

Periodontal Status of Patients Undergoing Treatment with Fixed Orthodontic Appliances Based on the Updated Classification: An observational study

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Abstract

The use of orthodontic appliances can increase plaque deposits and affect the periodontal status of the patient. The aim of this study was to evaluate the periodontal status of patient using fixed orthodontic appliances.

This study comprised 20 patients (age range, 18–36 years) undergoing fixed orthodontic treatment at the College of Dentistry, Jazan university, Saudi Arabia. The oral examinations were conducted using a dental mirror, tweezers, and a William's graduated probe. The following parameters were assessed in each patient: plaque index, gingival bleeding index, clinical attachment loss, pocket depth, and bone loss. All parameters were scored on the buccal, lingual, mesial, and distal surfaces of all teeth involved for the attachment of the fixed appliances.

The duration of treatment varied from 6 to 60 months (mean, 30.1 months). The mean plaque index was 89.4% (range, 62%–100%), and the mean bleeding index was 64.2%. The CAL ranged from 1.6 to 4. The mean probing depth was approximately 2.9 mm (range, 1.6 to 4.8 mm). The majority of the patients (90%; 18/20) presented with Stage II periodontitis, while the remaining 2 patients demonstrated Stage I periodontitis; likewise, the majority of the patients (75%; 15/20) were diagnosed with Grade B periodontitis, while the remaining 5 patients had Grade C disease.

The patients undergoing treatment with fixed appliances presented with poor periodontal health. Hence, it is important to monitor these patients regularly in order to achieve successful treatment outcomes.

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Introduction

Periodontal diseases are common among children, adolescents, and adults. They are often preceded by gingivitis, which presents as bleeding, swollen, and painful gums, followed by the loss of periodontal attachment and supporting bone (periodontitis), if left untreated. The global prevalence of periodontitis is reported to range from 20%-50%¹.

The objectives of orthodontic treatment include achieving good facial esthetics, an efficient masticatory apparatus, stable treatment results, and healthy dental and periodontal

tissues². The presence of orthodontic attachments, such as bands and brackets, increase plaque deposits, which can affect the periodontal status. Microbial plaque is the main etiological factor of periodontal diseases, and the use of orthodontic brackets makes it difficult to maintain good oral hygiene³. The use of fixed orthodontic appliances has been associated with the accumulation of bacterial plaque⁴.

If the orthodontic forces applied extend beyond the adaptive capacity of the periodontal ligament (PDL) and alveolar bone, it can lead to PDL deterioration, external root resorption, and the development of alveolar bone defects^{5,6}. Orthodontic treatment can improve the periodontal health in patients with traumatic occlusion or crowding of teeth; alternatively, it can prove detrimental to the periodontal status by causing gingival recession, bone dehiscence, and the formation of gingival pockets. Orthodontic treatment has been associated with

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gingivitis⁷, increased bacterial counts in the oral cavity⁸, and loss of attachment⁹.

In 1989, periodontitis was categorized as pre-pubertal, juvenile, adult, and rapidly progressive, based on factors such as the clinical presentation, of onset, and rate of progression of the disease¹⁰. The categories were then grouped into two major headings (adult and early onset periodontitis) during the 1993 European Workshop^{11,12}. Subsequently, periodontitis was reclassified as chronic, aggressive (localized and generalized), necrotizing, and manifestation of systemic disease in 1999¹³, and used for nearly two decades. The latest workshop conducted in 2017 developed a new classification, wherein three forms of periodontitis were identified: necrotizing periodontitis, periodontitis as a manifestation of a systemic disease, and periodontitis (which is described using a staging and grading system)^{10,14}. The stage of periodontitis is categorized based upon the severity of the disease at presentation and the challenges involved in managing the condition, whereas the grade is characterized according to the biological features of the disease, the rate and risk of disease progression, and the outcomes of the treatment¹⁴.

There is no concrete scientific evidence that fixed orthodontic treatment affects periodontal health¹⁵. The aim of this study was to assess the periodontal status of patients who were undergoing orthodontic treatments, based on the updated classification.

Materials and methods

The study comprised 20 female patients (age range, 18–36 years) who were treated with a conventional fixed orthodontic appliance at the College of Dentistry, Jazan University, Saudi Arabia. The study was performed at the College of Dentistry, Jazan University, Saudi Arabia, from October 2018-March 2019 (6 months)

Habitual smokers, those who underwent oral prophylaxis in last four weeks, and those with any systemic diseases were excluded from the study. The clinical examinations were conducted by one examiner using an intraoral mirror, a tweezer, and a William's graduated probe. The following parameters were used to assess each patient: plaque index (Oleary index), gingival bleeding index¹⁶ (as depicted in figure 1A) and periodontal pocket depth. All parameters

were scored on the buccal, lingual, mesial, and distal surfaces of all teeth that were included for the attachment of the fixed appliances.



Figure 1. (A) Bonded teeth with orthodontic brackets using disclosing agent to disclose presences of plaque.

The stage of periodontitis was evaluated based on the amount of clinical attachment loss (CAL) in each patient. The grade of periodontitis was measured using the cemento-enamel junction (CEJ) as a reference point; the length from the CEJ to the bone crest was divided by the length from CEJ to apex. Additionally, the percentage of bone loss was calculated depicted in (figure 1B) to determine the grade¹⁷.

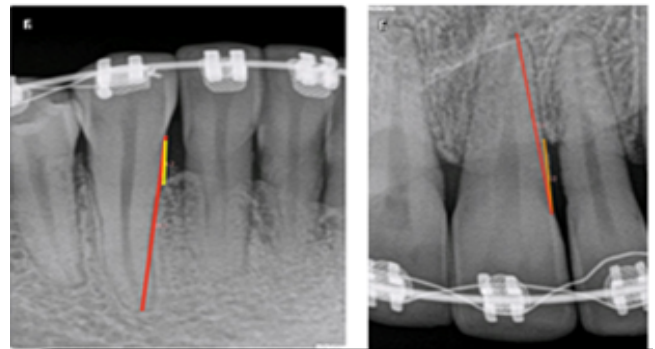


Figure 1. (B) Periapical radiographs showing bone grade evaluation.

Ethical clearance for the study was obtained from the Ethical Committee at Jazan University, and written informed consent was obtained from all 20 participants.

Statistical analysis

The data analysis was carried out using the Statistical Package for Social Science software (SPSS). P value of <0.05 was considered statistically significant.

Results

The descriptive statistics of the patients in this study are shown in table 1 and figure 1E. The mean plaque index was 89.4% (range, 62%–100%), and the mean bleeding index was 64.2%. The mean probing depth was approximately 2.9 mm (range, 1.6 to 4.8 mm). The duration of treatment varied from 6 to 60 months (mean, 30.1 months). The CAL ranged from 1.6 to 4. The standard 7 mean deviation of the variables are depicted.

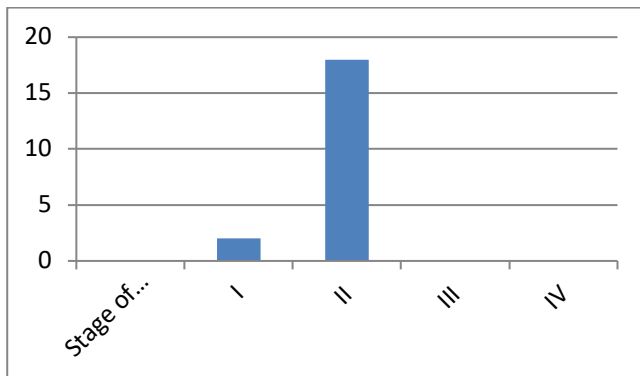


Figure 1. (C) Stage of periodontitis.

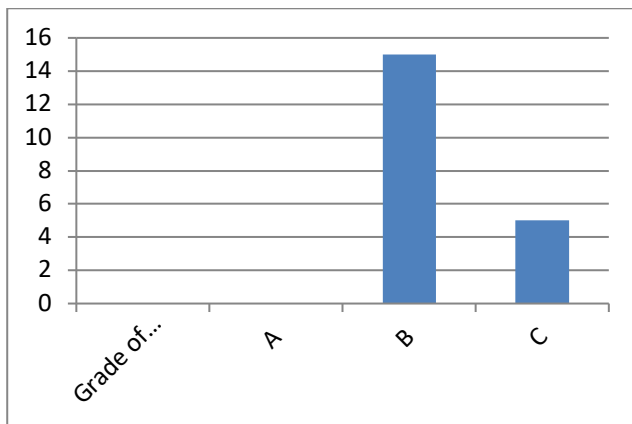


Figure 1.(D) Grade of periodontitis.

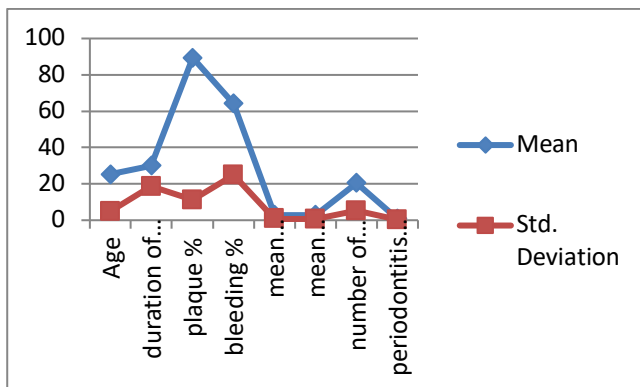


Figure 1. (E) Descriptive statistics of the patients in this study.

The majority of the patients (18/20) presented with Stage II periodontitis, while the remaining 2 patients demonstrated Stage I periodontitis (Figure 1 C); similarly, the majority of the patients (15/20) were diagnosed with Grade B periodontitis, while the remaining 5 patients had Grade C disease (Figure 1 D).

	N	Minimum	Maximum	Mean	Std. Deviation
Age	20	18.00	36.00	25.2000	4.79693
duration of treatment	20	6.00	60.00	30.1000	18.54128
plaque %	20	62.00	100.00	89.4000	11.09481
bleeding %	20	23.00	100.00	64.2500	24.86992
mean probing depth	20	1.60	4.80	2.8650	.76384
mean attachment loss	20	1.60	4.00	2.8100	.60428
number of teeth bonded	20	7.00	26.00	20.5000	5.21637
periodontitis grade	20	.37	1.46	.7535	.29793

Table 1. Descriptive Statistics

Discussion

This study aimed to evaluate the periodontal status of patients undergoing orthodontic treatment using a fixed orthodontic appliance. Increased progression of periodontitis were observed among the 20 patients undergoing orthodontic treatment.

It is important to understand the link between orthodontic treatment and periodontal health. Orthodontic treatment is planned based on periodontal factors such as the condition of the gingiva and alveolar bone. Therefore, the oral hygiene must be good before the patient undergoes orthodontic treatment. The use of appliances in the oral cavity (removable or fixed) makes it difficult for the patient to clean the surrounding areas and thereby maintain the oral hygiene. A recent study by Vijaykumar et al. demonstrated that both lingual and labial surfaces of patients undergoing fixed orthodontic therapy were affected by plaque and calculus accumulation, although the depositions were higher on the lingual surfaces¹⁸. The use of directly bonded brackets on the labial surfaces of the teeth have been shown to decrease plaque accumulation¹⁹.

The O'Leary plaque index²⁰ and gingival bleeding index²¹ have been used to assess plaque accumulation and gingivitis in the past. In the current study, the high mean plaque and bleeding indices (89.4% and 64.2%, respectively) indicated the initiation of periodontitis. Previous studies have reported an increase in these indices in patients undergoing orthodontic

treatment^{21,22}. Another recent study demonstrated a direct relationship between the placement of a fixed appliance and the increase in both plaque and gingival indices^{23,31}. Ristic et al. reported an increase in the plaque index, gingival bleeding index, and periodontal pocket depth 3 months after placement of an orthodontic appliance²⁴. The mean probing depth in the current study was 2.86 mm (range, 1.6–4.8 mm); this is similar to that reported in previous studies^{25,26}. Similarly, other studies have reported increase in the pocket depth during orthodontic treatment^{3,27}.

The use of fixed appliances has been associated with loss of periodontal attachment²⁸. On the other hand, a recent systematic review and meta-analysis reported that orthodontic treatment using fixed appliances might not have any detrimental effects on the clinical attachment levels²⁹. The CAL in the present study ranged from 1.6 to 4 (mean, 2.8), indicating moderate periodontitis³⁰.

The classification systems for periodontal diseases appears to be evolving with time¹². As stated by Armitage, the classification system in 1999, addressed and rectified the issues that were present in the 1989 classification of periodontitis; nonetheless, he believed that the new system would need to be reformed in the future^{12,13}. The latest 2017 system of classification comprises new approaches, such as the staging and grading systems, for the diagnosis and management of periodontitis. The stage refers to the severity and complexity of management, wherein stages I, II, III, and IV indicate initial, moderate, severe, and advanced periodontitis, while the grade refers to the risk of progression and potential risk of systemic influence of the disease and is defined as A, B, or C¹⁷. Most of the patients undergoing the treatment in the current study presented with Stage II and grade B periodontitis, indicating moderate severity and a moderate risk of progression of the disease.

This study has some limitations. The sample size was low and comprised of females only, which might have affected the findings of the study. However, to the best of our knowledge, this is the first study to evaluate the effect of fixed appliances on periodontal health, using the new modified classification system.

Conclusions

The use of fixed appliances negatively affected the periodontal health of the patients. Lack of adequate and timely intervention could lead to the initiation of periodontal diseases. Hence, patients using fixed orthodontic appliances should be monitored carefully and regularly in order to achieve successful treatment outcomes.

Declaration of Interest

The authors report no conflict of interest.

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