

Review Article

The Impact of Orthodontic Treatment on the Periodontium: A Literature Review

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Abstract: Introduction: The periodontium is a complex system of supporting tissues and alveolar bone that surrounds and maintains the teeth in place. It is essential for oral health and functionality. Orthodontic treatment, aimed at correcting dental malpositions and improving occlusion, has a significant impact on the health and integrity of the periodontium. Currently, there is a constant increase in demand for orthodontic treatments, both in children and adults, with a variety of available appliances, fixed or removable. However, these devices can compromise dental hygiene and potentially lead to periodontal problems. Our work, based on a literature review, aims to discuss the effects of fixed and removable orthodontic treatments on periodontal health. **Materials and Methods:** The objective of this work is to present the adverse effects of orthodontic treatment on the periodontium through a bibliographic study on the two databases Google Scholar and PubMed. There are numerous epidemiological studies on the influence of fixed and removable orthodontic treatment on periodontal health. **Conclusion:** Throughout this work, we will explore the interactions between orthodontics and the periodontium, highlighting the physiological mechanisms and therapeutic implications that stem from these close relationships, with the primary goal being to minimize adverse effects on the periodontium during and after orthodontic treatment. By fully understanding these periodontal manifestations following orthodontic therapy, orthodontists will be better equipped to plan and execute orthodontic treatments that not only improve aesthetics and occlusal function but also preserve the long-term health of their patients' periodontium.

Keywords: Orthodontic treatment, periodontium, oral hygiene.

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INTRODUCTION

Orthopedic dentofacial therapy is a medical discipline aimed at treating maxillary anomalies through orthopedic therapy and dental deformations through orthodontics, with the goal of restoring the function and aesthetics of the patient. Its main objective is to ensure harmonious facial and dental growth to promote the correct development of orofacial functions. In addition to its aesthetic aspect, orthodontics plays a crucial functional role in restoring proper occlusion and promoting effective self-cleaning after treatment. Currently, there is a constant increase in demand for orthodontic treatments, both in children and adults, with a variety of available appliances, fixed or removable. However, these devices can compromise dental hygiene and potentially lead to periodontal problems. It is therefore legitimate to question whether one type of appliance is preferable for maintaining oral health.

Furthermore, once orthodontic treatment is completed, the retention period aims to prevent relapses, but what is its impact on periodontal health? Our work, based on a literature review, aims to discuss the effects of fixed and removable orthodontic treatments on periodontal health.

During dental movement in orthodontic treatment, the moving tooth pulls along its supporting bone as well as surrounding structures such as sutures, cortices, sinuses, the periodontal ligament, and gingival tissues. This interaction is essential for understanding the physiological changes that occur during orthodontic treatment.

The alveolar bone is intimately linked to the tooth and evolves according to its movements. A phase of hyalinization occurs in front of the tooth, followed by bone resorption and bone apposition in response. These

physiological processes are closely regulated and effectively occur only in a healthy periodontal environment devoid of inflammation.

The orthodontist plays a crucial role in educating patients about oral hygiene, as orthodontic appliances can increase the risk of plaque retention. Therefore, it is essential to start orthodontic treatment only when the patient maintains effective plaque control. In case of neglect of oral hygiene by the patient, the orthodontist has the right and duty to interrupt treatment to avoid tissue damage and periodontal complications.

Dental movements can also lead to changes in periodontal tissues, such as reduction in the height of the attached gingiva and migration of roots beyond anatomical boundaries, leading to complications such as recessions, dehiscences, or fenestrations. In some cases, tooth extraction may be necessary for orthodontic reasons, which can result in the formation of gingival clefts and interdental fibrous bridges, thereby increasing the risk of inflammation and periodontal pockets [1].

Excessive or discontinuous force application may result in overly rapid dental movement, leading to alterations in gingival and bony tissues. This can manifest as a decrease in attached gingiva thickness or excessive bone resorption, compromising periodontal stability and health.

Modification of Oral Flora During Orthodontic Treatments

Orthodontic treatments using fixed appliances can lead to modifications in the microbial flora by promoting the presence of periodontal pathogens. A study conducted by Ahmed and colleagues [2] in 2019 revealed a significant increase in periodontal pathogens such as *Tannerella forsythia*, *Porphyromonas gingivalis*, *Campylobacter rectus*, and *Prevotella nigrescens* during orthodontic treatment with fixed appliances, thus suggesting an increased risk of periodontitis. Similarly, Shukla *et al.*, [3] in 2017 observed an increase in the number of *Streptococcus mutans* and *Candida albicans* after 2 and 3 months of orthodontic treatment.

Gingival inflammatory processes are often observed in the early months of orthodontic treatment with fixed appliances, but they generally decrease after the end of treatment, according to a study conducted by Martha *et al.*, [4] in 2016. This underscores the importance of rigorous oral hygiene throughout the treatment to reduce the risk of periodontal disease.

It is important to note that the periodontal modifications induced by orthodontic treatments with fixed appliances are not necessarily permanent and can return to normal with effective oral hygiene. Additionally, orthodontic treatments with fixed appliances can also alter salivary properties, thereby

increasing the risk of dental caries and periodontal diseases, as highlighted by Alshahrani in 2019 [5].

Contribution of Orthodontics to Periodontology:

Numerous studies have confirmed the adverse effects of fixed orthodontic treatments on oral health, particularly in promoting dental caries lesions, known as "white spots," as well as periodontal problems such as gingivitis, periodontitis, and halitosis. This is attributable to the presence of brackets and ligatures, which lead to increased plaque retention, thus increasing the risk of developing gingivitis according to research by Zhao [6] and Elkordy [7] conducted in 2019.

A systematic review conducted by Guo *et al.*, in 2017 [8] examined microbial changes in subgingival plaque in patients undergoing fixed orthodontic treatment to assess their clinical significance and the need for additional periodontal treatments. They found that these microbial changes could be transient, with some periodontopathogenic agents returning to normal levels after several months. This suggests that orthodontic treatment may not permanently induce periodontal disease, but rigorous oral hygiene and regular periodontal checks are recommended, especially at the beginning of treatment. However, this review has limitations, requiring further studies for more reliable evidence.

The work of Cerroni and colleagues (2018) [9] supports this idea by showing that fixed multi-bracket orthodontic appliances can lead to plaque accumulation and inflammation of periodontal tissues, but evidence of their impact on periodontal status remains moderate. Additional clinical studies are needed to obtain stronger evidence, particularly for a more comprehensive meta-analysis.

The Impact of Molar Bands Compared to Molar Tubes on Periodontal Health

The use of molar bands compared to molar tubes may have a different impact on periodontal health. Studies have shown that molar bands are associated with more pronounced periodontal inflammation than molar tubes during the first three months of orthodontic treatment. The results of the study by Al-Anezi cited by Atack [10] revealed increased probing bleeding and pocket depth with molar bands compared to molar tubes during this period. This observation may be explained by the direct contact of molar bands with the marginal gingiva, leading to mechanical irritation, as well as the use of cement which can be a chemical irritant [10]. However, since this study only examined three months of treatment, longer-term studies are needed to draw conclusions about long-term effects.

The presence of molar bands can also promote the formation of pseudo-pockets which tend to disappear approximately three months after their removal [11] according to Tiro in 2018.

Moreover, some research suggests that molar bands may not only affect supra-gingival tissue by displacing the epithelium but also lead to local destruction of the alveolar crest [12] according to the work of Yin *et al.*, in 2019.

Differences in the Impact of Conventional and Lingual Technique on Periodontal Health

We also examined a new fixed orthodontic technique called lingual technique. Tapia-Rivera¹³ and his team in 2015 conducted a review to compare the periodontal health of patients treated with the lingual technique to those treated with conventional vestibular technique. The examination focused on the presence of visible plaque, simplified oral hygiene index, probing bleeding, and gingival index.

Impact of Removable Aligner Therapy

The majority of adults seek discreet orthodontic treatment options, thus opting for transparent aligners. However, the use of these aligners can alter oral bacterial flora, creating a potentially detrimental imbalance to periodontal health [8]. Initially, some studies suggested that aligners could negatively affect periodontal health due to the coverage of dental and marginal gingival surfaces, which, lacking contact with saliva, were more susceptible to gingival inflammation⁶. Moreover, the rough edges of the aligners could irritate the marginal gingiva, thus promoting the accumulation of bacterial plaque and inflammations (Chhibber *et al.*, 2018) [14]. However, other studies suggest that aligners, being smooth and changed every two weeks, may reduce biofilm adhesion compared to fixed orthodontic appliances, facilitating better oral hygiene [6]. Nevertheless, aligners must be regularly cleaned to remove any accumulated biofilm [15] according to the works of Abbate *et al.* conducted in 2015.

A meta-analysis conducted by Lu *et al.*, [16] in 2018 showed that aligners, by covering dental crowns, can prevent the migration of supragingival plaque to the subgingival area, thereby reducing the risk of periodontal lesions. This meta-analysis suggests that patients treated with aligners have less dental plaque and less gingival bleeding than those treated with fixed orthodontic appliances during the first six months of treatment, a critical period when the risk of gingivitis is high.

These results are encouraging but should be interpreted with caution due to the limited number of studies included in the meta-analysis. Other systematic reviews, such as that of Rossini *et al.*, [17], also concluded that aligner treatments were associated with better periodontal health, with significantly lower plaque indices, gingival indices, and pocket depths than those of fixed orthodontic treatments. Similarly, the meta-analysis by Jiang *et al.*, [18] published in 2018 confirmed that aligners were preferable to fixed orthodontic appliances in terms of periodontal health. However, higher quality randomized clinical trials are needed to

confirm these conclusions, and longer-term studies should be undertaken to examine the long-term effects of aligners on periodontal health.

The Impact of Retention Devices

It is imperative that every orthodontic treatment is followed by a retention phase. This phase aims to stabilize the achieved results and maintain the alignment of the anterior teeth [19].

The retention system can take various forms, whether fixed or removable¹⁹. It would be relevant to explore if these devices can influence the health of periodontal tissues by promoting plaque accumulation, in particular.

Al-Moghrabi and his team [20] undertook a systematic analysis in 2016 to evaluate the effect of fixed and removable retention devices on periodontal health. Two studies did not observe a significant difference in terms of periodontal health in patients wearing a bonded stainless steel mandibular retainer from canine to canine, whether after one year or three years of follow-up.

Similarly, after three years, no distinction was found between this type of retention and a removable Hawley retainer. Only one significant study reported an increase in periodontal pocket depth and bleeding on probing at six and twelve months in patients wearing a stainless steel wire or fiber retention.

On the other hand, the plaque index and gingival index decreased after three years in patients using a removable Hawley retainer as a retention device (except for one study where these indices increased). Rigorous oral hygiene can prevent the establishment of periodontal lesions in the case of bonded retention according to Di Venere *et al.*, [21].

CONCLUSION

In conclusion, we have examined during this work the influence of orthodontic treatment on the periodontium, highlighting the crucial importance of understanding these interactions to provide effective and lasting orthodontic care. We have found that while orthodontic treatment can offer undeniable aesthetic and functional benefits, it can also exert constraints on the periodontium, potentially leading to anatomical changes and tissue responses.

As oral health professionals, it is imperative to consider the impact of orthodontic treatment and its potential effects on the periodontium when planning and executing orthodontic treatments. Appropriate preventive and therapeutic approaches, such as regular monitoring, reinforced oral hygiene, and the use of adequate retention devices, can help minimize complications and preserve the long-term health of the periodontium.

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