

Original Research

Evaluation of Gingival Health in Patients Undergoing Fixed Orthodontic Treatment

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ABSTRACT:

Aim- The aim of this study was to evaluate the impact of fixed orthodontic treatment on gingival health by assessing changes in visible plaque accumulation, clinically evident inflammation and gingival recession. **Materials and methods-** This study aimed to assess the effects of fixed orthodontic treatment on gingival health in a cohort of 60 patients preparing for orthodontic intervention. Data collection included intraoral and extraoral radiographs, along with photographic documentation, systematically recorded on separate forms. A comprehensive intraoral examination was conducted to evaluate visible plaque, clinically evident inflammation, and gingival recession, classified according to Miller's criteria. Demographic data, including age and gender, were documented to explore potential correlations with gingival health parameters. The study sought to provide a detailed understanding of how orthodontic appliances influence gingival health over time. Statistical analysis was performed using SPSS software. **Results-** 60 patients were included undergoing fixed orthodontic treatment, categorized into two groups: those who underwent dental extractions (n = 30) and those who did not (n = 30). The mean age in the extraction group was 15.8 years, whereas the non-extraction group had a higher mean age of 18.8 years. Both groups had an equal gender distribution, with 15 males and 15 females in each. Treatment duration varied significantly, with the extraction group requiring an average of 25.2 months, while the non-extraction group had longer treatment duration of 39.5 months. The study evaluated changes in gingival health parameters before and after fixed orthodontic treatment. Visible plaque levels increased from 2.9 pre-treatment to 5.1 post-treatment, showing a statistically significant difference (p = 0.003). Similarly, visible inflammation rose from 4.10 before treatment to 9.12 after treatment, with a significant p-value of 0.011. Gingival recession also increased, with scores rising from 0.16 pre-treatment to 0.99 post-treatment, demonstrating a statistically significant difference (p = 0.003). **Conclusion-** Fixed orthodontic treatment is associated with increased plaque accumulation, inflammation, and gingival recession.

Keywords- Orthodontic, inflammation, recession

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INTRODUCTION

The periodontium consists of the gingival unit and the periodontal attachment apparatus, which includes the cementum, periodontal ligament, and cribriform plate. While gingival disease precedes periodontitis, not all cases progress to severe periodontal infection. Various factors influence periodontal health, including host resistance, behavioral characteristics, genetic predispositions, and the composition of the bacterial biofilm. Orthodontic patients with inflamed gingiva are at risk for periodontal damage, particularly due to local factors like tooth anatomy, appliance design, and arch length deficiency, which contribute to plaque accumulation and gingival inflammation.

Malalignment can further complicate oral hygiene, leading to increased plaque retention and gingival disease.^{1,2,3}

Fixed orthodontic appliances introduce clinical changes that can affect gingival health. The proximity of bands and brackets to the gingival sulcus, combined with plaque accumulation and difficulty in maintaining oral hygiene, often leads to inflammatory responses. These responses include gingival hyperplasia, chronic infection, gingival recession, and, in severe cases, irreversible loss of periodontal attachment. Despite excellent oral hygiene, mild to moderate gingivitis is common within 1-2 months of appliance placement, with approximately 10% of adolescents experiencing significant periodontal attachment loss. However, gingival conditions typically improve within 48 hours of appliance removal.^{4,5}

Inflammatory changes due to orthodontic mechanotherapy alter the oral microbial environment,

increasing the presence of pathogenic bacteria. The shift from commensal Gram-positive cocci to Gram-negative periodontopathic bacteria leads to increased gingival inflammation. Studies using various indices, such as the plaque index and gingival index, consistently report that orthodontic appliances create favorable conditions for plaque accumulation, complicating oral hygiene and increasing the risk of gingival disease.^{6,7}

This study aimed to assess the impact of fixed orthodontic therapy on different aspects of gingival health in patients undergoing treatment. The evaluation focused on visible plaque accumulation, clinical signs of inflammation, gingival recession, and gingival biotype. By analyzing these parameters, the study sought to provide a comprehensive understanding of how orthodontic appliances influence overall oral health.

MATERIALS AND METHODS

This study aimed to assess the effects of fixed orthodontic treatment on gingival health in a cohort of 60 patients preparing for orthodontic intervention. Data collection included intraoral and extraoral radiographs, along with photographic documentation, systematically recorded on separate forms. A comprehensive intraoral examination was conducted to evaluate visible plaque, clinically evident inflammation, and gingival recession, classified according to Miller's criteria. Demographic data, including age and gender, were documented to explore potential correlations with gingival health parameters. The study sought to provide a detailed understanding of how orthodontic appliances influence gingival health over time. Statistical analysis was performed using SPSS software.

RESULTS

Table 1: Demographic data

Parameter	Fixed Orthodontic Treatment (n = 60)	
	With Dental Extraction (n = 30)	Without Dental Extraction (n = 30)
Mean age (years)	15.8	18.8
Gender		
Male	15	15
Female	15	15
Mean treatment time(months)	25.2	39.5

The study included 60 patients undergoing fixed orthodontic treatment, divided into two groups: those with dental extractions (n = 30) and those without extractions (n = 30). The mean age of patients in the extraction group was 15.8 years, while the non-extraction group had a higher mean age of 18.8 years. Both groups had an equal gender distribution, with 15 males and 15 females in each. The mean treatment duration varied significantly, with the extraction group requiring an average of 25.2 months, whereas the non-extraction group had a longer treatment time of 39.5 months.

Table 2: Comparison of Oral Health Parameters

Variable	Fixed Orthodontic Treatment	P value
Visible Plaque Value		
Before Treatment	2.9	0.003*
After Treatment	5.1	
Visible Inflammation Value		
Before Treatment	4.10	0.011*
After Treatment	9.12	
Gingival Recession Score		
Before Treatment	0.16	0.003*
After Treatment	0.99	

The study assessed changes in gingival health parameters before and after fixed orthodontic treatment. The visible plaque value increased from 2.9 before treatment to 5.1 after treatment, with a statistically significant difference (p = 0.003). Similarly, visible inflammation showed a notable rise, increasing from 4.10 before treatment to 9.12 after treatment, with a significant p-value of 0.011. Gingival recession also demonstrated a considerable increase, with the score rising from 0.16 before treatment to 0.99 post-treatment, showing a statistically significant difference (p = 0.003).

DISCUSSION

Orthodontic treatment plays a crucial role in improving dental alignment and function; however, it can also influence gingival health. Fixed orthodontic appliances create additional surfaces for plaque

accumulation, potentially leading to increased inflammation and other periodontal changes. Gingival health is a key factor in maintaining long-term oral health, and understanding the effects of orthodontic treatment on parameters such as plaque accumulation,

inflammation, and gingival recession is essential.^{8,9} This study aims to evaluate these changes in patients undergoing fixed orthodontic therapy, providing insights into the impact of treatment on periodontal health and the importance of maintaining effective oral hygiene throughout the process.

Our study included 60 patients undergoing fixed orthodontic treatment, categorized into two groups: those who underwent dental extractions ($n = 30$) and those who did not ($n = 30$). The mean age in the extraction group was 15.8 years, whereas the non-extraction group had a higher mean age of 18.8 years. Both groups had an equal gender distribution, with 15 males and 15 females in each. Treatment duration varied significantly, with the extraction group requiring an average of 25.2 months, while the non-extraction group had longer treatment duration of 39.5 months.

The study evaluated changes in gingival health parameters before and after fixed orthodontic treatment. Visible plaque levels increased from 2.9 pre-treatment to 5.1 post-treatment, showing a statistically significant difference ($p = 0.003$). Similarly, visible inflammation rose from 4.10 before treatment to 9.12 after treatment, with a significant p -value of 0.011. Gingival recession also increased, with scores rising from 0.16 pre-treatment to 0.99 post-treatment, demonstrating a statistically significant difference ($p = 0.003$).

Boke F et al.¹⁰ investigated the relationship between orthodontic treatment and gingival health in 251 patients (177 girls and 74 boys), the study considered factors such as age, treatment duration, and type of orthodontic therapy. Intraoral photographs assessed visible plaque, inflammation, and gingival recession, while lateral cephalometric films evaluated incisor inclinations before and after treatment. The results indicated that patients treated with functional appliances exhibited no significant changes in gingival health, whereas those undergoing fixed orthodontic treatment showed significant increases in plaque accumulation, inflammation, and gingival recession, with no alterations in gingival biotype. A positive correlation was found between lower incisor position and gingival recession, especially in patients treated with fixed appliances and extractions, with cuspids showing the highest prevalence of recession. The study highlighted the importance of collaboration among patients, orthodontists, and periodontists in managing gingival health during orthodontic treatment.

In the study conducted by Eid HA et al.,¹¹ participants were categorized into three age groups, and gingival enlargement (GE) was graded as 0, 1, or 2 based on the American Academy of Periodontology classification. The study included 62.3% males ($n=33$) and 37.7% females ($n=20$), with Group 1 (10-19 years) comprising 21 patients (39.7%), Group 2 (20-29 years) with 24 patients (45.3%), and Group 3 (≥ 30 years) with 8 patients (15.1%). The highest frequency

of GE (48%) was observed in Group 1, with age-related differences being statistically significant ($p=0.046$). Additionally, oral hygiene practices significantly influenced GE occurrence ($p<0.001$), as patients who brushed and flossed more than three times daily exhibited no GE, while those who practiced oral hygiene only once daily had the highest percentage of grade 2 GE. The study concluded that adolescents showed the highest frequency of GE, highlighting the critical role of consistent oral hygiene in preventing gingival enlargement.

Ashfaq M et al.¹² conducted a retrospective study on 72 post-orthodontic patients to identify factors associated with gingival recession. Patients were categorized based on the presence or absence of recession in posttreatment photographs, with assessments including lower incisor inclination, tissue thickness, alveolar bone height, and bone thickness. The mean age at treatment initiation was 16.56 ± 5.66 years. Gingival recession was observed in 40.3% of patients, with a thin gingival biotype significantly increasing the risk. Univariable logistic regression showed that patients with a thin biotype had 14.4 times higher odds of developing gingival recession, while multivariable analysis indicated a 10.2 times greater risk after adjusting for alveolar height changes. The study concluded that pre-treatment gingival biotype and male gender were key risk factors for gingival recession during orthodontic treatment.

Our study aligns with previous research in demonstrating the impact of fixed orthodontic treatment on gingival health, particularly in terms of increased visible plaque accumulation, inflammation, and gingival recession. Similar to the findings of Boke F et al., our study observed a significant rise in these parameters post-treatment, reinforcing the association between fixed appliances and adverse gingival changes. Additionally, Boke F et al. identified a correlation between lower incisor inclination and gingival recession, which is consistent with our study's findings, particularly in extraction cases where treatment duration was shorter but gingival recession was still evident. The study by Eid HA et al. further supports our results, as it highlights the influence of age and oral hygiene practices on gingival health, with younger patients showing higher susceptibility to gingival enlargement—a trend that parallels our study's observation of increased gingival inflammation and plaque accumulation in a younger cohort. Moreover, the study by Ashfaq M et al. provides additional context regarding the role of gingival biotype, demonstrating that a thin biotype significantly increases the risk of gingival recession. While our study did not specifically analyze biotype variations, the observed increase in gingival recession after orthodontic treatment may be partially attributed to underlying biotype differences among patients. Collectively, these studies complement our findings and emphasize the need for careful periodontal

monitoring and preventive strategies during orthodontic therapy.

However, the smaller sample size in our study limits the generalizability of these findings. To achieve a more comprehensive understanding of the long-term impact of orthodontic treatment on periodontal health and to optimize strategies for minimizing adverse effects, future research should include larger and more diverse populations.

CONCLUSION

Fixed orthodontic treatment is associated with increased plaque accumulation, inflammation, and gingival recession.

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