

Multi-modal Restorative Endodontic Management to Rehabilitate and Salvage a Tooth with External Cervical Resorption and Iatrogenic Over Enlarged Root Canal with Widened Apex

Abstract

The presence of both a pathologic external cervical resorption (ECR) and an iatrogenic over-enlarged root canal with a widened apex can significantly compromise the structural integrity of a tooth. Furthermore, regular restorative-endodontic management of the involved tooth poses many procedural challenges and difficulties. However, a multi-modal approach involving nonsurgical and surgical procedures with the application of advances in endodontics can help to manage and salvage such a tooth. This article aims to report on a case of multi-modal management with the application of cone-beam computed tomography, micro-endodontics, bioactive and biomimetic materials, and monobloc effect to manage and structurally rehabilitate and reinforce a tooth affected by both ECR and over enlarged canal with a widened apex. This multi-modal approach was applied with nonsurgical and surgical treatments to restoratively and endodontically manage the affected tooth. Clinical and radiographic follow-up of the tooth was uneventful and showed satisfactory and favorable outcomes.

Keywords: Biodentine, endodontics, external cervical resorption, iatrogenic, mineral trioxide aggregate

Introduction

External cervical resorption (ECR) of a tooth leads to loss of dental hard tissues and adjacent alveolar bone. Its prevalence is reported to range from 0.02% to 0.08%. Its initiation and progression are mostly related to underlying inflammation and/or infection.^[1-3] Although many risk factors have been identified for ECR, its definitive origin point is yet to be established.^[3] Mavridou *et al.*^[4] analyzed various factors associated with ECR and found that its occurrence is multifactorial in 59% of the cases with orthodontic treatment (45.7%) and trauma (28.5%) as the most common etiology. Internal or nonvital bleaching and iatrogenic damage are other prominent etiological factors.^[5] ECR is usually asymptomatic and can manifest without any signs and symptoms. On many occasions, it could be an incidental finding during routine radiographic examination.^[5] In case of pulp involvement, the associated pulpal symptoms could be the main clinical manifestation. A pink spot in the cervical

region is considered the pathognomonic sign of ECR.^[6]

Restorative management with or without endodontic therapy is mostly recommended as the treatment option to save the involved tooth. Restorative access to the resorptive defect could be obtained nonsurgically, surgically, or both.^[1,5,7] Although regular restorative and root-filling materials can be employed for this treatment option, it must be noted that ECR can lead to extensive loss of tooth structure and a significant weakening of the tooth, particularly in the critical cervical area. This can potentially result in a nonrestorable fracture of the tooth and, consequently, tooth loss.^[1,6] In addition, in a tooth with pathologic ECR, any excessive iatrogenic widening of the root canal and apex during endodontic therapy can further compromise the structural integrity of the tooth, increase the requirement of greater reinforcement for the tooth and worsen the overall prognosis for endodontic therapy and long-term retention of such a tooth. Moreover, under such circumstances, regular restorative-endodontic management poses many procedural challenges and

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difficulties related to various factors such as anatomical reasons pertaining to internal and external morphology of tooth, visibility and accessibility, control of working length, bonding between endodontic materials and root structure, manipulation and 3-dimensional adaptation or sealing of endodontic materials as per root anatomy or contour, and control of apical and lateral extrusion of endodontic materials.^[1] Hence, a multi-modal approach involving nonsurgical and surgical treatment with the application of advances in endodontics can help to manage, rehabilitate and, reinforce, and salvage such a tooth and facilitate better clinical success with satisfactory aesthetic, mechanical, biological, and functional outcomes.^[1,8]

Apart from having sound knowledge of the internal and external morphology of teeth, employing proper endodontic armamentarium, utilizing good radiographs, and diligent application of hand and rotary instruments, adopting strategies such as modern concepts, 3-dimensional imaging modalities, and newer or latest versions of endodontic instruments with improved characteristic features and performances play a crucial role to more accurately evaluate the root canal system, effectively detect morphological variations and pathological defects in a tooth, conserve as much coronal and radicular tooth structure as possible, minimize iatrogenic errors, and enhance overall endodontic success rate.^[9,10]

This article aims to report a case of multi-modal management by applying cone-beam computed tomography (CBCT), micro-endodontics, bioactive and biomimetic materials, and monobloc effect to restoratively and endodontically manage and structurally rehabilitate and reinforce a tooth affected by both a pathologic ECR and an iatrogenic over enlarged root canal with a widened apex.

Case Report

A 15-year-old female patient was referred with a history of previously initiated endodontic therapy in the maxillary right permanent central incisor. The patient gave a history of traumatic injury to the tooth, which occurred 3 years ago, and initiation of endodontic therapy a year back. Clinical examination of the tooth revealed a fractured incisal edge, discoloration involving the middle and incisal thirds of the labial surface, and open access preparation on the lingual aspect. The periapical radiograph of the tooth showed the presence of a cervical radiolucent lesion and an excessively wider root canal space. As the root canal outline looked intact and was traced running through the cervical radiolucent lesion, ECR was suspected, and CBCT imaging was done. With clinical assessment and CBCT evaluation, the presence of both a pathologic ECR and an iatrogenic over an enlarged root canal with a widened apex was confirmed.

Considering the structural weakening of the involved tooth and the challenges involved in its regular management, a multi-modal treatment plan was planned. It comprised

reinitiating root canal treatment, applying micro-endodontics, using a bioactive material with a nonsurgical approach for the endodontic management of over enlarged canal with a widened apex, employing a bioactive material with a surgical approach for the restorative management of ECR, and using a biomimetic adhesive or bonding material for postendodontic restoration. The patient and accompanying parents were explained the treatment plan, and consent was obtained. The planned treatment was carried out under a surgical operating microscope (Prima DNT, Labomed Inc., USA). The rubber dam was applied, and access preparation was refined. Working length was measured using an electronic apex locator (Root ZX mini, J Morita Corp, Japan). During radiographic verification of the working length, iatrogenic over-enlargement of the root canal with the widening of the apex was evident. The working length was adjusted and recorded accordingly. Due to already over-enlarged canal, canal cleaning and shaping were carried out gently with minimal manual instrumentation using K-files (Mani Inc., Japan). Chemical disinfection was accomplished with 3% NaOCl (Parcan, Septodont, India) and 17% EDTA (Desmear, Anabond Stedman, India) irrigation and ultrasonic activation (Ultra X, Eighteenth Medical, China). Saline was used to flush out chemical irrigants. Calcium hydroxide (Calcipect II, J Morita, Japan) was used for intracanal medication, and access was temporarily closed. In the next visit, after 2 weeks of follow-up, access was re-entered, intracanal medicament was flushed out, the canal was dried, and monobloc obturation was carried out by placing an apical collagen barrier and packing rapid setting mineral trioxide aggregate (MTA) (Angelus Dental, Brazil) as the bioactive material. MTA was manipulated as per manufacturer instructions, carried into the canal using an MTA carrier and compacted with precalibrated hand pluggers. MTA was down-packed initially for form an apical plug and then back-packed up to the middle 3rd of the root canal to complete monobloc obturation. The MTA apical plug and monobloc obturation were verified radiographically and with CBCT imaging [Figure 1].

Following this, surgical restorative management of ECR was carried out. Local anesthesia (Lignox 2%, Indoco, India) was administered. A full-thickness mucoperiosteal flap with a single releasing incision was elevated to obtain access to the site of resorption. A tungsten carbide bur (HP703, Prima Classic, UK) was used to refine the surgical site and to gain access and prepare the resorptive defect. The granulation tissue found in the resorptive defect was curetted out. The resorptive defect was found communicating with the pulp space. The resorptive defect and surgical site were decontaminated using cotton pellets soaked with 3% NaOCl and 17% EDTA to minimize any potential for progression or recurrence of resorption. Biodentine (Septodont Inc., France) was selected as the bioactive material for restoring the resorption defect. Biodentine was manipulated as per manufacturer instructions, carried into the defect, and well compacted to entirely fill the

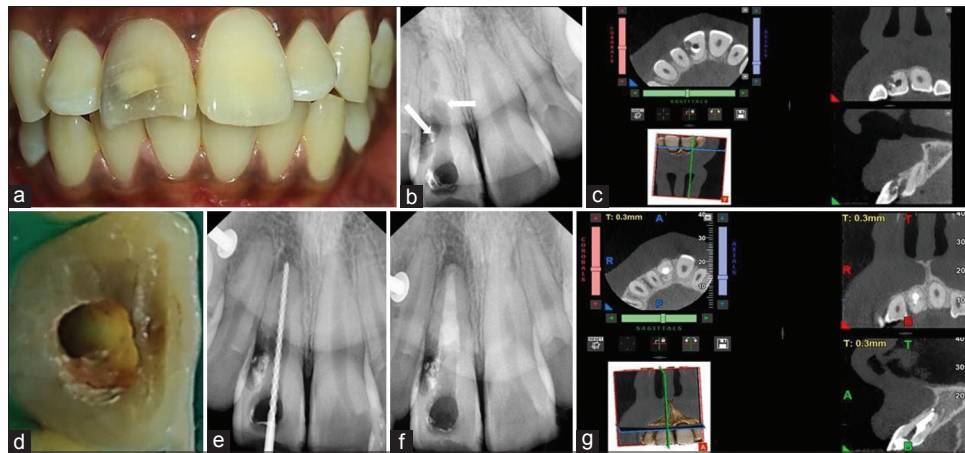


Figure 1: (a) Preoperative clinical view of the involved maxillary right permanent central incisor (b) Preoperative periapical radiographic view of the involved tooth with cervical radiolucency on the distal aspect (white arrow) and over the enlarged canal (white arrow) (c) Cone-beam computed tomography (CBCT) done for 3-dimensional assessment of the involved tooth and its surrounding structures (d) Clinical view of the refined lingual access opening under magnification. (e) Radiographic verification of the working length (f) Radiographic verification of the mineral trioxide aggregate (MTA) apical plug and monobloc obturation (g) CBCT view of the MTA-based radicular rehabilitation and reinforcement

resorptive defect and into the coronal 3rd of the canal through the communicating space between them. Apart from sealing the resorptive defect, this also facilitated cervical-coronal 3rd rehabilitation with a monobloc effect. Later, the access preparation was restored with packable composite resin (Tetric N Ceram, Ivoclar, USA) as the biomimetic bonding material. Following radiographic verification, the elevated flap was repositioned and sutured to facilitate healing. The patient was given postoperative instructions and prescribed medications. Clinical and radiographic follow-up was carried out at regular intervals. At 1½ year follow-up, the tooth was found clinically asymptomatic with satisfactory radiographic findings [Figure 2].

Discussion

Etiopathogenesis of ECR, based on recent histologic studies, could involve three stages, namely, initiation, progressive, and reparative stages. The presence of pericanal resorption resistant sheet (PRRS) plays a crucial role in the etiopathogenesis of ECR. PRRS is composed of dentin, predentin, and sometimes bone-akin tissues. Damage to this PRRS is assumed to initiate ECR.^[4]

In the present case, trauma could have been the main etiological factor for ECR. ECR has a greater predilection for occurrence in maxillary anterior teeth.^[5,6] Considering the tendency for ECR to spread in multiple planes and in a haphazard manner, conventional radiography must be supplemented with a 3-dimensional imaging modality to thoroughly evaluate the location, extent, and stage of ECR.^[1,2,5] Therefore, CBCT was employed.

In this case, due to the presence of ECR and over enlarged canal with a widened apex, both nonsurgical and surgical approaches were adopted, with the former approach for apical and canal sealing with radicular rehabilitation and the latter one for lateral resorptive sealing with cervical

rehabilitation. When overall survival and success rates are considered, the surgical approach with complete removal of resorptive tissues and conventional restorative sealing of ECR provides a satisfactory or good outcome. This outcome can be bettered with the application of advances in endodontics and stringent case selection criteria.^[5,7]

Micro-endodontics with the application of a surgical microscope was employed in this case to obtain enhanced magnification and significantly improve the visibility and accessibility. Because of the presence of a widened apex with extensive loss of radicular structure, MTA was used for apical sealing and root filling with monobloc reinforcement of the apical 3rd and middle 3rd of the root; whereas biodentine was employed for restorative sealing of extensive ECR and for reinforcement of cervical area and coronal 3rd of root with monobloc effect. Using both MTA and biodentine in the current case assisted in obtaining advantages of the application of dual bioactive materials. These bioactive materials are suitable for endodontic or radicular rehabilitation and reinforcement due to their favorable chemical, physical or mechanical, antibacterial, setting, sealing, biological, and radiopacity-related properties. In addition, biodentine is suitable for restorative sealing with cervical and coronal rehabilitation due to its aesthetic or color-matching ability, better handling or manipulation, and properties comparable to natural dentine.^[8,11] However, the major drawback of radicular monobloc rehabilitation with these bioactive materials is that there is limited scope for orthograde or nonsurgical retreatment due to the lack of a universal solvent to remove them.^[12] Composite resin was employed as the biomimetic restorative material for the conservative postendodontic restoration with effective coronal sealing and reinforcement due to its aesthetic property with superior polishability and ability for adhesive or micromechanical bonding.^[8] Patient follow-up showed that multi-modal management with biomaterials was successful

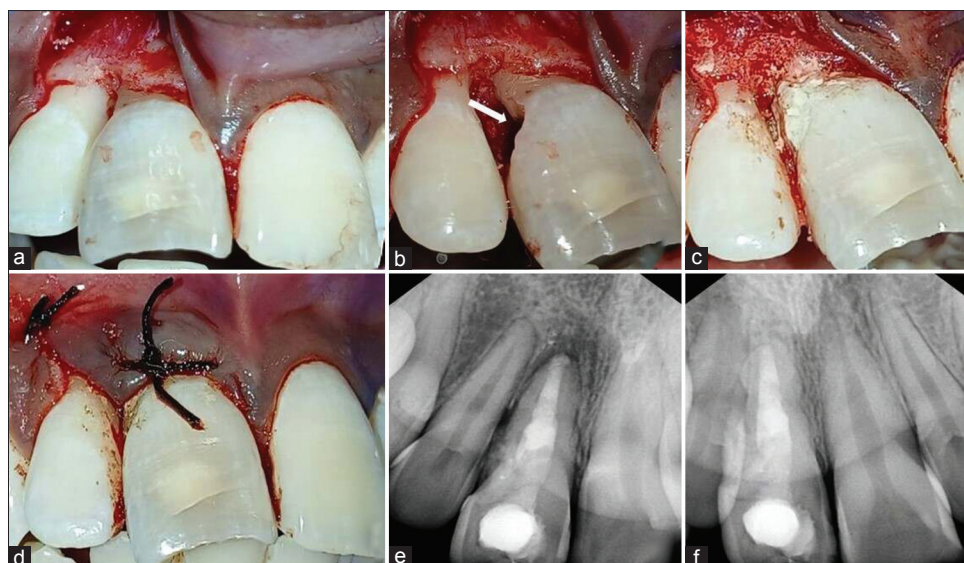


Figure 2: (a) Surgical access was obtained to the external cervical resorption defect (b) Surgical site and resorptive defect were refined (white arrow) (c) The restorative sealing of resorptive defects using biodentine (d) Closure of the surgical site with flap repositioning and suturing (e) Radiographic verification following corono-radicular rehabilitation and reinforcement of the involved tooth (f) 1½ year follow-up with a radiograph showed satisfactory periapical healing and status

in achieving corona-radicular sealing, rehabilitation, and reinforcement to salvage the affected tooth.

Conclusion

A tooth affected by both a pathologic ECR and an iatrogenic over-enlargement of the canal with a widened apex is vulnerable to significant structural weakening and poses many challenges to regular restorative-endodontic management. In such a case, a multi-modal approach by employing nonsurgical and surgical treatments with CBCT, micro-endodontics, bioactive and biomimetic materials, and monobloc effect is valuable for restorative-endodontic management and rehabilitation with corono-radicular reinforcement to salvage the affected tooth. This multi-modal management can ensure clinical success with satisfactory and favorable outcomes.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form, the legal guardian has given his consent for images and other clinical information to be reported in the journal. The guardian understands that names and initials will not be published and due efforts will be made to conceal identity, but anonymity cannot be guaranteed.

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Conflicts of interest

There are no conflicts of interest.

References

1. Berman LH, Hargreaves KM, Rotstein I. Cohen's Pathways of the Pulp. 12th ed. St. Louis, Missouri: Elsevier; 2021.

2. Mavridou AM, Bergmans L, Barendregt D, Lambrechts P. Descriptive analysis of factors associated with external cervical resorption. J Endod 2017;43:1602-10.
3. Chen Y, Huang Y, Deng X. A review of external cervical resorption. J Endod 2021;47:883-94.
4. Mavridou AM, Hauben E, Wevers M, Schepers E, Bergmans L, Lambrechts P. Understanding external cervical resorption in vital teeth. J Endod 2016;42:1737-51.
5. Jebril A, Aljamani S, Jarad F. The surgical management of external cervical resorption: A retrospective observational study of treatment outcomes and classifications. J Endod 2020;46:778-85.
6. Espoña J, Roig E, Durán-Sindreu F, Abella F, Machado M, Roig M. Invasive cervical resorption: Clinical management in the anterior zone. J Endod 2018;44:1749-54.
7. Irinakakis E, Haapasalo M, Shen Y, Aleksejuniene J. External cervical resorption – Treatment outcomes and determinants: A retrospective cohort study with up to 10 years of follow-up. Int Endod J 2022;55:441-52.
8. Jain R, Thomas MS, Pai AR. Rehabilitation of surgically failed anterior teeth using bioactive material and monoblock effect. Indian J Dent Adv 2015;7:1794-8.
9. Reda R, Di Nardo D, Zanza A, Bellanova V, Abbagnale R, Pagnoni F, et al. Upper first and second molar pulp chamber endodontic anatomy evaluation according to a recent classification: A cone beam computed tomography study. J Imaging 2023;10:9.
10. Seracchiani M, Reda R, Zanza A, D'Angelo M, Russo P, Luca T. Mechanical performance and metallurgical characteristics of 5 different single-file reciprocating instruments: A comparative *in vitro* and laboratory study. J Endod 2022;48:1073-80.
11. Wang Z. Bioceramic materials in endodontics. Endod Top 2015;32:3-10.
12. Torabinejad M, Parirokh M, Dummer PM. Mineral trioxide aggregate and other bioactive endodontic cements: An updated overview – Part II: Other clinical applications and complications. Int Endod J 2018;51:284-317.