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Review Article

Impact of clear aligners on plaque and periodontal health

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ABSTRACT

In recent years, clear aligners have become a well-liked substitute for traditional braces in orthodontic treatment. Examining the effects of clear aligners on periodontal health and plaque accumulation is the goal of this review. To examine pertinent studies that have been published up to this point, a comprehensive evaluation of the literature was carried out. The review includes research on the microbial alterations in tooth plaque composition that occur during clear aligner therapy and the subsequent impact on periodontal tissues. Clear aligners and traditional braces are also compared with respect to how they affect gingival health, periodontal disease prevalence, and oral hygiene practices.

In terms of plaque control, the results imply that transparent aligners offer special benefits and challenges. An important factor influencing the microbiological environment in the oral cavity is patient compliance, the type of aligner used, and the subtleties of its design. Moreover, the effect of orthodontic therapies on periodontal health is explored, providing insight into possible associations between the use of clear aligners and periodontal results. By underlining the necessity of individualized oral hygiene management strategies during clear aligner therapy, this review offers orthodontic practitioners' insightful information.

It highlights the need of maintaining periodontal health throughout orthodontic treatment and stresses the necessity of a multidisciplinary approach to optimize patient outcomes. In summary, this comprehensive review provides an overview of the most recent findings regarding the impact of clear aligners on plaque and periodontal health. By teaching clinicians, researchers, and patients about the subtleties of oral hygiene care during orthodontic treatment, the findings are meant to direct the development of effective strategies for maintaining good periodontal health in patients getting clear aligner therapy.

1. Introduction

The goal of orthodontic therapy is to rectify malocclusion, which is gaining popularity since it can enhance masticatory function, dental aesthetics, psychological and social wellness, and overall and oral health.[1] In addition to its advantages, orthodontic treatment carries some dangers and consequences, just like any other kind of medical care. On the other hand, in comparison to alternative surgical or nonsurgical procedures, the reported risk and complications related to the treatment are significantly reduced.[2]

There has been a significant increase in the use of clear aligners (CA) for the treatment of malocclusions in adults and children.[3,4] The concept of clear aligner treatment (CAT) comprises an aesthetic orthodontic treatment that may allow for better oral hygiene, periodontal health and safety of the roots.[5–7] Patients seem to show a greater degree of acceptance and collaboration towards CAT

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and a very high satisfaction level with the final result.[8] Orthodontic appliances make it more difficult for patients to maintain proper dental hygiene, which promotes the growth of bacterial plaque and can cause short-term, harmful periodontal processes.[9] It's critical to maintain proper oral hygiene in order to stop this bacterial build-up.

2. Clear Aligners' Effect on Periodontal Disease

Periodontal health must be the foundation of orthodontic treatment. The alveolar bone and the periodontal ligament (PDL) are remodelled when teeth are subjected to controlled orthodontic force.[10] During orthodontic therapy, patients with periodontitis have a greater requirement to maintain the health of their periodontal tissues and prevent further damage or return of the disease. For patients who are at a high risk of developing gingivitis, clear aligners may be advised as they have been shown to be superior than fixed appliances in terms of periodontal health.[11] During therapy, clear aligners generate controlled, intermittent stresses that allow for a precise window of time for periodontal membrane regeneration.[12]

A more uniform distribution of stress is offered with clear aligners. Researchers found that when aligners were employed, the strains on the teeth and alveolar bone were more evenly distributed and there were less areas of stress concentration.[13]This was determined using 3-dimensional finite element analysis. Thirteen Following periodontal therapy, Lee et al. treated a patient with chronic periodontal disease and maxillary anterior pathologic tooth migration using clear aligners. During therapy, they found that the mobility, clinical attachment level, gingival recession, and probing depth were all decreased.[14] Han et al. evaluated the use of clear aligners against fixed equipment in orthodontic therapy for patients with periodontitis. Patients with clear aligners had relatively good orthodontic treatment outcomes, and the periodontitis did not worsen.[15]In conclusion, clear aligners are preferred by both practitioners and patients for their convenience, comfort, and benefit to periodontal health maintenance[16] According to current studies, clear aligners can provide good treatment outcomes for patients with periodontitis. However, further studies are needed to make a conclusive research.

3. Effects of Clear Aligners on the Supra- and Ssubgingival Microbiota

Dental plaque, also known as biofilm, is an intricate formation that forms on the surface of teeth and is made up of a wide range of related oral species. These structures can develop pathogenic characteristics like a cariogenic or periodontal pathogenic profile, depending on a number of local and/or systemic modulator factors.[17] It was demonstrated by Shokeen et al. that the microbiota contained in the plaque that was removed from transparent aligner trays was distinct and less varied.[18] Yan et al. also observed that aligner plaque samples had higher Streptococcus abundance and lower microbial abundance.[19,20]

Gujar et al after one month of treatment, the microbiomes on the clear aligner, lingual fixed appliances, and traditional metallic fixed labial appliances were compared. Aligners showed a decrease in the amount of red and orange complexes and microbial colonization. It has been demonstrated that clear aligners do not significantly alter supragingival plaque. On crowns, they create a totally contained atmosphere. Therefore, in order to avoid any negative effects on the crown, it is also necessary to clean the inside surface of the aligner on a regular basis. Twenty Favorable antibacterial activity against P. gingivalis has been demonstrated by the aligners coated with gold nanoparticles.[21]

Sfondrini et al. used real-time PCR in their investigation and proposed that the use of clear aligners does not result in any appreciable changes to the bacterial count and bacterial percentage of A. actinomycetemcomitans or red and orange complexes. This eliminates the possibility of developing periodontitis, at least in the first two months of therapy.[22]

4. Clear Aligners' Effect on the Salivary Microbiota

Saliva causes plaque to accumulate on the inside surface of aligners by leaking into the crevices between the teeth and the aligner. The development of subgingival plaque is aided by salivary bacteria that enter the subgingival pocket.[23] Because of this, a stable salivary flora structure is necessary to maintain a healthy oral cavity during clear aligner treatment. Mummolo et al. compared patients wearing fixed versus detachable orthodontic equipment in terms of salivary concentrations of Streptococcus mutans (S. mutans), certain Lactobacilli, and plaque index (PI). They found that removable appliances had less of an effect on the oral microbiota than fixed ones.[24]

In their evaluation of the effects of Invisalign appliances on patients' dental health and the oral bacterial population, Zhao et al. found no discernible changes in the overall richness and structure of the salivary microbial community.[25] Accordingly, the research indicates that the salivary flora may maintain a comparatively stable structure in the early stages of clear aligner therapy. However, it is yet unclear if the microbiome will be steady for the course of the treatment.

5. Plaque in Outdated or Worn-Out Clear Aligners

All the time, with the exception of eating, cleaning, and flossing, clear aligners are worn. The color of the aligner will vary as a result of eating or drinking anything that contains colouring agents, which will modify how it looks.[26] Because they have ridges, grooves, microcracks,

and abrasions that promote bacterial adherence and the development of plaque biofilm, clear aligners are not totally smooth. When Low et al. visualized the surface configuration of the Invisalign device, they discovered that even the surface of a brand-new aligner tends to be corrugated and shows peaks, micro abrasions, and scratch marks.[27]

These deviations function as a kind of niche where bacteria can cling and proliferate. After two weeks, the aligners exhibited microcracks, abraded and delaminated patches, localized calcified biofilm deposits, and a loss of transparency, according to Gracco et al.[28] The results obtained by Schuster et al agree with these conclusions. It is clear from the studies that worn-out or outdated aligners make plaque build-up more likely.[29]

6. Dental Health Care

In a three-month follow-up, Madariaga et al.[30]conducted a prospective clinical trial to assess the periodontal health of orthodontic patients (clear aligners and multiple braces) receiving supportive periodontal therapy. He had taught each patient a specific method for brushing their teeth, and he called them every two weeks to remind them to practice good oral hygiene. The study's findings indicate that periodontal health is unaffected by the type of orthodontic treatment a patient receives as long as they receive motivation and sufficient training in oral hygiene. This is in line with what Caccianiga et al found.[31]

7. Conclusion

Individuals with Clear Aligners show superior indications of periodontal health than individuals with Fixed appliances. In addition to the appliance type itself, other factors that are often taken into consideration during a periodontal evaluation include motivation, supportive treatment, and guidance on dental care. The type of oral hygiene technique used must be considered in light of the patient's features. For example, dental floss may be recommended for people with closed interdental spaces, and inter-proximal brushes may be recommended for patients with periodontal disease or open embrasures. Periodic follow-up and patient motivation are also crucial.

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9. Conflict of Interest

None.

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