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Mini Review

Impact of Orthodontic Treatment on Oral Microbiota and Its Association with Periodontal and Systemic Health

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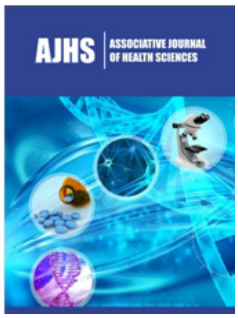

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Abstract

The oral cavity hosts a resident microbiota that maintains a symbiotic relationship with the host, promoting physiological and immunological homeostasis. However, alterations in the oral environment can induce dysbiosis, facilitating the development of periodontal diseases and their association with systemic conditions such as cardiovascular disease, stroke, and Alzheimer's disease. This article reviews current evidence regarding microbiological changes induced by orthodontic treatments, comparing fixed appliances with clear aligners. While some studies suggest that aligners provide periodontal advantages, others report dysbiosis associated with both treatments, indicating that oral hygiene may be the main protective factor. Given the growing relevance of the oral microbiota in personalized medicine, it is essential to investigate microbial changes linked to each type of orthodontic treatment.

Keywords: Oral microbiota; Orthodontics; Dysbiosis; Periodontal health; Clear aligners; Systemic diseases

Introduction

Oral microbiota plays a crucial role in the individual's oral and systemic health. Under physiological conditions, there is a balance between the host and the microbial communities inhabiting the oral cavity. However, external factors can disrupt this balance, creating an environment conducive to the proliferation of opportunistic pathogens. The resulting dysbiosis has been linked to periodontal and systemic diseases, such as cardiovascular conditions, strokes, and neurodegenerative disorders [1,2].

Microbial composition of the gingival sulcus and its clinical relevance

Under healthy conditions, the gingival sulcus predominantly hosts gram-positive cocci, particularly from the genus Streptococcus. The decreased redox potential in this area favors the growth of facultative anaerobes such as Actinomycesand Aggregatibacter actinomycetemcomitans. These bacteria can induce gingival inflammation, creating an environment conducive to the proliferation of strict anaerobes such as Porphyromonas gingivalis, Prevotella intermedia, Tannerella forsythia, and spirochetes. Some of these species, especially P. gingivalis and Fusobacterium nucleatum, have been associated with chronic systemic diseases via complex immunological and metabolic mechanisms [3].

Impact of fixed orthodontic treatment on oral microbiota

Fixed orthodontic treatment complicates oral hygiene, promoting plaque accumulation and altering the subgingival microbiota. Classic studies, such as those by Zachrisson et al. [4], reported signs of gingivitis in young patients with orthodontic appliances, even when oral hygiene was maintained [4,5]. Similarly, Ericson [6] observed that certain orthodontic forces could transform gingivitis into destructive periodontitis by displacing plaque into subgingival areas [6]. However, other studies, such as that by Kloehn and Pfeifer [7], showed that these changes were reversible after appliance removal [7].

Recent microbiological studies have documented an increase in periodontopathogenic bacteria during fixed orthodontic treatment. Tezal et al. indicated a correlation between supragingival and subgingival plaque. Conversely, Speer et al. observed a decrease in pathogens, which they attributed to the toxicity of corroded metals [8].

Clear aligners: Microbiological implications

The use of clear aligners has increased due to aesthetic reasons. Although the polyurethane material used in their fabrication may present micro abrasions that facilitate biofilm accumulation, most clinical studies suggest better periodontal health outcomes compared to fixed orthodontic appliances [9,10]. However, a study by Wang et al. [11] reported microbial dysbiosis in patients treated with both aligners and fixed appliances, suggesting that the clinical advantages of aligners may be attributed to improved oral hygiene rather than a more favorable microbial composition [11].

Conclusion

Orthodontic treatment, whether fixed or with aligners, can induce changes in the oral microbiota, potentially impacting the patient's periodontal and overall health. Although aligners demonstrate clinical benefits, the evidence regarding their microbiological effects remains inconclusive. It is essential to undertake more comprehensive investigations, particularly in the era of metagenomics and personalized medicine, to identify the microorganisms involved and to develop preventive and therapeutic strategies tailored to individual microbial profiles.

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