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# Partial Pulpectomy with Bio-Obturation for Internal Root Resorption: A Case Report

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**Abstract**

Internal root resorption (IRR) is an uncommon but clinically significant condition traditionally managed with complete pulpectomy and root canal therapy. Advances in vital pulp therapy and bioactive calcium silicate–based cements have enabled conservative strategies aimed at preserving residual pulp vitality. A 33-year-old woman presented with an asymptomatic, unperforated IRR in the maxillary left lateral incisor, confirmed by periapical radiography and cone-beam computed tomography. The tooth responded positively to sensibility testing and showed healthy periapical tissues. A partial pulpectomy was performed: diseased coronal and mid-root pulp was removed, while approximately 5 mm of vital apical pulp was preserved. The resorptive cavity and root canal were bio-obturated with calcium-enriched mixture cement, which also served as a capping biomaterial for the apical pulp stump. Postoperative imaging confirmed complete filling/sealing of the resorptive defect and root canal while maintaining the apical pulp segment. At 2-year follow-up, the tooth remained functional, symptom-free, and radiographically stable, with intact lamina dura and no evidence of progressive resorption. This case demonstrates that partial pulpectomy combined with bio-obturation using an endodontic biomaterial may successfully arrest IRR and preserve apical pulp vitality in carefully selected cases. While the outcome supports the biological feasibility of this approach, further studies with larger samples and longer follow-up are required before it can be considered a routine alternative to conventional treatment.

**Keywords:** Bio-obturation; Calcium Derivates; Calcium Silicate Cement; Calcium-Enriched Mixture; Dental Pulp; Endodontics; Mineral Trioxide Aggregate; Pulpotomy; Tooth Resorption; Volume CT

## Introduction

Internal root resorption (IRR) is a relatively rare but clinically significant form of pathological dentin loss, initiated within the pulp chamber or root canal system. It is often asymptomatic and incidentally detected on routine radiographic examinations, though advanced cases may present with discoloration (i.e., pink spot) or perforation into the periodontal ligament space [1, 2]. Cone-beam computed tomography (CBCT) has become the diagnostic modality of choice, enabling precise localization, assessment of lesion size, and detection of perforations [3, 4]. Management aims to arrest clastic activity by removing the inflamed resorptive pulp tissue, cleaning/shaping the defect/canal space, and filling/sealing the cavity with a stable biomaterial [5]. Conventional endodontic therapy is often employed, although large or perforated defects present considerable restorative and prognostic challenges [6].

In recent years, there has been increasing emphasis on vital pulp therapy (VPT) as a biologically based alternative to full pulpectomy/root canal therapy [7]. VPT includes procedures such as direct/indirect pulp capping and miniature/partial/full pulpotomy, which aim to selectively/gradually protect/remove inflamed pulpal tissue while preserving healthy/functional pulp [8]. Retaining vital pulp confers several biological advantages, including preservation of sensory innervation, proprioception, immune defense, and maintenance of dentinogenic potential [9]. When applied in the context of IRR, partial pulpectomy allows removal of the inflamed intracanal tissue, driving

resorption while conserving unaffected apical pulp, thereby balancing disease control with preservation of pulp vitality [10].

The introduction of calcium silicate–based biomaterials (CSBs), such as mineral trioxide aggregate (MTA) and calcium-enriched mixture (CEM) cement, has revolutionized VPTs and resorption management [11]. These biomaterials provide bioactivity, sealing ability, biocompatibility, and favorable handling properties [12, 13]. Specifically, CEM cement has demonstrated antimicrobial activity, dentinogenic potential, and reliable sealing capacity in both perforation repairs and VPT procedures [14]. Its ability to induce hard tissue deposition and remain dimensionally stable in moist environments makes it well-suited for managing IRR cavities.

In this context, bio-obturation (the filling and sealing of the prepared root canal system with CSBs rather than conventional gutta-percha and sealer) has emerged as a biologically driven alternative [15]. By creating a monoblock-like interface with dentin, this approach minimizes interfacial leakage, enhances sealing, and establishes a stable alkaline environment conducive to periradicular healing and hard tissue deposition [16]. The use of CSBs allows for superior adaptation in anatomically complex or irregular canal spaces, including resorptive defects, and enables direct protection of a preserved apical pulp segment. Bio-obturation is particularly advantageous in cases with thin dentinal walls or challenging canal morphology, where traditional root canal filling may compromise sealing quality or structural integrity.

Despite extensive literature on conventional management of IRR, there is a notable lack of published cases describing selective preservation of apical pulp tissue in IRR [17]. Most reports focus on full pulpectomy, even in unperforated lesions with residual vitality. This gap highlights the need to explore biologically driven alternatives that combine disease control with pulp preservation. Given these developments, conservative management of IRR using partial pulpectomy and bio-obturation with CEM cement represents a biologically sound and minimally invasive approach.

This case report describes the diagnosis and successful two-year outcome of such a strategy in an asymptomatic, unperforated IRR lesion of a maxillary lateral incisor. The report emphasizes the feasibility of VPT and bio-obturation using CEM cement as a novel treatment modality that extends beyond conventional pulpectomy and root canal therapy while supporting long-term function.

## Case Presentation

A 33-year-old female presented for a routine dental examination with no specific complaints. Her medical history was non-contributory, and she reported no systemic conditions or medication use. She denied any history of trauma, pain, or prior orthodontic treatment in the anterior maxilla.

Clinically, the maxillary left lateral incisor (tooth #22) demonstrated normal color and morphology, with no caries or fractures, but a small Class III mesial composite restoration. Periodontal probing depths (<3 mm) and mobility were within physiological limits. The tooth was asymptomatic to percussion and palpation. Sensibility testing with cold spray and electric pulp testing elicited responses within the normal range. Periapical radiography revealed a well-circumscribed, ovoid radiolucency producing symmetrical ballooning of the canal in the coronal third of the root (Fig. 1A). The periodontal ligament space and lamina dura were intact, and no periapical radiolucency was observed. CBCT confirmed an intracanal resorptive lacuna confined to the dentin walls, with intact external root surfaces and no perforation into the periodontium (Fig. 1B–1D). The pulpal and periapical diagnoses were an inflamed vital pulp with IRR and normal periapical tissues, respectively.

After obtaining informed consent, endodontic treatment was initiated. A conservative access cavity was prepared, and coronal and mid-root pulp tissue, including the resorptive lesion, was carefully removed using hand K-files, with limited use of appropriate Gates-Glidden burs solely for conservative coronal flaring, minimizing unnecessary dentin removal and preserving root structure integrity. Approximately 5 mm of vital apical pulp was intentionally preserved as a pulp stump. The canal and resorptive cavity were irrigated with 5.25% sodium hypochlorite [18], followed by saline flushing to minimize contact with the vital tissue. No mechanical instrumentation was carried into the apical third; finally, the canal was gently dried. CEM cement (BioniqueDent, Tehran, Iran) was mixed and inserted orthograde with a carrier. A thin layer was carefully applied over the vital apical pulp stump as a protective cap, and the remaining canal space was backfilled. It was adapted with fine pluggers to fill/seal the resorptive cavity and root canal walls. Postoperative radiography confirmed homogeneous bio-obturation of the resorptive defect and coronal/mid-root canal, with intentional preservation of the apical segment (Fig. 1E).

At the 1-week recall, the tooth remained asymptomatic and functional. At the 2-year follow-up, the patient remained asymptomatic, and the tooth was fully functional in occlusion. Periapical radiography revealed an intact lamina dura, no evidence of continued resorption, and stable CEM bio-obturation. The apical third and periradicular tissues remained unaltered, suggesting successful preservation of the apical pulp Stump (Fig. 1F).

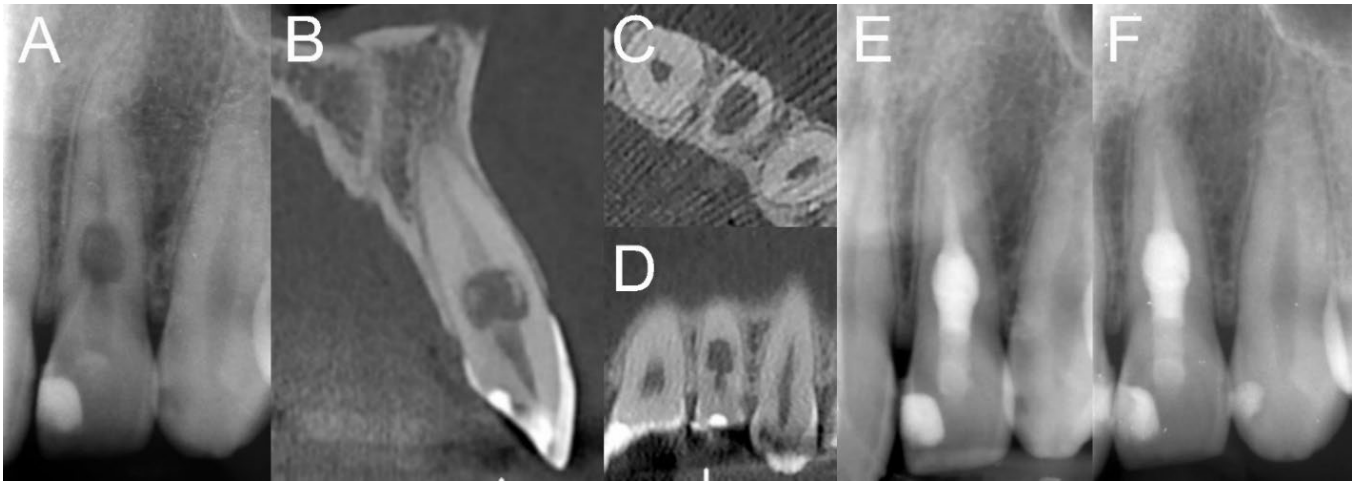


***Figure 1.*** Radiographic and CBCT findings of IRR in tooth #22; *A*) Preoperative periapical radiograph showing a well-circumscribed, ovoid radiolucency in the coronal third of the root, consistent with IRR; *B–D*) CBCT axial, sagittal, and coronal slices confirm the resorptive defect confined to dentin, with intact external root surfaces and no perforation; *E*) Immediate postoperative periapical radiograph showing complete bio-obturation of the resorptive lacuna and mid-root/coronal segment of the root canal with CEM cement; the apical ~5 mm of vital pulp is preserved; *F*) Two-year follow-up radiograph demonstrating stable obturation, arrested resorption, and intact lamina dura.

## Discussion

IRR is an uncommon degenerative change, usually asymptomatic, and most often detected incidentally on radiographic examination [19]. It results from chronic pulp inflammation stimulating odontoclastic activity, leading to progressive intracanal dentin loss [1]. Conventional management involves pulpectomy and root canal treatment, which removes all pulp tissue, including potentially healthy apical segments. In non-perforated cases with vital pulp, such radical treatment may be unnecessary, and more conservative approaches may be feasible [10].

In this case, a partial pulpectomy was performed, removing the diseased coronal and mid-root pulp while preserving ~5 mm of apical pulp stump. This strategy aligns with modern VPT principles, which emphasize retention of healthy pulp tissue to maintain vascularity, sensory function, immune defense, and dentinogenic potential [8]. While VPTs are well established in carious pulp exposures and traumatic injuries, their application in IRR remains limited [10, 15, 17, 20], highlighting the novelty of this conservative approach.

The use of bioactive CSBs, particularly CEM cement, was critical to treatment success. These biomaterials exhibit excellent sealing ability, biocompatibility, antimicrobial activity, and the capacity to stimulate hard tissue deposition [14, 21]. In this case, CEM cement served both as a pulp-capping agent over the apical pulp stump and as a root canal filling/sealing for the resorptive defect [16]. Its handling properties and dimensional stability allowed predictable adaptation to the irregular resorptive cavity while protecting the preserved pulp tissue. Moreover, the favorable clinical performance of CEM cement has been associated with reduced postoperative pain and improved patient outcomes, further supporting its selection in VPTs [22].

Bio-obturation with CEM cement offers distinct advantages over conventional gutta-percha/sealer root canal obturation [23]. By creating a monoblock-like interface with dentin, it minimizes microleakage, maintains a stable alkaline environment, and promotes hard-tissue formation. These properties are particularly valuable in IRR cases, where thin dentinal walls and irregular canal anatomy increase the risk of void formation or inadequate filling/sealing with traditional techniques. The use of bioactive cement also enables direct pulp protection of preserved apical segments, supporting continued pulp vitality [17].

The irrigation protocol in this case was deliberately conservative to protect the apical pulp stump. While adjunctive disinfection strategies can enhance outcomes in internal resorption, excessive instrumentation or chemical exposure could compromise pulp vitality. This highlights the need to balance disinfection with biological preservation in selective cases.

A key limitation of this report is the absence of objective pulp vitality testing (e.g., histological evaluation) at follow-up; vitality was inferred from the lack of symptoms and radiographic stability, which cannot definitively confirm the physiological status of the apical pulp stump.

This conservative VPT approach is limited to asymptomatic teeth with confirmed vital pulp through reproducible sensibility tests, no necrotic teeth with periapical lesions, and unperforated IRR verified by CBCT. Defects must be confined to the coronal or

mid-root third, with at least 4–5 mm of intact apical pulp, an intact external root surface, and sufficient residual dentin thickness (~1 mm). Baseline CBCT measurements, standardized radiographs, and follow-up images are essential for managing and monitoring. In cases with extensive infection or inflammation, conventional full pulpectomy and root canal therapy remain the standard of care, with predictable long-term outcomes supported by extensive clinical evidence. Lastly, this report serves as a proof of concept rather than establishing a new standard of care.

## Conclusion

This case demonstrates that partial pulpectomy combined with bio-obturation using CEM cement may successfully arrest IRR while preserving the vital apical pulp stump. The favorable two-year outcome suggests this approach may represent a conservative alternative and be minimally invasive in carefully selected, IRR cases. However, further clinical evidence with larger samples and longer follow-up is required before routine adoption can be recommended.

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***Author's contributions***
SA is the sole author and is solely responsible for all aspects of the study, including conception, data collection, analysis, and manuscript preparation.

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