



## ORTHO-PERIO RELATIONSHIP: IS IT A NUPTIAL KNOT

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### ABSTRACT

Teeth are responsible for aesthetics and functions such as chewing, speech etc. The thought is that, strong and sound periodontium is required for patients who desire orthodontic treatment. So, are people with poor periodontium denied orthodontic treatment? Or is it vice versa, that is, is orthodontic treatment limited by poor periodontium? This article will give a broad review on the inter relationship between orthodontics and periodontics.

**KEYWORDS:** Orthodontics, Periodontium, Bone resorption, Bone apposition.



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## INTRODUCTION

The term periodontium refers to the supporting structures of the tooth, comprising of the gingiva, the periodontal ligament, alveolar bone and the cementum. The gingiva, which is the soft tissue component of the periodontium, is normally firm, resilient and coral pink in colour. Inflammation of the gingiva, termed as gingivitis is characterized by redness and swelling of the gingival and is often associated with bleeding on probing and in more advanced cases, purulent discharge<sup>1</sup>. The primary etiological factor behind gingivitis is the plaque microbial biofilm<sup>2, 3</sup>. The other possible causes of gingivitis include over hanging dental restorations, closely placed roots, palato-gingival grooves, furcation anatomy and cervical enamel projection<sup>4, 5</sup>. Progression of the advanced lesion of gingivitis is known as the 'phase of periodontal breakdown' or periodontitis<sup>6</sup>. Periodontitis could be chronic or aggressive or in association with systemic diseases<sup>7</sup>. It can be localized or generalized. Chronic periodontitis is a slowly progressive disease where gingival inflammation may not be apparent. It is usually painless and often detected on probing<sup>7</sup>. Aggressive periodontitis is characterised by rapid progression leading to a severe destruction of the periodontium<sup>7</sup>. Orthodontic treatment involves an application of a continuous controlled force (by a fixed appliance) or intermittent forces (by removable appliance) which induces cellular changes in the periodontal ligament resulting in tooth movement. A sound periodontium is essential for maintaining the integrity of the dentition. During the course of orthodontic treatment the role that the healthy or diseased periodontium plays is often not understood or emphasised upon. However, it is imperative to understand that periodontal support forms the basis for orthodontic therapy. The objective of this review is to discuss the interplay between orthodontics and periodontics.

### **PERIODONTAL RESPONSE TO EXTERNAL FORCES**

The tooth in the oral cavity is subjected to a variety of forces differing in magnitude, direction, duration and frequency. The healthy periodontium is able to adapt itself to these

forces by altering the number and width of the ligament fibers<sup>8</sup>.

### **Nature of forces**

Any normal force on the periodontium (forces exerted during orthodontic movement) results in compression of the periodontal ligament on the side towards which the forces is applied, while on the other side it is stretched. On the compressed side there is a transient avascularity resulting in a zone of hyalinization. The magnitude of force applied determines the thickness and action of this zone. If the force remains normal, there is alternating bone resorption and bone deposition resulting in tooth movement in the direction of force. If the periodontium is healthy, the zone of hyalinization hinders tooth movement which is followed by undermining resorption (bone resorption from marrow spaces) resulting in periodontal regeneration. Zachrisson<sup>9</sup> demonstrated the relationship between orthodontic treatment and the periodontium. He showed that during the process of orthodontic treatment, plaque accumulation adjacent to the orthodontic band can result in gingivitis and progress to periodontitis with significant loss of connective tissue attachment. In prolonged orthodontic therapy or when the forces are chronically heavy, the compressed side undergoes ischaemia and cell death. In such a case of diseased periodontium, the zone of hyalinization will prevent tooth movement because of failure of regeneration of the periodontal ligament<sup>10</sup>.

### **Type of orthodontic movement**

Most commonly employed movements in orthodontics are intrusion and extrusion, rotation, retraction and protraction.

### **Intrusion and extrusion**

Intrusion is basically employed in teeth with horizontal bone loss or for increasing the clinical crown of single tooth. Essentially, intrusion alters the cemento-enamel junction and angular crestal relationship thereby creating only epithelial root attachment. Research done is contradictory on the effects of intrusion on gingiva. While Murakami et al<sup>11</sup>

showed movement of gingiva in the direction of intrusion, Erkan et al<sup>12</sup> found no changes in gingiva associated with intrusion. Interestingly, reduction in gingival recession has also been noticed in periodontally compromised teeth<sup>13</sup>. However, ineffective control of inflammation may result in deepening of the periodontal pocket<sup>14</sup>. Root resorption along with transient apical displacement resulting in reduced pulpal blood flow has also been demonstrated<sup>15, 16, and 17</sup>. Extrusion of teeth with advanced periodontal disease may have a positive result both clinically and histologically<sup>18</sup>. This has been shown in several reports wherein, coronal migration of the root, increased bone ridge, quantity of attached gingiva<sup>19 and 20</sup>, reduction of periodontal pocket depth<sup>21</sup>, reduced bacterial pathogens resulting in improved healing of osseous defects<sup>22</sup> and increase in the width of keratinized gingiva<sup>23</sup> has been reported.

### **Rotation**

Teeth treated by rotational movement demonstrate a higher tendency for relapse due to a faulty tissue arrangement during the retention phase<sup>24</sup>. The supracrestal fibres have been shown to be responsible for this relapse<sup>25, 26 and 27</sup>. While evidence on this is not unequivocal with different percentage of cases showing relapse<sup>25 and 26</sup>, the anatomy of the root appears to be the primary contributing factor. Roots with conical shape had an uniformly affected periodontium.

### **Retraction and protraction**

When orthodontic forces are applied to the anterior teeth that are proclined or retroclined the pattern of bone resorption and deposition is quite different. When anterior teeth are retracted the palatal bone undergoes resorption on the surface facing the roots of the anteriors whereas, the cortical bone facing the palatal gingival surface shows apposition. On the contrary, in the labial aspect of the anteriors, the surface of the bone facing the roots show apposition and bone resorption on the labial surface of the cortical bone. When force is applied to protrude the retracted teeth, the sequences of events that take place are just the opposite to those mentioned in the previous condition.

## **PERIODONTAL FACTORS THAT INFLUENCE ORTHODONTIC TREATMENT**

The following mucogingival issues play an important role during orthodontic movement- gingival recession, abnormal frenal and muscle attachments, dehiscence and fenestration, pathological migration.

### **Gingival recession**

Labial movement of teeth during orthodontic treatment may result in gingival recession in the upper or lower anteriors<sup>28</sup>. In the absence of keratinized gingiva, orthodontic treatment only further deteriorates gingival health<sup>29</sup>. In 28.6% of the cases undergoing tooth movement, gingival cleaving occur<sup>29</sup>.

### **Abnormal frenal and muscle attachments**

These are factors secondary to gingival recession. Abnormal frenal attachment may result in constant plaque accumulation resulting in gingival recession<sup>30</sup>. However, a cross sectional investigation disregarded frenal attachment<sup>31, 32</sup> as the only etiological factor of recession.

### **Dehiscences and fenestrations**

Root surfaces denuded of bone but covered only by periosteum and gingiva are termed fenestration. The marginal bone in these cases are intact. If integrity of the marginal bone is lost, the defect is termed a dehiscence. During movement of teeth in a facial direction, dehiscence and fenestration may be produced in the alveolar bone. If the teeth are moved back to their original position the bone will reform. So, orthodontic treatment may be considered an etiological factor as well as a treatment option for management of these defects<sup>33</sup>.

### **Pathological migration**

Pathological migration is important from two perspectives- it affects the dentofacial aesthetics, it results in severe periodontal breakdown. Treatment of teeth with pathological migration has to satisfy both these issues. Uprighting of molars, intrusion and rotation of teeth are the treatment options. It has been shown that these treatment options decreased the pocket depth<sup>34, 35</sup>, improves alveolar bone defects<sup>36</sup>, gingival aesthetics and the crown root ratio<sup>36</sup>.

However, pocket elimination therapy should be performed prior to intrusion to prevent apical displacement of plaque and further worsening of periodontal status<sup>37</sup>.

#### **PREVENTIVE PROGRAMME FOR ORTHODONTIC PATIENTS**

- Prior to start of treatment: Active control of periodontal disease, by proper oral prophylaxis.
- During treatment: Emphasis on maintenance of oral hygiene with proper brushing techniques and other interdental aids, periodic evaluation by dentist
- At the end of the treatment: Patients to be motivated to maintain good oral hygiene and follow proper dental follow ups. Nowadays, the uses of herbal mouthwashes are gaining popularity due to its advantages over the chemically prepared mouthwashes. They can be easily prepared at home and can be used safely by the patients. These are only adjunct to the oral hygiene measures such as brushing and flossing<sup>38</sup>.

#### **SURGICAL METHODS TWINING ORTHODONTICS AND PERIODONTICS**

There are certain surgical procedures that are done, which links orthodontics and periodontics. Such treatments are done prior, during and post orthodontic treatment. Treatment done prior to start of the orthodontic treatment are- frenectomy, gingivectomy, pocket elimination procedures, operculectomy (to facilitate forced eruption procedure). Circumferential supracrestal fibrotomy, gingival augmentations are usually done during the course of the treatment to facilitate tooth movement. At the end of the treatment, aesthetic treatments such as gingival sculpting, mucogingival surgery for root coverage are done. Apart from these, circumferential supracrestal fibrotomy, frenectomy are done as relapse preventive measures.

#### **RECENT ADVANCES**

The strong association between periodontics and orthodontics has resulted in a concept termed as PAOO (periodontally assisted osteogenic orthodontics)<sup>39</sup>. This technique is based on Bryan's technique of corticotomy facilitated tooth movement which was later modified by Kole as a combined radicular corticotomy or supra-apical osteotomy by using a combination of demineralised freeze dried bone allograft or a bio absorbable alloplastic graft. This technique is a combination of selective decortications which facilitated orthodontic movement and alveolar augmentation. An increase in the virulence of the micro biota has also been noticed due to orthodontic treatment<sup>40</sup>. To counteract this, anti bacterial agents like chlorhexidine, have been added to resins and glass ionomer cements. Addition of 18% of chlorhexidine digluconate to glass ionomer cement brought about a significant reduction in the bacterial counts<sup>41</sup>. A recent report showed that metronidazole gel with natural polymers could be used for targeted delivery for the management of periodontal lesions<sup>42</sup>.

#### **CONCLUSION**

Orthodontic treatment has both beneficial and harmful effects depending on the patient's compliance and maintenance of oral hygiene. It improves the mucogingival condition, induces bone formation, and re-establishes the biological width. On the contrary, it may also lead to gingivitis, periodontitis, loss of attachments, interdental clefts and marginal bone loss in patients who fail to maintain a good oral hygiene. Adult orthodontic treatment can be performed on both healthy and diseased periodontium with few detrimental effects. However if light continuous forces are to be employed, the patients maintenance of oral hygiene throughout the active phase of therapy is the key to success of orthodontic treatment. Where indicated, periodontal treatment should precede orthodontic care in the treatment plan.

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