



ORTHO-PERIO RELATIONSHIP: IS IT A NUPTIAL KNOT

¹ S.PRIYANKA,* ² DR.S.P.SARAVANA DINESH AND ³ DR. JAIGANESH RAMAMURTHY

¹ C.R.R.I SAVEETHA DENTAL COLLEGE AND HOSPITAL, NEW NO.36, OLD NO.72 FOURTH MAIN ROAD GANDHINAGAR, ADYAR CHENNAI-600020.INDIA

² SENIOR LECTURER SAVEETHA DENTAL COLLEGE AND HOSPITAL, 163A, SECOND STREET A.K.SAMY NAGAR KELLYS CHENNAI-600010.INDIA

³ ASSISTANT PROFESSOR SAVEETHA DENTAL COLLEGE AND HOSPITAL, 27/31, PALAYAKARAN CROSS STREET KODAMBAKKAM CHENNAI-600024.INDIA

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.



S.PRIYANKA

C.R.R.I SAVEETHA DENTAL COLLEGE AND HOSPITAL ADDRESS: NEW NO.36, OLD NO.72 FOURTH MAIN ROAD GANDHINAGAR, ADYAR CHENNAI-600020.INDIA

*Corresponding author

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 discharge¹. The primary etiological factor behind gingivitis is the plaque microbial biofilm^{2, 3}. The other possible causes of gingivitis include over hanging dental restorations, closely placed roots, palato-gingival grooves, furcation anatomy and cervical enamel projection^{4, 5}. Progression of the advanced lesion of gingivitis is known as the 'phase of periodontal breakdown' or periodontitis⁶. Periodontitis could be chronic or aggressive or in association with systemic diseases⁷. 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 probing⁷. Aggressive periodontitis is characterised by rapid progression leading to a severe destruction of the periodontium⁷. 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 fibers⁸.

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. Zachrisson⁹ 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 ligament¹⁰.

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 al¹¹

showed movement of gingiva in the direction of intrusion, Erkan et al¹² found no changes in gingiva associated with intrusion. Interestingly, reduction in gingival recession has also been noticed in periodontally compromised teeth¹³. However, ineffective control of inflammation may result in deepening of the periodontal pocket¹⁴. Root resorption along with transient apical displacement resulting in reduced pulpal blood flow has also been demonstrated^{15, 16, and 17}. Extrusion of teeth with advanced periodontal disease may have a positive result both clinically and histologically¹⁸. This has been shown in several reports wherein, coronal migration of the root, increased bone ridge, quantity of attached gingiva^{19 and 20}, reduction of periodontal pocket depth²¹, reduced bacterial pathogens resulting in improved healing of osseous defects²² and increase in the width of keratinized gingiva²³ has been reported.

Rotation

Teeth treated by rotational movement demonstrate a higher tendency for relapse due to a faulty tissue arrangement during the retention phase²⁴. The supracrestal fibres have been shown to be responsible for this relapse^{25, 26 and 27}. While evidence on this is not unequivocal with different percentage of cases showing relapse^{25 and 26}, 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 anteriors²⁸. In the absence of keratinized gingiva, orthodontic treatment only further deteriorates gingival health²⁹. In 28.6% of the cases undergoing tooth movement, gingival clefing occur²⁹.

Abnormal frenal and muscle attachments

These are factors secondary to gingival recession. Abnormal frenal attachment may result in constant plaque accumulation resulting in gingival recession³⁰. However, a cross sectional investigation disregarded frenal attachment^{31, 32} 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 defects³³.

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^{34, 35}, improves alveolar bone defects³⁶, gingival aesthetics and the crown root ratio³⁶.

However, pocket elimination therapy should be performed prior to intrusion to prevent apical displacement of plaque and further worsening of periodontal status³⁷.

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 flossing³⁸.

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)³⁹. 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 treatment⁴⁰. 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 counts⁴¹. A recent report showed that metronidazole gel with natural polymers could be used for targeted delivery for the management of periodontal lesions⁴².

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.

REFERENCES

1. Structural and chemical organization of teeth, Vol 2. Edited by A.Mills
2. Sbordone L, Bortolaia C: Oral microbial biofilms and plaque-related diseases: microbial communities and their role in the shift from oral health to disease. *Clin Oral Investig.*2003 Dec; 7(4):181-8
3. Marsh PD: Microbial ecology of dental plaque and its significance in health and disease. *Adv Dent Res.*1994.Jul; 8(2):263-71
4. Leknes KN: The influence of anatomic and iatrogenic root surface characteristics on bacterial colonization and periodontal destruction: a review. *J Periodontol.*1997 Jun; 68(1):507-16
5. Kornman KS, Loe H: The role of local factors in the etiology of periodontal diseases. *Periodontol* 2000.1993 Jun; 2:83-97
6. Armitage GC: Periodontal diseases:diagnosis. *Ann Periodontol* 1996; 1:47-215
7. Michael G.Newman, Henry H. Takei, Perry R.Klokkevold, Fermin A.Carranza: *Clinical Periodontology*.10th Edition
8. Glickman I, Roeber FW, Brion M, Pameijer JH: Photoelastic analysis of internal stresses in the periodontium created by occlusal forces. *J Periodontol.*1970 Jan; 41(1): 30-5
9. Zachrisson BU: Cause and prevention of injuries to teeth and supporting structures during orthodontic treatment. *Am J Orthod.*1976 Mar; 69(3):285-300
10. Ericsson I, Thilander B, Lindhe J, Okamoto H: The effect of orthodontic tilting movements on the periodontal tissues of infected and non-infected dentition in dogs. *J Clin Periodontol.*1977 Nov; 4(4):278-93
11. Murakami t, Yokota S, Takaham Y: Periodontal changes after experimentally induced intrusion of the upper incisors in macaca fuscata monkeys. *Am J Orthod Dentofacial Orthop.*1989 Feb; 95(2):115-26
12. Erkan M, Pikdoken L, Usumez S: Gingival response to mandibular incisor intrusion. *Am J Orthod Dentofacial orthop.*2007 Aug; 132(2):143.e-9-13
13. Re S, Cardarepoli D, Abundo R, Corrente G. Reduction of gingival recession following orthodontic intrusion in periodontally compromised patients. *Orthod Craniofac Res.*2004 Feb; 7(1):35-9
14. Proffit WR, Fields Hw, Sarver DM; *Contemporary Orthodontics*
15. Melsen B, Agerbae KN, Markenstam G: Intrusion of incisors in adult patients with marginal bone loss. *Am J Orthod Dentofacial Orthop.*1989 Sep; 96(3):232-41
16. McFadden WM, Engstrom C, Engstrom H, Anholm JM: A study of the relationship between incisor intrusion and root shortening. *Am J Orthod Dentofacial Orthop.*1989 Nov; 96(5):390-6
17. Ikawa M, Fujiwara M, Horiuchi H, Shimauchi H: The effect of short-term tooth intrusion on human pulpal blood flow measured by laser Doppler flowmetry. *ArchOralBiol* 2001 Sep; 46(9):781-7
18. Van Venrooy JR, Yukna RA: Orthodontic extrusion of single-rooted teeth affected with advanced periodontal disease. *Am J Orthod.*1985 Jan; 87(1):67-74
19. Rosenberg ES, Cho SC, Garber DA: Crown lengthening revisited. *Compend Contin Educ Dent.*1999; 20(6):527-32, 534, 536-38
20. Ainamo J, Talari A: The increase with age of the width of attached gingival. *J Periodontal Res* 1976; 11(4):182-8
21. Ingber JS: Forced eruption:alteration of soft tissue cosmetic deformities. *Int J Periodontics Restorative Den.*1989; 9(6):416-25
22. Melsen B: Tissue reaction following application of extrusive and intrusive forces to teeth in adult monkeys. *Am J Orthod.*1986 Jun;89(6):469-75
23. Kajiyama K, Murakamai T, Yokota S: Gingival reactions after experimentally induced extrusion of the upper incisors in monkeys. *Am J Orthod Dentofacial Orthop.*1993 Jul; 104(1):36-47
24. Reitan K: Tissue arrangement during retention of orthodontically treated

- rotated teeth. Angle Orthod.1959: 29:105-113
25. Brain WE: The effect of surgical transection of free gingival fibres on the regression of orthodontically rotated teeth in the dog. Am J Orthod.1969 jan; 55(1):50-70
 26. Boese LR: Increased stability of orthodontically rotated teeth following gingivectomy in macaca nemestrina. Am J Orthod.1969 Sep; 56(1):273-90
 27. Edwards JC: A surgical procedure to eliminate rotational relapse. Am J Orthod.1970 Jan; 57(1):35-46
 28. Sadowsky C, BeGole EA: Long-term effects of orthodontic treatment on periodontal health. Am J Orthod.1981 Aug; 80(2):156-72
 29. Coatoam GW, Behrents RG, Bissada NF: The width of keratinized gingival during orthodontic treatment. J Periodontal 1981; 52:307
 30. Parfitt GJ, Mjor IA: A clinical evaluation of local gingival recession in children. J Dent Child 1964
 31. Stoner JE, Mazdyasna S: Gingival recession in the lower incisor region of 15-year-old subjects. J Periodontol 1980 Feb; 51(2):74-6
 32. Goutoudi P, Koidis PT, Konstantinidis A: Gingival recession: a cross-sectional clinical investigation. Eur J Prosthodont Restor Dent.1997 Jun; 5(2):57-61
 33. Thilander B, Nyman S, Karring T, Magnusson I: Bone regeneration in alveolar bone dehiscences related to orthodontic tooth movements. Eur J Orthod.1983 May; 5(2):105-14
 34. Brown IS: the effect of orthodont therapy on certain types of periodont defects. 1. Clinical findings. J Periodontol 1973 Dec; 44(12):742-56
 35. Ingber JS: Forced eruption. 1. A method of treating isolated one and two wall infrabony osseous defects-rationale and case report. J Periodontol.1974 Apr; 45(4):199-206
 36. Iino S, Taira K, Machigashira M, Miyawaki S: Isolated vertical infrabony defects treated by orthodontic tooth extrusion. Angle Orthod 2008 Jul; 78(4):728-36
 37. Melsen B: Tissue reaction following application of extrusive and intrusive forces to teeth in adult monkeys. Am J Orthod 1986 Jun; 89(6):469-75
 38. Bhavna Jha Kukreja, Vidya Dodwad: Herbal mouthwashes- A gift of nature. Int J Pharm. Bio. Sci.2012 Apr; 3(2):46-52
 39. Nowzari H, Yorita FK, Chang HC: Periodontally accelerated osteogenic orthodontics combined with autogenous bone grafting. Compend Contin Educ Dent.2008 May; 29(4):200-6
 40. Balenseifen JW, Madonia JV: Study of dental plaque in orthodontic patients. J Dent Res.1970 Mar-Apr; 49(2):320-4
 41. Farret MM, de Lima EM, Mota EG, Oshima HM, Barth V, de Oliveira SD: Can we add chlorhexidine into glass ionomer cements for band cementation? Angle Orthod.2011 May; 81(3):496-502
 42. Shiva Kumar Yellanki, Jeet Singh, Manvi FV: Formulation, Characterization and evaluation of metronidazole gel for local treatment of periodontitis. Int J Pharm. Bio. Sci.2010; 1(2):1-9