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Comparative Analysis of Plaque Retention Between Conventional Brackets and Self-Ligating Brackets Using Plaque Index

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ABSTRACT

Aim

To evaluate the effects of two different brackets on the accumulation of microbial dental plaque.

Objectives

To evaluate and compare the amount of plaque accumulation in the self-ligating and conventional brackets by plaque index.

Materials and Methods

A total of 48 Patients commencing the orthodontic treatment with self- ligating or conventional brackets selected for study. All subjects were informed of all relevant aspects of the study and provided their written consent for participation; parents signed and approved the participation of underage patients (<18 years of age). The Plaque Index (given by Sillness J. and Loe H. in 1964) was used to measure the amount of the plaque accumulation in the subjects.

Result

It was observed that statistically significant difference between both group of self-ligating and conventional brackets for plaque score during baseline, one and two month period ($p \leq 0.05$*).

Conclusion

It can be concluded that Plaque accumulation in self-ligating bracket is less compared to conventional bracket systems (plaque index). This comparison can be especially helpful in patients with poor periodontal health.

KEYWORDS: *Plaque Index, self-ligating brackets, conventional brackets, bonding, orthodontics*

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INTRODUCTION

Self-ligating brackets are preferred over stainless-steel brackets because of their simpler, less retentive surface, which facilitates better cleaning and enhances oral hygiene.[1] Plaque accumulation and gingival inflammation may increase as a result of orthodontic brackets' detrimental effects on the sub-gingival microbiota's composition and rate of accumulation.[2]

Numerous authors have reported the increased risk of caries and periodontal diseases related to orthodontic fixed appliances which impede good oral hygiene practices and result in the accumulation of plaque.[2, 3] Although some author reported that bracket design and surface properties affect microbial dental plaque accumulation, bacterial species and periodontal status[4-6]

Addition of external ligation over conventional brackets which are used to fix the wires within the bracket slot create plaque retentive sites that are suitable for bacterial colonization and biofilm formation impending adequate oral hygiene maintenance leading to increased risk of caries in orthodontic patients.[7]

Self-ligating (SL) brackets were introduced to orthodontics several decades ago. One of the most favorable aspects with the use of SL brackets clinically would be the elimination of elastomeric ligation and steel ligature wires.

The aim of this study was to evaluate the effects of two different brackets on the accumulation of microbial dental plaque and compare the amount of plaque accumulation in the self-ligating and conventional brackets by plaque index.

Method and materials:

Study Design: Cross sectional study

Study Duration: 2 months

Study Population:
Group 1: patients were bonded self-ligating brackets

Group 2: patients were bonded conventional brackets.

Source of Data:

The study was conducted in the Department of Orthodontics and Dentofacial orthopaedics. The samplewas selected on the basis of following criteria.

Inclusion criteria

- Age Group: 12 to 25 years
- Gender: All gender
- Patients commencing the orthodontic treatment with self- ligating or conventional brackets
- Periodontally healthy patients
- Patients consenting for participation in the study

Exclusion Criteria

- Subjects with compromised periodontal health
- Subjects with any systemic disorder that may affect the accumulation of plaque
- Mentally challenged patients

Materials

Materials and instruments required for the study are[7]

- Plaque Index recording format
- Mouth mirror
- William's Periodontal probe
- Shepard's Hook explorer (no. 23)

Methodology:

The Plaque Index (given by Sillness J. and Loe H. in 1964) was used to measure the amount of the plaque accumulation in the subjects.

All subjects were informed of all relevant aspects of the study and provided their written consent for participation; parents signed and approved the participation of underage patients (<18 years of age). The 48 patients were randomly divided into two equal groups according to the type of bracket.

Group 1: patients were bonded self-ligating brackets.

Group 2: patients were bonded conventional brackets.

Before bonding of the brackets, plaque index of all patients was recorded and they received oral hygiene instructions. The same trained examiner evaluated the periodontal status of all participants with a periodontal probe and visual inspection.

The second scoring was done after one month of bonding the brackets and the third after 2 months of bonding the bracket.

Statistical analysis:

SPSS: - Statistical analysis will be performed using Statistical Product andservice solution (SPSS) version 16 for Windows (SPSS Inc, Chicago, IL).

Mean 4 SD

Unpaired't' test Formula:

$$n = \frac{2\,S^2(Z1+Z2)^2}{(M1-M2)^2}$$

M1:- Mean test intervention
M2:- Mean control intervention
S1:- Standard deviation of M1
S2:-Standard deviation of M2
S:- Pooled SD
1-α: - Set level of confidence. Usual values 0.95; 0.99
1-β: - Set level of power test. Usual value 0.8, 0.9
Z1:- Z value associated with α** 1.64
Z2:- Z value associated with β 0.84
n:- Minimum sample size

RESULT

Table 1 Intragroup comparison between Conventional and Self Ligating Brackets for plaque scores

		N	Mean	Std. Deviation	F-Value	p-Value
Conventional Brackets	Baseline	24	1.1708	.27104	85.30	0.01*
	1 Month	24	1.7423	.23694		
	2 Months	24	2.2182	.31112		
Self-Ligating Brackets	Baseline	24	.9542	.20426	96.15	0.01*
	1 Month	24	1.4769	.35362		
	2 Months	24	2.2727	.38691		

Level of significance p≤0.05*
Test applied One Way ANOVA

Statistically significant difference found in between both group of self-ligating and conventional brackets for plaque score during baseline, one and two month period (p≤0.05*).

Table 2 Intergroup comparison of plaque score between the groups

	Groups	N	Mean	Std. Deviation	F-Value	p-Value
Baseline	Conventional Brackets	24	1.1708	.27104	1.65	0.01*
	Self-Ligating Brackets	24	.9542	.20426		
Month-1	Conventional Brackets	24	1.7125	.21328	5.09	0.01*
	Self-Ligating Brackets	24	1.4500	.35386		
Month-2	Conventional Brackets	24	2.2083	.30491	2.75	0.80
	Self –Ligating Brackets	24	2.2333	.39416		

Level of significance p≤0.05*
Test applied Independent t test

Statistically significant difference found in between both group of self-ligating and conventional brackets for plaque score during baseline and one month period (p<0.05*).

DISCUSSION

The main goal of the introduction of periodontal indices was to cater to the specific demands of each patient, such as monitoring the course of disease or ensuring hygienic compliance in particular dental arch areas. However, the scope of their use has grown to include studies aimed at assessing a population's periodontal state and evaluating the efficacy of treatment regimens. This was done in order to compare the quantity of plaque buildup in the self-ligating and traditional brackets by plaque index and assess the impact of two different brackets on the accumulation of microbiological dental plaque.

Patients were first fitted with self-ligating and conventional brackets after the plaque index was determined. Children receiving orthodontic treatment have been found to have a definite decline in their gingival and periodontal health. Oral hygiene programs were heavily advised prior to orthodontic treatment in order to prevent negative effects on periodontal and gingival tissues. In our study, patients were given guidelines on dental hygiene and asked to follow up after a month.

Plaque accumulation is associated with more retentive sites becoming available for microbial colonization, which will eventually calcify. The fundamental premise underlying the usage of self-ligating brackets in relation to oral hygiene effects is the idea that ligatures—elastomerics in particular—increase the build-up of plaque. The pace of biological fluid flow at the site of contact, the kind of interfacial interactions that take place, and the strength of the attachment to the substrate all affect how biofilm adsorption turns out.

It was discovered that brackets had an indirect impact on the subgingival microbiota's makeup. In this investigation, the Plaque Index was run one month following bonding, two months following bonding, and prior to bonding. After a week, Sukontapatiparket al found a lot of plaque on bonded teeth. The third instance was carried out four weeks following the second, which matched the typical interval between orthodontic consultations.

As the clinical parameters (PI) increased after orthodontic treatment began, we found in this study that PI after one month of bonding showed a significant raise compared to the self-ligating brackets. This suggests that dental plaque accumulation may be the primary cause of the gingival inflammation observed in these patients. Within a week, Sukontapatipark et al.found a lot of plaque on bonded teeth.

Four weeks after the initial procedure, or the average amount of time between orthodontic appointments, was spent on the second occasion. The outcomes demonstrated a rise in the PI for both conventional and self-ligating brackets.

Careful monitoring of periodontal diseases is necessary for individuals receiving orthodontic treatment. Both permanent and removable orthodontic appliances make it more difficult to practice good periodontal hygiene, which increases the buildup of plaque, bleeding, and irritation. According to our research, both self-ligating and conventional bracket systems had the same amount of plaque retention over a two-month period.

Therefore, to control plaque, employ the proper tools and techniques for dental hygiene.In orthodontic patients, powered toothbrushes, interdental brushes, and specific kinds of floss have been demonstrated to enhance plaque control.

Conclusion

Based on the results of the present study, it can be concluded that Plaque accumulation in self-ligating bracket is less compared to conventional bracket systems (plaque index). This comparison can be especially helpful in patients with poor periodontal health.

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