Periodontic-orthodontic interactions—rationale, sequence and clinical implications

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ABSTRACT Periodontic-orthodontic interactions are mutually beneficial. Combined periodontic and orthodontic treatment can greatly enhance periodontal health and dentofacial esthetics. Adjunctive orthodontic management of pathological tooth migration has unique effects in subjects with moderate to advanced periodontitis. Orthodontic treatment should only be undertaken with healthy periodontium or healthy periodontium with reduced height, and oral hygiene instruction and regular periodontal care are essential during orthodontic tooth movement. Conversely, appropriate adjunctive periodontal procedures may facilitate orthodontic treatment in selected subjects. A predictable treatment outcome needs coordination of care between the two disciplines along with appropriate risk assessment. Successful treatment and its long-term maintenance can be achieved through close collaboration between the periodontist and orthodontist.

Key words: Esthetics; Orthodontics; Periodontal diseases

Introduction

Periodontic and orthodontic interactions usually deal with the establishment of an appropriate diagnosis and the treatment planning needed to enable coordinated period-ortho therapy. These interactions are mutually beneficial, allowing diseased periodontium to be significantly improved and permitting orthodontic tooth movement.

Adjunctive orthodontic treatment for periodontal patients

Among the most notable clinical signs of advanced periodontitis is pathological tooth migration including labial flaring, irregular spacing, rotation or extrusion of anterior teeth 1 (Figure 1). The pathological migration of teeth is usually caused by unresolved inflammation and subsequent destruction of periodontal tissues, increasing periodontal tension and leading to direct extrusion of teeth where this is not prevented by opposing forces.

Figure 1 An adult male patient with untreated advanced periodontitis presents with marked pathological migration of anterior teeth

Anterior teeth are therefore especially prone to elongation and displacement, since they are not protected by occlusal forces and have no anterior-posterior contacts able to inhibit tooth migration 2. Currently there is increasing demand for the improvement of dentofacial esthetics and oral functions to improve quality of life in adults, especially those with periodontally compromised conditions. A desire to improve their dentofacial appearance has been found to be the prime motivating factor for seeking treatment in adult patients 3,4. To ensure a predictable treatment outcome and avoid unwanted pitfalls, excellent coordination of care between the disciplines of periodontics and orthodontics is crucial.
Adjunctive orthodontic treatment is an essential component in the comprehensive management of patients with advanced periodontitis, which may involve orthodontic intrusion, bodily tooth movement, rotation, uprighting, and extrusion. It may facilitate other dental procedures needed for controlling periodontal disease and restoring oral functions. However, there are negative effects and risks inherent in patients with periodontal disease if the orthodontic treatment is poorly executed. These include gingival recession, attachment loss, bone resorption, and root resorption. In clinical practice, risk assessment and risk control are essential to allow predictable treatment outcomes to be achieved. Usually, high-risk patients are those with unresolved existing periodontitis, untreated aggressive periodontitis, heavy smoking habits, uncontrolled diabetes, genetic defects, poor compliance, and hypermobile teeth with occlusal trauma, or those with ‘special’ habits. Established evidence shows that in dentition with height-reduced but clinically healthy periodontium, orthodontic treatment does not induce destruction of periodontal tissues, if the periodontal disease is well controlled and regular maintenance is carried out. It is apparent that the crucial factors in the orthodontic treatment of patients with periodontal disease are the appropriate control of existing inflammation prior to commencing the orthodontic treatment and subsequent regular periodontal supportive care during orthodontic treatment (Figures 2 and 3).

Orthodontic treatment in periodontal patients with height-reduced periodontium differs considerably from that performed in subjects with healthy periodontium. One should be aware of the biomechanics and the importance of the treatment sequence. The key elements are listed as follows: (1) formulation of a tailor-made comprehensive treatment plan consisting of hygiene, corrective and maintenance phases; (2) orthodontic treatment undertaken within clinically healthy periodontium; (3) use of lighter force with greater moment and force ratios; (4) establishment of a stable anchor; (5) close monitoring of treatment progress; (6) regular periodontal care during active orthodontic tooth movement; (7) establishing appropriate retention after orthodontic treatment; and (8) long-term periodontal maintenance care. The biomechanical elements should be emphasized in adjunctive orthodontic treatment of periodontally compromised patients. When periodontal attachment and alveolar bone have been lost, the periodontal ligament area decreases significantly. Subsequently, the height-reduced periodontium exerts greater pressure on the periodontal ligament along with an increase in the magnitude of the tipping moment for a given force due to the apical shift in the center of resistance, which may cause damage to periodontal tissues and the root. Therefore, the absolute magnitude of orthodontic force should be reduced and a countervailing moment must be applied accordingly. It is also essential to select and establish stable anchor teeth without tipping, and periodontally compromised...
teeth can be splinted as appropriate to form combined and enhanced anchorage allowing tooth movement. For this reason a fixed appliance is usually the preferred option for adjunctive orthodontic treatment. When considering the best time to begin orthodontic treatment in patients with moderate to advanced periodontitis, multiple factors should be considered. These include the patient’s compliance, motivation and plaque control levels, an effective periodontal treatment response, periodontal stability, and establishment of a relatively stable occlusion. Patients should be followed for a period of up to 6 months after active periodontal treatment, for observation of resolution of inflammation and healing, prior to commencing orthodontic tooth movement. A clinical management protocol before, during and after orthodontic treatment has been recommended by Sanders as follows:

1. Before orthodontic treatment: an acceptable oral hygiene level; control of active periodontal disease; full documentation including periodontal chart, updated X-rays, risk assessment report, periodontal clearance statement; and decision-making on commencement, postponement and reassessment, or referral. When the orthodontic treatment commences, a consent form should be signed as an essential legal document.

2. During orthodontic treatment: regular oral hygiene instruction (OHI) and re-enforcement; regular recall and monitoring; control of risk factors; provision of necessary periodontal treatment; and application of simple orthodontic appliances and mechanics, e.g. no hooks and elastomeric rings, avoiding excess flash around bracket bases, and using bonds rather than bands.

3. After orthodontic treatment: regular OHI reinforcement with correction of traumatic brushing as appropriate; regular recall and monitoring; control of risk factors; provision of necessary periodontal treatment; and design of a long-term retainer with particular attention to providing a flexible spiral wire retainer bonded on lingual tooth surfaces in a segment and a hygienic periodontal splint.

Overall, a positive outcome with adjunctive orthodontic treatment is achievable in patients with periodontitis, as long as the treatment follows the standard protocol (Figure 4). Furthermore, specific periodontal problems may be better managed through adjunctive orthodontic treatment, following successful control of the periodontal inflammation. These include drifting incisors, tilted posterior teeth, traumatic overbite, certain intrabony defects, and various mucogingival problems. Previous reports from us and others show that the coordinated combination of periodontal treatment and orthodontic intrusion can result in the re-alignment of extruded teeth with intrabony defects and obtain a significant reduction of probing depth, gain of clinical attachment and bone fill on radiographs, as well as a significant enhancement of the esthetic profile.

**Adjunctive periodontal treatment for orthodontic patients**

Adjunctive periodontal procedures can facilitate orthodontic tooth movement enabling more effective and predictable outcomes.

**Surgical exposure of unerupted teeth**

Excision of gingival tissue over the embedded tooth with preservation of existing keratinized tissue can facilitate subsequent orthodontic treatment.

**Frenectomy**

It has been recommended that a frenectomy be performed.
in the maxillary midline for young children, because a midline diastema could be caused by the maxillary labial frenum. This may be considered prior to the closure of a large diastema overlying a frenum in early transitional dentition. Generally, surgical removal of a maxillary labial frenum should be delayed until after orthodontic treatment, unless the tissue prevents space closure or becomes painful and traumatized 19.

Supracrestal fiberotomy

This involves detachment of the supracrestal fibers to enhance the retention of a re-established tooth position 20,21. This procedure may be performed after correction of pre-orthodontically rotated teeth, especially maxillary lateral incisors in Class II division 2 problems, prior to debonding after mild overcorrection 19. A long-term prospective study 22 showed that this surgical procedure was more successful at reducing relapse in the maxillary anterior segment than in the mandibular anterior segment. There was no clinically significant increase in the periodontal sulcus, nor was a decrease in the labially attached gingiva of the teeth observed following the surgical procedure 22.

Mucogingival surgery

Pre-orthodontic mucogingival surgery might be considered in selected patients having teeth with thin gingiva and/or inadequate zones of keratinized gingiva to prevent further mucogingival involvement post-orthodontically. The decision should be made after careful consideration of growth and development, tooth position, type and direction of the anticipated tooth movement, oral hygiene, integrity of the mucogingival junction, tissue type, inflammation, muscle pull, frenum attachment, mucogingival and osseous defects, anticipated tissue changes, and profile demands 19.

Alveolar ridge augmentation

Under certain circumstances, osseous augmentation may be preferred pre-orthodontically because of the need for increased bone mass serving as alveolar housing.

Dental implants

When the existing anchorage is inadequate or lacking due to a decreased number of abutment teeth or reduced periodontal support, dental implants can serve as additional anchorage for facilitating orthodontic therapy 23.

Crown lengthening surgery

This can assist placement of orthodontic bands on teeth with short crowns and contribute to correction of the gummy smile as well 5,24 (see below).

Periodontic-orthodontic interfaces in gingival esthetics

The clinical management of esthetic problems secondary to advanced periodontitis is challenging for dental professionals. There are three typical situations: discrepancies in the gingival margin, missing papillae and the gummy smile 24,25. Appropriate treatment varies between cases, which may involve periodontal plastic surgery and/or orthodontic treatment.

Discrepancies in the gingival margin

If the gingival margin discrepancy is obvious on smiling, the correction required might be considerable. When the gingival sulcular depth is unequal over the teeth concerned, coronal-lengthening surgery may be performed. When crown length is concerned, extrusion of the relatively longer central incisor may move its gingival margin coronally for correction of the discrepancy with subsequent leveling of the resulting incisal edge accordingly 24,25. If the discrepancies are due to tooth over-eruption following incisal abrasion, the over-erupted tooth may be slowly intruded to allow apical migration of the gingival margin 25.

Missing papillae

This is usually due to the loss or cratering of interdental alveolar crests. This condition can be significantly improved by enameloplasty, orthodontic tooth movement and selective cosmetic bonding as appropriate 24,25. When the problem is not well resolved, direct-bonding resin may be an option 25. In recent years, a papillae creation procedure has been a predictable approach of improving the condition when performed by an experienced clinician 26.

The gummy smile

If the gummy smile is due to vertical maxillary excess in adults, orthognathic surgery may be the treatment of choice 27,28. If it is due to delayed apical migration of the gingival margins with shortened clinical crowns, gingivectomy may be one of the options for correction 24. In an individual with normal vertical maxillary development,
a gummy smile due to overeruption of the upper incisors, most commonly seen in Class II division 2 malocclusions, may be managed by orthodontic intrusion 23.

Conclusions

Adjunctive orthodontic treatment for patients with periodontal disease has some unique effects. Orthodontic treatment should only be undertaken with a healthy, or height-reduced but clinically healthy periodontium. Dental health education, enhanced oral hygiene instruction and regular periodontal care are essential during orthodontic treatment. Appropriate adjunctive periodontal procedures may facilitate orthodontic treatment enabling the achievement of more effective and predictable outcomes. A better treatment outcome that could be maintained long-term may be achieved through close collaboration between the periodontist and orthodontist.

References