

## Are the Effects of Fixed Orthodontic Treatment on Gingival Health Similar in Adolescents and Young Adults?

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### Abstract

**Objective:** To compare the relationship of fixed orthodontic treatment and gingival health between adolescents and young adults.

**Materials and Methods:** This retrospective study was performed by searching the files of the patients treated by post-graduate student of Gazi University, Faculty Dentistry, Department of Orthodontics and includes 60 patients. Each group, adolescents (12-17 years, mean chronological age  $14,06 \pm 1,18$  years) and young adults (18-32 years, mean chronological age  $22,36 \pm 2,82$ ), is composed of thirty patients of similar sexes and skeletal anomalies. Each group had undertaken similar treatments (fixed orthodontic treatment with extraction and nonextraction). The gingival condition assessment covering visible plaque, visible inflammation, the gingival biotype, gingival recession and gingival overgrowth is carried out through oral clinical photographs of pre- and post-treatment.

**Results:** The average value of visible inflammation in gingiva and of gingival recession showed statistically significant increase on adults and the average values of visible plaque and inflammation demonstrated a likewise increase on adolescents when the treatment was finished. Change in gingival biotype wasn't found statistically significant in both groups.

**Conclusion:** The results of the study showed that the responds of the periodontal tissue during orthodontic treatment are better in adolescents than those of young adults.

**Clinical Relevance:** Before receiving orthodontic treatment, the periodontal condition of the patient should be in healthiest possible level and this has to be maintained during the treatment.

And also, importance of the cooperation between patient, orthodontist and periodontologist should not be forgotten in the process of orthodontic treatment.

**Keywords:** Orthodontic treatment; Periodontal health; Adolescents and adult; Gingiva

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### Introduction

The relationship between orthodontic treatment and gingival health has been an important topic in many studies. However, the debates still go on. Orthodontic treatment recovers crowding of teeth. In doing so, it contributes to the provision of a better oral hygiene [1]. As a result, the periodontal health is easier to maintain.

It is a must to have a maximum oral hygiene to receive an orthodontic treatment since appliance attached for the fixed orthodontic treatment complicates the maintenance of proper care of mouth and it is directly related with periodontal health. Changes occur in microbial ecology through the attachment of appliance and the amount of visible supra- and subgingival plaque increase [2,3]. Furthermore, mechanics applied in the treatment tends to stimulate the response of gingival soft tissues [2,4].

Following the placing of the appliance, clinical effects such as chronic infection, inflammatory hyperplasia, gingival recession, attachment loss or gingival overgrowth can occur [4]. In addition, most of the studies [2,5-7] indicate that adults are better than adolescents in removing supragingival plaques. On the other hand children and adolescents develop gingivitis as a response against the presence of orthodontic appliance, periodontitis rarely progresses. However, this case is not guaranteed for adults even if their periodontal condition is fine [5].

The aim of this retrospective study is to find out and assess whether the relationship between fixed orthodontic treatment and gingival health is different among adolescents and adults.

## Materials and Methods

This study was performed by scanning the files of the patients treated by post-graduate students of Department of Orthodontics, Faculty of Dentistry, Gazi University and include 60 patients. Each group, adolescents (12-17 years, mean  $14,06 \pm 1,18$ ) and young adults (18-32 years, mean  $22,36 \pm 2,82$ ), was composed of thirty patients of similar sexes, skeletal anomalies. Each group had undergone similar treatments (fixed orthodontic treatment with extraction and nonextraction). The clinical oral photographs taken in pre- and post-treatment were watched over to provide a more qualified and complete image. The exclusion criteria were as follows: orthognathic surgery, lip and plate cleft and, medicine intake, pregnancy, medically and psychologically compromised patients. The evaluation of gingival plaque, visible inflammation, gingival recession and gingival overgrowth was made by a periodontist who reviewed the clinical oral photographs taken before and after treatment. The color photographs of pre- and post-treatment were taken from frontal and sagittal views and analyzed on the same screen in a dark room. The results were evaluated as follows: The presence or absence of 1- visible plaque, of 2- visible gingival inflammation, of 3-gingival overgrowth were recorded from mesial, buccal and distal surfaces of each tooth (except for second and third molars). The presence or absence of 4- gingival recession was recorded from buccal surfaces of each tooth (except for second and third molars) [8].

The examination of patients' gingival biotypes considering gingival structure and capillary translucency were done in labial surface of anterior teeth on pre- and post-treatment clinical photographs visually and recorded as thin or thick [9].

Intraoral clinical photographs were evaluated by one periodontologist and cephalometric films were evaluated by one orthodontist. The researchers revised all patients' medical records in 10-day intervals and the coefficient of concordance between each revision are found high ( $0,96 \leq ICC \leq 0,99$ ).

## Statistical Analysis

Data from all variables were transferred to the statistical program SPSS Base 15.0 (SPSS Inc, Chicago). Descriptive statistics showed with the mean  $\pm$ SD for the distribution of normal variables, median (min-max) for the distribution of non-normal variables and the number of cases and percentages for the nominal variables. Significant differences between the groups in terms

of arithmetic means were analyzed with Student's t test (with Bonferroni correction), significant differences in terms of median values were analyzed with Mann-Whitney U test (with Bonferroni correction). Nominal variables were assessed by Pearson's chi-square or Fisher's exact test. Intergroup differences between time periods were investigated with Wilcoxon test (with Bonferroni correction) for the distribution of non-normal variables, and Paired t test (with Bonferroni correction) for the distribution of normal variables. Spearman correlation analysis was used to determine a correlation coefficient and p value between incisor inclinations and gingival recession changes. P values of 0.05 or less were considered to be statistically significant.

## Results

Each group consists of 30 patients, 25 of whom were women. The average age of the young adult group is  $22,36 \pm 2,82$ , and of the adolescents is  $14,06 \pm 1,18$ . Each group has 21 patients with skeletal class I and 9 patients with skeletal class II anomaly. 13 patients of each group received fixed orthodontic treatment with extraction, 17 of each group patients underwent fixed orthodontic treatment without extraction. The average duration of treatment for young adults and adolescents was  $24,13 \pm 11,30$  and  $25,43 \pm 9,35$  months, respectively. The difference of treatment durations between these two groups was not statistically significant ( $p=0,428$ ). Likewise, no statistically significant difference of dental anomalies between these two groups appeared (**Table 1**). The average visible plaque, visible inflammation, gingival recession and gingival overgrowth of the patients before treatment were indicated in **Table 2**. Average plaque formation of the young adults and adolescents were  $2,96 \pm 5,59\%$  and  $2,77 \pm 10,0\%$ , respectively. Average percent of inflammation for young adults and adolescents were  $0,92 \pm 2,22\%$  and  $3,14 \pm 6,90\%$ , respectively. The difference between these pre-treatment values for each parameter was not statistically significant. When gingival recession values are compared, 11 cases of gingival recession for young adults were present ( $0,37 \pm 1,47\%$ ) but there was no such case for adolescents, revealing a statistically significant difference. The patients of each group had no gingival overgrowth before treatment. **Table 3** showed the average percentage of visible plaque, visible inflammation, gingival recession and gingival overgrowth of patients before and after treatment. Each group is demonstrated an increase in each value after the treatment. On the other hand, the increase of visible inflammation and gingival recession among the young adults was found statistically significant after treatment whereas the average visible plaque and inflammation values of the adolescents proved to be statistically significant after treatment. The change in the values of gingival biotypes before and after treatment does not show a meaningful difference (**Table 4**). When the percentages of average visible plaque, visible inflammation, gingival recession and gingival overgrowth before and after treatment were compared, the percentage increases of visible inflammation among adolescents after treatment was significantly higher than that of young adults (**Table 5**).

In each group, 480 teeth were examined before treatment (960 teeth in total for both groups). In the group of young adults,

**Table 1** Demographic variables.

	Adult (n=30)	Adolescent (n=30)	p
<b>Age (year)</b> Mean ± SD	22,36 ± 2,82	14,06 ± 1,18	<b>0,000*</b>
<b>Sex</b>			
Girl n (%)	25 (83,3%)	25 (83,3)	1,000
Boy n (%)	5 (16,7%)	5 (16,7%)	
<b>Treatment type</b>			
Fixed appliance with extraction n(%)	13 (43,3)	13 (43,3)	1,000
Fixed appliance without extraction n(%)	17 (56,7)	17 (56,7)	
<b>Treatment time (month)</b>			
Mean ±SD	24,13 ± 11,30	25,43 ± 9,35	0,428
(Median)Range	22 (2-52)	23,50(11-49)	
<b>Skeletal Classification</b>			
Class 1 n (%)	21 (70%)	21 (70%)	1,000
Class 2 n (%)	9 (30%)	9 (30%)	
<b>Angle Classification</b>			
Class 1 n (%)	17 (56,7%)	13 (43,3%)	0,430
Class 2 n (%)	12 (40%)	14 (46,7%)	
Class 3 n (%)	1 (3,3%)	3 (10%)	

**Table 2** Pretreatment Visible plaque, Visible inflammation and Gingival recession values of patients.

	Visible Plaque (%)	Visible Inflammation (%)	Gingival Recession (%)	Gingival Overgrowth (%)
<b>Adults</b>				
Mean ± SD	2,96 ± 5,59	0,92 ± 2,22	0,37 ± 1,47	0,0 ± 0
Median (Range)	0(0-19,44)	0(0-6,94)	0(0-8)	0 (0-0)
<b>Adolescents</b>				
Mean ± SD	2,77 ± 10,03	3,14 ± 6,90	0,0 ± 0	0,0 ± 0
Median (Range)	0(0-54,16)	0(0-26,38)	0(0-0)	0(0-0)
<b>p</b>	0,235	0,268	<b>0,040*</b>	1,00

**Table 3** Distribution of visible plaque, visible inflammation, Gingival recession and Gingival overgrowth values before and after treatment in each group.

	Visible Plaque			Visible Inflammation			Gingival Recession			Gingival Overgrowth		
	Before Treatment	After Treatment	P	Before Treatment	After Treatment	P	Before Treatment	After Treatment	p	Before Treatment	After Treatment	p
<b>Adults</b>												
Mean ± SD												
Median (Range)	2,96 ± 5,59 0 (0-19,44)	6,57 ± 8,78 2,77(027,77)	0,085	0,92 ± 2,22 0 (0-6,94)	7,63 ± 10,56 2,77(0-44,44)	<b>0,001*</b>	0,37 ± 1,47 0(0-8)	0,87 ± 1,85 0(0-8)	<b>0,027*</b>	0,0 ± 0 0 (0-0)	0,20 ± 0,92 0 (0-5)	0,18
<b>Adolescents</b>												
Mean ± SD	2,77 ±				18,88 ± 19,44							
Median (Range)	10,03 0(0-54,16)	8,21 ± 9,07 6,24 (0-27,70)	<b>0,005*</b>	3,14 ± 6,90 0 (0-26,38)	15,27(0-80,55)	<b>0,000*</b>	0,0 ± 0 0(0-0)	0,20 ± 0,55 0 (0-2)	0,063	0,0 ± 0 0 (0-0)	0,0 ± 0 0 (0-5)	0,68

there were 11 cases of gingival recession (2,29%) detected, which were 3 lower canine (5%), 2 upper canine (1,66%), 3 mandibular premolar (5%) and three maxillary premolar (5%) before treatment. After the treatment, the cases of gingival recession increases to 26 (5,41%) and this change is found statistically significant. As for adolescents, there was no case of gingival recession, however, 5 cases of gingival recession were detected after treatment: This change was not statistically significant (**Tables 5 and 6**).

## Discussion

The appliances attached for the orthodontic treatment hinders the maintenance of oral hygiene and it is directly related with periodontal health. Our study which compares the relationship

between fixed orthodontic treatment and gingival health among adolescents and young adults pointed out that each group experienced an increase in visible plaque and inflammation values after treatment. The increase in plaque was statistically significant only for adolescents but visible inflammation values turned out to be significant for adolescent and young adults alike. The results of this study is similar to the results of the studies [2,4,10] showing that the fixed orthodontic treatment facilitates plaque accumulation and reporting the development of generalized gingivitis independent from the plaque quality of patients following the fixed orthodontic treatment.

This study proved to be statistically significant only for adolescents even though there was an increase in the average visible plaque values for both groups after treatment. The increase in the

**Table 4** Distribution of Gingival Biotype In Jaws Before and After Treatment in Each Group.

	Maxilla					Mandible				
	Thin		Thick		p	Thin		Thick		p
	Before Treatment	After Treatment	Before Treatment	After Treatment		Before Treatment	After Treatment	Before Treatment	After Treatment	
<b>Adults n(%)</b>	5(%16,7)	5(%16,7)	25(%83,3)	25(%83,3)	1,000	12(%40)	18(%60)	12(%40)	18(%60)	1,000
<b>Adolescents n(%)</b>	8(%26,7)	8(%26,7)	22(%73,3)	22(%73,3)	1,000	17(%56,7)	13(%43,3)	17(%56,7)	13(%43,3)	1,000

**Table 5** Difference of visible plaque, visible inflammation, Gingival recession and Gingival overgrowth values before and after treatment in each group.

	Difference visible plaque	Difference visible inflammation	Difference Gingival Recession	Difference Gingival overgrowth
<b>Adults</b>	3,61 ± 10,41 0(19-29)	6,71 ± 10,79 2,77(7-44)	0,50 ± 1,16 0(0-4)	0,20 ± 0,92 0(0-5)
<b>Adolescents</b>	5,44 ± 11,81 2,77(28-38)	15,74 ± 20,32 11,11(15-81)	0,20 ± 0,55 0(0-2)	0,40 ± 1,19 0(0-5)
<b>p</b>	0,271	<b>0,023*</b>	0,425	0,394

**Table 6** Number of teeth with gingival recession in patients treated with fixed orthodontic treatment with extraction.

		Mand Incisor (n=120)	Max Incisor (n=120)	Mand Canin (n=60)	Maxil Canin (n=60)	Mand Premolar (n=60)	Max Premolar (n=60)	Mand molar (n=60)	Max Molar (n=60)	Total (n=480)
		<b>Adults</b>	<b>Before Treatment</b>	0	0	3 (5%)	2 (1,66%)	3 (5%)	3 (5%)	0
	<b>After Treatment</b>	4 (3,33%)	2 (1,66%)	6 (10%)	4 (6,66%)	4 (6,66%)	5 (8,33%)	1 (1,66%)	0	26 (5,41%)
<b>Adolescents</b>	<b>Before Treatment</b>	0	0	0	0	0	0	0	0	0
	<b>After Treatment</b>	0	1 (0,83%)	4 (6,66%)	1 (1,66%)	0	0	0	0	5 (1,04%)

visible inflammation values were significant for both groups, however, the increase of the adolescents was found greater. In accordance with the results of this study, the clinical study carried out by Boyd et al. [5] compared an interaction between fixed orthodontic treatment and periodontal tissues of the adults and adolescents with normal and decreased periodontium. The results of the study demonstrated that adolescents treated with fixed orthodontic treatment experienced more plaque accumulation and periodontal inflammation than adults having received the identical treatment. The researchers associated this situation with factors such that the adults are more willing to receive orthodontic treatment than the adolescents and the increasing hormone levels of adolescents related with pubertal development cause a surge in gingival inflammation.

The relationship between orthodontic treatment and gingival recession has been the hot topic of many studies on orthodontics and periodontology. There are studies showing that orthodontic treatment leads to gingival recession and some studies disagree with this finding, however [8,11-14]. On the other hand, the responds of periodontal tissues towards orthodontic treatment proved better among adolescents than young adults and adults [15]. The previous studies indicated that gingival recession and gingival inflammation [8], biotype of thin gingival tissue [8,16], the short width of keratinized gingiva [8,12,16] before orthodontic treatment showed a increasingly significant correlation with gingival recession after treatment. Melsen and Allais [8] highlighted that the gingival biotype was an important factor in gingival recession after orthodontic treatment but did

not ensure a quantitative parameter for gingival biotype. Vassali et al. [17], however, demonstrated that age, sex, skeletal and dental relationship, the type of orthodontic treatment and its duration were ineffective in the formation of gingival recession during the treatment process. The patients involved in this study resembled in sex, current skeletal and dental relationships, applied treatment and its duration. Each group did not indicate a significant change in gingival biotype during orthodontic treatment but adults experienced gingival recession more than adolescents in the post-orthodontic treatment and this increase has been found statistically significant. Thus, the results of this study supports that the respond of adolescents towards orthodontic treatment is better than that of adults.

One of the crucial problems of orthodontic treatment related gingivitis is the gingival overgrowth [2]. Kloehn and Pfeifer [18] evaluated the nature of gingival overgrowth and its degree following the placing of orthodontic appliance. They reported that gingival overgrowth appeared in posterior teeth more than four times than that in incisors and canines. In addition, the number of gingival overgrowth in interdental surface was more than that of facial surface. The researchers state that there was a dramatic decline in gingival overgrowth within 48 hours after the removal of appliance. The results of our study detected that even though the photographs were taken in the session when the orthodontic appliances were removed, there appeared no significant increase in the number of gingival overgrowth among both adolescents and adults.

## Conclusion

Average visible plaque and inflammation values increase during orthodontic treatment. Therefore, before receiving orthodontic treatment, the periodontal health of the patient should be the highest possible level and this has to be maintained during the treatment.

Considering gingival recession, the response of young adults towards orthodontic treatment are worse than those of adolescents.

Given these relationships between orthodontic treatment and gingival health, the importance of the cooperation between patient, orthodontist and periodontist should not be forgotten in the process of orthodontic treatment.

## Conflict of Interest

The authors report no conflicts of interest related to this study.

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