

How to Cite:

Indumathi, P., Aniz, A., Hemalatha, R., Vishnu, R. A., Veeramuthu, M., & Sankar, S. P. (2022). Orthodontic-periodontic interdisciplinary approach: A literature review. *International Journal of Health Sciences*, 6(S2), 63–70.
<https://doi.org/10.53730/ijhs.v6nS2.4962>

Orthodontic-Periodontic Interdisciplinary Approach: A Literature Review

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Abstract---In the last few years, there has been a major advancement in the orthodontic treatment of adult patients. Adult orthodontics differs from children's orthodontics in that there is virtually no more growth in adults and that the tooth-supporting structures, the periodontium, have changed. Because orthodontic treatment is done through the periodontium, having a healthy tooth supporting system is a must. At the same time, when the tooth moves under the influence of orthodontic treatment, the periodontium undergoes a variety of modifications. This review article discusses relationship between periodontal tissue and orthodontic treatment.

Keywords---adult patients, interdisciplinary approach, orthodontics, periodontium, recession.

Introduction

In the late 1800s, Kingsley claimed that age isn't a limiting factor when it comes to tooth movement. However, orthodontists have limited their services to children and adolescents for a long period. In the 1960s and 1970s, however, the primary motivation for obtaining orthodontic treatment was to prevent oral disorders such as caries and periodontal disintegration. Adults have been able to have orthodontic treatment since then¹. According to Perregaard, while untreated malocclusion is the primary complaint of 50% of adults seeking orthodontic treatment, a considerable percentage of patients (12%) seek orthodontic therapy to avoid the onset or progression of periodontal diseases. Adult patients' higher compliance compensates for the slower tissue response. The goal of periodontal therapy is to keep the teeth's attachment apparatus healthy. Patients' teeth would be destroyed, resulting in pathological migration. This can result in spacing, occlusion collapse, and a reduction in vertical dimension². Orthodontic treatment can correct or, at the very least, prevent these issues from getting worse. It was discovered in the 1960s that orthodontic band placement resulted in a widespread rise in salivary bacteria present, particularly lactobacillus. Orthodontic patients can be classified into three categories: (1) Patients with good oral health; (2) Patients with periodontal disease and/or loss of permanent teeth; and (3) Patients with severe skeletal discrepancies.[4] A multidisciplinary approach involving an orthodontist and a periodontist is required to treat patients belonging to the second category. While treating such patients, both specialists should be involved in treatment planning, and the treatment progress should be evaluated and shared. This review article discusses relationship between periodontal tissue and orthodontic treatment.

Periodontal tissue response to orthodontic force

- Effect of force magnitude
 - LIGHT PRESSURE: PDL is compressed on the pressure side and stretched on the tension side when the force is less than or equal to the capillary blood pressure. Metabolic alterations take place. Within the PDL and frontal lobes, cellular differentiation begins. The process of resorption is underway. The movement of teeth begins as a bony movement as remodels of sockets.
 - HEAVY PRESSURE: When the force is high, blood arteries within the POL get blocked on the pressure side, resulting in cell death in the compressed area. This causes hyalinization, which inhibits resorption. As a result, the ideal force levels for orthodontic tooth movement in PDL should be just high enough to activate cellular activity without totally occluding blood vessels.
- Effect of type of tooth movement

The force per unit area determines the PDL reaction. As a result, the ideal force levels for orthodontic reasons vary depending on the sort of tooth

movement required. Because the area of PDL that is being loaded is smaller than the overall PDL area, the force should be adjusted accordingly.

- **Effect of orthodontic forces on PDL**
PDL rearrangement is required for orthodontic tooth movement. Orthodontic therapy is predicted to result in a moderate increase in mobility. Heavy forces crush PDL, impairing resorption, discomfort, and mobility, and should therefore be avoided. All forces should be stopped if a tooth becomes extremely flexible during orthodontic treatment.
- **Effects on root structure**
Orthodontic tooth movement is characterised by root remodelling. Despite the possibility of correction, patients who have had longer-term complete orthodontic treatment demonstrate average shortening of their teeth. In the vast majority of cases, the shortening is undetectable and clinically insignificant. In orthodontic treatment, severe resorption is uncommon.
- **Effect on height of alveolar bone**
Except in cases of uncontrolled periodontal disease, excessive loss of crestal bone height is nearly never seen.
- **During orthodontic appliance therapy**, Artun J, Krogstad O (1987) noticed the development of bone dehiscence and some gingival retraction during severe proclination of anterior teeth, especially in patients with thin alveolar housing⁴.

Periodontal response to different types of orthodontic forces

According to Siew Han Chay, orthodontic extrusion can move the gingival edge incisally by up to 9 mm. When the mandibular incisor was intruded orthodontically, Erkan noted that the gingival edge and mucogingival junction moved in the same direction as the teeth by 79 and 62 percent, respectively. Extrusion of the mandibular incisor causes gingival edge and mucogingival junction to migrate 80 and 52.5 percent in the same direction as the extruded teeth, respectively. As a result, the sulcus depth is reduced without a considerable reduction in the breadth of the connected gingival. There was also no evidence of attachment loss. Alstad found no significant loss of attachment in patients undergoing orthodontic treatment in a longitudinal study. They came to the conclusion that if a professional preventative programme is followed during orthodontic treatment, attachment loss can be kept to less than 0.1 mm per surface.⁵⁻⁷

Mucogingival changes during orthodontic treatment

The periodontium is not damaged by properly applied orthodontic forces, according to popular belief. However, a lack of attached gingival width is widely thought to be a risk factor for recession. According to Lang and Loe's findings, 2 mm of keratinized gingiva is sufficient to maintain gingival health. Alveolar bone dehiscence is thought to be a risk factor for the development of gingival recession. As a result, orthodontic tooth movement (OTM) will not cause recession as long as a tooth is contained within the alveolar bone. Batenhorst discovered that incisor tilting, extrusion, and body motions result in apical shift of the labial gingival edge and loss of attachment in monkeys. A human research, on the other hand, came up short.⁸⁻¹¹

Periodontics as an adjunct to orthodontic treatment

Unless the tissue has become uncomfortable or limits space closure, the maxillary labial frenum should not be surgically removed until after orthodontic treatment. Forcing a labially or palatally impacted tooth to erupt is a typical orthodontic technique. An apically or laterally positioned pedicle graft would be required to expose the impacted tooth while preserving the keratinized tissue, which would require the expertise of a periodontist. A circumferential supracrestal fibrotomy can be used to maintain tooth rotation once it has been accomplished with orthodontic therapy.

Mucogingival operations may be required to maintain a suitable width of the connected gingiva during orthodontic therapy. The pathological migration of anterior teeth is a common cause of cosmetic concern in adults, and the etiological reasons can include attachment loss, behaviours such as bruxism and tongue pressure, inflammatory periodontal tissue, and unreplaced missing teeth. All of these factors have the potential to cause functional and aesthetic issues. This could be one of the main reasons for seeking orthodontic treatment. Once the periodontal disease is under control, orthodontic treatment can begin. A good treatment outcome can be achieved in a patient with compromised dentofacial aesthetics using this method¹²⁻¹⁶.

Orthodontics as an adjunct to periodontal therapy

There is a relationship between malocclusion and periodontal health, according to research. A periodontally compromised patient can benefit from orthodontic therapy in a variety of ways. Certain osseous abnormalities in periodontal patients can be improved by vertical repositioning of teeth by orthodontic therapy. Orthodontic therapy, which permits open gingival embrasures to be treated, can be used to reclaim the lost papilla. If the patient has been missing teeth for several years and has tipping and drifting of adjacent teeth, orthodontic treatment can help improve the position of the adjacent teeth. Patients with severe anterior fractures who require forced eruptions for root restoration may benefit from orthodontic therapy. This will provide the crown preparation enough resilience and form retention.

If OTM is desired in a patient with periodontitis, Tulloch believes that fixed appliance therapy is the better option. Teeth can be easily splinted to achieve solid anchoring with a fixed appliance. He also emphasises the significance of lowering force magnitude and using counteracting moments to alleviate stress on periodontal ligament fibres. When trying tooth movement in a height-reduced periodontium, Lijian lists the many precautions to be considered, including ensuring secure anchorage and long-term periodontal maintenance treatment. Deepa described how orthodontic soft aligners were used to reposition a periodontally compromised tooth. The soft aligner's light and intermittent stresses promote tissue regeneration during tooth movement. In patients with severely attrited lower anterior teeth, orthodontically assisted occlusal improvement may be required in addition to periodontal procedures.¹⁷⁻¹⁹

Gingival discrepancies which can be treated by orthodontic therapy

Uneven gingival margins

Four criteria must be reviewed in order to make an informed decision about which treatment to choose.

- When the patient smiles, analyse the relationship between the patient's lipline and the gingival margin of the maxillary central incisors. If there is a gingival margin disparity but it is not visible, it does not need to be corrected.
- Over the two central incisors, the labial sulcular depth is measured. When the gingival margin of a clinically shorter tooth with a deep sulcus needs to be moved, excisional gingivectomy may be the best option. Gingival surgery, on the other hand, may be ineffective if the sulcular depth of the short and long incisors is the same.
- The smallest central incisor's connection to the adjacent lateral incisor is assessed. The lengthier central incisor is extruded and the incisal edge is equilibrated if the shortest central incisor is still longer than the lateral incisor. The gingival margin will migrate coronally as a result, and the gingival margin discrepancy will be eliminated.
- Examining the teeth from an incisal perspective allows you to see if the incisal edges are abraded. If one incisal edge is thicker labiolingually than the next tooth, it could indicate that the incisal edge has been abraded and the tooth has overerupted. In this case, intruding the small central incisor is the best way to rectify the disparity since it will move the gingival margin apically and allow the incisal edges to be restored.

Lack of gingival papillae or open gingival embrasures

The presence of papilla between the maxillary central incisors is an important aesthetic factor in each individual. When adults have missing gingival papillae or open gingival embrasures, periodontal therapy might be difficult to provide. Orthodontic therapy, on the other hand, can help us fix them. The morphology of the tooth, the angulation of the root, and periodontal bone loss are the most common causes of open gingival embrasures. First and foremost, determine whether the issue is caused by the papilla or the tooth contact. If the papilla is the issue, the cause is a lack of bone support caused by a periodontal condition. Tooth contact problems are the source of many open embarrassments. Examine with an intra-oral periapical radiograph of the central incisor at this time. If the root angulations are found to be divergent from one another, brackets can be used to rectify the root location. If the roots are properly angled, the open contact could be due to abnormal tooth shape. The contact areas between central incisors are usually 2-3 mm long, however in these cases where shape is an issue, the contact areas are 1 mm between the two central incisors. The ideal way to fix these issues is to construct a diastema by reshaping the central incisors' mesial surfaces.²²

Osseous defects which can be treated by orthodontic therapy

Hemiseptal defects

Around mesially pointed teeth or supra erupted teeth, these types of abnormalities are common. In the event of a mesially tipped tooth, uprighting the tooth and eruption of the tooth can assist level the bone defect. Intrusion of the tooth and levelling of the surrounding cement enamel junction might assist level the osseous flaws if the tooth is supraerupted.

Furcation defects

They're difficult to keep clean and can make orthodontic treatment more challenging. Eliminating class III furcation by hemisectioning the crown and root of the tooth is one form of treatment. Moving the roots apart orthodontically allows for optimal restoration and splinting over the neighbouring edentulous areas if the hemisectioned teeth are to be utilised as abutments for a bridge. After hemisectioning, endodontic and periodontic surgery, and orthodontic components can be placed on respective teeth to separate roots in these patients. This procedure produces a place that can be cleaned more easily and efficiently, as well as eliminating the furcation process.

Accelerated osteogenic orthodontics and periodontal implications

Procedures like accelerated osteogenic orthodontics (AOOs) are becoming more common in an attempt to shorten treatment times. When temporary anchorage devices were utilised in conjunction with AOO, Kim et al. reported fast tooth movement. This method, on the other hand, necessitates decortications and the subsequent implantation of graft material. As a result, when this procedure is used, continual periodontal monitoring is essential. Partnership with a periodontist will become necessary for orthodontists in the near future, as the popularity of these invasive procedures grows.

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