



MULTIFACTORIAL CAUSES AND MANAGEMENT OF TOOTH ROOT RESORPTION IN PATIENTS UNDERGOING FIXED ORTHODONTICS MECHANOTHERAPY .

Orthodontics

Dr. Pooja Kanwar	Second Year Post Graduate Resident, Department of Orthodontics and Dentofacial Orthopaedics, Nims Dental College & Hospital, Jaipur, Rajasthan, India.
Dr. Divyaroop Rai	Professor and HOD, Department of Orthodontics and Dentofacial Orthopaedics, Nims Dental College & Hospital, Jaipur, Rajasthan, India.
Dr. Shantanu Sharma	Associate Professor, Department of Orthodontics and Dentofacial Orthopaedics, Nims Dental College & Hospital, Jaipur, Rajasthan, India.
Dr. Ananthu S. Kumar	Third Year Post Graduate Resident, Department of Orthodontics and Dentofacial Orthopaedics, Nims Dental College & Hospital, Jaipur, Rajasthan, India.
Dr. Abhishek Pandey	First Year Post Resident Resident, Department of Orthodontics and Dentofacial Orthopaedics, Nims Dental College & Hospital, Jaipur, Rajasthan, India.
Dr. Komal Saini	Internship, Nims Dental College & Hospital, Jaipur, Rajasthan, India.

ABSTRACT

Multifactorial tooth root resorption causes gradual cementum and dentin loss as well as progressive destruction of the tooth root. Root resorption can occur internally or externally. The most important etiological reasons for tooth root resorption are trauma, pulpal infection, bleaching, and orthodontic therapy. The pathophysiology and aetiology of this condition are poorly understood. Since tooth root resorption typically exhibits no symptoms, radiographic examinations inadvertently discover it. Among the disorders that progress as clinical manifestations include discomfort, tooth discolouration, and tooth movement. Early detection and prevention of tooth root resorption are made possible by knowledge of the causes and risk factors that contribute to the condition, as well as routine radiography evaluation as needed.

KEYWORDS

INTRODUCTION

The tooth roots' internal and external walls are shielded by a thin anti-resorptive layer.

The inner walls of the tooth dentin are shielded by odontoblasts and predentin, while the exterior walls are shielded by the precementum layer.

Resorption is the loss of dentin, cementum, or bone tissues and is linked to both physiological and pathological causes.

It has been determined that a number of mechanical, chemical, and thermal factors promote the early demineralization and start the resorption of roots.

The literature mentions a number of etiological variables that might lead to tooth root resorption; however, iatrogenic factors including bleaching and orthodontic treatment stand out among the others.

Etiopathogenesis

Root resorption's etiology is complex, broadly classified into idiopathic, mechanical, chemical, or biological causes. It can be hereditary, manifesting as autosomal dominant or recessive traits. Nutritional deficiencies like vitamin D and calcium deficiency, as well as habits such as bruxism, tongue thrust, and high tongue pressure, contribute to its occurrence. Anomalies in tooth number and position, like impacted canines, are linked to resorption of incisor and premolar roots, often involving distal roots of second molars. Trauma may lead to concussions, luxations, fractures, and root resorption, while endodontically treated teeth or those with obturation short of the apex may experience apical resorption. Maxillary and anterior teeth are more susceptible to root resorption, especially when subjected to forces exceeding ideal orthodontic force. Caustic bleaching agents like hydrogen peroxide can induce bone resorption. Idiopathic cases also occur.

Root resorption typically involves activation of resorption cells, primarily osteoclasts, which originate from mononuclear progenitor cells in the bloodstream. Osteoclast differentiation is regulated by substances like osteoprotegerin (OPG), receptor activator of nuclear factor-kappa B ligand (RANKL), and receptor activator of nuclear factor-kappa B (RANK). The interaction between RANKL and RANK

initiates osteoclast development and activation, essential for breakdown of the organic matrix and inorganic structure of bone during resorption.

Classification Of Root Resorption

For clinicians, classifications are crucial in the diagnosis and treatment planning process.

Although various classifications have been proposed, none of them have gained universal acceptance.

Previous Classification Schemes

Andresen divided root resorption in teeth into two categories: internal and exterior.

While exterior root resorption is divided as surface, inflammatory, and replacement types of resorptions, internal resorption is subcategorized as replacement and inflammatory types of resorption. It can also be divided into two categories based on where it is in relation to the root surface: external resorption, surface resorption, cervical resorption, and transient apical breakdown (TAB), and internal resorption, internal inflammatory resorption, or internal replacement resorption.

Tronstad developed the updated terminological system for root resorption in order to condense the understanding of root resorption from a clinically relevant perspective : divided root resorption into Transient inflammatory resorption, Progressive inflammatory resorption, Internal resorption and External resorption, which is divided into progressive inflammatory, cervical, dentoalveolar ankylosis and replacement resorption.

More Recent Classification Proposal

Root resorption in permanent teeth can be classified morphologically and etiologically as follows:

1. Origin of teeth
 - a. Internal resorption- Infectious/inflammatory/trauma, radial resorption, pulp enlargement, metaplastic (replacement), pulp resorption.
 - b. External resorption- Physiologic apical resorption, infective/inflammatory resorption, apical (pulp) resorption, cervical (periodontal) resorption, inflammatory resorption.
 - c. Trauma- Avulsed, luxated, fractured, traumatic apical bone cyst

- (TAB), periapical replacement resorption (PAAR) with ankylosis.
- d. Infective/inflammatory-apical or cervical, pressure, orthodontic: TAB, PAAR without ankylosis, impacted teeth, occlusal forces.
- e. Idiopathic Resorption- Localised, Multiple, Apical, PARR without Ankylosis, multiple, cervical.
- f. Surgical- Alveolar clefts or bone grafts.
- 2. Origin not dental
 - a. Herpes virus infection or internal resorption.
 - b. External resorption- Neoplasia/cysts of the jaws, systemic diseases.

This classification delineates the diverse origins and manifestations of root resorption in permanent teeth, providing a comprehensive framework for clinical evaluation and management.

Diagnosis And Management Of Root Resorption

Primary tooth resorption, a physiological process facilitating permanent tooth eruption, typically doesn't necessitate medical intervention. Understanding the mechanisms underlying this physiological root resorption enables the potential delay or prevention of primary teeth resorption in appropriate clinical scenarios.

Internal Desiccation

Internal desiccation involves gradual dentin and dentinal tubule loss in the apical and middle canal walls due to elastic activity. It manifests primarily as internal replacement or internal inflammatory.² Typically asymptomatic, internal desiccation may go undiagnosed until perforation occurs. If the resorption occurs in the coronal region, the tooth may appear pink. Radiographically, internal root resorption exhibits homogeneous density and inflated canal walls, while internal replacement resorption presents as a hazy, mottled radiopaque lesion with irregular edges.²⁻³

Apical Inflammatory Resorption

Deep carious lesions, invasive luxation injuries, or avulsion with reimplantation often lead to apical inflammatory resorption. Such conditions can result in periapical periodontitis or cysts, leading to necrosis of the root canal system. Individuals typically have a history of apical periodontitis and show no symptoms, although percussion may induce pain. Radiographically, lamina dura loss and related periodontal ligament (PDL) widening are observed. Advanced apical periodontitis may result in root resorption, necessitating the identification and elimination of the inflammation source.⁴⁻⁵

Cervical Inflammatory Resorption

The exact cause of cervical root resorption is unknown but may be attributed to factors such as periodontal disease, trauma, orthodontic forces, or idiopathic reasons. Patients are usually asymptomatic, with diagnosis often made through routine radiography checks.⁶

Other Influences on Root Resorption

Root resorption can be influenced by factors such as systemic disorders (e.g., hormonal imbalances, genetic conditions) and odontogenic or non-odontogenic neoplasia. Differentiating between lesion types is crucial to avoid unnecessary treatments. Biopsy may be necessary for definitive diagnosis and appropriate management.^{7,8,9}

In summary, root resorption can be influenced by various systemic and local factors, highlighting the importance of comprehensive evaluation and tailored treatment strategies. Regular monitoring and appropriate diagnostic measures are essential for effective management.¹⁰

CONCLUSION

Resorption is the loss of dentin, cementum, or bone as a result of either a physiological or pathologic event. Damage to or irritation of the tooth pulp and/or periodontal ligament is always the cause of tooth resorption. In addition to being unique to pulp damage and persistent infections, root resorption is also frequently an undesirable aftereffect of endodontic, periodontal, and orthodontic operations. Over many years, it could go unnoticed as most cases of resorption are essentially asymptomatic. Consequently, early resorption identification is crucial to reducing the detrimental effects of resorption and giving patients a successful course of treatment.

REFERENCES

- 1) Rosen E, Paul R, Tsesis I. Evidence-based decision making in dentistry: the endodontic perspective. *Evidence-Based Decision Making in Dentistry: Multidisciplinary Management of the Natural Dentition*. 2017:19-37.

- 2) Patel S, Ricucci D, Durak C, Tay F. Internal root resorption: a review. *Journal of endodontics*. 2010;36(7):1107-21.
- 3) Patel S, Kanagasingam S, Ford TP. External cervical resorption: a review. *Journal of endodontics*. 2009;35(5):616-25.
- 4) Apajalahti S, Peltola JS. Apical root resorption after orthodontic treatment—a retrospective study. *The European Journal of Orthodontics*. 2007;29(4):408-12.
- 5) Killiany DM. Root resorption caused by orthodontic treatment: An evidence-based review of literature. In *Seminars in orthodontics* 1999 (Vol. 5, No. 2, pp. 128-133). WB Saunders.
- 6) Bansode PV, Pathak SD, Wavdhane MB, Birage PP. Root resorption and its management: a review article. *IOSR Journal of Dental and Medical Sciences (IOSR-JDMS)*. 2019;18(1):63-9.
- 7) Bhardwaj I, Munjal S, Singh S, Singh H. Root Resorption-A Review Article. *Journal of Advanced Medical and Dental Sciences Research*. 2020;8(5):52-5.
- 8) Goultschin J, Nitzan D, Azaz B. Root resorption: review and discussion. *Oral Surgery, Oral Medicine, Oral Pathology*. 1982;54(5):586-90.
- 9) Andreasen JO, Andreasen FM, Andersson L, editors. *Textbook and color atlas of traumatic injuries to the teeth*. John Wiley & Sons; 2018 17.
- 10) Tronstad L. Root resorption—etiology, terminology and clinical manifestations. *Dental Traumatology*. 1988;4(6):241-52.