to the bracket types ($P = 0.270$). This result was not significantly different between different treatment durations ($P = 0.270$). There was no significant difference between the treatment periods ($P = 0.189$) in terms of BOP index, and this result did not change according to the bracket types ($P = 0.621$).

Conclusion: SLBs do not require ligatures, which may facilitate plaque accumulation. However, our results showed that SLBs were not advantageous over CBs in terms of periodontal health.

Keywords: Dental plaque, Orthodontic brackets, Periodontal index

INTRODUCTION

Fixed orthodontic appliances increase dental plaque accumulation resulting in gingivitis, gingival enlargement, gingival recession, and periodontitis.^[1,2] Conventional brackets (CBs) are generally used with elastomeric or stainless steel ligatures to keep the orthodontic wire inside the slot,^[3] which can aggregate and accumulate bacteria. This alters the plaque and interferes with oral hygiene.^[4]

Manufacturers have developed self-ligating brackets (SLBs) to eliminate the problems of CBs. SLBs have special hinge caps to eliminate the use of elastomeric and steel ligature wires that facilitate effective tooth movement while shortening the total treatment time.^[5-8] A recent study reported that CBs have a lower aggregation of microorganisms compared to SLBs.^[9] While the lack of ligatures with SLBs was expected to create fewer plaque retentive areas and thus results in more favorable periodontal status, SLBs can also generate further plaque retention sites due to their opening-closing mechanisms.^[10]

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Studies comparing the SLBs and CBs on periodontal health in the literature have had controversial results. While some authors showed that CBs ligated with elastomeric ligatures result in more periodontal problems,^[11] others found that SLBs have no advantage over CBs ligated with steel ligatures in terms of periodontal health.^[12] Nevertheless, van Gastel *et al.*^[13] reported more ineligible periodontal status in patients treated with SLBs than CBs.

Orthodontic treatment is a long process that may induce detrimental effects on periodontal health depending on the oral hygiene levels of the patients. Although the effect of the bracket system on periodontal status has been studied extensively, there is a lack of information about the effect of bracket type considering treatment duration. Therefore, the aim of this cross-sectional study was to compare the effect of self-ligating and conventional orthodontic brackets in adults on the periodontal status under different treatment durations.

MATERIALS AND METHODS

Ethical approval was taken from the Committee for Ethics in Human Research of Bolu Abant İzzet Baysal University (protocol number: 2017/185). All patients/parents were informed, and consent forms were obtained before attending the study. Seventy-seven patients (24 male and 53 female) aged between 18 and 30 years (mean age 23.38 ± 1.7 years) were included in this study between July 2017 and August 2018. All patients were treated at the Department of Orthodontics, Faculty of Dentistry, Bolu Abant İzzet Baysal University, by an experienced orthodontist (K.H). The patients were randomly divided into two groups as follows using the random number generator: Group 1, SLB group (Damon 3MX, Ormco Corporation, Glendora, Calif; $n = 40$) [Figure 1], and Group 2, CB group ligated with steel ligatures (Avex MX, 0.022-inch, Opal Orthodontics, South Jordan, Utah; $n = 37$) and also subdivided into four groups according



Figure 1: Self-ligating brackets.

to treatment duration as follows: <18 months (CB: $n = 18$; SLB: $n = 20$) and between 18 and 36 months (CB: $n = 19$; SLB: $n = 20$) of treatment time [Table 1]. A sample size of 16 patients per group at $\alpha = 0.05$ gave a statistical power close to 0.8.^[14] Patient numbers in the groups were increased to increase the power.

The inclusion criteria for the patients were as follows: Aged 18 of 30 years who started non-extraction fixed orthodontic therapy, good general health, minimal-to-moderate crowding of teeth with permanent dentition, adequate oral hygiene (plaque score $\leq 20\%$), no use of antibiotics or mouth rinses within 3 months before the periodontal examination, and no smoking. Patients who had mouth breathing, periodontal diseases, active caries lesions, or a history of previous orthodontic treatment were excluded from the study. All patients received oral hygiene instructions before the treatment and used standardized fluoridated toothpaste, toothbrush, and interdental brushes.

Clinical periodontal parameters including the plaque index (PI), gingival index (GI), and bleeding on probing (BOP) were recorded at the end of the treatment with a 0.5-mm diameter and 1-mm Williams probe at four sites for all teeth by a single calibrated periodontist (Ö.U). Periodontal examination used the PI of Loe and Silness, GI of Loe,^[15] and Seymour index^[16] for recording the occurrence of GE in the anterior segment by visual inspection.

BOP index was recorded as presence or absence.

Table 1: Distribution of gender, treatment duration, and oral hygiene habits according to the bracket types.

	Bracket type		P
	SLB	CB	
	n (%)	n (%)	
Gender			
Woman	29 (72.5)	24 (64.9)	0.470
Man	11 (27.5)	13 (35.1)	
Treatment duration			
<18 months	20 (50.0)	18 (48.6)	0.906
18–36 months	20 (50.0)	19 (51.4)	
Dental floss usage			
No	39 (97.5)	34 (91.9)	0.268
Yes	1 (2.5)	3 (8.1)	
Interdental brush usage			
No	21 (52.5)	15 (40.5)	0.293
Yes	19 (47.5)	22 (59.5)	
Tooth brushing frequency (number)			
1.00	5 (12.5)	3 (8.1)	0.762
2.00	25 (62.5)	21 (56.8)	
3.00	9 (22.5)	12 (32.4)	
4.00	1 (2.5)	1 (2.7)	

SLB: Self-ligating bracket, CB: Conventional bracket, n: Number

Statistical analysis

Descriptive statistics were calculated as the number and percentage frequencies. Kolmogorov–Smirnov tests were computed for each variable to assess whether the variables were distributed normally. Differences in gender distribution, use of dental floss and interdental brush, and tooth brushing frequency were analyzed by the Pearson Chi-square analysis between groups. Effects of bracket types and treatment times on clinical indices were evaluated by two-factor analysis of factorial variance. For all tests, values of $P < 0.05$ were considered to be statistically significant. Statistical analyses were done with the (SPSS Inc; Chicago, IL) Version 18 software package.

RESULTS

There was no significant difference in gender distribution, use of dental floss or interdental brushes, and daily tooth brushing frequency between SLB and CB groups. A number of CB and SLB groups with <18 months and 18–36 months of treatment were also similar [Table 1].

When the gingival characteristics were evaluated, the mean GI was the only higher value in patients who underwent treatment for 18–36 months (1.69 ± 0.50), whereas the treatment times and bracket type were not significantly effective at all other values [Table 2]. The PI showed was no statistically significant difference between the treatment times ($P = 0.670$) and bracket types ($P = 0.596$). The GI was significantly different between the different treatment durations ($P = 0.045$). It was higher in patients with a treatment duration of 18–36 months. However, the GI did not change according to the bracket types ($P = 0.270$);

this result was not significantly different between different treatment durations ($P = 0.270$).

The Seymour index had no significant difference between treatment durations ($P = 0.330$), and this result did not change according to bracket type ($P = 0.934$). No significant difference was detected between CB and SLB types ($P = 0.311$), and this result did not change according to treatment duration ($P = 0.934$) [Table 2].

The BOP index had no significant difference between the treatment periods ($P = 0.189$). This result did not change according to the bracket types ($P = 0.621$). There was no significant difference between the bracket types ($P = 0.201$), and this result did not change according to treatment duration ($P = 0.621$) [Table 2].

DISCUSSION

Fixed orthodontic therapy generally causes retentive sites associated with increased plaque accumulation and inadequate oral hygiene.^[17] In the literature, some studies concluded that orthodontic therapy deteriorates periodontal status such as gingival bleeding and gingival enlargement. This is associated with bracket type and treatment time.^[18,19]

The most favorable feature of the SLBs is the elimination of the need for ligatures. Brackets ligated with elastomeric ligatures have higher bacterial numbers than steel wires.^[20] We used steel ligatures here for CBs so that are a more comparable group to SLBs in terms of plaque accumulation.

This work evaluated periodontal tissues using the GI, PI, BOP, and Seymour index. We used the Silness and Løe gingival

Table 2: Comparisons of periodontal measurements according to the bracket type and treatment duration.

Bracket type	<18 months		18–36 months		P	Bracket type		P
	n	Mean±SD	n	Mean±SD		n	Mean±SD	
Plaque index								
SLB	20	0.80±0.52	20	0.96±0.88		40	0.88±0.72	0.128
CB	18	1.13±0.61	19	1.12±0.71		37	1.12±0.66	
Treatment duration total	38	0.96±0.58	39	1.03±0.80	0.670			
Gingival index								
SLB	20	1.30±0.70	20	1.69±0.61		40	1.50±0.68	0.270
CB	18	1.57±0.40	19	1.69±0.36		37	1.63±0.38	
Treatment duration	38	1.43±0.58	39	1.69±0.50	0.045	*		
Bleeding index								
SLB	20	60.18±27.90	20	47.19±35.19		40	53.69±32.03	0.201
CB	18	65.82±23.68	19	59.91±35.97		37	62.79±30.34	
Treatment duration	38	62.85±25.80	39	53.39±35.68	0.621			
Seymour index								
SLB	20	0.56±0.48	20	0.73±0.76		40	0.65±0.63	0.311
CB	18	0.74±0.59	19	0.88±0.93		37	0.81±0.77	
Treatment duration	38	0.65±0.53	39	0.81±0.84	0.934			

SLB: Self-ligating bracket, CB: Conventional bracket, * $P < 0.05$ significant, SD: Standard deviation

and PI similar to the literature.^[10,18] Our results show that the SLBs do not have an advantage relative to CBs in terms of periodontal status. Similar to our results, some researchers found that bracket design did not affect periodontal clinical parameters.^[21-23] Conversely, Nalçacı *et al.*^[18] reported that PI and GI were significantly lower in SLBs than in CBs after 5 weeks. Consistent with Nalçacı, Pellegrini *et al.* reported a higher amount of plaque accumulation on CBs than SLBs.^[11] The differences may be related to the study protocol including the study population, age, type of SLBs, and different statistical analyses. This could also be attributed to the oral hygiene instructions given to the patients at the start of the treatment.

The only difference in our study was for the GI as a function of treatment duration; this was despite similar PIs. The average GI was higher in people with a treatment duration of 18–36 months. This difference might be attributed to patients' decreased cooperation with increased treatment duration and elongated dental plaque exposure time.

Dietary habits, oral hygiene status, dental crowding, and age have significant effects on patients' composition of dental plaque. We investigated the effect of bracket type and treatment duration on the periodontal health. The fact that the patient's ages were all similar (and all adults) suggests that the subjects have similar oral hygiene procedures and a similar diet compared to the younger age group. Patients were advised on the same oral hygiene techniques, and patients with mild-to-moderate crowding were matched with a comparable group in terms of plaque accumulation. The only variable that affects plaque accumulation is bracket types. Although the use of SLBs and CBs both caused increased plaque accumulation, no significant differences were found between the groups in terms of treatment duration; this results were similar to Kaygisiz study.^[21] While SLB eliminates the use of elastomeric and steel ligatures, it also includes opening and closing mechanisms – this might create additional plaque retention areas.

Limitation

Gingival crevicular fluid analysis was not performed, and this might be one of the limitations of this study. It might also be beneficial to clarify subclinical inflammation and bone metabolism related with different bracket types.

CONCLUSION

Although SLBs do not require ligatures that may facilitate plaque accumulation, our findings showed that SLBs were not advantageous over CBs in terms of periodontal health. Our findings also showed that gingival health deteriorated as the duration of the treatment increased.

Declaration of patient consent

Patient's consent not required as patients identity is not disclosed or compromised.

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Nil.

Conflicts of interest

The authors declare that they have no commercial or associative interest that represents a conflict of interest in connection with the manuscript.

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