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PHARMACEUTICAL SCIENCES**<http://doi.org/10.5281/zenodo.3408384>Available online at: <http://www.iajps.com>**Research Article****EFFECTS OF FIXED ORTHODONTIC TREATMENT ON
GINGIVAL HEALTH: AN OBSERVATIONAL STUDY**¹Dr Sara Shoaib, ²Dr Bakhtawar Mushtaq, ³Dr Nausheen pearl Daniel, ⁴Dr Ausjah Abbas,
⁵Dr Muhammad Junaid Ahmed¹BDS, Lecturer in Periodontology, at Dow University Karachi²BDS Lecturer in Pharmacology, Sir Syed College Karachi³Dr. Ishrat Ul Ebad Khan Institute of Oral Health Sciences Karachi⁴BDS Resident of Operative Dentistry, Karachi Medical and Dental College⁵BDS Lecturer in Prosthodontics Sir Syed College Karachi**Abstract:**

Objective: The purpose of this study was to evaluate the association of orthodontic treatment and fixed retainers with gingival health.

Design: observational study.

Place of Study: This study was conducted at Dental unit of Sir Syed Dental Hospital Karachi

Patient(s): The study comprised of 80 patients who came in dental clinic for routine dental examination between the time period of August 2017 to August 2018.

Procedure: Plaque and gingival indices, gingival recession, probing depth, and bleeding on probing were measured at the anterior sextants. In the presence of fixed retainer, the distance was measured. It measured between the retainer and incised edge and to the cemento-enamel junction. Past orthodontic treatment and smoking habits were self-reported. By the presence or absence of fixed retainers, Post orthodontic patients were sorted.

Main Outcome Measure(s): gingival health

Result(s): The mean probing depth was 1.90 – 0.2 mm, and gingival recession was 0.06 – 0.02 mm; 20.8% of all sites exhibited bleeding on probing. Current smoking was reported by 20 (21.7%) patients. Labial gingival recession was significantly greater in treated (0.13 – 0.2 mm) patients compared to non-treated patients (0.05 – 0.2 mm; $P = 0.03$). Patients with fixed retainers Localized lingual gingival recession was significantly greater in teeth (0.09 – 0.2 mm) as compared to patient's teeth with no fixed retainers (0.01 – 0.1 mm; $P = 0.0002$), as were plaque and gingival indices and bleeding on probing. A weak, positive correlation was showed by Plaque on the lingual/palatal aspect with lingual gingival recession ($r = 0.16$; $P = 0.033$).

Conclusion: Orthodontic treatment is significantly associated in increased destruction of the periodontal structures.

Key words: Gingival health, Orthodontic treatment, Periodontitis

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INTRODUCTION:

Orthodontic treatment certifies proper alignment of the teeth and progresses the occlusal and jaw relationship. This not only helps in better mastication, speech, and facial aesthetics, but also contributes to general and oral health, thereby improving the quality of life. Orthodontic treatment, like any other treatment modalities, in addition to its benefits, has also associated risks and complications. However, the risk and complication associated with treatment are reported to be considerably lower compared to other surgical or nonsurgical interventions.¹⁻³ Orthodontics may represent an important part in periodontal patients with many conditions, may present with pathological tooth migration or other deformities of their treatment. Both periodontists and orthodontists should understand the results of one's work on the other's and cooperate in clinical practice to deliver the best possible treatment to their patients.⁴⁻⁶ Hence; we planned the present study to assess the effect of orthodontic treatment on the gingival health.

Gingival recession, characterized by apical displacement of the gingival margin from the cemento-enamel junction (CEJ), can be localized or generalized and can involve one or more tooth surfaces.⁷ Root surface exposure as a result of gingival recession, and patients often experience esthetic impairment,⁸ increased susceptibility to root caries,⁹ and dentin hypersensitivity.¹⁰ Although many risk factors play a role in the production of gingival recession, not necessarily simultaneously or equally,⁷ periodontal diseases and mechanical trauma are the two primary etiologic factors in the development of gingival recessions.^{7,8,11,12} Other, secondary etiologic factors might include tooth positioning, bone dehiscence, and smoking.^{7,8,13,14} Recently, we studied the prevalence, extent, and severity of gingival recession in young adult Israeli population.¹⁵ Gingival recession, frequently seen in among young adults, was found to be related to past orthodontic treatment and oral piercing.^{8,11,16} A strong correlation was also seen between the severity and extent of these recessions and past orthodontic treatment, and it was suggested that orthodontic tooth movement, especially beyond the labial or lingual alveolar plate, may lead to dehiscence formation and gingival recession. Thin gingival biotype, visual plaque, and inflammation are considered predictors of gingival recession.⁷ The purpose of the present study was to evaluate the association of orthodontic treatment and post orthodontic fixed retainers with gingival health.

METHOD:**Participants**

The study population consisted of 80 (40 men and 40 women) consecutively examined, healthy, 18- to 28-year-old (mean age, 22.6 – 1.9), subjects who arrived for routine dental examination at Dental unit of Sir Syed Dental Hospital Karachi between August 2017 to August 2018. Current smoking was reported by 20 (21.7%) patients. No former smokers were present in the study cohort.

Ethical Considerations

The Ethics Committee of the Medical Corps approved the study. After the examination.

Procedure

Patients were provided with a written report detailing their oral status and any diagnosed periodontal or mucosal lesions. Patients advised to seek specialist consultation and treatment who were diagnosed with pathologic conditions. Interview and Clinical Examination oral consent to participate is given by telling all detailed and aim of the study. A written questionnaire was used to record age, smoking habits (number of cigarettes and years of smoking), and past orthodontic treatment. One calibrated dentist (GRSN) performed all examinations. (Kappa statistic for recession intra examiner agreement was 0.959; tolerance level was 1mm.) parameters measured at six sites per tooth in the anterior sextants included plaque index (PI), gingival index (GI), and gingival recession, probing depth (PD), and bleeding on probing (BOP). Negative recessions were not evaluated. When an extra coronal bonded fixed retainer was present, the distance was measured between the retainer and incisal tooth edge and to the CEJ, using a Williams's periodontal probe. All measurements were rounded to the nearest millimeter, except for 0.5-millimeter readings, which were rounded down.

Data Analysis

For unpaired observations, a two-tailed t test was used to compare differences between the two groups. Chi square analysis was used to evaluate the association between orthodontic treatment/fixed retainer presence and the presence/absence of gingival recessions. The correlation of plaque, gingivitis, and fixed retainers to gingival recessions was tested with the Pearson correlation coefficient test. Data were analyzed with statistical software A 5% significance level was used.

RESULTS:

There were 56 past orthodontic patients (70%) and 24 with one or two fixed retained jaws. The mean period between orthodontic treatment and examination was 2 years to 1 month. Clinical examination revealed an overall mean PD of 1.90 – 0.2 mm and mean gingival

recession of 0.06 – 0.02 mm, 20.8% of all sites exhibited BOP, and 25% of all patients exhibited one or more sites with gingival recession.

Gender differences were not found in any of the parameters except labial gingival recession, which was

greater in men (0.15 – 0.03 mm) than in women (0.06 – 0.01 mm; $P = 0.014$). Gingival parameters sorted by the maxilla/mandible are presented in Table 1. Overall, BOP, PI, PD, and gingival recession were greater in the mandible than in the maxilla.

Table 1. Gingival Parameters According to Jaw

Variable	Maxilla (n = 90)	Mandible (n = 88)	P Value*
Labial BOP (% sites)	23.1	35.8	0.005
Lingual BOP (% sites)	36.5	47.4	0.033
Labial PI (%)	44.6	62.2	0.004
Lingual PI (%)	42.3	75.2	0.0001
Labial recession (mm; mean – SD)	0.98 – 0.27	0.11 – 0.21	0.76
Lingual recession (mm; mean – SD)	0.01 – 0.03	0.06 – 0.16	0.002
Lingual PD (mm; mean – SD)	1.74 – 0.23	1.91 – 0.23	0.0001

n = number of arches (six missing),* Student t test.

Significantly greater lingual PI, PD, and labial gingival recession were found in previously treated orthodontic patients compared to non-treated patients (Table 2; $P < 0.05$). These parameters were compared with regard to the presence or absence of a fixed retainer in the whole patient population (Table 3). Localized gingival recession, PD, PI, GI, and BOP were significantly more prominent and greater in teeth with a fixed retainer than in those without a fixed retainer.

Table 2: PI, PD, BOP, and Gingival Recession With Regard to Previous Orthodontic Treatment

Variable	Previous Orthodontic Treatment		P Value*
	Yes (n = 56)	No (n = 24)	
Lingual BOP (% sites)	44.2	37.3	0.2
Lingual PI (%)	63.9	48.4	0.016
Labial recession (mm; mean – SD)	0.13 – 0.27	0.05 – 0.16	0.03
Lingual recession (mm; mean – SD)	0.04 – 0.14	0.01 – 0.06	0.09
Lingual PD (mm; mean – SD)	1.87 – 0.23	1.73 – 0.25	0.0003

n = number of patients,* Student t test

Table 3. PI, PD, BOP, and Gingival Recession With Regard to Previous Orthodontic Fixed Retainer

Variable	Orthodontic Treatment With Fixed Retainer (n = 40)	No Fixed Retainer (with or without orthodontic treatment) (n = 130)	P Value*
Lingual BOP (% sites)	53.9	37.6	0.004
Lingual PI (%)	82.4	50.1	0.0001
Labial recession (mm; mean – SD)	0.14 – 0.24	0.09 – 0.24	0.245
Lingual recession (mm; mean – SD)	0.09 – 0.18	0.01 – 0.07	0.0002
Lingual PD (mm; mean – SD)	1.88 – 0.24	1.81 – 0.25	0.0675

n = number of arches (six missing). * Student t test

To assess the effect of the fixed retainer, data were further sorted between orthodontic patients only with or without fixed retainers (Table 4). Greater PD, BOP, PI, and gingival recession were observed in patients with fixed retainers compared to the post orthodontic patients without fixed retainers ($P < 0.05$)

Table 4. PI, PD, BOP, and Gingival Recession with Regard to Previous Orthodontic Fixed Retainer in Orthodontic Patients Only

Variable	Arches Treated With Fixed Retainer (n = 40)	Arches Treated Without Fixed Retainer (n = 72)	P Value*
Lingual BOP (% sites)	53.9	37.8	0.012
Lingual PI (%)	82.4	51.6	0.0001
Labial recession (mm; mean – SD)	0.14 – 0.24	0.13 – 0.29	0.8
Lingual recession (mm; mean – SD)	0.09 – 0.18	0.01 – 0.08	0.005
Lingual PD (mm; mean – SD)	1.88 – 0.24	1.87 – 0.23	0.703

Among all subjects, a greater proportion (31.4%) of patients who had orthodontic treatment had gingival recession compared to those who did not undergo orthodontic treatment (10.2%; $P = 0.019$; data not shown). Furthermore, among the subjects who had orthodontic treatment and a fixed retainer, the proportion of arches that presented with gingival recession (25.0%) was much greater than for those who had orthodontic treatment without a fixed retainer (2.8%; $P = 0.0002$; Table 5).

Table 5. The Association Between Fixed Retainer and Occurrence of Lingual Gingival Recession in Orthodontic Patients Only

Lingual Recession	Orthodontic Treatment With Fixed Retainer	Orthodontic Treatment Without Fixed Retainer
Yes ([%])	(25.0)	(2.8)
No ([%])	(75.0)	(97.2)
Total	(100.0)	(100.0)

A weak-positive correlation was found between plaque on the lingual/palatal aspect and gingival recession ($r = 0.16$; $P = 0.033$) in the whole subject population; and a moderate-positive correlation was found between plaque on the lingual aspect and lingual/palatal recession ($r = 0.23$; $P = 0.012$) in the subgroup of the post orthodontic patients. The average distance between the fixed retainer and CEJ was 1.25 – 2.0 mm. Fixed retainers placed in a more gingival position had greater gingival recession and adjacent inflammation compared to more retainers that were placed more incisally. However, this difference was not statistically significant ($r = 0.19$; $P = 0.19$).

DISCUSSION:

In the present study, the most important finding was the negative effects of orthodontic treatment, especially when combined with post orthodontic fixed retainer placement, on periodontal health. This could result from the plaque-retentive characteristic of the retainer, the effect it has on oral hygiene performance, and the bacterial composition as previously reported with regard to bands and brackets.¹⁵⁻¹⁶ The differences in plaque, BOP, and inflammation were noteworthy. The recession differences were small, on the order of 0.08 mm, with a large SD, and were of rather minimal clinical relevance. The small difference in clinical parameters between the groups might be attributed to the short period from orthodontic treatment to examination in this young adult population. Gingival recession, in its localized or generalized form, is an undesirable condition resulting in root exposure, which is often non-esthetic and may lead to sensitivity and root caries. Exposed root surfaces are also prone to abrasion.

In the present study, gingival recession was common in the 18- to 28-year-olds, which is in agreement with other studies.^{1,10,11,17} Also consistent was the finding that men had greater labial gingival recession than women, similar to other populations.^{10,11,17} According to data collected from the Third National Health and Nutrition Examination Survey, men have significantly more gingival recession, gingival bleeding, sub gingival calculus, and teeth with total calculus than women.¹⁷ This can result from the larger tooth dimensions in men, among other factors.^{18,19} Moreover, in the present study, gingival recession was greater in the mandible than in the maxilla, which

could result from the thin mandibular buccal plates. In a study²⁰ that described a 5-year incidence of periodontal attachment loss, the percentage of mandibular sites with attachment loss was greater than maxillary sites where the major contributor to periodontal attachment loss in either jaw was increased gingival recession.

The prevalence of gingival recession was positively correlated with past orthodontic treatment. Orthodontic tooth movement outside the labial or lingual alveolar plate may lead to dehiscence formation and gingival recession.

However, the relationship between orthodontic movement in different age populations and gingival recession was not found in previous reports. In one study, gingival recession of mandibular incisors did not increase significantly during orthodontic treatment. After treatment, 2 mm; at follow-up, 5% of the preexisting gingival recessions had improved. It was concluded that thin gingival biotype, visual plaque, and inflammation are useful predictors of gingival recession. Conversely, in another report, post orthodontic recessions developed in 10% of the examined teeth, but only 5% of those sites resolved. The discrepancy between studies may be due to the more complex etiology of gingival recession, in which orthodontic treatment and fixed retainers are only two factors in its pathogenesis. Periodontal phenotype, tooth brushing habits, and toothbrush characteristics also play a contributing role.¹⁰ In the present study population, data were not available regarding the nature of the orthodontic treatment. Therefore, no conclusions could be made on the relationship

between the direction of the orthodontic movement (i.e., in or out of the bony envelope) and its effect on gingival recession. Moreover, the initial tooth position and alveolar anatomy also might have an effect on the formation and susceptibility to gingival recession formation. Inconsistency in the previous literature was also exists with regard to the effects of fixed retainers on the gingiva. Recently, Booth *et al.* reported that long-term retention of mandibular incisor alignment is acceptable to most patients and quite compatible with periodontal health. Nevertheless, Pandis *et al.*²¹ reported greater calculus accumulation, greater marginal recession, and increased PD in patients with mandibular fixed retention for long periods.

The investigators raised the question of the appropriateness of lingual fixed retainers as a standard retention plan for all patients, regardless of their attitude toward dental hygiene. In a study by Heier *et al.* slightly more plaque and calculus were present on the lingual surfaces in the patients with fixed retainers. However, this did not result in more pronounced gingival inflammation than in the group with removable retainers. An ideal orthodontic fixed retainer should be passive and semi rigid, maintaining physiologic tooth mobility after splinting. From the patient's perspective, the retainer should not interfere with occlusion, oral hygiene, and speech. As, observed in the present study, teeth with fixed retainers showed a greater prevalence of gingival recession and plaque accumulation. The influence of orthodontic is suggested.

Treatment on the prevalence of gingival recessions. The retainer could promote plaque accumulation, resulting in greater gingival recession;¹ this was found in the present study in that orthodontic fixed retainers placed in a more gingival position had greater gingival recession and inflammation compared to more incisally placed fixed retainers. The young age of the patients may suggest that these differences could be more pronounced if an older adult population with longer exposure was studied.

Consequently, the fixed retainers should be placed as far from the gingival margin as possible to prevent oral hygiene impairment. No relationship was found between cigarette smoking and gingival recession, which supports the inconsistency in the literature. Albandar *et al.* and Calsina *et al.* in cross-sectional and case-control study designs, respectively, reported a positive relationship between smoking and recession. However, in a 6-month follow-up study by Müller *et al.*, a group of young subjects failed to show that smokers had an increased risk for recession. low prevalence of smoking subjects and the short duration

of their smoking-based results used in the current study.

CONCLUSION:

Based on the findings of this study, it is evident that patients who wears orthodontic appliances is having high plaque index, gingival bleeding index and ortho plaque index scores. Orthodontic treatment, especially when together with post orthodontic fixed retainer placement, could have a really negative effect on gingival health. Fixed retainers were related with an increased incidence of recession, plaque retention, and bleeding on probing; however, the magnitude of the difference in recession was of low clinical significance. 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.

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