10.5937/bjdm2502105Z

BALKAN JOURNAL OF DENTAL MEDICINE

ISSN 2335-0245

Periodontitis and Root Resorption- Two Case Reports

Stefanos Zisis[1], Nikolaos Shinas[2], Vasileios Zisis[3,4], Deeba Kashtwari[2], Christina Charisi[3], Konstantinos Poulopoulos[3], Dhurata Shosho[2], Joe Cordahi[5], Athanasios Poulopoulos[3]

[1] Department of Periodontology, School of Dentistry, Aachen University, Germany
[2] Department of Oral and Maxillofacial Radiology, Henry M. Goldman School of Dental Medicine, Boston University, USA
[3] Department of Oral Medicine/ Pathology, School of Dentistry, Aristotle University of Thessaloniki, Greece
[4] Department of Oral Medicine- Oral Pathology, School of Dentistry, European University of Cyprus, Cyprus
[5] Oral and Maxillofacial Radiology Clinic, Department of Comprehensive Dentistry, University of Texas Health Science Center, San Antonio, USA

SUMMARY

Background/Aim: *Root resorption (RR) refers to a cellular response resulting in loss of hard and soft dental tissue due to injury, irritation of the periodontal ligament, and/or tooth pulp. Typically, it is considered a physiologic response; however, in permanent dentition, it is associated with the presence of active pathology, and the basis of it has two main aspects: injury and stimulus. This is a presentation of two cases that show evidence of external apical resorption with concurrent periodontal bone loss of the involved teeth as the only evident stimulus in the history of the patient, clinically and radiographically.* ***Case Report:*** *The first case was that of a 43-year-old patient who presented himself with mild generalized pain in the second quadrant. The medical history revealed no underlying condition, and the patient provided informed consent. The clinical examination included periodontal charting of the dentition, which confirmed the presence of pockets in various locations, measuring between 4 mm and 6 mm. The initial panoramic radiograph (orthopantomogram: OPG) at the day of the appointment revealed a diffuse pattern of root resorption on the tooth #26 in contrast to the distinct and clear, although asymptomatic, root resorption of #47. The second case involved a 73-year-old patient who presented himself with mild generalized pain in the first quadrant, mostly while eating. Medical history revealed only the administration of furosemide as anti-hypertensive treatment, and the patient provided informed consent. Clinical examination included periodontal charting that confirmed deep pockets, more prominently in the posterior teeth of the maxilla, and specifically the first quadrant. The orthopantomogram examination on the day of the appointment confirmed the presence of the pockets radiographically. #16 did not respond to cold and therefore the patient was referred to an endodontist, who initiated the root canal treatment and suggested an exploratory flap, which in turn revealed the root resorption of the palatal root.* ***Conclusions****: Historically, intraoral periapical radiographs (PAs) were the first tool that was used to diagnose RR. However, over the years, the development of panoramic radiograph (OPG) and the later development of Cone Beam Computed Tomography (CBCT) has incrementally altered our ability to visualize and diagnose dental pathosis. Root resorption involves shortening or blunting of the root concomitant with loss of cementum and/or dentin. Physiological root resorption involves exclusively deciduous teeth and thus is considered pathological when affecting the permanent dentition. The periodontal status acts as a precursor since periodontal disease-related root resorption is reportedly found about three times more frequently. Root resorption presents with significant variation in the affected teeth and, with no guidelines in place correlating a specific class of root resorption with a singular treatment, a case-by-case approach is the gold-standard.*

Keywords: Periodontitis, Root Resorption, External, Internal, Apical.

CASE REPORT (CR)
Balk J Dent Med, 2025;105-109

Introduction

Root resorption (RR) refers to a cellular response resulting in clastic activity and subsequently loss of hard and soft dental tissue due to injury, irritation of the periodontal ligament and/or tooth pulp [1]. Typically, it is considered a physiologic response; however, in the permanent dentition is associated with the presence of active pathology and the basis of it has two main aspects: injury and stimulus[2].

Aidos *et al*. in 2018 proposed a new classification based on 15 previous classifications that involves both clinical and etiological aspects of the phenomenon, and also provides a diagram to facilitate diagnosis. The first category of RR is non-dental and is associated with cysts and tumors of the jaws. The most recognizable example which of RRs that caused by ameloblastoma due to its locally aggressive behavior[3]. In this category, the stimulus is considered to be the expansile nature of some cysts and tumors that results in external RR.

The second category of RR is of dental origin and involves active infection, history of trauma, and pressure at the level of the apex. The presence of infection can be noted either at the level of the pulp/apex, e.g. pulpal necrosis and/or apical periodontitis or at the level of the alveolar crest, e.g. periodontitis. Dental trauma associated with RR can result in infection, intrusion, avulsion, luxation, subluxation, concussion, and pressure. The presence of infection can induce external or internal resorption, regardless of the type of exposure. On the other hand, when trauma is involved without infection, RR is considered transitory and can result in ankylosis or transient apical breakdown. The third and final category is described as idiopathic and has obscure etiology.

This is a presentation of two cases that show evidence of external apical resorption with concurrent periodontal bone loss of the involved teeth as the only evident stimulus in the history of the patient, clinically and radiographically.

Case Report

The first case was that of a 43-year-old patient who presented himself with mild generalized pain in the second quadrant. The medical history revealed no underlying condition, and the patient provided informed consent. The clinical examination included periodontal charting of the dentition which confirmed the presence of pockets in various locations, measuring between 4mm and 6mm. The adjacent gingivae and associated oral mucosa demonstrated no changes in color or texture. The initial panoramic radiograph (OPG) at the day of the appointment revealed a diffuse pattern of root resorption on the tooth #26 in contrast to the distinct and clear, although asymptomatic, root resorption of #47 (Figure 1).

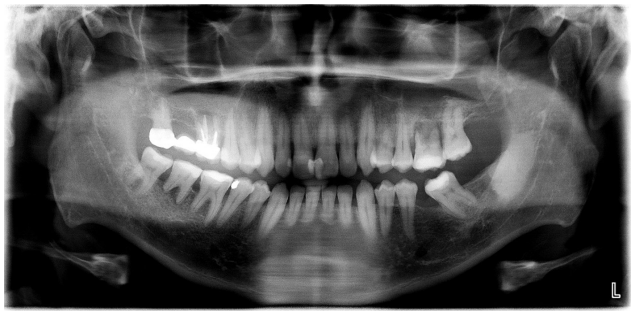

Figure 1. OPG examination on the day of the appointment.

The OPG was compared with one that the patient had from 3 years ago (Figure 2), proving that both #26 and #47's root resorption had commenced in the meantime.

Figure 2. OPG examination 3 years before the day of the appointment.

The history of the patient, medical, clinical and radiographic, ruled out all probable causes other than periodontitis, that was diagnosed by clinical and radiographic examination. The patient was subsequently referred to a periodontist who implemented conservative periodontal treatment, and due to extreme mobility, extracted both #26 (Figure 3) and #47 (Figure 4).

Figure 3. Post-operative display of #26. The RR is apparent in the mesial, distal and palatal root.

Figure 4. Post-operative display of #47. The RR may be noticed in the mesial and distal root, and specifically in the lower third.

The second case involved a 73-year-old patient who presented himself with mild generalized pain in the first quadrant, mostly while eating. Medical history revealed only the administration of furosemide as anti-hypertensive treatment, and the patient provided informed consent. Clinical examination included periodontal charting that confirmed deep pockets, more prominently in the posterior teeth of the maxilla, and specifically the first quadrant. An OPG examination on the day of the appointment confirmed the presence of the pockets radiographically (Figure 5) and intraoral periapical radiographs in the right posterior maxilla showed frank radiographic evidence of severe periodontal bone loss (Figure 6).

Figure 5. OPG examination when the symptoms commenced.

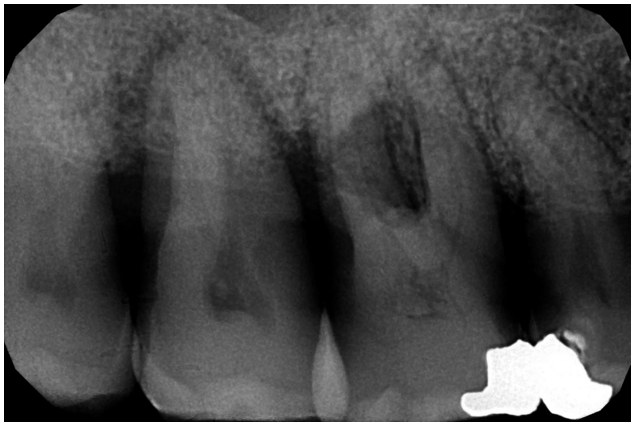

Figure 6. Severe periodontal loss is noticed at # 15, 16, 17 and 18.

The #16 did not respond to cold and therefore the patient was referred to an endodontist who initiated the root canal treatment and suggested an exploratory flap to determine the condition of the palatal root.

During the surgical procedure, a major resorption of the palatal root was noticed (Fig 7).

The periodontal status constituted the main causative factor in this case, because #16 had only a small, class 2, mesial filling in an adequate distance of the pulp.

The patient was interested in conservative care and therefore, the endodontist proceeded with the root canal treatment of the mesial and distal root, whereas the rest of the palatal root was removed with the purpose of halting the resorption process (Figure 8).

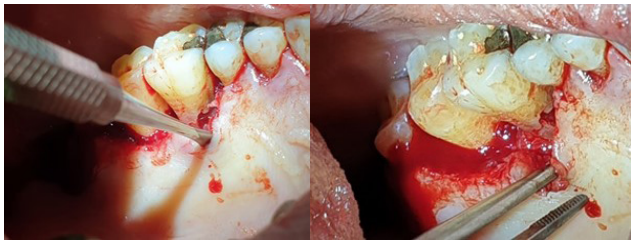

Figure 7. Exploratory flap revealing the resorption of the palatal root.

Figure 8. #16 post endodontic treatment.

Both patients adhere to a six-monthly dental check up to observe whether new root resorption sites will emerge, even after the implementation of periodontal treatment.

Discussion

Historically, intraoral periapical radiographs (PAs) was the first tool that was used to diagnose RR. However, over the years, the development of panoramic radiograph (OPG) and the later development of Cone Beam Computed Tomography (CBCT) has incrementally altered our ability to visualize and diagnose dental pathosis.

Levander and Malmgren in 1988 [4] suggested a classification for RR based on the percentage of the root that was resorbed using PAs. The classification ranged from 0-4 and included the following grades:

0 : absence of root resorption
1 : mild alteration of root shape
2 : root shortening < 2mm
3 : root shortening > 2mm but < 1/3 of root length
4: root shortening > 1/3 of root length

Based on this classification, the #26 of the first patient was rated as 4 whereas the #47 was rated as 3. Under the same classification system, the #16 of the second patient was rated as 3.

Yi *et al.* in a systematic review and meta-analysis compared the diagnostic capabilities of PAs versus CBCT [5]. The results showed that CBCTs had significantly

higher sensitivity and Area Under Curve (AUC) compared to PAs (0.89 vs 0.68 and 0.96 vs 0.88, respectively), thus strongly suggesting the reliability of CBCT in detecting external root resorption. In our case report, we relied exclusively on PA, in accordance to Moreira-Souza. Moreira-Souza *et al.*[6] compared the ability of CBCT to assess marginal bone loss (MBL) and external root resorption (ERR) on second molars when those are associated with third molar impaction to panoramic radiographs. After a two-phase selection of papers, five studies were included in the review and the results suggested a considerable agreement in the detection of ERR between CBCTs and OPGs. Therefore, CBCT could be avoided when OPG suffices for the establishment of RR diagnosis.

Baena-de la Iglesia *et al.* in a 2023 systematic review and meta-analysis of the literature reported an overall estimated sensitivity and specificity of 78.12% and 79.25%, respectively[7]. However, the clinical reality is that CBCT machines are not used to their full potential in order to limit the adverse effects of radiation as proposed by ALADA principle (As Low As Diagnostically Acceptable). Even though Malmgren index has been proven to be a useful tool in grading RR in two dimensional radiographs, it is not a suited method for three dimensions, with significant limitations[8].

As a result, new radiographic classifications are arising to assist communication between clinicians. Patel *et al.*[9] proposed an ingenious way to classify external cervical resorption three-dimensionally using the following 3 parameters: height of the defect, circumferential spread and proximity to the root canal. Chronic periodontitis is the most frequent type of destructive periodontal disease [10]. It is set forth with a gradual progression of the inflammatory process in the apical direction; it provokes the resorption of the alveolar bone, along with losing the tooth's attached soft tissue. Normally initiated at approximately 40 years of age, the disease slowly progresses with periods of exacerbation and remission [11,12].

Radiology plays a crucial role in detection and classification of periodontal disease, employing intraoral and extraoral techniques. Intraoral 2D radiographs include Bite Wings (BWs), both horizontal and vertical, which allow reliable representation of bone loss, and intraoral periapical radiographs, secondarily, which due to projection geometry tend to under-estimate bone loss, compared to the actual physical measurement during intraoperative procedures[13]. Extraoral techniques are the classic panoramic radiograph, which has been used due its low-dose radiation and cost-effectiveness with all the associated limitations (technique sensitive, superimposition of structures, etc.) and the more cutting-edge Cone Beam Computed Tomography (CBCT), with its accuracy in linear measurements, but increased patient exposure [13,14].

Root resorption involves shortening or blunting of the root concomitant with loss of cementum and/or dentin [15]. Physiological root resorption involves exclusively deciduous teeth and thus is considered pathological when affecting the permanent dentition [16]. The periodontal status acts as a precursor since periodontal disease-related root resorption is reportedly found about three times more frequently [15]. Certain studies concluded that more severe periodontal disease leads to more cases of transient external resorption [15,17].

Conclusions

Even though uncommon, the association of chronic periodontitis and root resorption has been reported in the literature. The latest classification of RR is based on height and circumference of the lesion and proximity to the root canal. Detection, classification and follow-up of the patient requires a thorough clinical and radiographic examination, either with 2D Panoramic and Bite Wings with 3D Cone Beam Computed Tomography for more complex cases. RR presents with significant variation in the affected teeth and, with no guidelines in place correlating a specific class of RR with a singular treatment, a case-by-case approach is the gold-standard.

References

1. 1. Ne RF, Witherspoon DE, Gutmann JL (1999). "Tooth resorption". *Quintessence Int.* **30** (1): 9-25. PMID: 10323155.
2. 2. Aidos H, Diogo P, Santos JM (2018). "Root Resorption Classifications: A Narrative Review and a Clinical Aid Proposal for Routine Assessment". *Eur Endod J,* **3** (3): 134-145. doi: 10.14744/eej.2018.33043. PMID: 32161869; PMCID: PMC7006572.
3. 3. Cadavid AMH, Araujo JP, Coutinho-Camillo CM, Sheyla Bologna S, Lemos Jr CA, Lourenço SV (2019). "Ameloblastomas: current aspects of the new WHO classification in an analysis of 136 cases". *Surg Exp Pathol,* **2**: 17. doi.org/10.1186/s42047-019-0041-z.
4. 4. Levander E, Malmgren O (1988). "Evaluation of the risk of root resorption during orthodontic treatment: a study of upper incisors". *Eur J Orthod*, **10** (1): 30-38. doi: 10.1093/ejo/10.1.30. PMID: 3162877.
5. 5. Yi J, Sun Y, Li Y, Li C, Li X, Zhao Z (2017). "Cone-beam computed tomography versus periapical radiograph for diagnosing external root resorption: A systematic review and meta-analysis". *Angle Orthod*, **87** (2): 328-337. doi: 10.2319/061916-481.1. Epub 2016 Nov 4. PMID: 27813424; PMCID: PMC8384368.

6. 6. Moreira-Souza L, Butini Oliveira L, Gaêta-Araujo H, Almeida-Marques M, Asprino L, Oenning AC (2022). "Comparison of CBCT and panoramic radiography for the assessment of bone loss and root resorption on the second molar associated with third molar impaction: a systematic review". *Dentomaxillofac Radiol*, **51** (3): 20210217. doi: 10.1259/dmfr.20210217. Epub 2021 Sep 14. PMID: 34520245; PMCID: PMC8925877.
7. 7. Baena-de la Iglesia T, Yañez-Vico RM, Iglesias-Linares A (2023). "Diagnostic Performance Of Cone-Beam Computed Tomography To Diagnose In Vivo/In Vitro Root Resorption: A Systematic Review And Meta-Analysis". *J Evid Based Dental Pract.* Elsevier Inc. Disponible en: https://doi.org/10.1016/J.JEBDP.2022.101803.
8. 8. Michielsens H, Decreus J, Begnoni G, Verdonck A, Jacobs R, Willems G, et al. (2023). "Performance of the Malmgren Index for Assessing Root Resorption on 2D vs. 3D Radiographs: A Pilot Study". *Healthcare*, ***11*** (13), 1860. https://doi.org/10.3390/healthcare11131860.
9. 9. Patel S, Foschi F, Mannocci F, Patel K (2018). "External cervical resorption: a three-dimensional classification". *Int Endod J,* **51** (2): 206-214. doi: 10.1111/iej.12824. Epub 2017 Sep 13. PMID: 28746776.
10. 10. Listgarten MA (1986). Pathogenesis of periodontitis. *J Clin Periodontol,* **13** (5): 418-430. doi: 10.1111/j.1600-051x.1986.tb01485.x. PMID: 3522650.
11. 11. Goodson JM, Tanner AC, Haffajee AD, Sornberger GC, Socransky SS (1982). "Patterns of progression and regression of advanced destructive periodontal disease". *J Clin Periodontol*. **9** (6): 472-481. doi: 10.1111/j.1600-051x.1982.tb02108.x. PMID: 6960023.
12. 12. Socransky SS, Haffajee AD, Goodson JM, Lindhe J (1984). "New concepts of destructive periodontal disease," *J Clin Periodontol*, **11** (1): 21–32. doi: 10.1111/J.1600-051X.1984.TB01305.X.
13. 13. Jacobs R, Fontenele RC, Lahoud P, Shujaat S, Bornstein MM (2024). "Radiographic diagnosis of periodontal diseases - Current evidence versus innovations". *Periodontol 2000*, **95** (1): 51-69. doi: 10.1111/prd.12580. Epub 2024 Jun 3. PMID: 38831570.
14. 14. Botsis C, Shinas N, Sapountzis A, Angelopoulos C (2021). "Accuracy of linear measurements of thin cortical bone on experimental surgical defects in cbct images with different exposure protocols: an in vitro study". *Oral Surg Oral Med Oral Pathol Oral Radiol*, **132** (3): e121. doi: 10.1016/j.oooo.2021.04.042.
15. 15. Mahajan AC, Kolte AP, Kolte RA, Agrawal AA (2017). "Dimensional Evaluation of Root Resorption Areas in Differing Severity of Chronic Periodontitis: A Scanning Electron Microscopic Study". *Contemp Clin Dent*, **8** (3): 433. doi: 10.4103/CCD.CCD_512_17.
16. 16. Fuss Z, Tsesis I, Lin S (2003). "Root resorption--diagnosis, classification and treatment choices based on stimulation factors". *Dent Traumatol*, **19** (4): 175–182. doi: 10.1034/J.1600-9657.2003.00192.X.
17. 17. Abelleira AC, Cobos MAR, Boquete IMF, Oreja MTC, Barreiro FJJ, Pato RBR (1999). "Morphological study of root surfaces in teeth with adult periodontitis". *J Periodontol*, **70** (11): 1283–1291. doi: 10.1902/JOP.1999.70.11.1283.

Received on December 20, 2024.
Revised on March 1, 2025.
Accepted on March 20, 2025.

Conflict of Interests: Nothing to declare.
Financial Disclosure Statement: Nothing to declare.
Human Right Statement: All the procedures on humans were conducted in accordance with the Helsinki Declaration of 1975, as revised 2000. Consent was obtained from the patient/s and approved for the current study by national ethical committee.
Animal Rights Statement: None required.

Correspondence

Vasileios Zisis
Department of Oral Medicine/ Pathology
School of Dentistry, Aristotle University of Thessaloniki, Greece
4 Oral and Maxillofacial Radiology Clinic, Department of Comprehensive Dentistry, University
e-mail: zisisdent@gmail.com