Periodontic-Orthodontic Interactions in Solving Dentofacial Esthetics

Meenakshi Singh, Praveen Mehrotra, Jitendra Bhagchandani

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.

Keywords: Esthetics, Orthodontics, Periodontal diseases.

INTRODUCTION

The goal of orthodontic treatment is not only to improve facial esthetics and function but also to address to the health of supporting structures and how teeth are placed in them. No matter how talented the orthodontist is, a magnificent orthodontic correction can be destroyed by failure to recognize periodontal susceptibility. Both the short- and long-term successful outcomes of orthodontic treatment are influenced by the patient’s periodontal status before, during and after active orthodontic therapy, which also includes post-treatment maintenance by the patient.

Periodontal pathogenesis is a multifactorial etiologic process, and the orthodontist must recognize the clinical forms of inflammatory periodontal diseases. Cooperation between different specialties in dentistry is extremely important in establishing diagnosis as well as in treatment planning. One such interaction exists between orthodontics and periodontics. The interrelationship between orthodontics and periodontics often resembles symbiosis. In many cases, periodontal health is improved by orthodontic tooth movement, whereas orthodontic tooth movement is often facilitated by periodontal therapy. There are certain questions which come in the way of day to day orthodontic practice while treating an adult patient, i.e. does orthodontic treatment provide dental health benefits in addition to the esthetic benefits? Do malocclusions harm the periodontium? Is correcting malocclusions with orthodontic treatment beneficial for periodontal health? Thus, the purpose of this paper is to enlighten some of these questions and give a better way to the orthodontist to manage such cases.

DISCUSSION

Orthodontic and Periodontic Interactions

Statistically significant periodontal differences between patients with normal and malaligned teeth have been noticed indicating that irregular teeth are a predisposing factor to periodontal disease. Various studies have shown that there is reduction in alveolar bone height in areas of increased overjet, gingivitis is generally associated with crowding and the level of bacteria is higher in areas of crowding compared with normal areas in same patient (Fig. 1).

Benefits of Orthodontics for a Periodontal Patient

There are several benefits of orthodontic tooth movement in improving the periodontal condition of the patient, such as aligning crowded or malposed teeth permits the adult patient a better access to clean all surfaces of their teeth adequately. Orthodontic tooth repositioning can improve certain types of osseous or bony defects. Certain periodontal procedures improve the esthetic relationship of the maxillary gingival margin. It allows correction of open gingival embrasures to regain lost papilla. It can also improve the adjacent tooth
position before implant placement or tooth replacement for the patient who has missing teeth and drifting and tipping of adjacent dentition has occurred. Age is not a contraindication for orthodontic treatment and lighter forces should be used since there is a decreased cellular activity of the PDL. An advanced periodontal disease affects 8 to 30% of population.6,7

**Periodontal Risk Assessment before Orthodontic Treatment**

Before starting the orthodontic treatment a careful assessment of periodontal health condition should be assessed, as several studies have reported that if orthodontic is performed in persisting periodontal disease it may aggravate the situation (Fig. 2). Zachrison et al8 reported an increase in gingival pocket depth after orthodontic treatment with edgewise appliance due to edematous swelling in the gingiva and by tissue accumulation during tooth movement but not by deepening of the pocket. Hence, special emphasis should be given on the following:

**History**

The following questionnaires should be kept in mind while taking the history of the patient. The patient should be asked about:

i. The occurrence of any previous periodontal disease
ii. Drug history, e.g. use of long-term corticosteroids, phenytoin, etc.
iii. Systemic diseases or physiological conditions, e.g. pregnancy, diabetes, asthma, chronic renal failure, etc.

**Clinical Examination**

Check for the following:

1. Bleeding on probing
2. Tooth mobility
3. Thin fragile gingiva
4. Pockets.

**MICROBIOLOGY ASSOCIATED WITH ORTHODONTIC MATERIALS**

Studies9-11 have reported that orthodontic band placement causes an overall increase in salivary bacterial counts especially *Lactobacillus, Prevotella intermedia, P. gingivalis, Bacteroids forsythus*, etc.

Periodontal response to various kinds of tooth movement12 (Tables 1 and 2) in periodontally compromised patients.

Orthodontic treatment is based on the premise that when force is applied to a tooth, it is transmitted to the adjacent investing tissues, certain structural alterations take place within these tissues which allow for and contribute to tooth movement. The various tooth movements that occur during orthodontic tooth movement are:

1. Extrusion
2. Intrusion
3. Tipping
   - Uncontrolled
   - Controlled

**Extrusion**

Extrusion or eruption of a tooth, or several teeth, along with reduction of the clinical crown height is reported to reduce infrabony defects and decrease pocket depth and this tooth movement even causes formation of new bone at the alveolar crest as the tooth erupts with no occlusal factor present. Raymond yukna et al (1985)13 studied the effects of extrusion of teeth with advanced periodontal disease. Extruded teeth had shallower pocket depths, less gingival inflammation and no bleeding on probing. The improved periodontal condition resulting from extrusion was because the subgingival microbial plaque may have been converted to a supragingival plaque by the extrusive tooth movement, thereby lessening its pathogenicity and effect on gingival tissues. Marc et al (2000)14 found that orthodontic extrusion of impacted teeth does not jeopardize their periodontal health (Fig. 3).
Table 1: Effects of orthodontic treatment on the periodontium

<table>
<thead>
<tr>
<th>Term</th>
<th>Effect</th>
</tr>
</thead>
<tbody>
<tr>
<td>Short</td>
<td>Gingivitis and gingival enlargement</td>
</tr>
<tr>
<td></td>
<td>No attachment loss</td>
</tr>
<tr>
<td></td>
<td>Effects are reversible</td>
</tr>
<tr>
<td>Long</td>
<td>Root resorption (1.0-1.5 mm)</td>
</tr>
<tr>
<td></td>
<td>Attachment loss in areas of active periodontitis</td>
</tr>
<tr>
<td></td>
<td>Effects are often irreversible</td>
</tr>
</tbody>
</table>

Table 2: Periodontal tissue response to orthodontic force

<table>
<thead>
<tr>
<th>Force</th>
<th>Tissue response</th>
</tr>
</thead>
<tbody>
<tr>
<td>Heavy force (forces far exceeding capillary blood pressure)</td>
<td>PDL on pressure side ischemia and degeneration of PDL = hyalinization = more delay in tooth movement</td>
</tr>
<tr>
<td>Moderate force (force exceeding capillary blood pressure)</td>
<td>PDL strangulation resulting in delay in bone resorption</td>
</tr>
<tr>
<td>Light force (force equal or less than capillary blood pressure)</td>
<td>Direct resorption—simultaneous bone resorption and formation = more continuous tooth movement</td>
</tr>
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Fig. 3: Cutting fibers on the normal side prevents an angular defect. Uncut fibers on the lesion side produce leveling of the bone defect during extrusion (arrow)

**Intrusion**

Intrusion alters the cementoenamel junction and angular crest relationships, and creates only epithelial root attachment; therefore, a periodontally susceptible patient is at greater risk of future periodontal breakdown. When this tooth movement is properly executed, it improves the periodontal condition and is beneficial to periodontal health (Fig. 4A). Orthodontic forces, when kept within biological limits, do not induce tissue alterations leading to loss of connective tissue attachment and periodontal pocket formation. The gingiva moves in the same direction as that of tooth intrusion but it moves only by about 60%. Gingival sulcus gets deepened by about 40% of tooth intrusion.

Ericsson et al (1987) have demonstrated in experimental animals that orthodontic intrusion of teeth can shift supra-gingivally located plaque to a subgingival location (Fig. 4B), leading to formation of infrabony pockets and loss of connective tissue attachment. Melsen et al (1989) found that incisor intrusion in adult patients with marginal bone loss had a beneficial effect where the post-treatment radiographs showed positive bone remodeling. Clark (1991) studied the effect of intrusion on the microvascular bed and fenestra in the apical periodontal ligament of rat molar. They found that with intrusive loading, the small arterial fenestra population was unchanged. Hence, it is essential that periodontal treatment with elimination of the plaque induced lesion be performed before the initiation of orthodontic treatment. Maintenance of excellent oral hygiene during the course of treatment is equally important.

**Indications of Intrusion**

1. It is indicated for teeth with horizontal bone loss
2. For increasing the clinical crown length of single teeth.

**Tipping**

a. **Uncontrolled tipping**: When heavy forces applied at the alveolar crest while performing uncontrolled tipping tooth movement, severe destruction of the epithelial attachment and crestal bone loss takes place. The crestal bone loss shifts the
center of resistance apically, thus, a large amount of moment will be generated on application of a very small amount of orthodontic force.\textsuperscript{12}

b. Controlled tipping: Controlled tipping produces high forces in the periodontal ligament, as the fulcrum shifts more and more apically with increasing amounts of bone loss. In fact, cases have been documented where a gingival lesion has been converted into a periodontal lesion by the injudicious use of tipping movements. Some studies\textsuperscript{17} have shown mild gingival changes which are associated with orthodontic appliances are transitory. These cause no periodontal damage and, if any damage is caused, it get resolved on its own.

**Bodily Movement**

Recently studies\textsuperscript{18} have shown that bodily movement causes an improved connective tissue attachment and worsens the bony defect. Hence, this movement is contraindicated when there is a periodontally compromised patient.

**PERIODONTAL SURGICAL PROCEDURES\textsuperscript{19}**

**Gingival Curettage**

Curettage means scraping of the gingival wall of a periodontal pocket to remove infected and necrotic tooth substance. It removes the inflamed soft tissue lateral to the pocket wall. The aim of the curettage is to reduce pocket depth by enhancing gingival shrinkage and new connective tissue attachment. It is also performed on recall visits as a method of maintenance treatment for areas of recurrent inflammation and pocket deepening.

**Gingivectomy**

Gingivectomy means excision of gingiva.\textsuperscript{20} The gingivectomy technique is useful in improving orthodontic results, especially in cases with missing maxillary central or lateral incisors, after premolar autotransplantation or in gummy smiles. It is possible to permanently increase the clinical crown length after orthodontic treatment by labial gingivectomy technique (Figs 5A and B).

**Gingivoplasty**

Gingivoplasty\textsuperscript{20} is the reshaping of gingiva to create physiologic gingival contours, for the sole purpose of contouring the gingiva in the absence of pockets.

**Crown Lengthening**

Crown lengthening\textsuperscript{20} is a simple localized gingivectomy to the bottom of the clinical gingival sulcus will increase the crown length. As shown in a human experimental model, nearly 50% of the excised tissue will regenerate and become clinically and histologically indistinguishable from normal gingiva (Figs 6A and B).

**Fibrotomy**

Methods to reduce the relapse of orthodontically treated rotated teeth could be the use of fibrotomy technique. Periodontal fiber bundles that influence stability are the principal fibers of PDL and the supra-alveolar fibers. Fibers of PDL remodel completely only after 2 to 3 months. The supra-alveolar fibers are stable and have a slower turnover.

The supracrestal gingival tissues contribute to rotational relapse and hence the technique of ‘circumferential supracrestal fibrotomy’.\textsuperscript{21-23} The trans-septal fibers are cut interdentally by entering the PDL space. Clinical healing occurs in 7 to 10 days.

It is not indicated during active tooth movement or in the presence of gingival inflammation. When performed in healthy tissues after orthodontics, there is minimal attachment loss.

**Frenotomy**

Hyperplastic types of frenum with fan-shaped attachment may obstruct diastema closure, and hence surgical intervention is desirable (Figs 7A and B).

In the past, frenectomy was undertaken. The complication with frenectomy is that the complete removal of the frenum may result in gingival recession between the central incisors. Hence, frenotomy with only partial removal of the frenum with the purpose of relocating the attachment in a more apical direction is currently undertaken.

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Figs 5A and B: (A) Preoperative condition with gingival hyperplasia and pseudopockets at the time of orthodontic treatment, the lower incisors are not visible. Measurement and marking of the pocket depth were done, then gingivectomy was performed, (B) after 8 days of postoperative condition. Crown build was also performed for the maxillary left right central incisor to improve the esthetics.
**Distraction Osteogenesis of the Periodontal Ligament**

DO is the process of growing new bone by mechanical stretching of pre-existing bone tissue. A new concept of distracting the PDL is proposed to elicit canine retraction in 3 weeks. This is called dental distraction. The PDL acts as a suture between the bone and the tooth. It was observed from that the periodontal ligament can be rapidly distracted without complications with the use of this technique which intensifies tooth movement.

**MANAGEMENT OF PERIODONTALLY COMPROMISED PATIENTS IN AN ORTHODONTIC OFFICE**

The following should be considered when a patient reports with an advanced periodontal disease:

i. Disease control, hygiene maintenance
ii. Use bonded rather than banded attachments
iii. Use self ligating brackets/steel ligatures
iv. Schedule periodontal maintenance visits in addition to orthodontic visits
v. Advise mechanical aids such as powered toothbrushes, interdental brushes, etc.
vi. Advise chemical aids, such as chlorhexidine.

**Potential Benefits of Orthodontic Treatment on the Periodontium**

The orthodontic treatment improves the width of attached gingiva especially when moving a labially positioned tooth lingually. Orthodontic tooth movement induces of bone formation in certain conditions. It can re-establish the alveolar bone as well as can reduce pocket depth. The closure of spaces which are formed by extraction of teeth due to gross caries may help prevent periodontal disease complications in that area.

**CONCLUSION**

Although comprehensive orthodontic treatment cannot preclude the possibility of periodontal disease developing later, it can
be useful part of the overall treatment plan for a patient who already has periodontal involvement.

REFERENCES