Periodontal and hard tissue maintenance in fixed orthodontic treatment: A review

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Abstract

The orthodontic appliances increase the degree of difficulty in maintaining a proper oral hygiene, resulting in higher plaque accumulation around the brackets, arches and the gingival margin, predisposing the development of a chronic gingivitis and enamel demineralization, known as white spot. Several studies have analysed the correlation between the degree of oral hygiene and orthodontic appliances and is still a topic of great interest for many authors. In the literature, there were no significant differences regarding the degree of adhesion of the bacteria in the use of orthodontic brackets of different materials (steel and ceramic brackets). The purpose of this article is to conduct a literature review to assess the problems encountered in periodontal tissue and tooth structure associated with and/or caused by fixed orthodontic treatment.

Introduction

The delicate balance of bacteria in the oral cavity is related to the presence of niches where bacteria can grow without response from the host's immune system. In sites where the equilibrium state is altered occurs uncontrolled colonization of bacteria that promotes the development of pathological conditions (1, 2).

The fixed orthodontic treatment may be the cause of the deterioration of the oral ecosystem due to the application of orthodontic forces, to the presence of arches, brackets and orthodontic bands that increase the accumulation of plaque and to the stress of the periodontal ligament, which can lead to loss of clinical attachment.

The presence and the increase of the plaque, during the orthodontic treatment, is an important side effect that should not be overlooked, because it can compromise the outcome of the treatment.

Factors that favor the accumulation of plaque during multi-brackets orthodontic treatment are:

1. The poor ability of the patient to maintain adequate oral hygiene
2. The ease of creating niches for bacteria retention around the brackets
3. Change in the microbial flora

By analysing the three factors independently it can be said that the presence of fixed orthodontic appliances undoubtedly contributes to a worsening of the plaque, complicating the daily hygiene operations which aim its removal.

Often the orthodontist finds a chronic hyperplastic gingivitis after a short period of time from the placement of an orthodontic appliance. The etiology of chronic hyperplastic gingivitis is not yet fully understood, although it is certain that the plaque is the most important causal factor. In some individuals were also identified co-factors: genetic and/or environmental conditions; these include polymorphism of the gene for interleukin-1 (IL-1), cigarette smoking, diabetes, and leukopenia. In these situations, the hyperplastic gingivitis leads to periodontitis and the loss of clinical attachment over time.

The business of professional mechanical cleaning, so the hygienist is a valuable aid to the patient, has the function of balancing the oral bacterial ecosystem and to motivate/encourage patients to improve their oral health management at home.

As regards the ease of creating niches for bacteria retention around the brackets, a number of studies (3, 4) have analyzed the association between the fixed orthodontic appliance and the unwanted accumulation of plaque bacteria around the brackets, which can be further complicated by the formation of tartar around the components.

Last but not least is the change in the composition of the bacterial flora (5). The variation of the quantity and the metabolic activity of the pathogenic microflora of the oral gingival hyperplasia can lead to a pathological condition generalized, to a bleeding on probing (BOP) and a periodontal inflammation with consequent worsening gingival index (GI) and the probing pocket depth (PPD).

Often periodontal problems associated with fixed orthodontic treatment are transient, as opposed to the "white spots" that can sometimes be in an advanced stage to be recovered (6).
The bacterial flora changes dramatically following the placement of a multi-brackets appliance; several studies have shown, in fact, the presence of a greater number of anaerobic bacteria such as T. forsythia, C. rectus and P. Nigrescens, (4) (7) which are the cause of gingival and periodontal problems.

Here are clear changes in the sub-gingival flora where the predominant species are: Tennerella Forsythia, P. Gengivalis and Treponema Denticola.

The orthodontic appliances are responsible for the transition from gingivitis to periodontitis (8); plaque can build up inside the brackets and / or between the band and the gingival margin (9), the process can be exacerbated when the bands are positioned under the gum.

Although this is a risk that involves all patients treated with fixed orthodontic appliance, attachment loss is more significant in patients with a before treatment attachment loss, and these subjects are more sensitive to the worsening of the disease process. It is strongly evident even in patients with hormonal changes due to puberty, pregnancy, menopause, using oral contraceptives, and those with poor manual dexterity to clean teeth. Particular attention should be given to patients who smoke because smoking not only promotes the development of gingivitis and periodontitis, but results in a slowing of cellular turnover(10). It is very important that smoking patients give up the habit before starting treatment.

The incidence of caries and demineralization, as reported in literature (11), increases during orthodontic treatment. In the process of demineralization, the tooth (enamel and dentin) has lost calcium and phosphate, which can be precipitated together somewhere else in the tooth or be lost in the mouth by saliva and plaque. The demineralization is defined as a complication of considerable interest in orthodontic treatment, in addition to determining irreversible changes to allow for the continuation alter the orthodontic treatment from aesthetic point of view.

During orthodontic treatment is needed to stop the progression of white spot, whose incidence ranges from 2% to 97% (12) (13).

Preventive procedures that avoid undesired accumulations of plaque reduce the damage to the soft and hard dental tissues are:

- Professional Cleaning
- Use of topical fluoride (gel-paint)
- Plaque detectors
- Motivation of the patient
- Rinsing with chlorhexidine
- Laser therapy

The association of various preventive procedures have better results compared to a procedure applied alone.

Review

In a literature review of 218 studies, Grey and McIntyre (14) found that in a short period of time, when it was adopted a protocol for the prevention of oral health in patients with fixed orthodontic appliance, will have significant reductions in levels of plaque. Denes and Gabries (11) comparing the indices of plaque of the two groups of patients have observed that the group treated with amine fluoride showed better oral hygiene compared to the second group that had been subjected only to oral hygiene. They concluded their study by stating that the use of fluoride gel has a beneficial effect in reducing plaque.

Boyd et al. (15) (16) (17) studied the accumulation of plaque and decalcification of dental hard tissue during orthodontic treatment. They claim that the use of an electric toothbrush, of a manual toothbrush, and the application of the gel to 0.4 stannous fluoride are associated with low values of the plaque index and the gingival index, but also to a less hard tissue decalcification.

Boyd (18) observing orthodontic patients for ten months has highlighted the need to strengthen education on hygiene procedures every 4-7 weeks to keep plaque under control.

Holder-Olsen et al. (19) compared a group of patients with a comprehensive preventive approach with a control group that received no treatment specific quote. From this study, there were no differences on the rise in the number of caries between the two groups, but a statistically significant difference has been described for the increase of white spots.

Holderin Olsen et al. (19) (20) established a protocol of oral hygiene consisting of: brushing teeth 3 times a day after main three meals, the use of dental floss although complicated by the presence of the device multi-brackets and the use of fluoride rinse . In addition, patients were instructed to avoid especially if sugary sweets, fizzy drinks and acidic fruit juices.

Buck et al. (20) and Dalessandri et al. (21) showed a reduction in plaque using a bonding indirect than a direct one.

Giannini et al. (22) in the surgical-orthodontic have suggested a plaque control program that is represented by hygiene, fluoridation local, and in the chlorhexidine mouthwash.
Indices of plaque

Plaque index was introduced by Silness and Loe, and it is widely used in dentistry for its simplicity. It is constituted by four codes as follows:

1. Code 0: no plaque
2. Code 1: This plaque in the gingival third of the tooth
3. Code 2: visible plaque
4. Code 3: accumulation of plaque visible

Williams et al. (23) changed the original classification of Silness and Loe on the evaluation of tooth surfaces affected by plaque. In the new classification of Williams et al. the tooth was divided into 4 regions based on the bracket:

- incisal
- gingival
- mesial
- distal

The quantity of plaque is then reported on the basis of 4 codes the index of Silness and Loe, finally, the values are summed to obtain a total score that can vary from 0 to 16 for each tooth. This index was also used by Clerehugh et al. (24) and shows higher reliability than the index of Silness and Loe. To quantify the degree of gingival inflammation based on the surface of another index of particular importance evaluates revealed the plaque on the buccal and lingual surfaces of the non-restored teeth on scales from 0 to 5, defined by Quigley and Hein in 1962 and modified by Turesky and Gilmore. All teeth except the third molars are assessed.

An index for the entire mouth is determined by dividing the total score by the number of surfaces examined.

Quigley-Hain plaque index:

No plaque
1. Isolated flecks of plaque at the gingival margin
2. A continuous band of plaque up to 1 mm at the gingival margin
3. Plaque greater than 1 mm in width and covering up to one third of the tooth surface
4. Plaque covering from one thirds to two thirds of the tooth surface
5. Plaque covering blackberries than two thirds of the tooth surface

This index is of particular importance to quantify the degree of gingival inflammation according to the tooth surface covered by plaque.

Plaque in brackets and bindings

Ira and Dewi Lindel et al. (25) in their study stated that the stainless steel and ceramic brackets show no significant differences in the type of plaque biofilm. The study by Lindel showed that the amount is significantly higher than of stainless steel brackets on ceramic brackets. Most of plaque feedback on the mesial and distal surfaces for stainless steel bracket surfaces and gum for ceramic brackets.

Forsberg et al. (26) through their work have shown that incisor bound with an elastic ligature are associated with a greater amount of plaque than the incisor bound with a steel ligature.

In a more recent study (6), it has been demonstrated that the two methods of bindings of the arcs show no difference with regard to the accumulation of plaque.

Saud and Al-Anezi (27) has shown that, in the first three months of fixed orthodontic treatment, BOP (the Bleeding On Probing index) involving lateral incisors, which were applied elastic ligatures, underwent a significant increase; but the most surprising is that the bleeding index declined for the incisors which have not been applied elastic ligatures, the patients who were treated with self-ligating brackets.

There were no statistically significant changes in index of probing depth and gingival inflammation.

The same study confirmed that there is no difference in plaque accumulation between self-ligating brackets and elastomeric devices, although there is a significant change in the microbial flora of three months of treatment.

Turkkohramom et al. (28) comparing the steel ligatures and elastomeric devices, found that there is no difference in plaque index (PI) in probing depth (PPD) and gingival index (GI).

The elastomeric ligatures are associated with an increased bleeding on probing that is why the authors have not recommended to use this kind of ties in patients with poor oral hygiene motivation.

In a recent systematic review (29), it is argued that there is no evidence, in terms of retention of plaque and periodontal health for preferring self-ligating brackets to conventional brackets and vice versa.

Conclusions
Each time a patient takes a fixed orthodontic treatment, it is necessary to plan and carry out a protocol for the prevention of oral health, to avoid complications that are difficult to manage and can affect the outcome of orthodontic treatment. An increase in the plaque, as well as producing a chronic hyperplastic gingivitis can cause permanent damage to the hard tissues of the tooth [30]. A single preventive method in many cases is not sufficient to avoid complications.

Every patient should receive counseling by a dental hygienist, supported by written documents and, if possible, by video evidence. The method of video gives significant advantages in terms of dissemination of information and are more effective in positively influencing the behavior of the patient, the disadvantage is the high cost of video production. The verbal advice of a professional associated with a program of detection of plaque has been shown to be greater than the simple consultation with an oral hygienist.

The response of a patient to a protocol of maintaining oral health during orthodontic treatment is, however, variable from subject to subject. All patients who present loss of attachment prior the orthodontic treatment, who are predisposed to the development of attachment loss, or who experience systemic problems (immunocompromised, diabetes, pregnancy, menopause, puberty, smoking) should receive regular preventive oral maneuvers by the hygienist.


18. Boyd R.L. Longitudinal evaluation of a system for...


