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Gingival Marginal Alterations Related to Orthodontic Treatment: a Literature Review

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Faculdade de Ciências da Saúde

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a Literature Review

Literature Review presented to the Universidade Fernando Pessoa as part of the requirements for the obtention of Dental Medicine master's degree

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RESUMO

O objetivo deste estudo é compreender o impacto que o tratamento ortodôntico pode ter na alteração das margens gengivais.

Foi realizada uma pesquisa bibliográfica nas bases de dados *PubMed e Cochrane,* de artigos em inglês publicados entre 2015 e 2021. Após a implementação dos critérios de inclusão e exclusão para a seleção dos manuscritos. No total, 29 artigos foram analisados. Também foi realizada uma pesquisa manual, para a realização deste estudo.

Concluiu-se que a recessão gengival é uma patologia frequentemente observada, em que 88% dos pacientes com 65 anos ou mais e 50% dos pacientes com 18 a 64 anos apresentam pelo menos um ou mais locais com recessão. O Ortodontista desempenha um papel fundamental na prevenção do aparecimento desta patologia, através de uma avaliação de risco antes do início do tratamento. Bem como, pode atuar como o meio de tratamento, redirecionando as raízes para dentro do envelope alveolar.

Palavras-chave: recessão gengival; retração gengival; ortodontia; ortodontia corretiva; tratamento ortodôntico; aparelhos ortodônticos.

ABSTRACT

The aim of this study is to understand the impact that orthodontic treatment might have in gingival margins alterations.

A literature search in the databases *PubMed* and *Cochrane*, was conducted in English articles published between 2015 and 2021. After the implementation of the inclusion and exclusion criteria for the selection of the manuscripts. In total, 29 articles were analyzed. It was also performed manual search for this study.

It was concluded that the gingival recession is a frequently observed pathology, that 88% of patients aged 65 years and above and 50% of patients aged 18 to 64 years present at least one or more sites with recession. The Orthodontist plays a fundamental role, in preventing the appearance of this pathology, through a risk assessment before the beginning of the treatment. As well as, it can act as the means of treatment, redirecting the roots into the alveolar envelope.

Keywords: Gingival recession; gingival retraction; orthodontics; corrective orthodontic; orthodontic treatment; orthodontic appliances.

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ATTACHMENT I:

INDEX ACRONYMS

RG – *Gingival Recession*

CBCT – *Cone Beam Computed Tomography*

TMJ – *Temperomandibular Joint*

I. INTRODUCTION

The oral mucosa is composed of the masticatory mucosa, the specialized mucosa and the lining mucosa. The gingiva, that is part of the masticatory mucosa, covers the entire alveolar process and involves the cervical portion of the teeth. The gingiva consists of an epithelial layer and an connective tissue, called the lamina propria. It is possible to identify three types of gingiva: free gingiva, interdental gingiva and attached gingiva.

The free gingiva comprises the vestibular, lingual or palatal faces of the teeth. It presents a coral pink colour and a firm texture. Thus, extends from the gingival margin in the apical direction to the free gingival groove, at the level of the cemento-enamel junction. The epithelium that covers it differs in three parts: oral epithelium (rendered into a keratinized stratified squamous epithelium), oral sulcular epithelium and junctional epithelium (Lindhe *et al*., 2015).

The interdental gingiva, in the anterior sector presents a pyramidal shape while in the posterior sector it presents a flattened shape. Its shape depends on the contact relationships between the teeth, the width of the approximal tooth surfaces and the course of the cemento-enamel junction (Lindhe *et al*., 2015).

The attached gingiva is immobile and has an orange peel appearance. In the coronal sense it is limited by the gingival groove or by a horizontal plane at the level of the cemento-enamel junction when it is absent, and extends apically to the mucogingival junction, where it becomes continuous with the alveolar mucosa. It is firmly adhered to bone and cement through connective tissue fibers.

After total dental eruption, the normal positioning of the gingival margin on the enamel surface is approximately 1.5 to 2mm coronal at the cementoenamel junction (Lindhe *et al*., 2015).

However, the gingival margin may suffer a change in its positioning. It can migrate in the apical direction, leading to a gingival recession with root exposure. Or the opposite, migrate in the coronal direction, leading to gingival hyperplasia and crown covering.

The gingival recession was defined as the displacement of marginal periodontal tissues apically to the cemento-enamel junction (Dominiak *et al*,. 2014). Nevertheless, in the 2017 World Workshop on the Classification of Periodontal and Peri-Implant Diseases and Conditions, it was defined recession as an apical shift of the gingival margin caused

by different conditions/pathologies, associated with clinical attachment loss (Jepsen *et al*., 2018). This may apply to all surfaces (buccal/ lingual/interproximal) of teeth.

Gingival recession is a frequently observed pathology that affects 88% of patients aged 65 years or above and nearly 50% of patients aged 18 to 64 years present at least one or more dental sites with recession (Kassab *et al*., 2003).

The etiology of the gingival recession is multifactorial but usually composed of predisposing and precipitating factors. Risk factors such as thin gingival phenotype, faulty dental restorations, the narrow width of keratinized gingiva, tooth malposition, frenum traction, and overzealous brushing may increase the risk of developing gingival recession (Jepsen *et al*., 2018). Certain types of orthodontic movements also act as causal factors for the gingival recession, such as the proclination of the incisors out of the dentoalveolar envelope. However, the orthodontic tooth movement, alone, may not cause gingival recession but it can create a favourable environment that predisposes certain individuals to this condition. (Rasperini *et al*.,2015).

The aim of this study is to understand the impact that orthodontic treatment might have in gingival margins alterations.

In the literature it has long been debated whether there is a correlation between orthodontic treatment and the appearance of gingival recession. It is known that orthodontic treatment alone usually does not lead to this pathology, however it can act as a predisposing factor, when there is the displacement of the tooth out of the alveolar bone through orthodontic forces, this may lead to dehiscence and bone fenestration which can result in gingival recessions. On the other hand, orthodontics can act as a means of treatment for gingival recession, redirecting the exposed roots into the alveolar envelope, reducing bone dehiscence (Jati *et al*., 2016, Laursen *et al*., 2020).

1. Methods

This review was conducted through a systematic search in two electronic databases: PubMed and Cochrane.

The search strategy at Pubmed and Cochrane comprised the following search terms articulated using the Boolean "AND" and "NOT" markers: gingival recession "OR" gingival retraction techniques "AND" orthodontic "OR" corrective orthodontic. As inclusion criteria were considered articles published between 2015 and 2021, in English, with the full text available. Only studies in human subjects were selected and in the Cochrane database only the topic dentistry oral health was used.

Through the search strategy followed, a total of 2006 articles were obtained from the electronic database Pubmed and 2052 articles in Cochrane. Of the total of 4058 articles found and, after eliminating the repeated documents, a total of 2879 articles were obtained. After reading the title and corresponding abstract, a second selection was made, with 39 articles selected. Therefore, full texts of the selected articles were obtained according to the inclusion criteria. Which 31 articles were considered relevant for the elaboration of the present study.

Also, the book: LINDHE, Jan; LANG, Niklaus.P. *Clinical Periodontology and Implant Dentistry*. 6th Ed. Wiley Blackwell, 2015 was used as a consultation document.

II. DEVELOPMENT

The gingival tissue has its major function in protecting oral alveolar bone and teeth. As orthodontic treatment compresses the teeth through the bone to induce movement, it also affects gingival tissue, therefore, one of the main concerns is the maintenance of the tooth sustentation and protecting tissues.

1. Gingival Recession

Gingival recession is defined as an apical displacement of the gingival margin beyond the cemento-enamel junction, with exposure of the root surface, caused by different conditions or pathologies (Jepsen *et al*., 2018). It is often associated with clinical attachment loss, and can affect one or more surfaces of the teeth. As a consequence of

root exposure in the oral cavity, it can lead to aesthetic problems, dentin hypersensitivity, caries and non-carious cervical lesions (Jepsen *et al*., 2018).

1.1 Etiology

The etiology of gingival recession is multifactorial, composed of direct causes and predisposing factors.

As factors that are considered as direct causes of gingival recession can be included the chronic trauma, which gingival recession may be associated with inadequate daily tooth brushing over time in a high frequency are the most correlated factors with this pathology. Gingival recession is often combined with cervical wear caused by abrasion from other agents used in oral hygiene (Heasman *et al.*, 2015). Another important direct cause is the chronic inflammatory periodontal disease, when bone loss occurs gradually, and without bone support, the gingival tissue migrates apically leaving the root exposed. Some types of periodontal treatment involve surgical removal of tissue and, after its removal, there is an accumulation of inflammatory exudate that leads to a decrease of gingival volume and consequently root exposure. Occlusal trauma is another factor when, in response to an excessive occlusal load, cells of the periodontal ligament release chemical mediators associated with bone resorption, which leads to vertical bone loss on the periodontal surface of the alveolar bone crest and results in bone dehiscence with gingival recession. Intrasulcular restorative margin placement, in a thin periodontal phenotype has a higher risk of developing recession lesions.

Predisposing factors of gingival recession are decreased alveolar bone crest thickness and dehiscence, the reduction in the thickness of the alveolar bone crest may be related to bone dehiscence, that is, the areas where the buccal bone plate is absent, normally located apically to the cervical contour of the alveolar bone. So, in the absence of bone support, the gingival tissue may retract in response to numerous factors such as plaque, mechanical and clinical factors. The movements of the labial and lingual frenulum, depending on the insertion site, can predispose the region where they are inserted to gingival recessions. Gingival phenotype, that influences the gingival thickness and the keratinized tissue width is one of the last predisposing factor and there is evidence that places with reduced amounts of keratinized tissue such as thin biotypes are more likely to develop more defects related to the recession (Agudio *et al.*, 2016).

Orthodontic treatment alone seems not to cause gingival recession, however it can act as a predisposing factor in certain teeth leaving them vulnerable to the direct causes that can act and lead to gingival recessions. It means, before the gingival recession is installed the orthodontic movement can induces dehiscence at the bone crest as a result of the movement of the teeth towards an area with extremely thin bone, such as the external cortical plate (Jati *et al*., 2016, Jepsen *et al*., 2018).

1.2 Classification

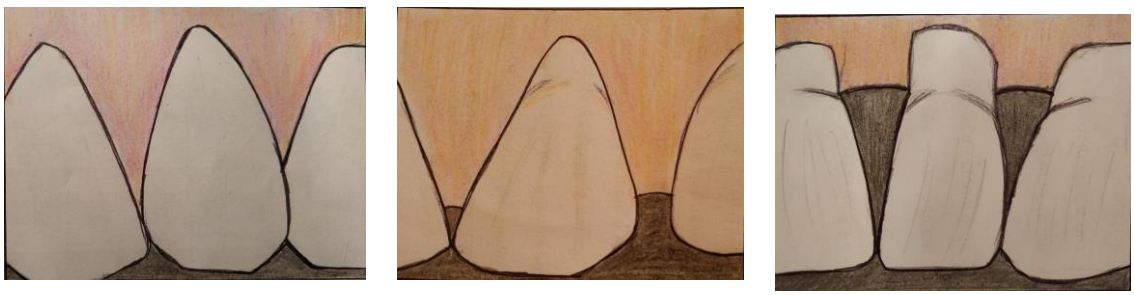
In the literature there are many classifications of gingival recession types. One of the most common is the Miller classification, which classifies gingival recessions in four classes according to the retraction of the gingival margin (Guttiganur *et al*., 2018). However, the is a new classification proposed in 2017 World Workshop on the Classification of Periodontal and Peri-Implant Diseases and Conditions (Jepsen *et al*., 2018) with reference to the interdental clinical attachment loss and divide as in three types (FIGURE 1 a,b,c):

Recession Type 1: Gingival recession with no loss of inter- proximal attachment.

Recession Type 2: Gingival recession associated with loss of interproximal attachment. The amount of interproximal attachment loss is less than or equal to the buccal attachment loss.

Recession Type 3: Gingival recession associated with loss of interproximal attachment. The amount of interproximal attachment loss is higher than the buccal attachment loss.

Figure 1



a – Recession Type 1 *b*– Recession Type 2 *c* – Recession Type 3

2. Correlation between orthodontic treatment and gingival recession

Orthodontic treatment as the cause of gingival recession

Orthodontic treatment as a cause of gingival recession is still a controversial topic in the literature, if on the one hand there are studies that refute this correlation, on the other, there are studies that find a positive correlation. In many cases the clinical effect is insignificant (Renkema *et al*., 2013).

It has been studied and discussed in the last decades that some orthodontic movements can lead to more incidence of gingival recession. One example is excessive orthodontic proclination of incisors that can lead to the development of gingival recessions, through the formation of bone dehiscence and clinical attachment loss.

Some appliances, though its force vector, can also lead to a large proinclination of the lower incisors. This is the case of classe II fixed corrective appliances as the Herbst Appliance. The studies of Bock and collaborators (Bock *et al*.,2019, Bock *et al*., 2020) evaluated the prevalence, incidence and magnitude of gingival recession during class II correction with the Herbst appliance plus Multibracket treatment followed by an Hawley retention device. In both studies, the tree parameters (prevalence, incidence and magnitude) evaluated increased from the pre-treatment to the post-containment period. The study carried out in 2019, obtained a higher incidence of gingival recession on upper right premolars and lower central incisors, and in the other study, the results indicate a higher incidence of gingival recession in the lower central incisors.

2.1 Proclination

The influence of orthodontic treatment, as well its mechanism in the development of gingival recessions, remains unclear and controversial in the literature.

Periodontal tissues usually adapt to tooth movements in the dental arch through orthodontic forces, however, when they are subjected to extreme forces such as excessive proclination of the lower incisors (more than 10 degrees in relation to the mandibular line). It can lead to the formation of bone dehiscences that many authors refer to as a prerequisite during orthodontic treatment for the development of gingival recessions (Artun *et al*., 1987, Renkema *et al*., 2013, Pernet *et al*., 2019). That is, if there is a movement of the root out of the alveolar envelope, it can lead to bone

dehiscence and without the proper alveolar support the gingival margin can migrate apically and expose the root (Morris *et al*., 2017).

Another explanation for the appearance of recessions is that during orthodontic intervention, the alveolar bone may become thinner due to its expansion and the gingival tissue is more susceptible to long-term recessions. This means that the excessive proclination of the lower incisors in thin symphyses can lead to retraction of the gingival margin (Artun *et al*., 1987).

2.2 Retainers

Due to the often unstable results in orthodontics, the use of fixed retainers in the post orthodontic period is increasing (Corbett *et al.*, 2015).

Similar to what happens in proclination, the effect of fixed retainers on gingival health is contradictory, some studies show an increase in gingival recession, others show that there is no relationship (Juloski *et al*., 2017). However, there is scientific evidence that the accumulation of plaque and gingival inflammation is higher in individuals with retention than without (Tacken *et al.*, 2010). And it is through these mechanisms, such as plaque accumulation and gingival inflammation promoted by the retainer, that some authors refer to being the main factor for the development of gingival recession (Levin *et al*., 2008).

The use of fixed retention makes oral hygiene difficult, so before placing it, it is necessary to assess whether the patient will be able to maintain a good oral hygiene and instruct him, so that there is no accumulation of bacterial plaque around the retainer (Corbett *et al.*, 2015).

In the literature, some authors (Tacken *et al.*, 2010) hypothesized a possible correlation between the type of retainer and periodontal changes, however, recent studies have shown that the presence of orthodontic retainer induces periodontal changes regardless of the type of retainer chosen (Tacken *et al.*, 2010).

Finally, another concern of the orthodontist when placing the orthodontic bandage is the placement of the retainer as far as possible from the gingival margin, that is, it should be positioned more incisally than gingival in order to facilitate oral hygiene and reduce the risk of development of gingival recessions (Levin *et al*., 2008).

2.3 Orthodontic treatment as treatment of gingival recession

There are several surgical techniques in order to cover the exposed root and increase the dimensions of keratinized tissue with defects of gingival recession as is the case: pedicle flap, tunnel technique, free gingival grafts, soft tissue substitutes, tissue engineering, technique guided tissue regeneration and biologically active proteins (Dominiak *et al*., 2014).

As already mentioned, the displacement of the tooth out of the alveolar bone is considered a risk for the development of bone dehiscence and can lead to the development of a gingival recession. In this sense, orthodontic treatment can help by redirecting the exposed roots into the alveolar envelope, thus decreasing the prominence of the root and reducing bone dehiscence.

(Laursen *et al*., 2020) evaluated the impact of orthodontic root movement, namely, the redirection of the root to the center of the alveolar process, in gingival recessions. She noted that the depth, width and area of gingival recessions decreased in all patients and that Class III and IV recessions improved for Class I and II. In this way, she made the periodontal plastic surgery for the total covering of the root more favourable.

In this case, mucogingival surgery during orthodontic treatment is favourable to maintain an adequate width of keratinized gingiva (Deepthi PK *et al*., 2015).

3. Prevention of gingival recession with CBCT

The use of conventional 2D imaging techniques for the observation of hard and soft tissues is inadequate due to problems of superimposition and distortion of the image, leading to a incomplete diagnosis. In this way, 3D images as, CBCT (cone beam computed tomography) are an alternative to conventional techniques, improving diagnosis and treatment planning in specific cases. It is only in specific cases, such as impacted teeth, cleft lip and palate, skeletal discrepancies involving surgery, root resorption, supernumerary teeth, pathologies of the temporomandibular joint (TMJ), asymmetries and alveolar boundary conditions, maxillary expansion, airway morphology, among others, it justifies its use at the expense of conventional techniques, due to the associated risks of radiation exposure and high costs.

In the case of Orthodontics is a very useful tool in the evaluation of potential effects on the integrity and morphology of alveolar bone in therapy with fixed appliances. In cases

of bimaxillary protrusion or incisal proclination/retroclination, the alveolar limit may be compromised, leading to bone dehiscence, which in turn can lead to gingival recessions. Therefore, a pre-treatment evaluation is important, in cases of alveolar bone phenotypes that may not tolerate significant labio or buccolingual displacements, pre-existing periodontal disease, orthodontic movements that extend the alveolar limits that may constitute a limitation to orthodontic treatment (Kapila *et al*., 2015).

Jager and collaborators (2017), in their retrospective study, intended to quantify the height and thickness of the periodontal bone in orthodontic patients. A significant decrease in the height and thickness of periodontal bone during treatment and a significantly greater dehiscence depth with increased vertical bone loss in patients over 30 years. That is, orthodontic patients over 30 years old are a risk factor for vertical bone loss, requiring a more routine assessment.

Another advantage of using CBCT for orthodontists is the identification of alveolar bone dehiscence and fenestrations before orthodontic treatment, although the technique is not accurate and gives rise to false positives is a fundamental aid in the diagnosis. Dehiscence and fenestrations can lead to the appearance of gingival recessions making the final result unaesthetic and with future problems of tooth sensitivity.

One study (Choi *et al*., 2020) evaluated the prevalence of posterior alveolar bone dehiscence and fenestration in adults with posterior crossbite compared to adults without crossbite. He concluded that the prevalence of bone defects was higher in the study group than in the control group.

4. Gingival Hyperplasia

Gingival hyperplasia is defined as the enlargement of the gingiva due to the increase in the number of cells, which may be limited to one region or be generalized.

The mechanism which gingival enlargement occurs during orthodontic treatment is still not entirely clear, however, it is known that the accumulation of plaque is one of the reasons, but not the only one. Factors such as the type of metal used in brackets and the duration of treatment are also linked to gingival enlargement (Paschos *et al*., 2008, Vincent-Bugnas *et al*., 2021).

Most orthodontic treatments are started in adolescence, where the cooperation and adherence of the individual to maintain good oral hygiene is sometimes difficult. And in the case of orthodontic brackets, these serve as microbial shelters, and when there is an

accumulation of plaque in this region it will induce inflammatory changes in the gingival tissue. Gingival enlargement is therefore associated with plaque microbiota, in which inflammatory mediators cause an increase in vascular permeability and dilation, exudative fluid and proteins swell the tissue and an influx of the underlying connective tissue cells into the junctional epithelium occurs. In turn, periodontal pathogens signal immune system cells that infiltrate the gingival tissue and an immune response occurs. That is, the individual's response to aggression will depend on their immune response and the quality and quantity of the biofilm (Paschos *et al*., 2008, Vincent-Bugnas *et al*., 2021).

Although it is a pathology frequently observed in orthodontic patients, it is usually transitory. Studies show that one month after the removal of the band or brackets an improvement in gingival health occurs, with the alteration not being permanent ((Zachrisson *et al*., 1972).

Finally, to prevent the development of this pathology, there are studies that demonstrate the use of chlorhexidine varnishes in this type of patients helps to control the development of plaque and prevent gingivitis (Paschos *et al*., 2008).

III. DISCUSSION

The normal positioning of the gingival margin on the enamel surface is approximately 1.5 to 2 mm coronal to the cementum-enamel junction, however, it can undergo changes in its positioning, leading to gingival recession if it migrates apically or the opposite, gingival hyperplasia if it migrates coronally (Lindhe *et al*., 2015).

Gingival recession is a pathology frequently observed, although its etiology is still not entirely clear and the literatures suggest that it is caused by multiple factors divided into precipitants and predisposing factors (Jati *et al*., 2016).

The literature is not consistent with the etiological factors that contribute to the development of this pathology. Jati *et al*. 2016 in his work refers to the occlusal force as one of the etiological factors for the development of gingival recession as a response of the periodontal ligament to an excessive occlusal load. Other studies corroborate this correlation, firstly because the recession can be observed on teeth which there is no occlusal contact and second, an occlusal trauma presupposes greater tooth mobility, so a higher mobility in teeth with recession would be expected than in the homologous

contralateral teeth without recession and the same is not true in the Bernimoulin and collaborators study (Bernimoulin and Curilović, (1977), Harrel *et al*., 2004).

However, the aim of this study is to correlate orthodontic treatment with gingival recession, it does not directly cause this pathology but can act as a predisposing factor. The literature is divided in this aspect, if there are authors who find a positive correlation between these two factors, others establish a negative correlation.

Within orthodontic treatment, proclination and the use of fixed retainers were the orthodontic movements studied that can lead to a higher incidence of gingival recession.

Renkema *et al*. (2013) and Kamak *et al*. (2015) divided their sample into three groups: "Retroclination" (≤-1 degree), "Stable position" (> -1 degree) and "Proclination" (> 1 degree). Both concluded that the change in the inclination of the lower incisors during orthodontic treatment does not affect the development of gingival recession.

Renkema observed the appearance of gingival recessions 5 years after the end of orthodontic treatment in 3 patients in the Retroclination group, 1 patient in the Stable group and 20 patients in the Proclination group. Although there was a difference before treatment, it was not significant. However, obtained superior results of recession in relation to the study by Kamak, which only observed the presence of recession in 2 patients. This can be explained by the fact that the sample in the Renkema study is larger and has longer observation time, since the Kamak study only evaluated the presence of recession in two moments, before and after orthodontic treatment.

Navratilova *et al.* (2015) divided his sample into two groups: non-proclined (<95 degree) and proclined (> 100.5 degree), assessing the presence of gingival recession before, after and 5 years after orthodontic treatment. Unlike the study by Rekema and his collaborators (Renkema *et al*., 2013) which obtained 8.8% in the non-proclined and 16.3% proclined group, Navratilova and collaborators (Navratilova *et al.,* 2015) in their study obtained a higher percentage of gingival recession in the non-proclined (12,3%) than proclined group (11.7%), thus came to the conclusion that the proclination of the lower incisors does not increase the risk of developing gingival recession in relation to non-proclined teeth.

One study (Morris *et al*., 2017) evaluated the prevalence of gingival recession after proclination of mandibular incisors and expansion of maxillary posterior teeth in three moments: before, at the end of orthodontic treatment and at least 2 years after removal of retainers. After the retention period almost half of the teeth showed gingival

recession but without severity, deducing that there is no relationship between proclination during orthodontic treatment and gingival recession post treatment. However, they found a weak positive correlation between maxillary expansion during orthodontic treatment and the presence of gingival recession after treatment.

Pernet *et al*. (2019) corroborated the other studies, assuming that an excessive proclination (≥ 10º) in the lower incisors, increases the risk of the appearance of gingival recession in 25% of the cases. The difference of these findings to other studies, lies in the fact that individuals with different malocclusions were included (individuals with Class III are more susceptible to recession because they have a thinner gengiva) and their sample have a disparity in ages (the risk of recession increases with age).

In short, there is a higher prevalence of gingival recession in orthodontically treated than untreated individuals, but it is not due to the proclination alone, but if it is combined with other factors such as a periodontal phenotype, the degree of inclination and age.

The appearance of gingival recession is more susceptible in orthodontically treated individuals, however, due to its often unpredictable results, more and more use is made of fixed retainers after orthodontic treatment (Corbett *et al.*, 2015). And the combination of orthodontic treatment combined with the use of fixed retainers has a negative effect on periodontal health, whether in the development of recessions, the accumulation of bacterial plaque, among other factors. Again, the literature is not coincidental if, on the one hand, there are studies that make a positive association between the use of fixed retainers and the development of gingival recession, others establish a negative correlation.

Levin *et al*. (2008) in his study concluded, first that 31.4% of patients who had orthodontic treatment had gingival recession, compared with 10.2% who did not have orthodontic treatment. Second, in patients who had orthodontic treatment combined with fixed retention, 25% of the arches presented gingival recession when compared to 2.8% which they had orthodontic treatment but without fixed retention. In other words, it demonstrated a positive correlation between orthodontic treatment combined with fixed retention and the increased incidence of gingival recession. It also established a correlation between the accumulation of plaque and gingival recession.

Juloski *et al*. (2017), unlike the other study, concluded that fixed retainers do not increase the risk of developing mandibular gingival recession. The orthodontically

treated group was divided into two sub-groups, one that received fixed mandibular retainers and the other did not, assessing the presence or absence of gingival recession before orthodontic treatment, after debonding and 5 years after debonding. They found that gingival recession was present in all groups, that is, in the treated group and in the untreated group, deducing that the use of fixed retainers no longer increases the risk of developing gingival recession. However, it established a correlation between the use of fixed retainers and the increase in calculus accumulation.

The non-coincident results between these two studies can be explained by the fact that the study by Julosky and his collaborators eliminated some known predisposing factors, through the homogenization of his sample, with no differences between the two groups in relation to age, gender, angle classification, duration and retention of treatment.

Thus, the use of fixed retention can serve as a risk factor for the development of gingival recession, since, combined with poor oral hygiene will lead to an accumulation of bacterial plaque and consequently gingival inflammation, which if not controlled can give rise to a periodontal disease and as a consequence is bone resorption and attachment loss resulting in gingival recession.

Gingival hyperplasia is another pathology that can develop due to orthodontic treatment. Like gingival recession, it becomes unsightly for the patient, questioning the final result of the treatment.

The exact mechanism which orthodontic treatment induces gingival hyperplasia is not clear, however, there are predisposing factors that can lead to the development of this pathology.

In the study of Vincent-Bugnas *et al*. (2021), 49.7% of orthodontically treated patients developed gingival enlargement due to two factors, metal brackets and the duration of treatment. On the other hand, he concluded that the plaque index is not directly related to this pathology, that is, the quality of the biofilm and not the quantity may be at the origin of the development of gingival enlargement during orthodontic treatment.

Contrary to the study of Bugnas and his collaborators, (Zanatta *et al.*, 2014) established a positive correlation between gingival bleeding and the excess of resin around the brackets with gingival enlargement. Therefore, carelessness in bonding brackets to the enamel surface may be one of the causes of the development of this pathology. Excess resin increases the adhesion of plaque and consequently the formation of gingivitis.

Vincent-Bugnas *et al*. (2021) studied only specific conditions that may arise as predisposing factors for the development of gingival enlargement, omitting others that could be relevant. Leading to different results from the Zanatta and his collaborators study.

Poor oral hygiene is an important causal factor of gingival hyperplasia. Gingival hyperplasia translates into a response to the accumulation of plaque in orthodontic patients, and in this specific population there are other predisposing factors, such as metal brackets (specially with Niquel), and the excess of resin around them, which further hinder proper oral hygiene. And it is known that poor oral hygiene leads to the accumulation of supragingival plaque, which in turn results in inflammation of the tissues and the appearance of gingival hyperplasia. However, different times of clinical response can be justified by the individuality of each one, in factors such as the difference in plaque growth, local and systemic resistance of the individual.

IV. CONCLUSION

Although it is not clear in the literature what is the role of orthodontic treatment in the development of gingival recession, the development of gingival recessions during or after orthodontic treatment is a problem for orthodontists, it is unaesthetic, causes dentin hypersensitivity and leads to caries and non-carious cervical lesions. So it is crucial for the Orthodontist to carry out a risk assessment before the start of orthodontic treatment.

The assessment would start with the early identification of predisposing and precipitating factors, such as: the brushing technique, periodontal biotype, presence of periodontal disease, presence of fenestrations or bone dehiscences, among others. The evaluation must continues throughout the treatment.

The use of CBCT, before the start of treatment is a fundamental tool for the Orthodontist, as it provides crucial information that may constitute a limitation for the treatment, such as the presence of bone dehiscences, the alveolar bone phenotype, periodontal disease pre-existing.

This would imply greater success in the treatment, and made the Orthodontist would be aware of the potential risks of recession and the need for referral before, or during orthodontic treatment for a Periodontist.

The initial assessment of the patient's oral hygiene and gingival inflammation with the presence of calculus should be considered by the Orthodontist as a potential risk of future recession or progression during treatment.

It should be noted that the choice of the treatment modality by the Orthodontist is fundamental, to minimize the appearance of recessions and the negative impact after the completion of the treatment. Proclination of incisors should be avoided, in the presence of fenestration or bone dehiscence. The Orthodontist should also try to avoid overexpansion of the arch trying to keep the teeth inside the alveolar envelope.

Finally, if the recession occurs during or after orthodontic treatment, the Orthodontist in conjunction with the Periodontologist must select the best treatment to cover the exposed root.

In conclusion, the Orthodontist plays a very important role both in preventing the onset of gingival recession and resolving it.

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ATTACHMENTS

ATTACHMENT I: Figure 1. Flowchart of the bibliography research methodology