



Research Article

Effects of fixed orthodontic treatment on gingival health: An observational study

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ISSN Print: 2394-7489
ISSN Online: 2394-7497
IJADS 2017; 3(3): 156-161
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www.oraljournal.com
Received: 06-05-2017
Accepted: 07-06-2017

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Abstract

Objective: To evaluate the effects of fixed orthodontic treatment on gingival health.

Materials and methods: In the present study 30 orthodontic patients under fixed mechanotherapy mean aged 19.82 years were selected.

The selection criteria were: Treatment that consisted of full-mouth fixed orthodontic appliances.

Exclusion criteria included patients with systemic disease, are on antibiotics or mouth rinses and uncooperative patients.

Information about the patient's oral hygiene practices was obtained using a validated questionnaire designed to be comprehensive for all patients.

Results: The clinical examination of their oral health status showed that the mean value of the plaque index (PI) was 65.24 (SD 16.43), while the gingival bleeding index (GBI) was 19.14 (SD 7.95) and the ortho-plaque index (OPI) was 53.56 (SD 8.74).

Limitations: The sample size selected was small.

Conclusion: Patients wearing orthodontic appliances were having high plaque index, gingival bleeding index and ortho plaque index scores therefore, educating and motivating these patients remains the cornerstone for achieving optimal oral hygiene results.

Keywords: Fixed Orthodontic Treatment, Gingival Health

Introduction

Periodontic-orthodontic interrelationship has been subject to a lot of investigation until today, and it is a still controversial issue. Malocclusion has been shown to affect periodontal health and one of the objectives of orthodontic treatment is to promote better dental health and prolong the life of dentition. Orthodontic treatment contributes to better oral hygiene by correcting dental irregularities and reduces (or eliminates) occlusal trauma. Due to these reasons, it has been suggested that orthodontic treatment leads to an improved periodontal status. It seems reasonable that straighter teeth are easier to clean, and perhaps having all teeth centered in the alveolar housing and occluding correctly may promote a healthier periodontium.

Orthodontic appliances, as well as mechanical procedures, are prone to evoke local soft tissue responses in the gingiva. The proximity of orthodontic appliances to the gingival sulcus, plaque accumulation, and the impediments they pose to oral hygiene habits further complicate the process of efficient salutary orthodontic care^[1]. The effects seen clinically following the insertion of orthodontic appliances into the oral cavity can contribute to chronic infection, inflammatory hyperplasia, irreversible loss of attachment (permanent bone loss), and gingival recession.

There is very few literature and scarcity of this type study. Hence the study is planned to determine and observe the gingival health status among patients undergoing fixed mechanotherapy.

How can orthodontic treatment afford some degree of protection against periodontal breakdown?

A strong relationship between the abnormal positions of the teeth in the dental arch and the periodontal disorders had been previously described. Moreover, it has been shown that the number of periodontal pathogens in the anterior sites of crowded teeth is much greater than that in the sites of aligned teeth^[2].

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The correction of the crowded teeth can eliminate any harmful occlusal interference which may offer a great opportunity for the development of a periodontal breakdown [3]. This data definitely supports the concept that orthodontic treatment can positively affect the periodontal health, prevent the development of periodontal diseases and offer a possible action to enhance the bone formation within the bony defects [4].

Recent Aspects in Periodontic-Orthodontic Interrelationship

Generally, the main reasons routinely cited to justify the provision of orthodontic treatment are improvement of facial and dental aesthetics and of dental health and function. However, association between malocclusions and periodontal condition is still controversial. Some authors found significant correlations between malocclusions and periodontal condition and suggested that malocclusions are risk markers for periodontal diseases [5].

A review of the literature conducted showed contradictory findings on the impact of malocclusion and orthodontic appliances on periodontal health, since only a few studies reported attachment loss during orthodontic treatment. [6] It has been suggested that this contradiction may be partly due to the selection of materials and differences in the research methods employed. However, our previous studies showed that orthodontic treatment in general does not have any negative effects on the periodontal tissues when a high level of oral hygiene is maintained [7].

Actually, between the year 1964 and 2007, sufficient studies had been conducted in terms of orthodontic treatment and possible related periodontal changes. Thus, it sounds plausible to extract evidence-based conclusions from those studies by means of systematic reviews.

An author [8] conducted two systematic reviews to address the following questions: does a malocclusion affect periodontal health, and does orthodontic treatment affect periodontal health? The first review found a correlation between the presence of a malocclusion and periodontal disease. Subjects with greater malocclusion have more severe periodontal disease. The second review identified an absence of reliable evidence on the effects of orthodontic treatment on periodontal health. It has been suggested that the results of both reviews do not warrant recommendation for orthodontic treatment to prevent future periodontal problems, except for specific unusual malocclusions.

Materials and Methods

Sample selection

In the present study 30 orthodontic patients under fixed mechanotherapy aged 15-30 years were selected.

Method to collect data

The selection criteria were:

1. Treatment that consisted of full-mouth fixed orthodontic appliances
2. No systemic diseases.
3. No history of taking antibiotics for the last three months.
4. No treatment by a dental hygienist any time during the month preceding the study.

Exclusion criteria included patients with systemic disease, are on antibiotics or mouth rinses and uncooperative patients.

Method

Information about the patient's oral hygiene practices was obtained using a validated and pretested questionnaire having

an acceptable reliability and validity designed to be comprehensive for all patients (Table 1). The study did not obtain any confidential demographic information such as income or educational level. The questionnaire did cover oral hygiene practice, oral hygiene tools, and numbers of visits to a dental hygienist.

Examiner Calibration

One examiner conducted the study. Ten subjects who volunteered to participate were examined on two occasions using the three indices (PI, GBI, and OPI) to establish intra-examiner reliability. The Kappa test was used to analyze the intra-examiner reliability and scored 70.4 percent, 78.7 percent, and 80 percent for GBI, PI, and OPI respectively.

Orthodontic Plaque Index, 'The O'Leary plaque index (PI) [9], and gingival bleeding index [10], were used to determine the present state of the patient's oral hygiene and the gingiva. An orthodontic plaque index [11], was used to evaluate plaque levels in the areas cervical to the bracket base and mesial and distal to the bracket body, which are the most critical zones of plaque accumulation. OPI was calculated using the index formula shown in Table 2 where the factors used were 1, 2, and 3 for occlusal, cervical, and central, respectively.

OPI was scored as Good (0-25 points), Average (26-50 points), and Poor (>50 points).

Gingival Bleeding Index

For the gingival bleeding index (GBI), all four surfaces of the teeth were assessed to

Examine probing elicited bleeding present or not. The severity of gingivitis was expressed as a percentage calculated as follows:

$[\text{Number of bleeding sites} / \text{Number of evaluated sites} \times 100]$.

Data Analysis

Data were entered into the computer using the FoxPro program [FoxPro 7.0; Sybase Inc., Dublin, CA, USA], and the Statistical Package for the Social Sciences [SPSS 10; (SPSS Inc., Chicago, IL, USA)] was utilized for the statistical analyses.

Results

30 orthodontic patients (15 male and 15 female) needing fixed mechanotherapy aged 15-30 years participated in this six-month study. The clinical examination of their oral health status showed that the mean value of the plaque index (PI) was 65.24 (SD 16.43), while the bleeding index (GBI) was 19.14 (SD 7.95) and the ortho-plaque index (OPI) was 53.56 (SD 8.74) (Table 3).

Tooth Brush and Brushing Frequency (Question 1)

All patients reported using a manual soft orthodontic toothbrush to clean their teeth, and Table 4 shows the frequency of brushing per day. 18 percent patients brushed once daily, whereas 54 reported brushing twice daily and 22 percent said they brushed their teeth three times per day. The remaining 6 percent patients reported brushing infrequently.

Brushing Technique

The evaluation of brushing techniques revealed that 8 percent patients were using a circular brushing movement, 42 percent used a horizontal movement, and 26 percent of the patients were using a vertical movement in one direction. The remaining patients were unable to describe their method of brushing so their technique of brushing was considered as

irregular.

Oral Hygiene Aids

About half of the patients stated they also were using other oral hygiene tools. Table 4 shows 6 percent used dental floss once daily and 24 percent used a toothpick.

8 percent of the patients were miswak users, but three of them used it once daily. whereas the fourth patient used it twice daily. Miswak is a teeth cleaning twig made from a twig of the *Salvadora persica* tree, also known as the arak tree or the peelu tree.

Among all patients 16 percent patients used an interdental brush with one patient reportedly using it twice a day and seven patients saying they used it twice daily (Table 4). The remaining patients reported not using any oral hygiene aids.

Mouthwash (Question 3)

Among the 30 patients in the study, a total of 34 percent reported using mouthwash. 8 reported using a mouthwash containing fluoride.

Sugar Consumption (Question 4)

Among the 30 patients surveyed, 14 percent indicated they consumed sugar during the treatment, whereas 72 percent consumed sugar sometimes. The remaining seven reported they did not consume any sugar.

Sticky Food Consumption (Question 5)

Among all patients 4 percent patients reported eating sticky food (e.g., toffee), whereas 44 percent were eating sticky foods occasionally. The remaining 52 percent did not eat any sticky foods.

Visits to a Dental Hygienist (Question 6)

Only 32 percent of the participants reported being treated by a dental hygienist during their orthodontic treatment, while the remaining 68 percent did not visit the hygienist. No significant difference was observed between male and female patients for the plaque index ($p=0.925$) and for the orthodontic plaque index ($p=0.072$). On the other hand, a significant difference was observed for the bleeding index at the 5 percent level ($p=0.033$). When evaluating the relationship between the three indices and age group, no statistically significant difference was noted for the PI ($p=0.677$), the GBI ($p=0.534$), or the OPI ($p=0.336$). The result of OPI showed that all the patients scored 52 or higher with 40 percent patients rated as having fair oral hygiene and 60 percent having poor oral hygiene. None of the patients scored between 0 and 25 and could be classified as having good oral hygiene. There was no significant correlation between the OPI and GBI ($p=0.99$) (Table 5).

1) Do you use a toothbrush?				
Yes	No			
If yes, how many times do use it/day?				
Once/d	Twice/d	Three times/d	Irregular	
What type of toothbrush do you use?				
Extra Soft	Soft	Medium	Hard	I don't know
Describe brushing technique:				
2) Do you use any of the following cleaning aids and how many times?				
Dental floss				
Once	twice	three times	irregular	
Interdental brush				
Once	twice	three times	irregular	
Toothpick				
Once	twice	three times	irregular	
Miswak				
Once	twice	three times	irregular	
3) Do you use mouthwash? If yes...				
Once	twice	three times	irregular	
Please write the brand name of the mouthwash: _____				
4) Do you consume sugar during orthodontic treatment?				
Yes	Sometimes	No, I don't take sugar		
5) Do you eat sticky food?				
Yes	Sometimes	No, I don't take sticky food.		
6) Do you go to the dental hygienist during your orthodontic treatment?				
Yes	No			

Table 1: Questionnaire

Maxillary																
Cervical	Σ	2x														
Central	Σ	3x														
Occlusal/incisal	Σ	1x														
Tooth #			7	6	5	4	3	2	1	1	2	3	4	5	6	7
Mandibular																
Occlusal/incisal	Σ	1x														
Central	Σ	3x														
Cervical	Σ	2x														
Sub total:																
OPI=Sum total-number of teeth x5.																

Table 2: Orthodontic Plaque Index Form

	Min	Max	Mean	Std. Dev
PI	27.8	95.6	65.24	16.43
GBI	5.2	43.8	19.14	7.95
OPI	36.7	73.3	53.56	8.74
Age	15	30	19.82	4.3

Table 3: Mean of PI, GBI, OPI AND AGE

Oral Hygiene Tool	Patients		Frequency/day		
	%	No.	1/d	2/d	3/d
Floss	6%	3	8	—	—
Miswak	8%	4	3	1	—
Toothpick	24%	12	3	7	2
Interdental brush	16%	8	7	1	—

Table 4: Adjunct Aids used By Patients

Index	Correlation	OPI	GBI
OPI	Pearson correlation	1.000	0.236
	Sig. (2-tailed)		0.99
	N	30	30
GBI	Pearson correlation	0.236	1.000
	Sig. (2-tailed)	0.99	
	N	30	30

Table 5: Correlation between OPI AND GBI

Discussion

Patients undergoing orthodontic treatment with fixed

appliances are at risk for developing gingival inflammation because of the increased challenge to oral hygiene. Dental

plaque is a primary etiologic factor in gingivitis [12].

The patient's inability to clean his or her teeth adequately around fixed orthodontic devices promotes plaque accumulation that can then lead to gingival inflammation. An overall increase in salivary bacterial counts, especially *Lactobacillus*, has been shown after orthodontic appliance placement [13].

Similarly, one study showed an early increase in anaerobes and *Prevotella intermedia*, and a decrease in facultative anaerobes [14].

Irregular alignment of teeth may make plaque control even more difficult. Some studies have found a positive correlation between crowding and periodontal disease [15], while others have not [16].

Nonetheless, effective plaque control is the prime consideration for good oral hygiene. This study sought to evaluate oral practice and effect of fixed appliances on gingival health among orthodontic patients treated at marathwada population, India. Despite the fact that more than half of the patients (54 percent) were brushing their teeth twice daily, their oral hygiene was unsatisfactory. PI and OPI were high in general, having a mean value of 65.23 and 53.56, respectively. This finding is in agreement with previous studies reporting an increase in tooth surfaces displaying visible plaque following the placement of orthodontic appliances [16]. This is due to the increase in plaque retentive areas and the inability of the patient to perform adequate oral hygiene.

However, increasing the frequency of toothbrushing does not automatically lead to clean teeth. Levels of education and motivation, as well as continuous reinforcement of oral hygiene, can improve patient's performance of oral home care. Orthodontic patients, in particular, must be trained in proper oral hygiene maintenance and their brushing procedures must be checked regularly. It is possible to achieve and maintain a high standard of oral health behavior following an intense period of individual oral hygiene education.

On the other hand, the results of the current study are understandable because only three (6 percent) patients were using dental floss and eight (16 percent) patients were using an interdental brush. Using a toothbrush alone is not sufficient to clean the teeth (dental arches) with bonded appliances in place. Therefore, the daily use of dental floss with a floss threader and interdental brushes is recommended.

Large portions of the buccal surfaces (and sometimes the lingual surfaces of banded teeth) are covered by adhesive attachments in patients with fixed appliances. Areas cervical to a bracket base and those mesial and distal to the bracket body are the most critical sites for plaque formation. Therefore, it is highly desirable to use an ortho-plaque index to evaluate these surfaces separately when recording the plaque index.

In assessing the brushing methods used, it is clear that patients need motivation and instructions on how to employ an appropriate technique. The so-called scrubbing method has previously been recommended to patients during orthodontic treatment; however, the modified Bass technique was superior to the scrub method. Many patients place the toothbrush too far coronally thus the gingival third of the tooth is routinely neglected, which can then lead to an increase in plaque accumulation and the development of gingivitis. Therefore, all patients should be instructed to clean the tooth structure cervical to an orthodontic appliance as well as the remaining coronal surfaces.

Daily oral hygiene can become challenging for some patients in the presence of orthodontic appliances. Accordingly, an electric toothbrush has been recommended for patients with orthodontic appliances.

It is clear from the results of this study that most of the patients (68 percent) assessed did not visit a dental hygienist during their orthodontic treatment. Yet the effectiveness of professional prophylaxis has been demonstrated in patients with fixed orthodontic appliances. Consequently, oral hygiene instruction and reinstruction must take place during orthodontic treatment. Also some patients need to be reminded to concentrate on cleaning the cervical area of their teeth below the brackets. A continuous increase in oral hygiene awareness not only will reduce the prevalence and severity of iatrogenic tissue damage but also will extend the long-term benefits of orthodontic therapy.

The mean value of GBI was 19.14, which is considered a reasonable value. The reason for this outcome could possibly be due to the fact that 32 percent of the patients visited the hygienist during their orthodontic therapy.

Regarding the relationship of the three indices to gender, the results of this study showed that this relationship was not significant for PI and OPI, whereas it was significant for the GBI ($p=0.033$).

Even though female patients were more likely to visit the dental hygienist, both males and females had problems maintaining good oral home care practices, as evidenced by their respective scores. On the other hand, 33.3 percent of the female patients were using interproximal aids for cleaning, compared to just 15.6 percent of their male counterparts.

Although diet is more related to dental caries than plaque or gingivitis, it has been demonstrated that the amount of carbohydrates in one's diet and the frequency of intake influence bacterial growth. The mechanism of attachment and the subsequent colonization on tooth surfaces by certain microorganisms also may be made possible by the components of one's diet.

In this study, 72 percent of the patients reported consuming sugar sometimes. Additional research is recommended to study the relationship between diet and plaque accumulation in orthodontic patients.

Conclusion

Based on the findings of this study, it is evident that patients wearing orthodontic appliances were having high plaque index, gingival bleeding index and ortho plaque index scores. Therefore, educating and motivating these patients to maintain their oral health and providing recommendations for oral home care aids to improve their compliance remains the cornerstone for achieving optimal oral hygiene results.

Clinical significance

Inadequate oral home care among orthodontic patients may make them more prone to develop gingivitis during orthodontic therapy. It is essential, therefore, that the maintenance of proper oral hygiene during orthodontic treatment not be overlooked.

Funding

'This work was supported by 'medical research council of Maharashtra''[grant number is EFOTG/ORTHO/2011]'

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