

# Oral Hygiene in the Presence of Orthodontic Therapy

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## Abstract

Orthodontic treatment offers great advantages in improving facial and smile aesthetics, self-confidence and the function of the stomatognathic apparatus. The pursuit of these advantages makes use of orthodontic appliances that could be fixed or removable. However, it's worth stating that these appliances interfere with tooth brushing, making it more difficult to brush teeth effectively. Orthodontics appliances therefore promote the accumulation of dental plaque, which results in both quantitative and qualitative changes in the oral microbiota, hence, exposing patients to several adverse effects such as White spot lesions, dental caries, periodontal pathologies and halitosis. For this reason, oral assessment of patients before, during and after treatment is necessary as well as oral hygiene instructions and motivation. Orthodontists therefore, should educate patients on oral and periodontal hygiene in order to control dental and periodontal complications. Prescriptions of plaque control materials adapted to each patient are done in order to optimize the final result and minimize unwanted complications.

## Keywords

Orthodontic Treatment, Oral Microbiome, Oral Hygiene, Periodontitis, Gingivitis, Orthodontic Fixed Appliances, Orthodontic Removable Appliances, White Spot Lesions (WSL)

## 1. Introduction

This review highlights the importance of oral hygiene in orthodontic patients. It also reveals various plaque control items needed in the course of orthodontic treatment in order to prevent cavities and periodontal diseases. Orthodontic treatment offers great advantages in improving facial and smile aesthetics, self-confidence and the function of the stomatognathic apparatus.

The pursuit of these advantages makes use of orthodontic appliances that could be fixed or removable. However, these appliances interfere with tooth brushing, making it more difficult to brush teeth effectively [1].

Orthodontics appliances therefore promote the accumulation of dental plaque, which results in both quantitative and qualitative changes in the oral microbiota [2] [3], hence exposing patients to several adverse effects such as white spot lesions, dental caries, periodontal pathologies and halitosis. For this reason, oral assessment of patients before, during and after treatment is necessary as well as oral hygiene instructions and motivation [4]. Orthodontists therefore, should educate patients on oral and periodontal hygiene in order to control dental and periodontal complications.

## 2. Oral Microbiota Changes during Orthodontic Treatment

The interest in studying the biological and microbiological changes that accompany orthodontic treatment is of great concern in recent times.

Orthodontic fixed and removable appliances promote the retention of food particles and serve as retention sites for dental biofilm [5].

A correlation exists between orthodontic appliances and the quantitative and qualitative alterations of the oral microbiota in the presence of oral negligence [6]. Orthodontic appliances promote supra and subgingival plaque accumulation hence being predisposing factors for the onset of enamel decalcification, dental caries and periodontal diseases [7] [8] [9]. The majority of orthodontic patients are seen with hypertrophic and severe inflamed gum surrounded with dental plaque.

A study conducted by Pan *et al.* [10], comparing the composition and quantity of the oral microbiota in orthodontic patients and in subjects not undergoing orthodontic treatment, established that, the microbial counts showed a significant increase in periodontopathic bacteria and cariogenic bacteria in orthodontic patients. This result was also confirmed by recent studies [11] [12] [13]. The periodontopathic bacteria revealed include: *P. gingivalis*, *P. intermedia*, *Prevotella nigrescens*, *T. forsythia*, and *Fusobacterium spp* [1] [14]. A systematic review and meta-analysis by Spyridon N Papageorgiou *et al.* [15] showed that, the presence of *Aggregatibacter actinomycetemcomitans* in the subgingival cervical fluid of orthodontic patients increased 3 - 6 months after inserting fixed appliance compared to untreated patients, with still an increased subgingival prevalence of *Aggregatibacter actinomycetemcomitans* and *T. forsythia* in orthodontic patients, up to 6 months after the removal of the orthodontic appliance compared to untreated patients. However, in addition to the increase in periodontopathic bacteria, cariogenic bacteria such as *S. mutans*, *Lactobacilli*, are reported to show a significant increase in quantity in patients undergoing orthodontic treatment with poor oral hygiene [16].

An uncertain prevalence of *Candida spp.* and the scarcity of studies on viruses and *protozoas* in the oral microbiota of orthodontic patients need to be investi-

gated to a greater extent. However, a study by Topaloglu-Ak *et al.* [17] on 35 children with fixed appliances and 34 children with removable appliances, reported a significant increase in *Candida albicans* and cariogenic bacteria, 6 months after insertion of appliances with a higher prevalence in the subjects with fixed appliances.

The evidence in these studies suggests that, the roughness and constituents of the orthodontic materials influence the retention of biofilm together with bacterial colonization.

It is therefore important to emphasize adequate oral hygiene to all orthodontic patients. They must be frequently reminded and motivated to achieve good oral hygiene. **Figure 1** shows severe generalized gingivitis in an orthodontic patient with poor oral hygiene.

### 3. Prescription and Oral Hygiene Motivation for Orthodontic Patients

It has been established in the previous parts of this research the necessity of plaque control in patients undergoing orthodontic treatment since the latter plays a major role in the retention of dental biofilm [18]. It was also highlighted that dental plaque are difficult to be eliminated in the presence of orthodontic appliances. Oral hygiene and motivation are therefore essential for quality and timing of orthodontic therapy [19]. Studies have revealed that poor oral hygiene might prolong therapy duration and could as well compromise the outcome of the treatment [20] [21] [22].

#### 3.1. Oral Motivation

Optimal oral hygiene requires rigorous and detailed professional instructions, adequate prescription of tools, and regular motivation of patients which is essential to obtain compliance [23] [24]. There are certain adverse outcomes such



**Figure 1.** Periodontal disease in an orthodontic patient with poor oral hygiene [61].

as periodontal diseases that could be encountered by poor hygienic patients undergoing orthodontic treatments leading to irreversible loss of periodontal tissues [25]. At the end, these undesired potential side effects could lead to patients being unsatisfied with the results even to the extent of prematurely terminating the whole orthodontic treatment. Orthodontic treatment in itself has no direct effect in causing periodontal diseases.

However, the appliances used could be a risk factor in the retention of plaque and also increase the difficulty of teeth brushing.

For the reason, it is very crucial to constantly remind patients of the importance of oral hygiene in the protection of periodontal tissues for obtaining optimal and satisfactory results.

Many orthodontic patients demonstrate decline in oral hygiene compliance due to difficulty in brushing [26] however, constant follow-up procedure through text messages or calls or face-to-face meetings provide encouragement and reassurance and have seen to improve post-procedural pain and anxiety as well as improving oral hygiene compliance in orthodontic patients [27] [28] [29] [30]. Motivation and reassurance guaranteed by post-procedural communication are essential factors of improving oral hygiene compliance of patients [20]. Improving oral hygiene therefore reduces plaque retention hence sustaining periodontal health [31].

### 3.2. Plaque Control and Prescription

- Toothbrush

Brushing remains very essential for the removal of dental plaque during orthodontic treatment. Brushing after meals is important for removing retained food particles. There are two main types of toothbrush; electric toothbrush and manual toothbrush.

- Electric toothbrush

Shukla *et al.*, in the study in 2017 highlighted on the superiority of electric brush to manual brush during orthodontic treatment with fixed appliances [32]. Many articles [33]-[38] also highlighted on this superiority including a study by *Admakin Oleg et al.* in 2018 [33], in which the use of ultrasonic brush reduced 60% of gingival bleeding and gingival inflammation by up to 28%. It is hence stated by these articles that the use of electric brush is more efficient in controlling plaque and reducing periodontal inflammation compared to the use manual toothbrush.

In addition, A randomized controlled trial by *M. Shilpa et al.*, in 2019 [39] concluded that electric tooth brush group subjects exhibited significantly lesser score in plaque index, PI, Gingival index, GI, and Modified papillary bleeding index (MPBI) than the manual tooth brush group at the end of 2 months, although the manual tooth brush combined with chlorhexidine mouth wash group subjects showed maximum improvement, having significantly lesser PI and GI scores than the powered toothbrush group.

- Manual toothbrush

The use of manual toothbrushes contributes effectively to plaque control even though many articles have revealed that they are less effective as compared to powered toothbrushes. According to the “Société Française d’orthopédie dento-faciale” [40], the best toothbrush should be short and narrow-head on a semi-curved handle suitable for usage, and should have synthetic bristles that could be of soft or medium hardness. There exist practically two types of toothbrush recommended by orthodontist; Orthodontic toothbrush (O-TB) and Conventional toothbrush (C-TB). Orthodontic toothbrush has a different design from the conventional toothbrush in that it presents a V-shaped groove along the long axis of the toothbrush head. O-TB infers to promote better oral hygiene by increasing the contact surface between the orthodontic appliance and the toothbrush bristles [41]. Many controversies exist about the superiority of the efficiency of orthodontic toothbrush (O-TB) over conventional toothbrushes (C-TB). There is a deficit of systematic reviews assessing clinical efficacy comparing O-TB to C-TB as a strategy to improve oral hygiene in orthodontic patients. However, O-TB is widely recommended by orthodontists over conventional toothbrush in the presence of orthodontic appliances due to its design [42] [43].

A systematic review and meta-analysis by *Felipe Franco Marçal et al.* 2021 reported that the O-TB is more effective in removing plaque compared to the C-TB yet did not reflect better gingival parameters.

According to this meta-analysis, gingival bleeding is not modified by orthodontic toothbrush (O-TB), however, there is circumstantial scientific evidence for recommending the use of an O-TB instead of a C-TB based on the analysis of plaque index control [41].

A manual toothbrush during orthodontic treatment is suggested to be changed every 3 months due to the fact that it wears off faster in the presence of orthodontic appliances [40], and in order to maintain good oral and periodontal health, orthodontic patients are advised to practise brushing their teeth at least twice a day [44].

- Dentifrices: Fluoride toothpaste

Toothpaste is used together with the toothbrush. During orthodontic treatment, one of the major sequelae observed is enamel decalcification which appears as a chalky-white spot known as a white spot lesions (WSLs) [45]. The sight of WSLs and its complications after removing orthodontic appliances can be unsightly and discouraging [46]. For this reason, it is important to prevent demineralisation and/ or its complications via methods of remineralisation of demineralised spots. The use of fluoride-based toothpaste is revealed to prevent white spot lesions during the treatment of fixed orthodontic appliances [47] [48]. The fluoride ion prevents WSLs and dental caries, by altering bacterial metabolism in dental biofilm through the inhibition of some enzymatic reactions.

This inhibits acid production which in turn decreases demineralization and promotes remineralization of carious lesions at early stages through a reminer-

alization effect, especially at low concentrations [49].

A narrative review by Lazar L *et al.* in 2023 [50] revealed that the use of fluoride toothpaste with more than 1000 ppm fluoride at home, reduces the frequency of white spot lesions. Singh S *et al.* [51] also stated that the use of 1000ppm of fluoride toothpaste twice daily had a beneficial effect on the regression of WSLs. Alexander SA *et al.* [52] reported that using 5000 ppm fluoride toothpaste twice daily by orthodontic patients was more effective in the regression of enamel demineralisation than 1000 ppm fluoride toothpaste. However, higher concentrations usually above 1500 ppm are rarely available over the counter and sometimes with age restrictions depending on the country. It is established then that the use of fluoride toothpaste should contain fluoride concentration of over 1000 ppm for significant results [53].

There exist other non-fluoride agents of toothpaste that are also classified as remineralisation agents. These components include calcium phosphate compounds such as tri-calcium phosphate (TCP), di-calcium phosphate dihydrate (DCPD), amorphous calcium phosphate (ACP) and its composites [54] [55].

- Adjuvants
  - Monotouffe toothbrush

Studies have revealed that monotouffe toothbrush remains effective in controlling oral plaque. However, these studies recommended its use in combination with manual toothbrush. It is highlighted that they should be used as an adjuvant strategy in order to tackle cervical areas and lingual surfaces [56] [57] [58].

- Dental floss

Dental floss, when properly used, promotes the removal of interproximal dental plaque. However, its usage could be complicated or rather impossible during certain orthodontic treatments. For this reason, as an available method of improving interdental hygiene, water flossers are used for the cleaning of interproximal dental plaque together with mouthwash. A study by Sawan N *et al* reported that the use of super floss or water flosser as an interproximal adjuvant for removing dental plaque in patients undergoing orthodontic treatment is equally effective, and that both interproximal tools proved to be safe and efficient for use by orthodontic patients [59].

- Interdental brush

An interdental brush is also recommended to be used as an adjuvant brush in order to aid in removing interdental plaque in places difficult to attain by the normal toothbrush. The European Federation of Periodontology in 2015 stated that cleaning with interdental brushes is the most effective method for interproximal plaque removal, consistently associated with more plaque removal [60]. Two systematic reviews also revealed that the adjunctive use of interdental brushes results in massive improvements in clinical parameters such as plaque scores, bleeding scores, and probing depth, when compared to brushing alone [61] [62]. Orthodontic patients also use them to clean around and between the

brackets and wires on their teeth. A study by *Niko C Bock* [63] showed that the use of an interdental brush reduced the Plaque index irrespective of the design of the brush head. There are several factors worth considering when choosing an interdental brush. Firstly, the appropriate size of the interdental brush which should correspond to and fit snugly in the proximal space for significant plaque removal [64].

Interdental brushes with metal wire in the middle can be uncomfortable for patients with sensitive root surfaces [65]. Rubber bristles interdental cleaners are a recent development and could stand as an alternative to conventional interdental brushes when the need arises. A systematic review by *Weijden F. V. et al.* [66] confirmed its efficacy and safety in the removal of biofilm in the interproximal space.

Waist-shaped and straight shaped interdental brushes but also conical form is revealed to be more effective than angled interdental brushes with long handles, however, angled interdental brushes are more effective for posterior teeth [61] [65]. A self-controlled clinical trial by *Chen Q. et al.* [67] together with other studies concluded that waist-shaped interdental brush is more effective in plaque removal than straight-shaped interdental brush.

- Dental water flosser

There exist few studies on the efficiency of dental water flossers in plaque control. The dental water flosser works by directing a stream of water toward the interproximal space. The stream of water helps to loosen and remove dental plaque and food particles stuck in the area. However, many controversies revolve around its usage and efficiency. A study by *Mazzoleni S et al.* 2019 revealed that the dental water jet does not improve significantly the efficacy of home oral hygiene in orthodontic patients wearing a multi-bracket fixed appliance [68]. However, another study by *Naresh C. Sharma et al.* concluded that a dental water jet with a specialized orthodontic jet tip is effective for adolescents in fixed orthodontic appliances having demonstrated beneficial results for the reduction of plaque and bleeding [69].

A dental water flosser is helpful especially for patients having difficulties in using dental floss.

- Antiseptic Mouthwash

When flossing is impossible, or during the persistence of bleeding, mouthwash may be recommended occasionally. According to the French society of dento-facial orthopedics (SFODF) [40], mouthwash should only be prescribed in case of pain or bleeding. Although its liquid consistency allows access to places that are difficult to reach with a toothbrush, its constant usage may cause a perturbation of oral flora which could be negative to oral health. Research supports the effectiveness of antiseptic mouth rinses in decreasing dental plaque and gingivitis as an adjunct to home care. However, inadequate evidence is available to support the claim that oral antiseptics can reduce the risk of developing periodontitis or the rate of progression of periodontitis. Mouthwash should therefore



be prescribed when necessary and depending on the condition. There exist mouthwashes with chlorhexidine that help to fight against bleeding and gingival inflammation, mouthwashes with fluoride promote enamel remineralization, and thus fight against carious lesions [69]. Their efficacy in promoting the elimination of dental plaque, their antiseptic and anti-inflammatory role have been demonstrated in a systemic review by Admakin Oleg *et al.*, 2018 [33]. However, it is recommended to limit their use over time because a mouthwash that can be used continuously throughout the duration of orthodontic treatment does not exist.

#### 4. Conclusions

Orthodontic treatment is very beneficial in re-establishing dental esthetics and function. However, it may have an impact on oral hygiene due to the fact that orthodontic appliances render brushing difficult and they also tend to retain food particles and plaque.

This could therefore be a risk factor in developing WSL, dental caries and periodontal diseases such as gingivitis. Thus, in order to maintain good oral and periodontal health, orthodontic patients are required to practice optimal oral hygiene measures such as brushing their teeth at least twice a day. Other additional tools stated in this article may be needed in order to attain optimal oral hygiene. Practitioners should therefore constantly sensitize and motivate patients via text or calls or face-to-face meetings in order to promote oral hygiene compliance for an optimal result [59].

#### Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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