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Hybrid Approach to Manage Inflammatory Internal Root Resorption: A Case Report

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Internal inflammatory root resorption (IRR) poses significant challenges in endodontic treatment due to its potential to compromise tooth integrity. This case report describes the conservative management of IRR in a 40-year-old woman with a radiolucent lesion in the midroot of a maxillary central incisor. Early diagnosis using cone-beam computed tomography prevented perforation and guided treatment planning. Non-surgical endodontic treatment was performed using a dental operating microscope, ultrasonic irrigation, and a hybrid obturation technique. The apical portion of the canal was sealed with a bioceramic sealer and single-cone gutta-percha, while the resorptive defect was filled with calcium-enriched mixture cement due to its biocompatibility and sealing properties. At one-year follow-up, the patient was asymptomatic, with radiographic evidence of healing. This case highlights the efficacy of combining advanced diagnostic tools, bioactive materials, and minimally invasive techniques for successful IRR management.

Keywords: Bioceramic Sealer; Calcium-enriched Mixture; CEM Cement; Cone-beam Computed Tomography; Endodontics; Root Resorption

Introduction

Resorption is a pathological or physiological process characterized by the loss of dentin, cementum, or bone [1]. It is classified as either internal or external, depending on its origin [2]. Internal root resorption (IRR), a rare condition, is further categorized into replacement or inflammatory types [1, 3]. Inflammatory IRR is driven by odontoclastic activity, which progressively degrades dentinal tubules from the pulpal canal surface toward the outer root surface, potentially leading to cementum invasion [4, 5]. This process is often sustained by bacterial stimuli within the root canal system, resulting in necrotic pulp tissue coronally and vital pulp tissue apically [6].

The prevalence of inflammatory IRR is estimated to range from 0.01% to 1% with a higher incidence in incisors [7, 8]. Despite its rarity, IRR poses significant diagnostic and therapeutic challenges in endodontics [9]. The exact etiology of IRR remains unclear, but several predisposing factors have been identified, including dental trauma (acute or chronic), orthodontic treatment, pulp amputation, inadequate cooling during crown preparation, hyperthyroidism, invagination, and viral infections such as herpes zoster [4, 6, 10]. Interestingly, a case involving monozygotic twins has also suggested a potential genetic predisposition [11].

Early diagnosis and effective management are critical to preserving tooth structure and preventing complications such as perforation or tooth loss [12]. Advanced imaging techniques, such as cone-beam computed tomography (CBCT), have become indispensable tools for accurate diagnosis and treatment planning in IRR cases [13, 14]. Additionally, the use of bioactive materials, such as calcium-enriched mixture (CEM) cement, has gained attention due to their unique properties, including biocompatibility, antibacterial activity, and the ability to promote osteogenesis, dentin genesis, and cementogenesis [15, 16]. These biomaterials not only provide a biological seal but also support tissue regeneration, making them ideal for managing complex restorative defects.

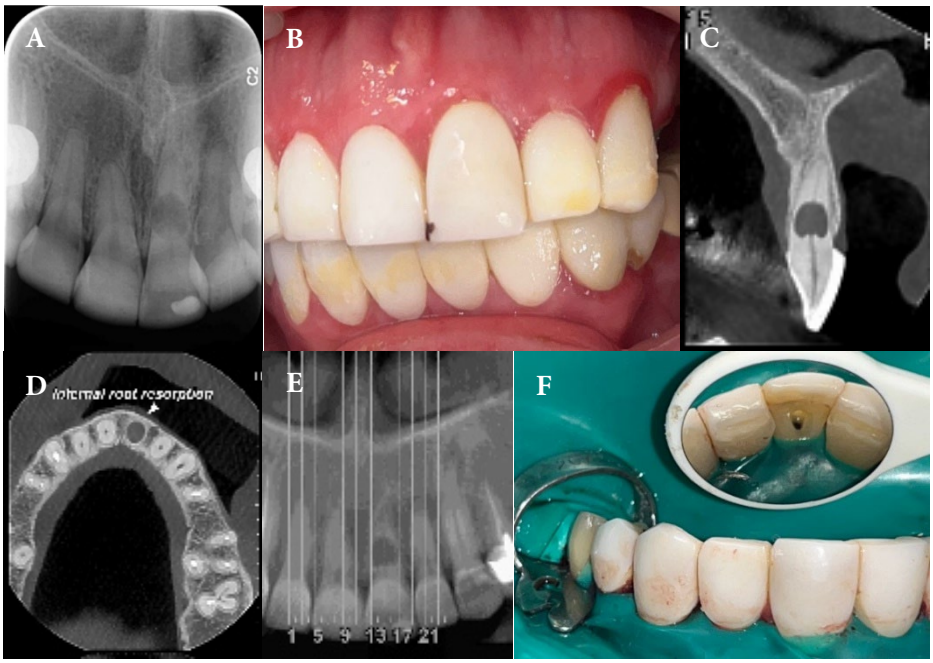

Figure 1. *A*) Preoperativ periapical radiography showing internal root resorption in maxillary left incisor; *B*) Preoperative clinical photograph; *C, D, E*) Sagittal, axial, and coronal planes of CBCT showing that no perforation has occurred; *F)* Isolation by split dam technique

In this case report, we present the conservative management of internal inflammatory root resorption in a permanent maxillary central incisor using a hybrid approach involving CEM cement and a bioceramic sealer. This combination leverages the strengths of both materials to achieve optimal sealing and promote healing, offering a minimally invasive alternative to traditional treatment methods.

Case Presentation

A 40-year-old female patient with good oral hygiene and no significant systemic medical history was referred to the endodontic department. Her chief complaint was mild discomfort in the left maxillary central incisor (tooth #8). The patient reported no history of dental trauma or orthodontic treatment.

Clinical examination revealed composite veneers on the anterior teeth (from the left canine to the right canine), placed approximately five years prior. The veneers showed no signs of discoloration or deterioration. Pulp sensibility tests, including thermal and electric pulp testing (Parkell, Edgewood, NY, USA), elicited no response, indicating necrotic pulp. The tooth was insensitive to percussion and palpation, with no detectable periodontal pockets or mobility.

CBCT (NewTom Vgi, Italy; voxel size: 100 µm, kVp: 110, FOV: 6×6 cm) was performed to evaluate the tooth in sagittal, axial, and coronal planes. CBCT revealed a significant circular radiolucent lesion in the middle third of the root of tooth #8, accompanied by slight widening of the periodontal ligament (PDL) space and thinning of the surrounding dentinal walls (Figures 1A-1E). Based on the clinical and radiographic findings, a diagnosis of IRR with necrotic pulp was established.

The treatment options, including non-surgical endodontic therapy or extraction, were discussed with the patient. After obtaining informed consent, the patient opted for conservative endodontic treatment to preserve the tooth.

The treatment was initiated under local anesthesia (2% lidocaine with 1:80,000 epinephrine, DarouPakhsh, Tehran, Iran) and rubber dam isolation using a split-dam technique to accommodate the composite veneers (Figure 1F). All procedures were performed under 4× magnification using a dental operating microscope (Carl Zeiss, Oberkochen, Germany). The working length was determined using an apex locator (Root ZX, J Morita, Japan) and confirmed with digital radiography (Figure 2A) (Kodak RVG Radiography System; Kodak, Toronto, Ontario, Canada). Chemo-mechanical preparation was carried out using ProTaper Gold rotary files (SP1 Gold Rotary, Shenzhen, China) in a crown-down technique. The canal was irrigated with 2 mL of 5.25% sodium hypochlorite (Golrang, Pakshoo Co., Iran), followed by ultrasonic activation (Woodpecker U6 ultrasonic scaler; PD1 tips, power: 6 V; USA) for 20 sec. A creamy calcium hydroxide paste (CH; Aria Dent, Tehran, Iran) was prepared by mixing CH powder with saline

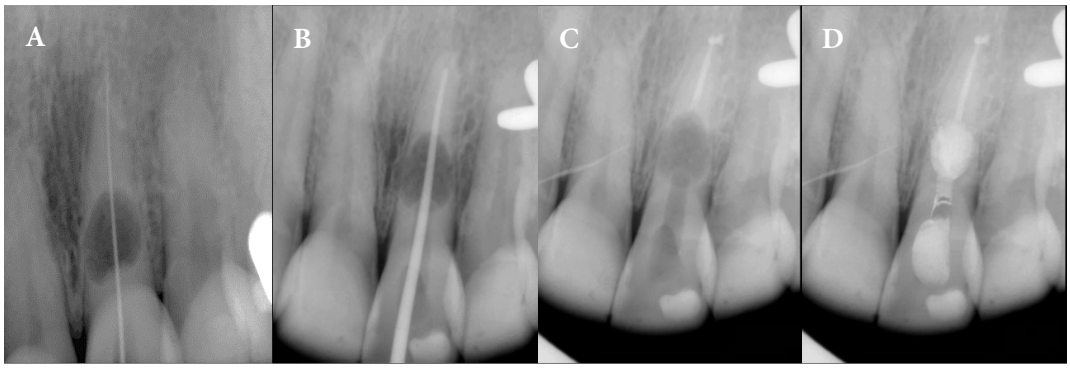

Figure 2. *A*) Confirming initial length of canal by radiography; *B*) Confirming MAC by radiography; *C*) Cutting off the gutta-percha below the resorption defect under DOM; *D*) Immediate post-operative radiography

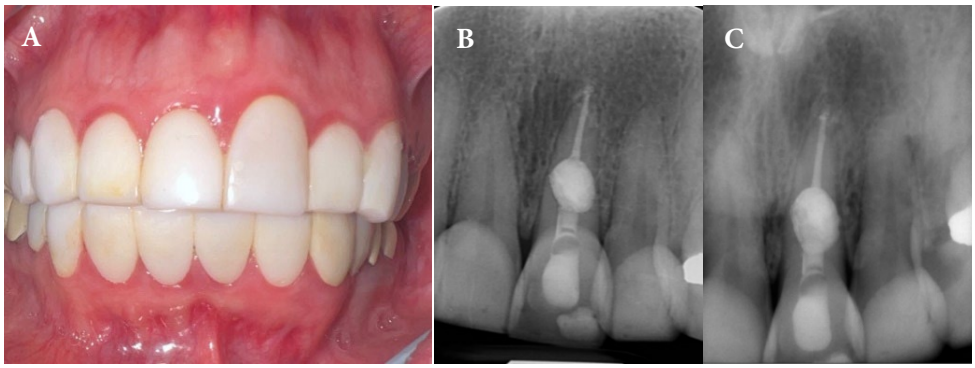

Figure 3. *A*) Intraoral examination after 6-month follow-up; *B*) Periapical radiography after 6-month; *C*) Periapical radiography after one year

and placed in the canal using a Lentulo #30 spiral filler (Mani, Japan). The access cavity was sealed with Cavit temporary filling material (Nik Darman, USA).

Two weeks later, the patient returned with swelling in the anterior maxilla and apical sensitivity to palpation. Drainage was performed through the canal, followed by irrigation with 5.25% sodium hypochlorite and ultrasonic activation. The canal was then irrigated with 3 mL of 17% EDTA for 3 min, and CH paste was reapplied. The tooth was temporarily sealed, and the patient was scheduled for a third visit.

At the third visit (two weeks later), the patient was asymptomatic. The canal irrigation was performed with 17% EDTA and 5.25% sodium hypochlorite, then, dried with paper points. Before obturation, the MAC length was confirmed by radiography (Figure 2B). The apical portion of the canal (below the resorption defect) was obturated using a single-cone technique with a 40/0.04 gutta-percha point and bioceramic sealer (EndoSeal, Maruchi, Wonju, Korea) (Figure 2C). The resorptive defect was filled with CEM cement (BioniqueDent, Tehran, Iran), manually condensed using pluggers (#70 and #80) to 1 mm below the cementoenamel junction (Figure 2D). The access cavity was temporarily restored with Cavit. One week later, the temporary restoration was replaced with a final composite restoration (Z250; 3M/ESPE, St. Paul, MN, USA).

The patient was evaluated clinically and radiographically at six months and one year post-treatment. At both follow-ups, she remained asymptomatic, with no clinical signs of infection or mobility; radiographic examinations revealed normal PDL (Figure 3).

Discussion

This case report demonstrates the successful conservative management of IRR in a maxillary central incisor using a hybrid approach involving a bioceramic sealer and CEM cement. The favorable outcome highlights the importance of early diagnosis, advanced imaging, and the use of bioactive materials in preserving tooth structure and function.

Early detection of IRR is critical to preventing complications such as root perforation or tooth loss [4, 17]. In this case, CBCT played a pivotal role in accurately diagnosing the extent and location of the resorptive defect. CBCT provides 3-dimensional visualization, enabling clinicians to assess the integrity of the root structure and plan treatment more

effectively than conventional radiography [13]. The use of CBCT in this case allowed for precise identification of the circular radiolucent lesion in the midroot region, facilitating a conservative treatment approach.

The irregular morphology of resorptive defects often complicates root canal cleaning and shaping. Mechanical instrumentation alone is insufficient to address these irregularities, necessitating the use of adjunctive techniques such as ultrasonic activation of irrigants [18]. In this case, ultrasonic activation of 5.25% sodium hypochlorite enhanced the removal of necrotic tissue and biofilm from the inaccessible areas of the canal.

The use of CH as an intracanal medicament in this case was based on its well-documented antibacterial properties and ability to neutralize endotoxins within the root canal system [19]. However, the development of a localized abscess two weeks after the initial visit highlights the limitations of CH in completely eliminating intracanal bacteria, particularly in complex cases with irregular anatomy. The resolution of the abscess following repeated CH therapy underscores its role in controlling persistent infection and promoting healing. Nevertheless, some studies suggest that CH may not always be necessary for effective disinfection, as thorough chemomechanical instrumentation completed with a hermetic seal can achieve successful outcomes without prolonging treatment [20]. This raises questions about the optimal use of intracanal medicaments and emphasizes the importance of case-specific decision-making in endodontic therapy.

The hybrid obturation technique employed in this case, offered several advantages. The bioceramic sealer (EndoSeal) was used in the apical portion of the canal due to its excellent sealing ability, biocompatibility, and ability to bond to dentin [21]. CEM cement, a bioactive material, was chosen to fill the resorptive defect because of its unique properties, including osteogenic, dentinogenic, and cementogenic potential, as well as its superior sealing ability [16]. The synergistic combination of these biomaterials provided an effective hermetic seal while facilitating the natural healing processes of adjacent tissues, without the need for additional additives [22].

The introduction of bioactive calcium silicate cements, such as CEM cement and bioceramic sealers, has marked a paradigm shift in root canal therapy. These materials not only act as a physical barrier against microbial invasion through bio-obturation [23] but also actively stimulate tissue regeneration [16]. Notably, CEM cement demonstrates minimal discoloration compared to mineral trioxide aggregate (MTA), a material containing bismuth oxide [24], making it particularly advantageous for anterior teeth in the aesthetic zone due to its superior esthetic outcomes [16].

Conclusion

This case report highlights the importance of a multidisciplinary approach to managing IRR, incorporating advanced diagnostic tools, minimally invasive techniques, and bioactive materials. The favorable outcome at one-year follow-up suggests that the hybrid obturation technique using bioceramic sealer and CEM cement is a viable option for treating IRR. However, further studies with larger sample sizes and longer follow-up periods are needed to validate the long-term efficacy of this approach. Additionally, comparative studies evaluating different materials and techniques for managing IRR would provide valuable insights for clinicians.

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Conflict of interest
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