

Root resorption following orthodontic treatment – A short review

Sam Jebaraj¹, R. Sarah Sathiyawathie^{2*}, Sumathi Felicita¹

ABSTRACT

All permanent teeth may show microscopic amounts of root resorption that is clinically insignificant and radiographically undetected. Root resorption is a condition associated with either a physiologic or a pathologic process resulting in a loss of dentin, cementum, and/or bone. Permanent teeth have the potential to clinically undergo significant external root resorption when affected by several stimuli. Root resorption is considered as one of the complications which can be caused due to orthodontic treatment. However, there is a lot of ambiguity regarding how much resorption is actually taking place. Various studies for the last 40–50 years which have given various contradictory statements on root resorption. Some of them have gone to 2–5% of resorption have been reported. There are many reasons which have been given for root resorption happening right from tooth movement and the amount of force applied. This article is a review of various aspects of root resorption following orthodontic treatment. This study aims at the various aspects of root resorption following orthodontic treatment.

KEY WORDS: Orthodontics, Root, Treatment, Resorption

INTRODUCTION

All permanent teeth may show microscopic amounts of root resorption that is clinically insignificant and radiographically undetected.^[1] Root resorption is a condition associated with either a physiologic or a pathologic process resulting in a loss of dentin, cementum, and/or bone. It may be initiated in the periodontium and affect initially the external surfaces of the tooth (external resorption), or it may start with the pulp space affecting primarily the internal dentin surfaces (internal resorption). The incidence of reported root resorption during orthodontic treatment varies widely among investigators. Usually, extensive resorption does not affect the functional capacity or the effective life of the tooth.^[2] Tooth structure, the alveolar bone structure at various locations, and types of movement may explain these variations. The extent of treatment

duration and mechanical factors definitely influence root resorption.^[3]

Root Resorption

Root resorption is a necessary process in case of the deciduous root during the eruption of permanent tooth. However, in the case of the permanent tooth is considered as unfavorable and pathological. The external root resorption has perplexed the orthodontic specialty since early reports. External apical root resorption (ARR) is uncommon and is a frequent sequel to orthodontic tooth movement.^[4] External ARR is an undesirable complication of orthodontic treatment that results in permanent loss of tooth structure from the root apex. However, it can be avoided with more accurate management of orthodontic treatment.^[5] Han *et al.*^[6] suggested that each clinician ought to know about the expulsion of teeth that may likewise cause root resorption in vulnerable patients. The writing demonstrates that jiggling and development caused by the use of intermaxillary elastics are two kinds of development that is probably going to expand the danger of root resorption.^[7]

Access this article online

Website: jprsolutions.info

ISSN: 0975-7619

¹Department of Orthodontics, Saveetha Dental College, Saveetha Institute of Medical and Technical Sciences, Saveetha University, Chennai, Tamil Nadu, India, ²Department of Research, Saveetha Dental College, Saveetha Institute of Medical and Technical Sciences, Saveetha University, Chennai, Tamil Nadu, India

*Corresponding author: Dr. R. Sarah Sathiyawathie, Department of Research, Saveetha Dental College, Saveetha Institute of Medical and Technical Sciences, Saveetha University, 162 Poonamallee High Road, Chennai - 600 077, Tamil Nadu, India. Phone: +91-9884156513. E-mail: dr.sarahrobin@gmail.com

Received on: 07-10-2018; Revised on: 20-12-2018; Accepted on: 29-01-2019

CLASSIFICATION OF ROOT RESORPTION

According to Type

- Physiological root resorption: Physiological resorption is the resorption of root in deciduous tooth for the eruption of permanent teeth.
- Pathological root resorption: Pathological resorption is due to the pressure of pathological condition on the root.

According to Location

- Internal root resorption: Internal root resorption is relatively rare in occurrence. It is caused by trauma.
- External root resorption: External resorption originates in the PDL and is recognized by an irregular radiolucent area overlying the root canal; the canal outline remains visible and intact.

According to Severity^[8]

- Surface root resorption: It occurs commonly periapically as micro defects on the root surface and stops when the instigating agent is removed, and there is repair of cementum.
- Inflammatory root resorption: It occurs when root resorption progress into the dentinal tubules to reach the pulpal tissue.
- Replacement root resorption: It produces ankylosis of a tooth because bone replaces the resorbed bone substance.

According to Brezniak and Wasserstein

Classification of orthodontically induced root resorption:

- Cemental or surface resorption with remodeling: In this process, only the outer cemental layers are resorbed, and they are later fully regenerated or remodeled. This process resembles trabecular bone remodeling.
- Dentinal resorption with repair: In this process, the cementum and the outer layers of the dentin are resorbed and usually repaired with cementum material. The final shape of the root after this resorption and formation process may or may not be identical to the original form.^[9]
- Circumferential ARR: In this process, full resorption of the hard tissue components of the root apex occurs, and root shortening is evident. Different degrees of apical root shortening are of course possible [Figure 1].

EFFECTS OF ORTHODONTIC FORCE

Studies show that orthodontic powers have an extensive impact on the event of root resorption. It has, additionally, been exhibited that substantial

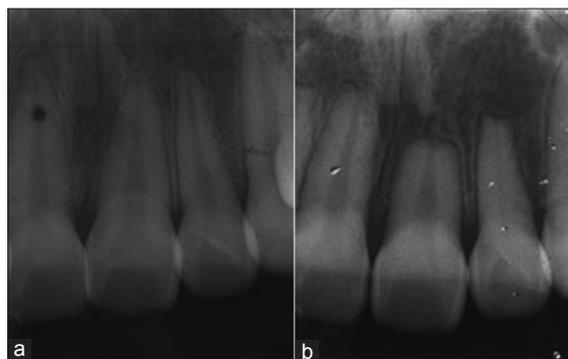


Figure 1: (a) Radiograph of the tooth before orthodontic treatment (b) radiograph of tooth showing ARR after orthodontic treatment

powers created essentially more root resorption than light forces.^[10,11] When thinking about the course of power and tooth development in the event of root resorption, Chan and Darendeliler demonstrated that compressive powers cause more resorption than malleable forces.^[6] Han *et al.*^[12] likewise inferred that the interruption of teeth causes around 4 times more root resorption than expulsion; in any case, it ought to be noticed that the expulsion of teeth may likewise cause ARR in vulnerable people. Meddlesome powers together with lingual root torque and shaking development remain the most persuasive powers in causing ARR.^[13]

ORTHODONTIC PRESSURE ROOT RESORPTION

The injury originating in orthodontic root resorption is from the pressure applied to the root during tooth movement. Continuous pressure stimulated the apical third of the root to resorb, significantly may cause shortening of the root. Teeth are asymptomatic and pulp is usually vital unless the pressure of the operative procedure is high, which disturbs the apical blood supply. Radiologically, orthodontic pressure root resorption is seen in an apical third of the root whereas no resorption is seen in the bone of the root.

REFERENCES

1. Mohandesan H, Ravanmehr H, Valaei N. A radiographic analysis of external apical root resorption of maxillary incisors during active orthodontic treatment. *Eur J Orthod* 2007;29:134-9.
2. Harris EF, Robinson QC, Woods MA. An analysis of causes of apical root resorption in patients not treated orthodontically. *Quintessence Int* 1993;24:417-28.
3. Killiany DM. Root resorption caused by orthodontic treatment: An evidence-based review of literature. *Semin Orthod* 1999;5:128-33.
4. Brezniak N, Goren S, Zoizner R, Dinbar A, Arad A, Wasserstein A, *et al.* A comparison of three methods to accurately measure root length. *Angle Orthod* 2004;74:786-91.
5. Brezniak N, Goren S, Zoizner R, Shochat T, Dinbar A, Wasserstein A, *et al.* The accuracy of the cemento-enamel junction identification on periapical films. *Angle Orthod*

- 2004;74:496-500.
6. Han G, Huang S, Von den Hoff JW, Zeng X, Kuijpers-Jagtman AM. Root resorption after orthodontic intrusion and extrusion: An intraindividual study. *Angle Orthod* 2005;75:912-8.
 7. Levander E, Malmgren O, Stenback K. Apical root resorption during orthodontic treatment of patients with multiple aplasia: A study of maxillary incisors. *Eur J Orthod* 1998;20:427-34.
 8. Barbagallo LJ, Jones AS, Petocz P, Darendeliler MA. Physical properties of root cementum: Part 10. Comparison of the effects of invisible removable thermoplastic appliances with light and heavy orthodontic forces on premolar cementum. A microcomputed-tomography study. *Am J Orthod Dentofacial Orthop* 2008;133:218-27.
 9. Chan E, Darendeliler MA. Physical properties of root cementum: Part 5. Volumetric analysis of root resorption craters after application of light and heavy orthodontic forces. *Am J Orthod Dentofacial Orthop* 2005;127:186-95.
 10. Chan E, Darendeliler MA. Physical properties of root cementum: Part 7. Extent of root resorption under areas of compression and tension. *Am J Orthod Dentofacial Orthop* 2006;129:504-10.
 11. Katona TR. Flaws in root resorption assessment algorithms: Role of tooth shape. *Am J Orthod Dentofacial Orthop* 2006;130:698.e19-27.
 12. Parker RJ, Harris EF. Directions of orthodontic tooth movements associated with external apical root resorption of the maxillary central incisor. *Am J Orthod Dentofacial Orthop* 1998;114:677-83.
 13. Costopoulos G, Nanda R. An evaluation of root resorption incident to orthodontic intrusion. *Am J Orthod Dentofacial Orthop* 1996;109:543-8.

Source of support: Nil; Conflict of interest: None Declared