

Challenges in Integrated Orthodontic-Periodontic Treatment: A review article

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Received: 13.08.2024

Revised: 22.09.2024

Accepted: 07.10.2024

ABSTRACT

Introduction: As the periodontium is normally affected in adult orthodontic treatment, orthodontics and periodontology are more connected than is true of many other Branches of dentistry. In most of the cases of orthodontic treatment, diagnosis, mid-course periodontal reevaluation, and postorthodontic evaluation, periodontal consideration is mandatory. It can also be useful to remember that periodontal health always influences orthodontic success. Evidenced in the study was that periodontal disease patients require additional treatment from orthodontic tooth movements.

Aim of work: To elucidate the orthodontic-periodontic relation for the enhancement of therapy techniques and the attainment of optimal treatment outcomes in patients.

Methods: The keywords "interrelationship, orthodontic treatment, periodontal treatment, clinical assessment, orthodontics, periodontics" were used to conduct a thorough literature search in the MEDLINE database in order to find relevant publications published between 2020 and 2024. Using the proper search terms, Google Scholar was utilized to find and access pertinent scientific publications. Various inclusion criteria were used to choose which articles to select.

Results: The research included in this study was published from 2017 to 2024. The research included a discussion segment that was broken into many specific elements. Orthodontics and periodontal health are intricately linked. Some areas that are plaque-retentive may be eliminated using orthodontic. Due to altering life and objectives of individuals, more and more people start to consider having orthodontic treatment. An inter-relationship between orthodontists and periodontists is effective and can improve the planning of the treatment, in a qualitative functional and esthetic manner giving the best possible plans especially in complex case scenarios. Moreover, well developed periodontal surgical procedures such as piezosurgery and PAOO may augment the movements of orthodontic teeth thus, shortening treatment time of every session.

Conclusion: The study's conclusions highlight the value of an interdisciplinary approach to dental care and call for increased cooperation between periodontists and orthodontists in order to guarantee complete oral health care and maximize treatment outcomes.

Keywords: interrelationship, orthodontic treatment, periodontal treatment, clinical assessment, orthodontics, periodontics

INTRODUCTION

Dentofacial aesthetics as a principle of contemporary dentistry has been utterly successful and has led to an increase demand of orthodontic treatments in adults and children (Koaban et al., 2024). Increasing adult patients are demanding orthodontic treatment because of the advancement in orthodontic material and techniques and esthetic fixed appliances including lingual appliances and ceramic brackets. These patients usually present with periodontal issues and orthodontic needs in most cases making the periodontal management and treatment a combined approach. A thorough comprehension of orthodontics and periodontics is crucial in the management of these patients (Han, 2024).

Both periodontics and orthodontics could benefit from the interdisciplinary cooperation of the specialists. Bone remodeling is done alveolar bone is the process by which orthodontic treatment causes displacement of the teeth. The PDL which depends on periodontium health and which plays an essential role for bone remodeling is what enables the teeth to shift (Singh et al., 2021). Periodontal care is therefore integral in orthodontic therapy as it begins from the time of orthodontic diagnosis up to the mid-course assessment and after treatment assessment. Maxillary front teeth proclination, having little or no interdental space, and rotation of teeth, super

eruption, pathologic migration, dental abscess, tooth loss and traumatic occlusion are other orthodontic features that are associated with poor periodontal health in people (Garbo et al., 2023).

Orthodontic intervention may be required during periodontal therapy. Moved teeth orthodontically will enhance biofilm and bacterial plaque control, increase dental profile cleanliness, correct faulty gingival and osseous position, enhance aesthetics, and provide better foundations for prosthetic dentures (Newman et al., 2023). The periodontist and the orthodontist have to collaborate to evaluate all periodontal conditions and to decide on the most effective orthodontic therapy in order to enhance the end results (Newman et al., 2023). This review sought to elucidate the orthodontic-periodontic correlation and examine the collaborative efforts of both disciplines to enhance patient care.

Aim Of Work

To elucidate the orthodontic-periodontic correlation and examine the collaborative efforts of both disciplines to enhance patient care

METHODS

Scientific researches involved in this review were obtained through scientific websites (Google scholar and Pubmed) using various keywords (interrelationship, orthodontic treatment, periodontal treatment, clinical assessment, orthodontics, periodontics) to obtain all possible articles related to the current subject. The articles were chosen based on a set of criteria for selection. First, each article's main titles and abstracts were reviewed, and then we excluded duplicate articles, non-full text articles, irrelevant articles, and case reports. The publications examined in this review were published between 2017 and 2024.

RESULTS

The current study included research on the challenges in integrated orthodontic-periodontic treatment. The publications considered were published throughout the timeframe of 2020 to 2024. Hence, in the discussion part, the review was organized according to several topics such as Orthodontic Treatment Effects on the Periodontal Parameters, Orthodontic treatment in supplement to periodontal therapy, Periodontal therapy as a supplement to orthodontic therapy.

DISCUSSION

Orthodontic Treatment Effects on the Periodontal Parameters

Oral Hygiene Maintenance

Studies demonstrate that good management of gingival inflammation prevents orthodontic therapy from adversely affecting periodontal attachments (Harshita et al., 2018). However, fixed orthodontic appliances may hinder oral hygiene, leading to plaque buildup (Calniceanu et al., 2020). Orthodontics may increase the risk of periodontal disease by compromising proper oral hygiene.

Proper dental hygiene is challenging in a malocclusion case because some areas cannot easily be washed, thus leading to breath problems and experience of more pain and bleeding (Alauddin et al., 2021). Among orthodontic patients, few clinical researchers have quantified severe clinical attachment loss (CAL) and periodontal disease in the maxilla and mandible. Food holing can also be caused by inadequate cleaning of the teeth within the molar regions due to molar bands (Antonarakis et al., 2024). However, using a thorough mouth cleanliness protocol throughout orthodontic treatment reduces any negative effects such as gingival bleeding or plaque indices, there exists a positive association between periodontal health status and plaque control. Javali et al. (2020) have correlated the occurrence of aesthetic malocclusion with periodontal diseases in patients under orthodontic treatment.

Bracket Positions and Molar Band Placements

Orthodontic bands that are anchored subgingivally may exert pressure on the alveolar bone. While bonded appliances have differing impacts on periodontal condition compared to bonded appliances. Whereas bonding appears to be less toxic with regard to inflammation and disconnection compared to banding (Ivanović et al., 2020). Interproximal gingival hyperplasia induced by orthodontic bands may lead to the formation of what is known as "pseudo periodontal pockets" (Inchingolo et al., 2023). Nonetheless, gingival hyperplasia tends to settle a few weeks after cessation. If one wants to reason out, it should be noted that the slots oriented in the orthodontic bands are placed perpendicular to the long axis of the tooth instead of parallel to the occlusal plane in order to minimize hyperplasia. Furthermore, the increased root divergence can lead to the locomotor system presenting an unattractive open gingival embrasure if the position of brackets is based on incisal margins (Nambiar et al., 2022). On the other hand, Lu et al. (2018) showed that patients with healthy periodontium will derive much more benefit from orthodontic treatment using The Clear Aligner system than from lingually or labially bonded appliances.

Orthodontic forces and periodontal health

When undergoing orthodontic treatment, decided forces are applied on teeth. As a result of the imposed pressures, the periodontal and dental tissues begin to remodel. In the unarchived literature, mild and continuous pressures ranging from 5 to 15 g are preferred for an affected periodontium. After periodontal surgery, shift of the teeth can happen between week one week, through one year (KBM skill 2). Also, some papers have suggested that the degree of root resorption rises with increasing force magnitude (Al-Kyssi et al., 2022; Ma et al., 2021). The difference in the force distribution explains the relationship between the risk of root resorption and steady or oscillating pressures. Most of the researchers concur that the application of sporadic pressures results in reduced root resorption due to the interference presented cementum provided a chance to remineralize amid sequential tooth movements (Wang et al., 2020).

Orthodontic treatment in supplement to periodontal therapy

Often periodontal therapy is used in combination to orthodontic therapy. These movements include intrusion, rotation and tooth uprighting are commonly recommended to correct pathologically misplaced teeth, to counteract further destruction of periodontal tissues, and to enhance the overall facial aesthetics and functional occlusion, all of which enhance the patients' standard of living. Neither, before the active periodontal disease has been brought under control perhaps orthodontics may be attempted.

Teeth movement association with infra-bony defects

Orthodontic movement of teeth with infra-bony abnormalities is feasible in the absence of inflammation and with adequate bacterial plaque management. This is carried forward by the suggestion that tooth movement through an intra-bony defect occurs by 'carrying the bone along with the tooth as the case is and as much as clinical trials may not offer much in this regard improving the bone defect and the positioning of teeth adjacent to an implant or theoretical tooth (Antoun et al., 2017).

Orthodontic extrusion

Gingival tissues change their form in response to the motion of teeth. 'Forced eruption' associated with orthodontic extrusion is defined as the movement of a tooth's intact connective tissue attachment to a more apical position, established by deposition of bone (Antoun et al., 2017). This can be used in order to alter the position of the free gingival margin and/or the clinical crown length (Antonarakis et al., 2024). This is achieved by showing that the clinical attachment is at the crestal bone level following the cemento-enamel junction (CEJ). As a result, there is decrease in the rate of intraosseous anomalies because of the increase (or reconstruction) of the crestal bone associated with the ejected tooth + adjacent teeth. Concerning to clinical crown lengthening, orthodontic extrusion accompanied by supra-gingival fibrotomy should be suggested. Meanwhile, as mentioned by Choudhary et al. (2017), it is inadvisable to perform osteotomy at the crestal bone.

An orthodontic extrusion could be practically applied for the treatment of the vertical periodontal conditions. It appears that the most effective means of achieving bone augmentation at the implant recipient site is to dentally move an irreversible tooth before implanting it. In this case the buccolingual thickness of the alveolar ridge has to be augmented. Low level forces should be applied while extruding the tooth and it is recommended that the amount of labial root torque should not exceed two millimeters each month. Additionally, a retention period of one month is preferable before tooth extraction. While akin to surgical augmentation, the total duration of orthodontic extrusion therapy may be reduced (Hayashi & Shin, 2019).

Orthodontic intrusion

The patients with normal vertical maxillary development and with maxillary anterior supra eruption are appropriate for orthodontic tooth intrusion. It can also be of some value as therapy for teeth with infrabony pockets or horizontal defects in the bone, and in lengthening crown preparations where there is abnormal bone overgrowth. To permit anchoring fibrovascular tissue also reposition itself to this newly intruded position, these teeth should be maintained in their intruded position for at least six months (Solanki et al., 2022). Proper maintenance of oral hygiene may facilitate beneficial periodontal changes through the use of intrusive orthodontic pressures. On the other hand, poor oral hygiene and invasive dental procedures may encourage the development of bacterial plaque in the subgingival region, exacerbating the already-existing periodontal disease. During aggressive tooth intrusion, proficient supragingival and subgingival debridement is required. Orthodontic tooth movement uses light forces, ranging from 5 to 15 g per tooth, which may lower the risk of root resorption (Newman et al., 2023). Furcation abnormalities necessitate specialized and concentrated attention during orthodontic therapy. In such instances, maintenance is an ongoing challenge, and the furcation abnormalities may deteriorate during orthodontic treatment. In the case of a Class III furcation, performing a hemisection of the tooth and segregating the roots may yield superior results. To rehabilitate a supraerupted tooth with an osseous defect, it may be essential to intrude the defect and then level it (Zucchelli et al., 2017).

Guided tissue regeneration (GTR) may be pertinent in specific circumstances related to orthodontic encroachment. Currently, there are no definitive indications. Published case studies indicate that when orthodontic intrusion is necessary, the use of GTR techniques prior to the intrusion facilitates new bone formation and gingival reattachment. Additional research indicates that incursion may augment blood circulation and exacerbate a particular osseous defect, hence establishing advantageous conditions for guided tissue regeneration (Melsen, 2022).

Uprighting permanent molars

Mesially inclined molar alignment requires distal tooth movements in order to allow alveolar bone to cover the mesial deficiency. On the mesial side, a plaque-retentive region and gingival overgrowth are also removed (Yuvaraj & Kumar, 2020). One common clinical observation is the mesial inclination of the second molar, particularly the mandibular one, which results from the absence of the first molar. Possessing this mesial inclination increases the risk of developing localized periodontitis. In order to mitigate or resolve existing periodontal diseases, orthodontic uprighting is seen to be a beneficial technique. Following pockets have not been seen to form, improve, or disappear as a result of orthodontically straightening mesially inclined teeth (Yuvaraj & Kumar, 2020).

Periodontal therapy as a supplement to orthodontic therapy

Because, irritations often occur before the orthodontic treatment through periodontal ligaments, it is advised to have periodontal therapy. If, irrespective of the orthodontic therapy, improved plaque control and reduced probing depth is possible, then phase 2 periodontal (surgical) treatments are initiated for any mild to moderate periodontal pockets. New attachment gains are considered minimal, yet open-flap debridement remains the standard of care initial treatment when pocket depths and bleeding on probing persist post initial periodontal treatment (Garbo et al., 2023).

If anatomical defects are shallow, for example with osseous crater type of defect that is within 4-5 mm from the bottom of the periodontal pocket, it is recommended that regenerative periodontal therapy be performed prior to attempting orthodontic tooth movement. In addition, this may reduce the frequency of having periodontal surgery with orthodontic therapy. However, osseous abnormality of osseous crater type or severe intrabony defect that disables proper hold of tooth may possibly remain untreated with conventional orthodontic therapy. These defects are not amenable to complete instrumentation due to the unfavorable crown-root scenario and the level of CAL that would be expected following osseous surgery. It is essential that periodontal therapy is finalized 3-6 months prior to commencing orthodontic treatment (Schmerman & Obando, 2020).

Proclination or labial tooth movements

Dental crowding can best be addressed via labial tooth movements, or the proclination of teeth. Gingival recession is frequently believed to have its origins in these movements. For the best periodontal health, there must be at least two millimeters of keratinized gingiva. Gingival regression is the outcome of orthodontic pressures that put strain on the gingival margin (Esen et al., 2022). The orthodontic proclination of the incisors increases the risk of recession and attachment loss, particularly in areas lacking in gingival and osseous support, such the lower incisor area. In order to keep the connecting gingiva's proper breadth throughout orthodontic therapy, mucogingival surgery may be recommended. Recession is hypothesized to not occur when orthodontic movements occur inside the functionally or genetically defined "bone envelope" (Antuon et al., 2017). According to a recent study by Meyer-Marcotty et al., the excessive labial tilting of the mandibular incisors during decompensation—which was necessary—did not negatively impact the periodontal structures in patients with mandibular prognathism who underwent orthognathic surgery. The 'bone envelope' notion is supported by this research (Meyer-Marcotty et al., 2021).

Although proclinations and labial tooth movements do not always result in gingival recession, they can occasionally cause the dehiscence of sensitive soft tissues or bone, especially in areas where sensitivity to inflammation or trauma is reduced. Notably, lingual tooth movements have the potential to cause small incisal gingival migration and increased labiolingual gingival widths, while labial movements have the opposite effect (Shekar et al., 2017).

Unequal gingival margins

In terms of aesthetics the contours of the gingival margins of six maxillary anterior teeth must harmonize. The gingival margins of the maxillary central incisors should lie 1 mm apical to the CEJ and should be parallel to the cusp tips aesthetically in order to provide pleasing smile line. Thakur et al, (2024) indicate that teeth in proximity to the lateral incisor may well have a lower aspect of 1-2 mm. Variences in the position of the gingival edge could possibly be as result of ectopic tooth budding or shift in placement of the gingiva. The fact is that if no abrupt difference in the gingival margin is seen, no changes are made. If the shorter tooth has a deeper sulcus, an excisional gingivectomy probably would be necessary to achieve primary closure and bring

the gingival border closer to the tooth crown. An incisal edge of one tooth may be thicker labiolingually than the other if the former has been overerupted or abraded as compared to the latter. Periodontal therapy and orthodontic treatment should ideally be done as a part of a single clinic so as to treat these distortions. Routine overerupted teeth need to be accessed with light orthodontic forces. According to Yousif et al., 2020, orthodontic encroachment should be done at least six months before the removal of the appliance to minimize the chance of relapse (Yousif et al., 2020).

The missing interdental papilla

Papilla is the tissue that lies between two teeth; the presence or absence of a papilla between maxillary central incisors is one of the key components within the framework of aesthetics. Patients with open gingival embrasure or patients who do not possess gingival papillae present difficult cases in periodontal management. On the contrary, the orthodontic therapy might be beneficial. Three reasons are usually given for an open interdental space: represents a shift in position of the bone, bone recession, cavity formation, root direction or tooth shape. This would entail factors such as distance from contact points to the bone crest, the height of the papilla in the interdental space, the extent of root convergence, and the shape of the tooth.: The evaluation of various factors such as the distance between contact points and the bone crest, height of the papilla in the interdental space, extent of root divergence and the morphology of the tooth should guide the best treatment approach. Firstly, one must ask whether the problem is with the papilla or with the tooth contacts. If the papilla is troublesome, the inadequate bone support might be explained by periodontal disease. In some cases, additional steps are needed, including enameloplasty (reduction of interdental black triangle width), orthodontic tooth movement, and specific composite resin augmentation (Thakur et al., 2024). Following proximal recontouring and orthodontic tooth approximation, the soft tissues between adjacent teeth collapse to create a new papilla.

Some open embrasures have been caused by dental contact issues. They should be examined using a central incisor periapical radiograph. If the root angulations are divergent, the root location radiographically may be changed by the use of brackets. An open contact may occur if there is a large, triangular or bell shaped teeth, depending of the position if the roots are well positioned. They also observed that if a point contact is close to a tooth's incisal edge, black triangles could occur (Thakur et al., 2024). Although, in certain cases, additional surgical procedures are required to correct the gingival contour, simple diastema closure and interproximal enamel reduction will enable the surgeon to rebuild the lost papilla in ninety percent of the instances.

Excessive gingival display

Contemporary beauty parameters define that an ideal maxillary gingival show should range between 1mm and 2mm in size. It is noticeable that the degree of gingival display increases during childhood and gradually declines with age. As mentioned earlier when assessing and managing gummy smiles, it is important to keep age of the patient as one of the determinates in treatment planning (Helwig et al., 2017). Any possibility to have gummy smiles sometimes need to be identified before starting orthodontic treatment. Gummy smiles can be attributed to a hyperactive upper lip, abnormally short lip, excessive lower facial height, increased vertical dimension of the maxilla, protrusion of the front dental alveolus, and shortened clinical crown length. The treatment will depend on the cause and has to be given properly; Niemczyk et al., 2024).

In some people, they present cases of marked deviations from the ordinary apical migration of the gingival boundaries as well as presenting a gingival sulcus probing depth of 3-4mm. This kind of gummy smile is characterized by two main clinical features: a significantly higher thickness of the labiolingual gingival tissue and less clinical crown height. Moreover, surgical aesthetic operations that requires moving or altering the position of the gingival margin has to be deferred and perhaps reconsidered in early adulthood unless the esthetic problem is potentially fatal. More, dentist stated that change form and location of gingival level have a higher probability in adolescents. There is usually considerable gingival show because the maxillary anterior teeth show a strong tendency for extrusion. Apex enlargement of maxillary incisors is often indicated in the Angle Class II Division 2 cases, which is quite widespread; in case of the gummy smile (Partal& Aksu, 2017).

Orthodontics with corticotomy

In order to enhance rate of such biomechanical alterations, corticotomy assisted orthodontics (CAO) approaches have been utilised. In the year 1959, a Dentist by the name Henry Köle developed corticotomy, which was faster method of tooth movement. Conventional knowledge shows that the primary obstacle to orthodontic tooth migration is the bone cortical plates. As the cortical bone is sectioned to optimise the rate of tooth displacement, dental and marginal periodontal health remain uncompromised in the CAO (Charrier & Ancel, 2019).

Three main procedures make up Köle's surgical technique: an infraosseous transverse osteotomy; buccal longitudinal incision; and vertical incision on the lingual surface of the mandible. CAO construes the targeted tooth and its corresponding bone as a single "bony block", thus accelerating tooth movement. But this approach has not been practiced much due to high work load stress and patient compliant. It appears that because of localized tissue reactions to damaging stimuli the tissues heal faster than they should (without the need for

corticotomy). Orthodontic tooth movements are enhanced by increased osteoblastic and osteoclastic problematic biology as well as up-regulated levels of inflammatory modulators in the sites around the incisions (Apalimova et al., 2020). When compared to other tooth movement techniques the CAO has following benefits such as short treatment duration, ease of the arch expansion, and less root resorption. Further, it minimizes relapse possibility and improves the stability after orthodontic treatment (Dukka et al., 2018).

CONCLUSION

Orthodontics and periodontal health are closely interconnected. Orthodontics may eradicate regions that harbor plaque. A dynamic periodontium is crucial for enabling orthodontic tooth motions. A growing percentage of adults are contemplating orthodontic treatment due to evolving lifestyles and ambitions. In these situations, a combined orthodontics-periodontics strategy is beneficial and can enhance qualitative, functional, and aesthetic planning, resulting in optimum treatment plans, particularly in intricate clinical instances. However, other kinds of periodontal surgeries such as piezocision and PAOO may enhance ease of tooth movements during orthodontic treatment, reduce duration of treatment and enhance effectiveness.

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