

Ortho-perio relation: A review

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ABSTRACT

Orthodontic treatment aims at providing acceptable functional and aesthetic occlusions using appropriate tooth movements. These movements are specifically related to interactions of the teeth with their supportive periodontal tissues. Periodontic and orthodontic interactions usually deal with the establishment of an appropriate diagnosis and the treatment planning needed to enable coordinated periodontic-orthodontic therapy. A harmonious cooperation of the periodontist and the orthodontist offers great possibilities for the treatment of various orthodontic-periodontal problems. The present discussion focused on the effects of a combined periodontal and orthodontic treatment on the periodontal health and dentofacial aesthetics, and the mode that each field can contribute to optimize treatment of combined orthodontic-periodontal clinical problems.

Key words: Adult orthodontics tooth movement, interdisciplinary approach, orthodontic therapy, periodontics

INTRODUCTION

Orthodontic-periodontic interactions are mutually beneficial. The combined approach can greatly enhance the periodontal health and dentofacial aesthetics in many situations. The main aim of periodontal therapy is to restore and maintain the health and integrity of the attachment apparatus of teeth.^[1] Orthodontic treatment aims at providing acceptable functional occlusion and aesthetic occlusion with appropriate tooth movements. These movements are strongly related to the interactions of teeth with their supportive periodontal tissues.^[2] Orthodontic treatment can be justified as a part of periodontal therapy if it is used to reduce plaque accumulation, correct abnormal gingival and osseous forms, improve aesthetics, and facilitate prosthetic replacement.^[3]

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PERIODONTAL TISSUE RESPONSE AND ORTHODONTIC FORCES

Tooth movement induced by orthodontic force is the result of placing controlled forces on teeth. The applied force causes remodeling changes in the dental and periodontal tissues. Orthodontic force application results in compression of the alveolar bone and the periodontal ligament on one side while the periodontal ligament is stretched on the opposite side. The bone is selectively resorbed on the compressed side and deposited on the tension side.^[4]

Light orthodontic force, i.e., force less than capillary blood pressure, causes periodontal ligament ischemia with simultaneous bone resorption and deposition resulting in continuous tooth movement. Moderate orthodontic forces, i.e., forces exceeding capillary blood pressure lead to periodontal ligament strangulation resulting in delayed bone resorption. Strong/heavy orthodontic forces, i.e., forces far exceeding capillary blood pressure, cause ischemia and

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degeneration of the periodontal ligament on the compressed side resulting in hyalinization with more delay in tooth movement.^[5]

The most common periodontal problems that can be solved by minor orthodontic procedures are mainly the correction of crowding, pathologic tooth migration, mesially tilted molar, closure of midline diastema, etc.

ORTHODONTIC TREATMENT AS AN ADJUNCT TO PERIODONTAL THERAPY

In many situations, orthodontic treatment can serve as an adjunct to periodontal therapy. Various orthodontic treatments such as uprighting, intrusion, and rotation are performed to correct the pathologically migrated teeth that control further periodontal breakdown, improve oral function, and provide acceptable aesthetics. These procedures should be performed only after controlling the periodontal disease.

Although there is no consistent relation between malocclusion and periodontal disease, certain characteristics of malocclusion can promote a pathologic environment and hinder periodontal therapy.^[3] Correction of crowded or malposed teeth permit the patient better access to clean all the surfaces of his/her teeth. Food impactions are also reduced or eliminated by the creation of proper arch form and proximal contact.^[6]

Orthodontic uprighting of the tilted molars has several advantages: The distal movement tooth allows the deposition of alveolar bone on the mesial defect. This also eliminates the gingival folding and plaque retentive area on the mesial side.^[7]

Orthodontic extrusion of teeth may be indicated for shallowing out intraosseous defects and for increasing the clinical crown length of single teeth. Extrusion results in coronal positioning of intact connective tissue attachment along the tooth and also the bone deposition.^[8]

Orthodontic intrusion has been recommended for teeth with horizontal bone defect or infrabony pockets, and for increasing the crown length of a single tooth. The intrusion of plaque-infected teeth may lead to apical displacement of supragingival plaque, which results in periodontal destruction.^[9] Professional supragingival and subgingival scalings are important during the active phase of intrusion.

Furcation defects require special attention during orthodontic treatment. They are difficult to maintain and can worsen during orthodontic treatment. In Class III furcation cases, a possible method for treating the furcation is by hemisecting the crown and root and pushing the roots apart may be advantageous.^[3]

The hemiseptal defects can be eliminated using uprighting, extrusion, and leveling of the bone defect.^[10] Bodily movement of the tooth into an intrabony defect has been believed to “carry the bone,” along with the tooth, that results in improvement of the defect. This could improve adjacent tooth position before placement of implant or tooth replacement.^[6] If the tooth is supraerupted with osseous defect, intrusion and leveling of the bone defect can help to eliminate these problems.

PERIODONTAL TREATMENT AS AN ADJUNCT TO ORTHODONTIC THERAPY

Properly delivered orthodontic forces do not induce any damage to the periodontium. However, it is widely believed that insufficient width of the attached gingiva predisposes the development of recession. To maintain proper gingival health, a 2-mm width of keratinized gingiva is adequate.^[11] Tension on the gingival margin during orthodontic force application also results in gingival recession.^[12] Orthodontic proclination of the incisors have a greater risk of recession and loss of attachment, especially in areas with minimal gingiva and bone support. To maintain adequate width of the attached gingiva in these conditions, mucogingival surgery may be advised during the course of orthodontic treatment.^[1]

High frenal attachment is considered to be one of the causes for midline diastema. The abnormal frenum prevents mesial migration of the central incisor and the aberrant fiber increases the relapse tendency after orthodontic space closure. Surgical removal of the frenum is usually advised in these situations and it should be performed after the completion of orthodontic treatment unless the frenum prevents space closure or become painful or traumatized.^[11]

Forced eruption of an impacted tooth is a common orthodontic treatment procedure. Proper exposure of the impacted tooth and preservation of the keratinized tissue are important to avoid loss of attachment after orthodontic treatment. Apically or laterally positioned pedicle graft is usually advised in this situation.^[13]

Orthodontic tooth movement results in reorganization of collagenous fibers, elastic fibers, and the periodontal ligament to accommodate the new tooth positions. In order to prevent orthodontic relapse and to achieve proper rearrangement of the supporting tissues, the teeth must be retained. However, Sharpey’s fibers of the newly formed bundle bone as well as supraalveolar and transseptal fibers undergo rearrangement even after 4-6 months of retention, especially after the correction of rotation. Hence, the teeth must be retained for at least 12 months to allow time for complete remodeling of these fibers. Circumferential supracrestal fiberotomy is usually advised to reduce this relapse tendency.

Fiberotomy is usually performed toward the end of the active orthodontic therapy, i.e., a few weeks before the removal of the orthodontic appliance.^[14]

Crown lengthening is usually performed in teeth with shorter clinical crown to facilitate proper placement of orthodontic appliance. Crown lengthening is usually performed by gingivectomy or an apically repositioned flap in combination with gingivectomy prior to orthodontic bonding procedures.^[15]

Preorthodontic osseous surgery is mainly indicated for crater, hemiseptal defect, three-wall defect, and furcation lesion. Osseous craters are interproximal, two-wall defects that do not improve with orthodontic therapy alone. Some shallow craters (i.e., 4-5 mm pocket depth) can be maintained nonsurgically during orthodontic therapy. Large craters can be eliminated by reshaping the bony defect. This enhances the patient's ability to maintain these interproximal areas during orthodontic treatment.^[3]

Three-wall defects are amenable to pocket reduction with regenerative periodontal therapy. Bone grafts are usually advised to fill these defects. If the result of periodontal therapy is stable, orthodontic treatment can be initiated 3-6 months after periodontal surgery.^[16]

Alveolar ridge augmentation and placement of implants for orthodontic retention are other adjunctive procedures performed to achieve orthodontic treatment goals.^[3]

Gingival invaginations were usually noted after the orthodontic closure of extraction space. These invaginations act as a site for plaque retention and are considered as one of the risk factors for periodontal disease during orthodontic treatment. A surgical correction of these invaginations is usually performed to eliminate plaque accumulation.^[17]

The gingival margin level of the six maxillary anterior teeth plays an important role in the aesthetic appearance of the crowns.^[3] Discrepancies in the gingival margin level may be due to ectopic eruption of the tooth or due to altered position of the gingiva. A combined orthodontic-periodontic interdisciplinary approach is usually preferred to correct these abnormalities.

Missing interdental papilla are frequently referred to as gingival "black holes" and may be due to a number of factors such as over-divergence of adjacent roots and advanced periodontal disease with loss interdental alveolar crest. An orthodontic periodontic interdisciplinary approach is usually advised to manage these problems.^[18]

The gummy smile is generally due to a delayed apical migration of the gingival margins; aesthetic gingival surgery is usually indicated in this situation. Vertical maxillary excess

also results in a gummy smile. Orthognathic surgery involving a LeForte I osteotomy with maxillary impaction is usually advised in adult patients; however, in growing patients "first bicuspid extractions followed by application of a high pull J-hook headgear to the premaxillary segment" helps to prevent the development of this problem.^[18]

ORTHODONTIC TREATMENT IN ADULTS

In the recent era, there is a raising influx of adult patients seeking orthodontic treatment. Adult orthodontics need special consideration in several aspects such as psychosocial, biological, mechanical, and age-related considerations such as the aging of tissues, lack of growth potential, vulnerability to temporomandibular joint (TMJ) disorder, and root resorption.^[7]

Age *per se* is not a contraindication to orthodontic treatment. Compared to children and teenagers, the tissue response to orthodontic force, especially cell mobilization and conversion of collagen fibers, is much slower in adults. The hyalinized zones are easily formed on the pressure side of orthodontically moved teeth and it temporarily prevents tooth movement in the intended direction. Once the hyalinized zone is eliminated, tooth movement can occur.^[1]

Adult bone is less reactive to orthodontic force. Compared to the elderly, there is a greater risk of marginal bone loss and loss of attachment with mild gingival infection. Loss of attachment results in apical shift of the center of resistance, thereby increasing the distance from the point of force application to the center of resistance, which in turn increases the tipping moment produced by the given force than that of the healthy tooth. Hence, the absolute magnitude of force should be reduced.^[7]

Lindhe (1989) recommended the use of an interrupted force of 20-30 g in adults during the initial stage of orthodontic treatment. Later, the force might be increased up to 50-80 g in bodily movement and 30-50 g in tipping, corresponding to a distance of movement of 0.5-1.0 mm per month, depending on the amount of the remaining alveolar bone and the degree of marginal bone loss.^[8]

TOOTH MOVEMENT AND IMPLANT AESTHETICS

There are mainly three areas where orthodontics plays a role in implant rehabilitation. The lack of adequate space for implant can be managed by orthodontic movement of the neighboring teeth to an optimal position, which will allow redistribution of the available space in the dental arch and provide space for implant placement.^[8]

Selective orthodontic extrusion of a hopeless incisor or molar may be useful to improve the placement of a single tooth

implant by vertically increasing the height of the ridge upon extrusion. Both the alveolar bone and periodontal tissues follow the extruded tooth, leading to bone formation in the direction of tooth movement.

The reduced buccolingual ridge thickness associated with extraction space shows difficulty in implant placement. It can be managed by orthodontic movement of the adjacent tooth to the edentulous space, which results in bone deposition along the tension side and the implant can be placed at the site of the orthodontically moved tooth. This is an alternative to surgical horizontal ridge augmentation.^[8]

CORTICOTOMY-ASSISTED ORTHODONTICS

Corticotomy-assisted orthodontics has been employed in various forms to accelerate orthodontic treatment. Rapid tooth movement associated with corticotomy was first introduced by Henry Kole in 1959.^[19]

The cortical plates of the bone are believed to be the main resistance to orthodontic tooth movement. In corticotomy-assisted orthodontics, rapid tooth movement is achieved by disrupting the continuity of the cortical bone by a selective cut and preserving the vitality of the teeth and marginal periodontium.^[19]

The biology behind corticotomy-assisted orthodontics is the regional acceleratory phenomenon (RAP). It is a local response of the tissue to noxious stimuli, through which the tissue regenerates at a faster rate than normal (without corticotomy). The areas around the cuts are associated with intensified bone response, i.e., increased osteoblastic-osteoclastic activity and increased level of inflammatory mediators, which accelerate the bone turnover and facilitate rapid orthodontic tooth movement.^[20]

Corticotomy-assisted orthodontics has several advantages such as this procedure reduces the treatment time and facilitates expansion of the dental arch and produces less root resorption rate compared to normal tooth movement due to decreased resistance from the cortical bone.^[21] It also provides improved postorthodontic stability and slower relapse tendency.^[21]

PERIODONTALLY ACCELERATED OSTEOGENIC ORTHODONTICS

Periodontally accelerated osteogenic orthodontics (PAOO), also termed Wilckodontics, was introduced by Wilcko *et al.* in 2001. It is a revised corticotomy-facilitated technique, which involves a full-thickness labial and lingual flap elevation accompanied by selective surgical scarring of the labial and lingual cortical bones (corticotomy) followed by placement of the graft material, surgical closure, and orthodontic force application.^[21]

Rapid tooth movement associated with PAOO is substantially different from periodontal ligament cell-mediated tooth movement. Recent evidence suggests that RAP is a localized osteoporosis state, which occurs as a part of healing and may be responsible for rapid tooth movement associated with PAOO.

The placement of orthodontic appliance and its activation are typically done in the week before surgical procedure. However, in complex mucogingival procedures, the absence of orthodontic appliance may enable easier soft tissue manipulation and suturing. A heavy orthodontic force immediately after surgery is usually recommended in this condition. The initiation of orthodontic force should not be delayed more than 2 weeks after surgery. The time period for RAP usually lasts for 4-6 months. A delay in activation of the orthodontic appliance will fail to take full advantage of the regional acceleratory phenomenon.^[21]

PIEZOCISION-ASSISTED ORTHODONTICS

Piezosurgery assisted orthodontics is a new minimally invasive surgical procedure introduced by Dibart *et al.* in 2009. In this technique microincision is performed on the buccal gingiva that allows the piezoelectric knife to give osseous cuts to the buccal cortical plates and initiate RAP. This procedure provides rapid tooth movement without an extensive traumatic surgical approach. This procedure also maintains the clinical benefit of the bone or soft tissue grafting, along with tunnel approach.^[22]

Piezosurgery works only on mineralized tissues, sparing soft tissues and producing micrometric and selective osteotomy cuts without any osteonecrosis. Compared to the classic decortication procedure, piezosurgery has added advantages such as being minimally invasive, safe, and less traumatic to the patients.^[23] Piezocision can also be combined with Invisalign in selected cases to produce outcomes that are less time-consuming as well as satisfy the patient's desire of aesthetic appliance.^[24]

CONCLUSION

Periodontal health is essential for any form of dental treatment, especially for orthodontic treatment. The orthodontic treatment has two ways of action on the periodontal tissues; it provides some degree of protection to the periodontium and keeps the gingiva, the bone, and the periodontal ligament in a healthy status but on the other hand, it produces negative effects on the periodontium, mainly gingivitis, gingival recessions, and bone dehiscences, etc.

In the recent years, because of the increased number of adults seeking orthodontic treatment, orthodontists frequently face patients with periodontal disease. The combined

orthodontic-periodontic interdisciplinary approach could be effective in these situations. Adult patients must undergo regular oral hygiene performance and periodontal maintenance in order to maintain healthy gingival tissue during active orthodontic therapy.

The development of new methods to accelerate orthodontic tooth movement through periodontal surgical procedures, especially PAOO and piezocision, has shortened the treatment time and increased the quality of treatment. The harmonious cooperation of the periodontist and the orthodontist offers great possibilities for the treatment of combined orthodontic-periodontal problems.

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REFERENCES

- Ong MA, Wang HL, Smith FN. Interrelationship between periodontics and adult orthodontics. *J Clin Periodontol* 1998;25:271-7.
- Gkantidis N, Christou P, Topouzelis N. The orthodontic-periodontic interrelationship in integrated Treatment challenges: A systematic review. *J Oral Rehabil* 2010;37:377-90.
- Newman MG, Takei HH, Klokkevold PR, Carranza FA. Carranza's Clinical Periodontology. 10th ed. Noida: Saunders, Reed Elsevier India Private Limited; 2006. p. 856-70.
- Vinod K, Reddy YG, Reddy VP, Nandan H, Sharma M. Orthodontic-periodontics interdisciplinary approach. *J Indian Soc Periodontol* 2012;16:11-5.
- Meeran NA. Cellular response within the periodontal ligament on application of orthodontic forces. *J Indian Soc Periodontol* 2013;17:16-20.
- Singla S. Influence of orthodontic therapy on Periodontal health: A review. *Indian J Dent* 2013;2: 127-31.
- Bagga DK. Adult orthodontics versus adolescent orthodontics: An overview. *J Oral Health Comm Dent* 2010;4:42-7.
- Lindhe J, Lang NP, Karring T. Text Book of Clinical Periodontology and Implant Dentistry. 5th ed. Wiley-Blackwell; p. 1241-97.
- Ericsson I, Thilander B, Lindhe J. Periodontal condition after orthodontic tooth movements in the dog. *Angle Orthod* 1978;48:210-8.
- Ingber JS. Forced eruption. I. A method of treating isolated one and two wall infrabony osseous defects-rationale and case report. *J Periodontol* 1974;45:199-208.
- Lang NP, Löe H. The relationship between the width of keratinized gingiva and gingival health. *J Periodontol* 1972;43:623-7.
- Steiner GG, Pearson JK, Ainamo J. Changes of the marginal periodontium as a result of labial tooth movement in monkeys. *J Periodontol* 1981;52:314-20.
- Vanarsdall RL, Corn H. Soft-tissue management of labially positioned unerupted teeth. *Am J Orthod* 1977;72:53-64.
- Proffit WR, Fields HW. Contemporary Orthodontics. 3rd ed. St. Louis: Mosby; 2000. p. 644-74.
- Bhaskar N, Garg AK, Gupta V. Periodontics as an adjunct to clinical orthodontics: An update. *Indian J Multidiscip Dent* 2013;3:756-61.
- Becker W, Becker BE. Treatment of mandibular 3-wall intrabony defects by flap debridement and expanded polytetra fluoroethylene barrier membranes. Long-term evaluation of 32 treated patients. *J Periodontol* 1993;64(Suppl):1138-44.
- Dannan A. An update on periodontic-orthodontic Interrelationships. *J Indian Soc Periodontol* 2010;14:66-71.
- Keim RG. Aesthetics in clinical orthodontic-periodontic Interactions. *Periodontol* 2000 2001;27:59-71.
- Wilcko WM, Wilcko T, Bouquet JE, Ferguson DJ. Rapid orthodontics with alveolar reshaping: Two case reports of decrowding. *Int J Periodontics Restorative Dent* 2001;21:9-19.
- Cano J, Campo J, Bonilla E, Colmenero C. Corticotomy-assisted orthodontics. *J Clin Exp Dent* 2012;4:e54-9.
- Goyal A, Kalra JP, Bhatiya P, Singla S, Bansal P. Periodontally accelerated osteogenic orthodontics (PAOO) — A review. *J Clin Exp Dent* 2012;4:e292-6.
- Dibart S, Sebaoun JD, Surmenian J. Piezocision: A minimally invasive, periodontally accelerated orthodontic tooth movement procedure. *Compend Contin Educ Dent* 2009;30:342-4, 346, 348-50.
- Mittal SK, Sharma R, Singla A. Piezocision assisted orthodontics. A new approach to accelerated orthodontic tooth movement. *J Innov Dent* 2011;1:1-4.
- Keser EI, Dibart S. Piezocision-assisted Invisalign treatment. *Compend Contin Educ Dent* 2011;32:46-8, 50-1.