PERIODONTAL HEALTH STATUS OF SAUDI PATIENTS UNDERGOING ORTHODONTIC TREATMENT

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Abstract

The growing awareness about dental aesthetics and functionality in the general population has led to more and more people seeking orthodontic treatment.

The patient's ability to achieve and maintain good overall oral hygiene and prevent periodontal disease is fundamental while undergoing orthodontic treatment. This study was done to evaluate the periodontal health status of Saudi patients scheduled for fixed orthodontic treatment.

Fifty patients (12-26 years old) were selected from orthodontic clinics of King Abdul-Aziz Medical City of National Guard, Riyadh, Saudi Arabia. The periodontal health status of the patients was evaluated using the plaque index (PI), the orthodontic plaque index (OPI) and the gingival bleeding index (GBI). These indices were determined prior to the placement of fixed appliances, after 6 months and after 12 months of the beginning of the orthodontic treatment.

Results showed that PI and OPI were high with mean scores of 65.24 ± 16.43 for PI and 53.56 ± 8.74 for OPI, while the average GBI scored a much lower value of 19.14 ± 7.95.

After 6 months of treatment, the probing pocket depth at the first molars was 1.5-2.0 mm. In some severe cases it exceeded 3mm. After 12 months of treatment, the probing pocket depth was greater than that observed at 6 months and it mostly fell in the range of 2.0-2.5mm.

No significant differences were observed between male and female patients for the PI ($p=0.925$) and for OPI ($p=0.072$); However, a significant difference was observed for the GBI ($p=0.033$). Thus it was concluded that plaque deposition during orthodontic treatment can promote periodontal inflammation and destruction. Oral hygiene measures, patient education and motivation can help maintain oral hygiene and minimize the hazardous effects of orthodontic treatment on periodontal tissues.

Keywords: Plaque index - bleeding index - probing pocket depth – gingivitis - oral hygiene - fixed orthodontics.

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ETAT DE SANTÉ PARODONTAL DES PATIENTS SAOUDITES RECEVANT DES SOINS ORTHODONTIQUES

Résumé

La prise de conscience sur l'esthétique et la fonction dentaire dans la population générale a poussé de plus en plus les gens à demander un traitement orthodontique.

Lors d'un traitement orthodontique, la capacité du patient à maintenir une bonne hygiène bucco-dentaire et à prévenir les maladies parodontales est fondamentale. Cette étude a été réalisée pour évaluer l'état de santé parodontale des patients saoudiens subissant un traitement orthodontique fixé.

Cinquante patients (12 - 26 ans) ont été sélectionnés à partir des cliniques d'orthodontie de la Cité Médicale de la Garde Nationale du roi Abdul -Aziz, Riyad, Arabie Saoudite.

L'examen parodontal a été effectué avant, après 6 mois et après 12 mois du début du traitement. L'état de santé parodontale des patients a été évalué en utilisant l'indice de plaque, l'indice de plaque d'orthodontie et l'indice gingival de saignement.

Les résultats ont montré que l'indice de plaque et l'indice de plaque orthodontique sont élevés avec des scores moyens respectifs de 65,24 ± 16,43 et 53,56 ± 8,74. Seul l'indice de saignement gingival était plus faible, avec une valeur de 19.14 ± 7.95.

Après 6 mois de traitement, la profondeur de poche au niveau des premières molaires était de 1,5 -2 mm. Dans certains cas graves, elle a dépassé les 3 mm. Après 12 mois de traitement, la profondeur de poche était supérieure à celle observée à 6 mois avec des valeurs de 2-2,5 mm.

Aucune différence significative n'a été observée entre les hommes et les femmes pour l'indice de plaque ($p = 0,925$) et pour l'indice de plaque orthodontique ($p = 0,072$). Cependant, une différence significative a été observée pour l'indice de saignement gingival ($p = 0,033$).

En conclusion, la déposition de plaque au cours du traitement orthodontique a entrainé une destruction du parodonte. Un détartrage régulier des dents couplé à la motivation du patient permettent de maintenir une bonne hygiène bucco-dentaire et de minimiser les effets néfastes du traitement orthodontique sur les tissus parodontaux.

Mots-clés : indice de plaque – indice de saignement – gingivite – hygiène orale – orthodontie.

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Introduction

Periodontal disease is one of the major problem and concern during orthodontic treatment.

Periodontal disease is not a single pathologic entity but comprises a number of inflammatory and degenerative processes of the supporting periodontal structures [1, 2].

The most important etiological factor of periodontal disease is plaque deposition around gingival margin [3, 4]. The accumulation of plaque can cause gingival redness, bleeding, edema, changes in gingival morphology, reduced tissue adaptation to the teeth, an increase in the flow of gingival crevicular fluid and other clinical signs of inflammation.

It is well established that the patients who undergo orthodontic treatment have a high susceptibility to plaque accumulation on their teeth because of the presence of bands, brackets, wires and other orthodontic attachment [5].

The elements of fixed orthodontic appliance can change the biological balance in the oral cavity [6] (Fig. 1).

An important rational in performing orthodontic treatment is to promote the health of the periodontium, thereby enhancing longevity of the dentition [8, 9].

Orthodontic treatment is a double-action procedure regarding the periodontal tissues, which may be sometimes very significant in increasing the periodontal health status, and sometimes a harmful procedure which can be followed by several types of periodontal complications, namely gingival recession, bone dehiscence, gingival invaginations and/or the formation of gingival pockets [10]. Thus orthodontic treatment can be referred to as a two-edge sword.

The positive effects of orthodontic treatment on patient's appearance and self-esteem are easy to envision [11]. Past studies have shown that orthodontic treatment can positively affect the periodontal health; however, recent reviews didn't show reliable evidence on the positive effects of orthodontic therapy on patients' periodontal status [12].

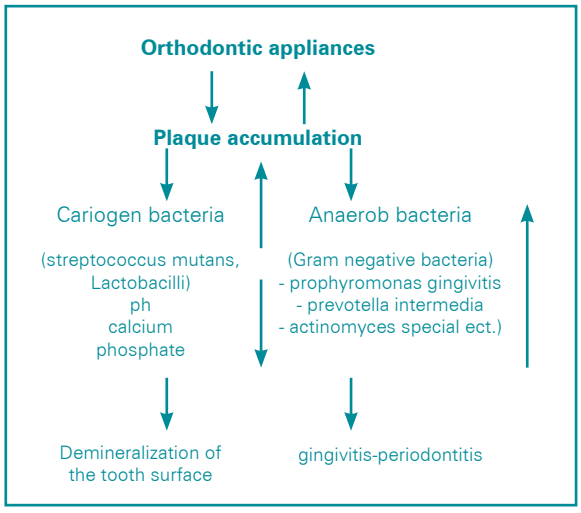

Fig. 1: Risk of treatment with fixed orthodontic appliances [7].

Periodontic-orthodontic interrelationships are still controversial. However, a standard language between the periodontist and the orthodontist must always be established to improve the outcomes of the whole treatment [12].

Therefore, it is essential to emphasize oral hygiene instructions and to maintain high standards of oral hygiene for patients undergoing orthodontic treatment [13].

The aim of the present study was to evaluate the periodontal health status in patients scheduled for orthodontic therapy with fixed appliances.

Materials and Methods

The sample in the present study consisted of 50 orthodontic patients attending the orthodontic clinic in King Abdul-Aziz Medical City of National Guard, Riyadh, Saudi Arabia.

Saudis patients, between 12 and 26 years old, and requiring full-mouth fixed orthodontic treatment were included in the study. All maxillary and mandibular teeth should be present, exempt of caries, extensive fillings or crowns. Also, the initial probing pocket depth on all first molars should not exceed 1.5mm.

Patients who received orthodontic treatment or need treatment with removable appliances, have a history of taking antibiotics for the last three months and smoking habits or suffering from any systemic disease, generalized periodontal problems, cyst, clefts, or congenital malformation were excluded from the study.

All patients were treated with preadjusted fixed appliances, with 0.022″ x 0.028″ slot brackets (MBT prescription, American Orthodontics, Sheboygan, WI, USA). Fixed appliances were placed on the buccal surfaces of teeth according to the specific needs for tooth movements and alignments either buccally, lingually, gingivally or occlusally.

Brackets were placed in the centre of the middle third of the crown along the long axis of the tooth, bearing in mind the level and the contour of the gingival margins.

The study did not obtain any confidential demographic information such as income or education level. Before starting the study, the objectives of the research were explained to the patients and their parents; a consent form was signed.

Maxillary																
Cervical	S	2x														
Central	S	3x														
Occlusal/Incisal	S	1x														
Tooth number			7	6	5	4	3	2	1	1	2	3	4	5	6	7
Mandibular																
Occlusal/Incisal	S	1x														
Central	S	3x														
Cervical	S	2x														
Sub-Total																
OPI= Sum Total – Number of Teeth x 6																

Table 1: Orthodontic plaque index (OPI) form.
The number of stained sites is added and the total is multiplied by the corresponding factor.

Patients were strictly advised with oral hygiene measures before and during the entire course of the treatment.

Clinical examination was conducted by one examiner (A.A) in the orthodontic clinic at King Abdul-Aziz Medical City, Riyadh, SA. The instruments used in the clinical examination were:

- Plane dental mirror.
- Michigan periodontal probe.
- Metallic ruler with an accuracy of 1.0 mm.

The following periodontal parameters were assessed for each participant:

- O'Leary plaque index (PI).
- Orthodontic plaque index (OPI).
- Gingival bleeding index (GBI).
- Pocket depth (PD).

To determine the O'Leary plaque index [14], plaque is disclosed with a chewable tablets and its amount estimated. To determine an individual's score, the examiner multiplies the number of surfaces with plaque by 100 and divides that by the number of tooth surfaces examined (WHO, 2011) [15].

The orthodontic plaque index [16] was used to evaluate plaque level in the areas cervical to the bracket base and mesial and distal to the bracket body considered the most critical zones of plaque accumulation. OPI was calculated using the formula shown in table 1.

The factor used was: 1 for occlusal-incisal; 2 for cervical and 3 for central.

OPI was scored as:

Good: 0-25 points.

Average: 26-50 points.

Poor: > 50 points.

For the gingival bleeding index [17], all four surfaces of each tooth were assessed to determine whether probing elicited bleeding or not. The severity of gingivitis was expressed as a percentage calculated as follows:

The pocket depth in the present study was probed using the Michigan periodontal probe. Probing was performed by inserting the probe gently into the gingival sulcus until the base of the pocket was reached. Pocket depth was assessed as the distance (mm) from the gingival margin to the bottom of the pocket.

The probe was stepped around the tooth at about 1mm increments. The probe was kept as close as possible to axial direction of the tooth while the tip maintained in contact with the root surface.

Probing was done on 6 points of each first molar, i.e, buccal, mesio-buccal, disto-buccal, lingual, mesio-lingual and disto-lingual.

Periodontium was also evaluated and categorized into thick or thin on a site level. This evaluation was based on the transparency of the periodontal probe through the gingival margin while probing the sulcus at the mid-facial aspect of both central maxillary incisors [18]. If the outline of the underlying periodontal probe could be seen through the gingiva, it was categorized as thin (score: 0); if not, it was categorized as thick (score: 1) [18].

Calculus deposits were removed prior to measuring pocket depths. Hand scaling was performed by examiner (A.A) in order to have a clean area while probing pocket depth.

Examiner calibration

Ten of the participants were examined on two occasions within one week interval by the same examiner (A.A) 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% for GBI, 78.7% for PI and 80% for OPI.

For measurements made on a continuous scale such as pocket depth in millimeters, Pearson's correlation

	Min.	Max.	Mean
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

Table 2: Mean values of PI, GBI and OPI obtained throughout the study.

test and paired t-test were used to evaluate the probing pocket depth at 240 registration points of both jaws. Paired t-test showed no statistically significant differences between the readings ($p< 0.05$) and the Pearson correlation test showed that the two readings were highly correlated.

Statistical Analysis

Mean, standard deviations and range for quantitative variables were computed using SPSS software for windows, version 15.

One-way analysis of variance (ANOVA) was used to determine any significant difference at the 5% significance level ($p< 0.05$).

Results

The study was performed with 50 patients (32 males (64%) and 18 females (36%)) undergoing fixed orthodontic treatment. Their age ranged between 12-26 years (mean age = 17.44 ± 3.073 years).

The clinical examination of their periodontal status showed that the mean value of the PI was 65.24 ±16.43 while the GBI was 19.14 ± 7.95; the OPI was 53.56 ± 8.74 (Table 2).

The patients were analyzed on the basis of the pocket depth on six different surfaces of the first molars. Table 3 presents the pocket depth probing at the first molars of the patients 6 months after the beginning of the orthodontic treatment.

After 6 months of treatment, the probing pocket depth at the first molars was 1.5-2.0 mm. In some severe cases it exceeded 3mm.

Table 4 shows data of patients at 12 months of treatment. Pocket depth values were greater than those obtained at 6 months; values fell mostly in the range of 2.0-2.5mm.

No significant difference was observed between male and female patients for PI ($p=0.925$) and for OPI ($p=0.072$). However, a significant difference was observed for the GBI ($p=0.033$) (Table5).

When studying the correlation between the indices, we found no significant correlation between the OPI and the GBI ($p=0.99$) (Table 6).

Discussion

The results of the current study showed a marked change in periodontal status after placement of fixed appliances. Similar results were reported by Naranjo et al.[19] who found that the placement of fixed appliances promoted the accumulation of the biofilm at the retentive sites and modified the ecological environment. The marked increase in plaque and gingival indices reflected the increase in bleeding and periodontal inflammation [19].

Dental plaque is the primary etiologic factor in gingivitis [20]; the plaque index and orthodontic plaque index were high in general, with a mean value of 65.24 for PI and 53.56 for OPI, respectively. This finding is in agreement with the previous studies reporting an increase in tooth surfaces displaying visible plaque following the placement of orthodontic appliances [21 -23].

This observation is due to the increase in plaque retentive areas and the inability of the patient to perform adequate oral hygiene [24].

The mean value of GBI was 19.14, which is considered reasonable. This result could possibly be due to the fact that 32% of the patients visited the hygienist during their orthodontic therapy.

The values of the probing pocket depth increased with time. Similar age group has been studied by Zachirson et al. [25] with the data collected at pretreatment, 1 and 2 months after the beginning of the treatment showing an increase in pocket depth values after 2 months.

The presence of fixed appliances with banded molars influences inflammation which is clearly related to the increase in pocket depth [26]. Pocket depth values obtained in our study were slightly higher than those reported by Kobayashi [27] because of many factors like oral hygiene measures, band positioning and over hanging materials.

Inter-dental areas are especially more periodontally affected in orthodontic patients, as suggested by Baer et al. [28]. This increase reflects the accumulation of dental plaque on these surfaces and the difficulty for patients to maintain those areas free of plaque [28, 29]. In our study, the pocket depth increased significantly on mesial and distal sites.

Zachrisson et al. [30] reported an increase in probing depth, gingival bleeding and a slight loss of attachment around teeth of patients who underwent orthodontic treatment with fixed appliances. In their study, the maximal record of probing depth was 2.34mm after 6 months (lower jaw-mesial sites), whereas in our study, the maximum recorded pocket depth

Tooth number	Probing site	Pocket depth values (mm)					
		1	1.5	2	2.5	3	3.5
16	Buccal	5	23	22	0	0	0
	Mesio-buccal	7	20	17	6	0	0
	Disto-buccal	7	15	19	7	2	0
	Lingual	11	24	12	3	0	0
	Mesio-lingual	3	20	19	6	2	0
	Disto-lingual	6	16	16	10	2	0
26	Buccal	10	17	20	3	0	0
	Mesio-buccal	5	20	15	10	0	0
	Disto-buccal	7	15	14	11	3	0
	Lingual	13	23	10	4	0	0
	Mesio-lingual	8	17	17	8	0	0
	Disto-lingual	8	22	14	6	0	0
36	Buccal	10	17	19	4	0	0
	Mesio-buccal	5	24	14	7	0	0
	Disto-buccal	8	16	18	5	3	0
	Lingual	15	17	16	2	0	0
	Mesio-lingual	5	23	18	4	0	0
	Disto-lingual	8	15	22	5	0	0
46	Buccal	10	18	20	2	0	0
	Mesio-buccal	6	18	13	11	2	0
	Disto-buccal	8	15	12	12	3	0
	Lingual	11	19	18	2	0	0
	Mesio-lingual	5	23	16	6	0	0
	Disto-lingual	6	19	18	5	2	0

Table 3: Prevalence of the different values of probing pocket depth at the six sites around each first molar, six months after the beginning of the treatment.

Tooth number	Probing site	Pocket depth values (mm)					
		1	1.5	2	2.5	3	3.5
16	Buccal	0	7	35	8	0	0
	Mesio-buccal	0	4	29	17	0	0
	Disto-buccal	0	5	20	23	2	0
	Lingual	0	7	23	20	0	0
	Mesio-lingual	0	6	16	21	7	0
	Disto-lingual	0	5	23	16	6	0
26	Buccal	0	5	22	23	0	0
	Mesio-buccal	0	7	25	18	0	0
	Disto-buccal	0	4	20	26	0	0
	Lingual	0	5	25	20	0	0
	Mesio-lingual	0	6	21	23	0	0
	Disto-lingual	0	5	19	26	0	0
36	Buccal	0	3	25	23	0	0
	Mesio-buccal	0	4	21	25	0	0
	Disto-buccal	0	2	15	25	8	0
	Lingual	0	13	25	12	0	0
	Mesio-lingual	0	6	31	13	0	0
	Disto-lingual	0	6	28	16	0	0
46	Buccal	0	7	29	12	2	0
	Mesio-buccal	0	5	17	26	1	1
	Disto-buccal	0	7	17	21	5	0
	Lingual	0	9	29	12	0	0
	Mesio-lingual	0	10	26	12	2	0
	Disto-lingual	0	6	27	16	1	0

Table 4: Prevalence of the different values of probing pocket depth at the six sites around each first molar, twelve months after the beginning of the treatment.

Index	Sex	N	Mean	STD. DEV.	P Value
PI	M	32	65.4	16.76	0.925*
	F	18	64.94	16.3	NS
GBI	M	32	20.78	8.49	0.33**
	F	18	16.22	6.08	S
OPI	M	32	55.3	8.1	0.072*
	F	18	50.46	9.2	NS

Table 5: Relationship between indices and gender.
*: NS: Not statistically significant; **: S: Statistically significant.

Index	Correlation	OPI	GBI
OPI	Pearson correlation	1.000	0.238
	Sig. (2-tailled)		0.99
	N	50	50
GBI	Pearson correlation	0.236	1.000
	Sig. (2-tailled)	0.99	
	N	50	50

Table 6: Correlation between OPI and GBI.

after 6 months was 3mm. The scores remained almost unchanged after 12 months of treatment; only a slight increase of 0.5mm in some cases and sites was observed. These differences between the results obtained after 6 and 12 months don't reflect any destructive disease that may have affected the periodontal tissues.

Periodontal status in patients undergoing orthodontic treatment should be monitored carefully. Removable and fixed orthodontic appliances impede correct periodontal hygiene, resulting in more plaque accumulation, inflammation and bleeding. Therefore, appropriate oral hygiene methods and instruments should be used to control plaque. Powered and interdental toothbrushes, special types of floss and the use of mouthwashes have shown improved plaque control in orthodontic patients [31].

Conclusion

Within the limitations of the present study, we found that during the orthodontic treatment, the plaque accumulation promoted by the fixed appliances was increased; this was reflected by a raise of the PI, OPI, GBI and the probing depth.

Further histological studies are still needed in order to reveal the exact tissue alterations that might take place during the different phases of orthodontic treatments.

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