

Review Article

Perio-ortho interrelationship: A Review

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Abstract: It is well established that the patients who undergo orthodontic treatment have a high susceptibility to present plaque accumulation on their teeth because of the presence of brackets, wires and/or other orthodontic elements on the teeth surfaces with which the oral hygiene procedures might be more difficult. The considerable variance of the design and the material characteristics of orthodontic elements may also play an important role in this field. The orthodontic treatment is a double-action procedure, regarding the periodontal tissues, which may be sometimes very meaningful in increasing the periodontal health status, and may be sometimes a harmful procedure which can be followed by several types of periodontal complications, namely: gingival recessions, bone dehiscences, gingival invaginations and/or the formation of gingival pockets. A harmonious cooperation of the periodontist and the orthodontist offers great possibilities for the treatment of various orthodontic-periodontal problems. The present discussion focused on the effects of a combined periodontal and orthodontic treatment on the periodontal health and dentofacial aesthetics, and the mode that each field can contribute to optimize treatment of combined orthodontic-periodontal clinical problems.**Keywords:** Periodontics, Orthodontics, Oral Hygiene

INTRODUCTION

The purpose of this review is to highlight the orthodontics and periodontics interface in clinical practice for optimized treatment outcomes. Orthodontic treatment aims at providing an acceptable functional and esthetic occlusion. Tooth movements are strongly related to interactions of teeth with their supportive periodontal tissues. In recent years, due to the increased number of adult patients seeking orthodontic treatment, orthodontists frequently face patients with periodontal problems. Esthetic considerations, like uneven gingival margins or functional problems resulting from inflammatory periodontal diseases, should be considered in orthodontic treatment planning.

Harmful effects of orthodontic therapy on periodontium

A patient with a past history of previous periodontitis obviously is, always, more susceptible to develop the disease once again in the future. Therefore, It is not recommended to begin any orthodontic treatment if active destructive sites are present, and a

person who has had periodontal disease in the past should be monitored more closely to prevent new bursts of active sites which may in turn result in rapid bone loss during the orthodontic treatment.

Orthodontic treatment may inhibit complete oral hygiene procedures [1-3] and create the possibility of transition of the subgingival plaque to a more aggressive periopathogenic flora [4, 5](converting gingivitis into periodontitis). If a thorough oral hygiene regime is applied before and during orthodontic treatment, minimal or no increase in gingival bleeding index [6] or a plaque quantity will be evident [7]. After appliance removal, there is a significant improvement on plaque index and bleeding index [8]. With adequate plaque control, patients with reduced but healthy periodontium can undergo orthodontic treatment without aggravating their periodontal conditions [9,10]. However, when inflammation is not fully controlled orthodontic treatment may trigger inflammatory processes and accelerate the progression of periodontal destruction leading to further loss of

attachment, even in patients with sound oral hygiene [11-13]. Specific long-term clinical and radiographic findings support the fact that periodontal disease develops in regions where orthodontic bands are placed and leads to statistically significant loss of attachment [14].

It has been also shown that different species of bacteria such as *Bacterioids intermedius spirochetes*, *motile roads*, *B.forsythus*, *T.dentcola*, *P.nigrescens*, *C.rectus* and *fusiform Bacteria* were considered to increase more frequently in the dental plaque of patients undergoing orthodontic treatment.

An adequate amount of attached gingiva is necessary for gingival health and to allow appliances (functional or orthopedic) to deliver orthodontic treatment without causing bone loss and gingival recession. Clinical experiments and animal studies have shown that clinically recognizable inflammation occurs in regions with a lack of attached gingiva than in areas with a wider zone of attached gingiva. With labial bodily movement, incisors showed apical displacement of the gingival margin, but no loss of connective tissue attachment was apparent where there were no signs of inflammation. Where inflammation was present, loss of connective tissue attachment occurred [15]. Therefore if the tooth movement is expected to result in a reduction of soft tissue thickness and an alveolar bone dehiscence may have occurred in the presence of inflammation, gingival recession is a risk. Thin, delicate tissue is far more prone to exhibit recession during orthodontic treatment than in normal or thick tissue. If a minimal zone of attached gingiva or thin tissue exists, a free gingival graft that enhances the type of tissue around the tooth helps control inflammation. This should be done before any orthodontic movement is begun.

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. Most gingival recessions which occur during an orthodontic treatment had been shown to occur in the regions of the anterior upper and lower teeth [16-19]. However, there are few studies showed no features of gingival recession after an orthodontic treatment. Steiner and his colleagues [20] mentioned that the gingival recessions noted after an orthodontic treatment tend to occur in the regions were

the keratinized gingiva and the underlying bone tissues are thin.

Tooth extraction is considered a frequently needed procedure when planning most orthodontic treatments, especially those which aim at correcting the insufficient space disorders in the upper and the lower jaws and/or some other aesthetic and occlusal problems. The first premolars – and sometimes the second premolars – in either the upper or the lower jaw are usually the first choice when extraction becomes a part of the whole orthodontic treatment plan. Gingival invaginations are defined as superficial changes in the shape of gingiva which arise after moving the teeth orthodontically in order to close the spaces resulted from extraction procedures [21]. Gingival invaginations were noted in 35% of cases after orthodontic space closure procedures [22]. They vary from slight fissures located in the keratinized gingiva to deep gaps crossing the interdental papilla buccally or lingually through the alveolar bone deeply [23, 24]. Histological and histochemical specimens taken from sites of gingival invagination showed hypertrophy in the epithelial and the connective tissues, and sometimes, loss of gingival collagen [25]. The real reason for gingival invaginations is still unknown. One expected reason could be the break-up of the continuity of the fiber models within the gingiva, and also the movement of the root [26]. However, other studies suggest the gingival peeling as a reason for such changes [27]. Since gingival invaginations may offer good sites in which dental plaque can be easily embedded, researchers considered these changes in the gingiva as risk factors for the periodontal tissue disorders during orthodontic treatment [28].

Orthodontic treatment as an adjunct to periodontal therapy

A strong relationship between the abnormal positions of the teeth in the dental arch and the periodontal disorders had been previously described [29-30]. Moreover, it has been shown that the number of periodontal pathogens in the anterior sites of crowded teeth is much greater than that in the sites of aligned teeth [31]. The correction of the crowded teeth can eliminate any harmful occlusal interference which may offer a great opportunity for the development of a periodontal breakdown [32]. This data definitely supports the concept that orthodontic treatment can positively affect the periodontal health, prevent the development of periodontal diseases and offer a possible action to enhance the bone formation within the bony defects [33].

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 [34]. 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 [35]. 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 [36-37]. 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.

It has been suggested that orthodontic tooth movement into infrabony defects can result in healing and regeneration of the tooth attachment apparatus. In addition, periodontists have believed that if a wide osseous defect is adjacent to a tooth and the teeth were moved to narrow the better healing potential may be present.

Orthodontic uprighting of mesially tipped molars is accompanied by the elimination of osseous defects, improvement in pocket probing depth and in crown-root ratio [38]. However, in molars with furcation involvement, there is an increased risk of aggravation of the periodontal problem during the orthodontic uprighting procedure [39, 40]. Orthodontic movement of teeth in edentulous areas with reduced alveolar ridge height is, usually, possible with minimal loss of alveolar bone [41]. The movement should be parallel and performed with low orthodontic forces.

Periodontal therapy as an adjunct to orthodontic therapy

Properly delivered orthodontic forces do not induce any damage to the periodontium. However, it is widely believed that insufficient width of the attached gingiva predisposes the development of recession. To maintain proper gingival health, a 2-mm width of keratinized gingiva is adequate [42]. Tension on the gingival margin during orthodontic force application also results in gingival recession [43]. Orthodontic proclination of the incisors have a greater risk of recession and loss of attachment, especially in areas with minimal gingiva and bone support. To maintain adequate width of the attached gingiva in these conditions, mucogingival surgery may be advised during the course of orthodontic treatment.

High frenal attachment is considered to be one of the causes for midline diastema. The abnormal frenum prevents mesial migration of the central incisor and the aberrant fiber increases the relapse tendency after orthodontic space closure. Surgical removal of the frenum is usually advised in these situations and it should be performed after the completion of orthodontic treatment unless the frenum prevents space closure or become painful or traumatized.

Forced eruption of an impacted tooth is a common orthodontic treatment procedure. Proper exposure of the impacted tooth and preservation of the keratinized tissue are important to avoid loss of attachment after orthodontic treatment. Apically or laterally positioned pedicle graft is usually advised in this situation [44].

Orthodontic tooth movement results in reorganization of collagenous fibers, elastic fibers, and the periodontal ligament to accommodate the new tooth positions. In order to prevent orthodontic relapse and to achieve proper rearrangement of the supporting tissues, the teeth must be retained. However, Sharpey's fibers of the newly formed bundle bone as well as supraalveolar and transseptal fibers undergo rearrangement even after 4-6 months of retention, especially after the correction of rotation. Hence, the teeth must be retained for at least 12 months to allow time for complete remodeling of these fibers. Circumferential supracrestal fiberotomy is usually advised to reduce this relapse tendency. Fiberotomy is usually performed toward the end of the active orthodontic therapy, i.e., a few weeks before the removal of the orthodontic appliance [45].

Crown lengthening is usually performed in teeth with shorter clinical crown to facilitate proper placement of orthodontic appliance. Crown lengthening is usually performed by gingivectomy or an apically repositioned flap in combination with gingivectomy prior to orthodontic bonding procedures [46].

Preorthodontic osseous surgery is mainly indicated for crater, hemiseptal defect, three-wall defect, and furcation lesion. Osseous craters are interproximal, two-wall defects that do not improve with orthodontic therapy alone. Some shallow craters (i.e., 4-5 mm pocket depth) can be maintained nonsurgically during orthodontic therapy. Large craters can be eliminated by reshaping the bony defect. This enhances the patient's ability to maintain these interproximal areas during orthodontic treatment.

Three-wall defects are amenable to pocket reduction with regenerative periodontal therapy. Bone grafts are usually advised to fill these defects. If the result of periodontal therapy is stable, orthodontic treatment can be initiated 3-6 months after periodontal surgery [47].

Alveolar ridge augmentation and placement of implants for orthodontic retention are other adjunctive procedures performed to achieve orthodontic treatment goals.

Gingival invaginations were usually noted after the orthodontic closure of extraction space. These invaginations act as a site for plaque retention and are considered as one of the risk factors for periodontal

disease during orthodontic treatment. A surgical correction of these invaginations is usually performed to eliminate plaque accumulation [48]. The gingival margin level of the six maxillary anterior teeth plays an important role in the aesthetic appearance of the crowns. Discrepancies in the gingival margin level may be due to ectopic eruption of the tooth or due to altered position of the gingiva. A combined orthodontic-periodontic interdisciplinary approach is usually preferred to correct these abnormalities.

Missing interdental papilla are frequently referred to as gingival "black holes" and may be due to a number of factors such as over-divergence of adjacent roots and advanced periodontal disease with loss interdental alveolar crest. An orthodontic periodontic interdisciplinary approach is usually advised to manage these problems [49].

Periodontally accelerated osteogenic orthodontics (PAOO)

Surgically accelerated modalities like selective alveolar decortication (SAD) and periodontally accelerated osteogenesis orthodontics can be used as an adjunct to conventional approaches to accelerate orthodontic tooth movement (OTM) with fewer adverse effects. SAD is a procedure where linear and punctuate decortications are made after reflecting the flap [50-52]. The decortications should not impinge on root-PDL-cribriform plate complex and not extend to the alveolus crest. Accelerated OTM occurs due to inflammation and wound healing processes that are evoked by surgical trauma to the alveolar bone. In addition, alveolar bone surgery may also stimulate the production of MSCs in marrow cavities that function synergistically with neighboring PDL and alveolar bone cells resulting in accelerated OTM. Addition of bone graft to a teeth moving through a surgical wound increases bone mass and enhances long-term stability [52]. The term popular is the "regional acceleratory phenomenon" with normal metabolic rate of inflammation and wound healing process is accelerated.

CONCLUSION

Harmonious cooperation between the periodontist and the orthodontist offers great possibilities for the treatment of combined orthodontic-periodontal problems. Orthodontic treatment along with patient's compliance and absence of periodontal inflammation can provide satisfactory results without causing irreversible damage to periodontal tissues. Orthodontic treatment can expand the possibilities of periodontal therapy in certain patients, contributing to better control of microbiota, reducing the potentially hazardous forces applied to teeth and finally improved the overall prognosis. Participation of the periodontist is also essential, either in management of orthodontic-periodontal problems or in specific interventions aiming to prevent orthodontic treatment's relapse.

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