

Review Article

ORTHODONTIC TREATMENT AND PERIODONTAL HEALTH: A SYSTEMIC REVIEW

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ABSTRACT:

Periodontic-orthodontic interrelationship has been subject to a lot of investigation until today, and it is a still controversial issue. Malocclusion has been shown to affect periodontal health and one of the objectives of orthodontic treatment is to promote better dental health and prolong the life of dentition. A thorough assessment of the periodontal health and level of attached gingival is recommended prior to the orthodontic treatment. Also, it is equally important to lay emphasis on the necessity of good oral hygiene in order to achieve the best treatment outcome. Oral hygiene instructions should be given before the start of orthodontic treatment and it should be reinforced during every visit.

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INTRODUCTION

Periodontic-orthodontic interrelationship has been subject to a lot of investigation until today, and it is a still controversial issue. Malocclusion has been shown to affect periodontal health and one of the objectives of orthodontic treatment is to promote better dental health and prolong the life of dentition. Orthodontic treatment contributes to better oral hygiene by correcting dental irregularities and reduces (or eliminates) occlusal trauma. Due to these reasons, it has been suggested that orthodontic treatment leads to an improved periodontal status. It seems reasonable that straighter teeth are easier to clean, and perhaps having all teeth centered in the alveolar housing and occluding correctly may promote a healthier periodontium.¹⁻³

Although, orthodontic treatment improves dental and skeletal problems, placement of an orthodontic appliance in a patient's mouth is often associated with alterations in the oral hygiene habits and periodontal

health. Orthodontic appliances, as well as mechanical procedures, are prone to evoke local soft tissue responses in the gingiva. The proximity of orthodontic appliances to the gingival sulcus, plaque accumulation, and the impediments they pose to oral hygiene habits further complicate the process of efficient salutary orthodontic care.^{4,5}

The effects seen clinically following the insertion of orthodontic appliances into the oral cavity can contribute to chronic infection, inflammatory hyperplasia, irreversible loss of attachment (permanent bone loss), and gingival recession. Although an association between orthodontic tooth movement and gingival recession has been mentioned in both the orthodontic and the periodontal literature, many of these studies are relevant to mandibular incisor teeth. Some investigators have shown gingival recession to be associated with labial movement of the mandibular incisors and have therefore considered this movement

as a risk factor for gingival recession, while others have found no such association between orthodontic tooth movement and gingival recession. Moreover, it is argued that preexisting mucogingival problems can be exacerbated with orthodontic force application.⁵⁻⁷

SOFT TISSUE CHANGES

Orthodontic treatment can be implemented to improve dental aesthetics not only by correcting position of the jaws and deformities of dentition, but also by creating the conditions for improved gingival health. Adult patients previously affected by periodontal disease often present with “black triangles” due to missed interdental papillae height. By means of orthodontics, it is possible to correct teeth position and to improve soft tissue aesthetics. It was suggested that orthodontic teeth approximation might change the topography of the interproximal alveolar crest level and enhance the position of the interdental papilla although black triangles may also appear as a consequence of teeth alignment when resolving crowding.⁶⁻⁸

It should however be taken into consideration that during OTM some adverse effects on the soft periodontal tissue may be observed. The most frequently occurring changes in soft tissues are gingival overgrowth (GO), gingival recessions (GR), and gingival invaginations (GIs), which commonly occur in orthodontic extraction cases.⁶⁻⁹

Gingival overgrowth is a very common condition in the orthodontic population that is characterized by gingival enlargement possibly resulting in pseudo-pocketing with or without attachment loss. When involving the anterior region, it may have an impact on oral health-related quality of life. Traditionally, GO was considered as an inflammatory reaction consecutive to bacterial plaque accumulation. Other factors as chemical irritation produced by materials used for banding, mechanical irritation by bands, and food impaction have been suggested to explain the pathogenesis of GO. It was considered that, during orthodontic treatment, the mechanical stress appeared to be one of the key factors determining the increase of MMP-9 production and the onset of GO. Some authors also evaluated the possible role of an allergic reaction to nickel, releasing from the orthodontic appliances made of stainless steel. In vitro and in vivo studies suggest that released nickel ions may cause an exposure time dependent allergic reaction characterized by an upregulated proliferation of keratinocytes and increased epithelial cell proliferation. It may be therefore important to treat patients with nickel-free appliances and to adopt questionnaires to evaluate previous history of allergies to metals as they have been linked to an increased frequency of GO.¹⁰⁻¹⁴

Enlargement of interdental papillae and accumulation of gingival tissue may appear due to the application of compressive or retraction forces at the site of extraction

space closure. In orthodontic treatment, the extraction of teeth, most commonly, first or second premolars, may be required. Orthodontic space closure of extraction sites may result in gingival invagination or accumulation of gingival tissue.¹⁰⁻¹⁴

PATHOPHYSIOLOGY

The periodontal ligament mainly consists of type I collagen, although type III collagen fibres are also present. The main function of PDL is sending proprioceptive signals to the brain and withstanding compressive forces during chewing movements. Various studies have reported significant recruitment of mononucleated cells, macrophages, dendritic cells, and MHC class II Ia-expressing cells in the pressure zone incident to orthodontic tooth movement. In the tension zone, however, minimal changes in the number and distribution of immune cells have been reported. Under stress from the orthodontic treatment, there would be changes to the blood flow.¹⁴⁻¹⁶

Neuropeptides are released from the periodontal nerve endings, which causes neurogenic inflammation in the compressed periodontal ligament. Furthermore, various immunoregulatory molecules, such as interleukin-1 a, interleukin-6, and tumour necrosis factor- α , are released during inflammation and participate in the remodelling of the periodontium.¹⁴⁻¹⁶

Several etiological factors for root resorption are known (trauma, periodontal diseases, etc.), with almost similar outcome of root structure loss. Orthodontic root resorption is unique as compared to other types of root resorption. Orthodontically induced inflammatory root resorption (OIIRR) is a sterile inflammatory process that is extremely complex and composed of various disparate components including forces, tooth roots, bone, cells, surrounding matrix, and certain known biological messengers.¹⁷⁻²⁰

GINGIVAL RECESSION IN ORTHODONTICS

The development of gingival recession during or after orthodontic treatment would be a significant clinical problem. A number of predisposing and precipitating factors include anatomical and morphological characteristics, such as alveolar bone dehiscence, gingival biotype, skeletal pattern, narrow symphysis and ectopic tooth eruption or morphology. Precipitating factors lead to an acceleration of the defect, such as traumatic tooth brushing, traumatic overbite, age, smoking, parafunctional habits, pregnancy and piercing. In addition and perhaps equally important are inappropriate treatment mechanics, such as arch expansion, with excessive proclination and the use of RME in adult patients. Care should also be taken when decompensating a class III incisor relationship in preparation for surgery and aligning ectopic/transposed

teeth. In patients requiring pre-surgical decompensation, preprosthetic preparation or where a non-extraction approach is judged as necessary: The importance of ensuring optimal oral hygiene and using a free gingival graft prior to the planned OTM should be considered. The preferred approach in these susceptible patients should be to again ensure optimal oral hygiene, align the roots within the alveolar envelope, avoiding proclination and to re-evaluate the need for a mucogingival graft after treatment.¹⁷⁻²¹

ORTHODONTIC EXTRUSION AND INTRUSION

A recent clinical study on orthodontically treated patients with intact periodontium concluded that extrusion of mandibular incisors resulted in displacement of the gingival margin and the mucogingival junction by 80% and 52.5%, respectively, of the total amount of extrusion. Thus, in cases where movement of bone margin and attachment along with the tooth is not desirable (as in crown-root fractures), there is a need for periodical circumferential supracrestal fiberotomy at the start and every 2 weeks during orthodontic extrusion. According to experimental studies and clinical reports, orthodontic extrusion of teeth with one or two wall-infrabony defects results in a more favorable position of the connective tissue attachment and reduction in the defect. Orthodontic extrusion of non-restorable teeth prior to implant placement appears to be a viable alternative for conventional bone augmentation procedures in implant recipient sites.¹⁷⁻²¹

During orthodontic intrusion of lower incisors in patients with an intact periodontium, the gingival margin and the mucogingival junction moves apically 79% and 62% of total intrusion, respectively. Regarding periodontally affected teeth, sufficient clinical data suggest that the intrusion of teeth can considerably improve the level of attachment when there is absolute control of inflammation and bacterial biofilms. The use of light forces is recommended to move teeth efficiently and probably reduce the amount of root resorption. This is of capital importance in teeth with a reduced periodontium as the specific implication results in further loss of periodontal support and increase in crown-root ratio.¹⁷⁻²¹

PREVENTIVE PROGRAMME FOR ORTHODONTIC PATIENTS WITH FIXED APPLIANCES

Before Orthodontic Treatment:

1. Initial diagnosis and referral for treatment to control active periodontal disease and caries
2. Informed consent of the risks during orthodontic treatment and responsibilities of the patients and clinician

3. All general dental and periodontal treatment completed before orthodontic treatment

During Orthodontic Treatment

1. Provide the patient with initial brushing instruction with orthodontic tooth brush when the appliances are first placed. The patient should use fluoride toothpaste with that also has an antigingivitis effect.
2. Record plaque removal effectiveness in the patient's chart.
3. Use a positive reinforcement approach (praise) and avoid criticism.
4. Introduce additional methods to improve oral hygiene such as flossing only when success is established with simple brushing

Most studies investigated the correlation between the change in incisor inclination and the development of gingival recession in a patient group or they compared two patient groups with more or less proclination during treatment regarding recession. Two animal studies found statistically significant more gingival recession in displaced incisors than in control teeth. Five human studies found statistically significant differences in the extension of recessions or the number of teeth with recession after changing the inclination of the incisors or comparing the T-group with the C-group. It seems possible that orthodontic therapy involving movement of the incisors out of the osseous envelope of the alveolar process constitutes a risk that recession of the gingiva may result. More proclination during treatment may be accepted for a low initial inclination than for a high initial inclination.¹⁷⁻²¹

CONCLUSION

Periodontal health is essential for any form of dental treatment. Adult patients must undergo regular oral hygiene instruction and periodontal maintenance in order to maintain healthy gingival tissue during active orthodontic treatment. Close monitoring of adults with reduced periodontal support is mandatory. Orthodontic treatment is usually contraindicated in patients with active periodontal disease or poor periodontal health as the chance of further periodontal deterioration is high in such case. Therefore, a thorough assessment of the periodontal health and level of attached gingival is recommended prior to the orthodontic treatment. Also, it is equally important to lay emphasis on the necessity of good oral hygiene in order to achieve the best treatment outcome. Oral hygiene instructions should be given before the start of orthodontic treatment and it should be reinforced during every visit.

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