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**ENDODONTIC MANAGEMENT OF A MANDIBULAR PRIMARY SECOND
 MOLAR WITH PULPAL NECROSIS AND PERIAPICAL ABSCESS: A CASE
 REPORT**

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ABSTRACT

Background: Dental caries in children remains a major public health concern due to its high prevalence and propensity to progress to pulp tissue involvement. The thinner enamel and dentin of primary teeth accelerate bacterial penetration to the pulp and periapical tissues. **Purpose:** This case report describes the endodontic management of pulpal necrosis with a periapical abscess in a mandibular primary second molar. The unique value of this case lies in the integration of emergency trepanation to manage severe acute infection with a specific biocompatible obturation material in a primary molar that served as a space maintainer in a developing dentition. **Case Report:** An 8-year-old boy presented with food impaction in tooth 85 without accompanying pain. Clinical and radiographic examination confirmed pulpal necrosis with a periapical abscess. **Case Management:** Treatment was initiated with open access, trepanation, and placement of intracanal dressing. Subsequent visits involved root canal preparation using the conventional step-back technique, irrigation with 2.5% NaOCl, and intracanal medication with calcium hydroxide. Obturation was performed using a combination of Ca (OH)₂ and iodoform paste (Metapex), followed by final restoration with a stainless-steel crown. **Conclusion:** At the 19-day post-obturation follow-up, clinical evaluation demonstrated complete resolution of symptoms, and radiographic findings indicated early signs of healing and an absence of lesion progression. Within the limits of this single case and a short follow-up of approximately 19 days, structured endodontic management employing initial trepanation, conventional preparation techniques, and a calcium hydroxide-iodoform obturation material was associated with early clinical improvement and early radiographic findings consistent with healing. Longer-term follow-up is required to confirm periapical healing, tooth preservation, and guidance of the permanent successor's eruption until natural exfoliation.

Keywords: Dental caries; Endodontic management; Periapical abscess; Primary teeth; Pulpal necrosis

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INTRODUCTION

Dental caries is one of the most prevalent chronic diseases affecting children worldwide, and, when left untreated, can progress to serious complications including pulp disease and periapical pathology.¹ A meta-analysis conducted in Indonesia reported a caries prevalence of approximately 76% among children, reflecting a substantial burden of disease in the early-age population.² Studies in other developing countries, such as India, have demonstrated that more than 49% of children with untreated caries develop clinical consequences including pulp involvement and abscess formation.³ Global evidence further confirms that pulp involvement secondary to caries significantly impairs children's quality of life, both functionally and psychosocially.⁴ However, the management of advanced cases involving pulpal necrosis with periapical abscesses remains a

formidable clinical challenge due to the highly complex and tortuous root canal anatomy of primary molars, as well as the proximity of the infection to the developing permanent tooth germ.

The high prevalence of caries and the large proportion of cases progressing to pulp disease underscore the importance of early detection and comprehensive intervention in pediatric dental health services.⁵ The anatomical characteristics of primary teeth predispose them to rapid caries progression: thinner enamel and dentin compared with permanent teeth, more coronally positioned pulp horns, and wider dentinal tubules collectively accelerate bacterial penetration to the pulp.⁶ Once bacteria infiltrate the dentinal tubules, pulp inflammation ensues,⁷ and, when the pulp's defense capacity is overwhelmed, endodontic intervention becomes necessary.⁸ Unlike simple pulpitis, a periapical abscess dictates a high clinical urgency. It requires an immediate and structured approach to control the acute infection and prevent systemic dissemination. Emergency access via trepanation is often a critical first step to establish immediate drainage and relieve intracanal pressure, which is essential to lay the foundation for the success of subsequent endodontic phases.

The primary goal of root canal treatment in primary teeth is to maintain the integrity and health of the tooth until it exfoliates naturally.⁹ In addition, endodontic treatment aims to prevent or eliminate pulpal and periradicular pathology, thereby preserving the tooth's functional role in the primary dentition.¹⁰ Procedures should be carried out efficiently and without complications; the key objective is thorough debridement and shaping of the root canal system while preserving structural integrity and avoiding iatrogenic damage to the underlying permanent tooth germ.¹¹ This case report aims to describe the endodontic management of pulpal necrosis with periapical abscess in the mandibular right primary second molar. Furthermore, the presence of a periapical lesion complicates the selection of root canal filling materials. An ideal obturation material must be biocompatible, possess potent antibacterial efficacy to eradicate persistent pathogens, and resorb synchronously with physiological root resorption. While Zinc Oxide Eugenol (ZOE) has traditionally been used, it is known to resorb slower than the roots and can provoke foreign body reactions if extruded. Consequently, a combination of calcium hydroxide and iodoform paste (e.g., Metapex) has emerged as a superior alternative, offering excellent radiopacity, prolonged antibacterial action, and optimal tissue tolerance even when extruded into the periapical region.

While pulpectomy using calcium hydroxide–iodoform paste followed by a stainless steel crown is an established protocol, reports detailing the specific clinical reasoning that integrates emergency trepanation with this obturation strategy in severe acute cases remain scarce. Therefore, the clinical and educational significance of this case report lies in demonstrating this structured, stage-by-stage approach. This article aims to describe the endodontic management of pulpal necrosis with a periapical abscess in a mandibular right primary second molar. By highlighting the synergistic use of initial trepanation and Metapex obturation, this case illustrates a critical learning point: how to manage acute periapical pathology while aiming to retain a severely compromised primary molar as a natural space maintainer in a developing dentition.

CASE REPORT

1. Patient Information An 8-year-old boy presented to the UMY Dental Hospital (RSGM UMY) accompanied by his mother, reporting that food frequently became lodged in his lower right posterior teeth. The complaint had persisted for approximately three months and was not associated with spontaneous pain or thermal sensitivity. The patient had no prior dental treatment history and was unaware of when the cavity had developed.
2. Clinical Findings Intraoral examination revealed a blackish brown cavitated lesion on the occlusal surface extending to the distal surface of the mandibular right primary second molar (tooth 85), with carious involvement at pulp depth. Sounding examination yielded a negative result; however, percussion and palpation yielded positive results, suggesting involvement of the periradicular tissues. Sensibility testing with ethyl chloride spray, as well as air and water stimulation, yielded negative responses. Because pulp sensibility testing in primary teeth can often be unreliable and challenging for pediatric patients to report accurately, these negative thermal responses were not used in isolation but were carefully integrated with radiographic evidence to establish the definitive diagnosis.
3. Diagnostic Assessment Preoperative radiographic examination revealed a deep radiolucency communicating with the pulp chamber, alongside prominent furcation and periapical radiolucencies. Although the patient did not report spontaneous pain or present with extraoral swelling, the positive palpation response indicated localized inflammatory exudate accumulating in the periapical tissues. This finding, combined with the

radiographic periapical breakdown and the subsequent clinical observation of purulent exudate upon initial access (trepanation), confirmed the diagnosis of pulpal necrosis accompanied by a periapical abscess, distinguishing it from a non-suppurative apical periodontitis.

Furthermore, radiographic interpretation initially identified two roots (mesial and distal). However, thorough exploration during the subsequent access preparation confirmed the presence of four distinct root canal orifices: mesiobuccal, mesiolingual, distobuccal, and distolingual canals within the two roots.

4. Therapeutic Intervention (Treatment Plan) The treatment plan comprised immediate endodontic consultation (IEC) for emergency trepanation and drainage, followed by comprehensive root canal treatment. The working lengths were determined radiographically for all four canals (final working lengths after a 2-mm safety reduction: mesiobuccal, 12 mm; mesiolingual, 12 mm; distobuccal, 13 mm; and distolingual, 13 mm) to ensure accurate apical preparation. The procedure would conclude with a final restoration using a stainless-steel crown and scheduled follow-ups to monitor periapical healing.



Figure 1. Clinical photograph of tooth 85

CASE MANAGEMENT

Visit I (Open Access, Trepanation, Extirpation, and Dressing)

A periapical radiograph of tooth 85 was obtained as a supporting examination prior to treatment. Radiographic interpretation revealed a radiolucent lesion in the distal one-third of the crown extending to the pulp chamber. Multiple roots with two root canals were identified, with radiolucency observed along the root canal to the apex, straight roots, and an open apex at the distal root. Loss of the periodontal ligament space and lamina dura was noted in the apical one-third of the distal root. A diffuse periapical radiolucent lesion measuring 3–4 mm was observed on the distal aspect of the root. Alveolar crest resorption was identified at the cervical one-third of the mesial aspect. The radiodiagnosis was deep caries with periapical abscess.

The treatment at the first visit consisted of open access, trepanation, extirpation, and dressing. The procedure began with removal of carious tissue using a round metal bur. Access cavity preparation was performed until straight-line access was achieved and four root canal orifices were visualized using a round diamond bur. The access was further refined using a flat-tipped fissure bur oriented parallel to the long axis of the tooth. Root canal access was then negotiated through each orifice using a smooth broach.

Working length was determined by the direct measurement method from periapical radiographs, measuring from the occlusal reference point to the radiographic apex. Radiographic evaluation revealed early signs of physiological root resorption, particularly associated with an open distal apex situated in close proximity to the developing permanent tooth germ. The estimated working length was 15 mm for the distal root and 14 mm for the mesial root. A 2-mm safety reduction was applied, yielding a final working length of 13 mm for the distal root and 12 mm for the mesial root (i.e., 12 mm for the mesiobuccal and mesiolingual canals and 13 mm for the distobuccal and distolingual canals). This specific 2-mm deduction was implemented to account for the altered apical anatomy caused by physiological root resorption. It serves as a necessary clinical safeguard to prevent iatrogenic over instrumentation, protect the underlying permanent successor follicle from mechanical trauma, and avoid the extrusion of irrigants and obturation materials through the wide, open apex.

Pulp extirpation was performed using a barbed broach fitted with a rubber stop to the working length at two-thirds depth. A pull-stroke technique was employed (180° clockwise rotation followed by withdrawal). Following complete removal of pulp tissue remnants, a calcium hydroxide and glycerin dressing was placed on the pulp chamber floor using a cotton pellet. The access cavity was sealed with a temporary filling material (Cavit).



Figure 2. Root canal access preparation**Visit II (Root Canal Preparation and Intracanal Medication)**

At the second visit, the patient reported no pain but noted that a small swelling persisted beneath the tooth, though it had diminished since the first visit. The temporary restoration had been displaced approximately two days prior during eating. Intraoral examination revealed an open access cavity on the occlusal to distal surfaces of tooth 85 packed with food debris, and a pustular lesion of rubbery consistency measuring 3 mm in diameter was observed on the cervical gingiva. To manage the clinical risk of severe root canal recontamination caused by the lost temporary seal, the tooth was immediately isolated, and gross food debris was meticulously removed using a sterile excavator. The access cavity and root canals were then copiously irrigated with 2.5% sodium hypochlorite (NaOCl) and sterile saline. This aggressive disinfection protocol was essential to flush out salivary and bacterial contaminants and thoroughly debride the re-exposed canal walls prior to initiating further mechanical instrumentation and applying a fresh intracanal medicament. Percussion and palpation remained positive. The diagnosis was tooth 85 with initiated therapy and persistent periapical abscess.

Root canal preparation was performed using the conventional step-back technique. Negotiation of the root canal was achieved with the smallest K-file that passively reached the working length, designated as the Initial Apical File (IAF); in this case, a size #15 K-file was used. Preparation was continued sequentially with files #20, #25, #30, and #35 until white dentin shavings were obtained. Copious irrigation was performed between each file change.

Canal wall smoothing was performed using an H-file corresponding to the final K-file size (#35) with a circumferential filing motion. Final irrigation was completed using 2.5% sodium hypochlorite (NaOCl) solution, and root canals were dried with sterile paper points.

Intracanal medicament consisted of a non-setting calcium hydroxide ($\text{Ca}(\text{OH})_2$) paste prepared by mixing calcium hydroxide powder and glycerin in a 1:1 ratio on a glass slab until a creamy consistency was obtained. The paste was delivered to the working length using a lentulo spiral fitted with a rubber stop, rotating clockwise continuously to coat the canal walls. Excess medicament was removed with a cotton pellet and excavator, and the access cavity was sealed with Cavit using a plastic instrument.

Visit III (Root Canal Obturation)

At the third visit for obturation, the patient reported mild pain persisting until the second day following the previous visit, which had since resolved. The swelling had completely resolved. Intraoral examination of tooth 85 revealed an intact temporary restoration; the surrounding gingiva showed no signs of inflammation, and percussion and palpation yielded negative results. The diagnosis was tooth 85 with previously initiated therapy and normal periapical status. The treatment plan for this visit was root canal obturation.

The working field was isolated using cotton rolls and a high-volume saliva ejector. Although rubber-dam isolation is universally recognized as the gold standard for endodontic infection control and patient safety, cotton-roll isolation was strictly maintained in this instance due to the 8-year-old patient's severe anxiety and poor tolerance for rubber-dam clamp placement. Airway safety, moisture control, and prevention of irrigant extrusion were meticulously managed through careful handling and continuous high-volume aspiration. The temporary filling was removed with a round bur. Root canals were irrigated with NaOCl and dried with paper points.

Subsequently, a bacterial contamination test was performed by introducing a 3% hydrogen peroxide (H_2O_2) solution into the root canals. The diagnostic principle of this test relies on the interaction between H_2O_2 and the catalase enzyme produced by residual organic tissue, exudate, and many facultative anaerobic bacteria within the canal. The interpretation criterion is straightforward: the presence of effervescence (visible bubbling) indicates active infection or residual exudate, whereas the absence of bubbling suggests a clinically clean canal. In this case, a negative result (no effervescence) was observed, validating the decision to safely proceed with root canal obturation.

Obturation was accomplished using a combination of $\text{Ca}(\text{OH})_2$ and iodoform paste (Metapex) supplied as a premixed injectable material, which was delivered directly into each root canal using the provided disposable capillary tip. A plugger was used only for gentle coronal adaptation of the material, and vertical compaction was deliberately avoided to prevent extrusion through the open apex. Delivery was continued until the canals were completely filled. A periapical radiograph was taken to confirm obturation quality. A Fuji IX

GIC lining was placed, and the cavity was sealed with a Cavit temporary filling. The patient was instructed to return in one week for post-obturation evaluation.



Figure 3. Periapical radiograph of tooth 85 after obturation

Visit IV (Follow-Up)

At the follow-up visit, the patient reported no pain or discomfort related to tooth 85, although he had been cautiously avoiding chewing on the right side. Intraoral examination revealed an intact temporary restoration on the occlusal to distal surfaces of tooth 85, with no signs of gingival inflammation. Percussion and palpation yielded negative results. Treatment at this visit comprised IEC, placement of the final stainless-steel crown restoration, and scheduling for further evaluation.



Figure 4. Final restoration: stainless-steel crown on tooth 85



Figure 5. Root canal obturation radiograph of tooth 85 at follow-up

Table 1. Treatment timeline

Visit	Date
Open Access, Trepanation, Extirpation, Dressing (Visit I)	July 7, 2025
Preparation and Intracanal Medication (Visit II)	July 14, 2025
Root Canal Obturation (Visit III)	July 17, 2025
Follow-Up and Final Restoration (Visit IV)	August 5, 2025

DISCUSSION

The patient's presenting complaint of food impaction without pain is consistent with the clinical profile of pulpal necrosis, in which irreversible destruction of the pulp eliminates the capacity for pain sensation. Periapical radiography confirmed a diffuse periapical radiolucent lesion, and negative vitality testing with ethyl chloride, combined with positive percussion and palpation responses, supported the diagnosis of pulpal necrosis with a periapical abscess. These combined findings established the indication for root canal treatment. The rationale for retaining tooth 85 rather than opting for extraction was based on the critical need for space maintenance, premature loss of the second primary molar risks significant space loss and potential impaction of

the developing permanent successor. Radiographic evaluation revealed that the permanent tooth germ was still in its developmental stages, further necessitating the preservation of the primary tooth to guide its proper eruption. The presence of an open apex in this case introduced specific clinical challenges, particularly an increased risk for apical extrusion of irrigants and filling materials, requiring careful management. Furthermore, the patient experienced a temporary restoration failure during the treatment course, underscoring the importance of a robust interim coronal seal to manage and prevent persistent infection. Readiness for final obturation was strictly determined using established clinical criteria: the complete resolution of symptoms, absence of swelling or fistulas, and the confirmation of completely dry, exudate free root

The initial visit incorporated open access and trepanation to decompress the periapical infection. Trepanation or incision and drainage is the recommended intervention when periapical infection has spread to adjacent soft tissues, as it prevents further dissemination of the infectious process.¹² Gazali et al. demonstrated that trepanation and external drainage effectively alleviated symptoms in pediatric patients with extensive odontogenic abscesses.¹³ Although non-surgical root canal treatment with intracanal medication remains the primary treatment modality, trepanation is a valuable adjunct when there is risk of spread or inadequate natural drainage.¹⁴

Calcium hydroxide was selected as the intracanal medicament in this case. $\text{Ca}(\text{OH})_2$ is widely used in the endodontic management of primary teeth with periapical abscesses owing to its well-documented effectiveness in reducing periapical inflammation and promoting healing.¹⁵ A randomized clinical trial by Pekpinarli et al. demonstrated that $\text{Ca}(\text{OH})_2$ significantly reduced MMP-8 levels in periapical tissue and produced favorable radiographic outcomes in cases of apical infection.¹⁶ A systematic review by Arikatla et al. further reported that $\text{Ca}(\text{OH})_2$ significantly reduced post-treatment pain relative to alternative medicaments.¹⁷ The material's broad-spectrum antibacterial activity, capacity to stimulate hard tissue formation, and high alkalinity make it an agent of choice in the conservative management of periapical abscesses in pediatric patients.¹⁸

Root canal preparation was performed using the conventional step-back technique, commencing with establishment of straight-line access, followed by sequential preparation at a constant working length to minimize apical debris extrusion and avoid disruption of root canal geometry.¹⁹ This technique has been demonstrated to be effective in debriding root canals in primary teeth.²⁰

Irrigation was performed with 2.5% NaOCl throughout the procedure. To mitigate the risk of apical extrusion a critical precaution given the primary tooth's open apex and its close proximity to the permanent tooth germ irrigation was meticulously controlled. The protocol utilized approximately 2 to 3 mL of NaOCl per canal, delivered via a side-vented endodontic irrigation needle. The needle was inserted no deeper than 2 mm short of the working length without binding in the canal, and the irrigant was dispensed using minimal positive pressure. Sodium hypochlorite is routinely used in endodontics at concentrations ranging from 0.5% to 5.25%.²¹ NaOCl possesses potent broad-spectrum antimicrobial properties, effectively eliminating organisms such as *Enterococcus*, *Actinomyces*, and *Candida albicans* that are otherwise difficult to eradicate from the root canal system.⁸

Obturation was completed using a combination of $\text{Ca}(\text{OH})_2$ and iodoform paste (Metapex). Given that this paste is supplied as a premixed injectable material, it was delivered directly into the root canals using the provided disposable capillary tip. A plugger was subsequently used only for gentle coronal adaptation to ensure a dense fill in the coronal third, consciously avoiding vertical compaction that could inadvertently force the material beyond the open apex. Calcium hydroxide has been utilized extensively in dentistry as a sub-base material, pulp-capping agent, and root-filling material in primary teeth.²² Iodoform is a halogenated compound with bactericidal, bacteriostatic, antifungal, and antiviral properties; importantly, it is biocompatible with periapical tissues and demonstrates favorable physiological resorption characteristics commensurate with root resorption of the primary tooth.²³ The combination of $\text{Ca}(\text{OH})_2$ and iodoform enhances the radiopacity of the filling material, facilitating radiographic assessment of obturation quality.²⁴

Rahaswanti et al. reported that calcium hydroxide with iodoform paste closely approximates the ideal root canal filling material for primary teeth, demonstrating more rapid resolution of periapical inflammation compared with zinc oxide eugenol preparations, although the difference did not reach statistical significance.²⁵ This material is also less rigid than zinc oxide eugenol paste, reducing the risk of interference with or damage to the permanent tooth germ.²⁵

The success of root canal treatment is contingent upon multiple factors, including diagnostic accuracy, the patient's systemic status, tooth anatomy, and procedural quality. Clinical success criteria include the absence of pain or functional impairment on subjective evaluation, negative percussion, palpation, and extraoral swelling tests on objective evaluation, and absence of pathological tooth mobility or gingival hyperemia.²⁷ Radiographic success is defined by the absence of new or enlarging periapical radiolucency and no widening of the apical periodontal ligament space.²⁶ In this case, the clinical parameters and early radiographic findings at the 19-day follow-up were consistent with a favourable short-term response; however, this interval is too short to establish definitive treatment success.

In conclusion, accurate diagnosis and structured endodontic management are critical determinants of successful treatment outcomes in primary teeth with pulpal necrosis and periapical abscess. In this case, conventional root canal preparation, intracanal calcium hydroxide medication, and obturation with a Ca (OH)₂ iodoform combination were associated with control of the acute infection and observed short-term clinical improvement and provided early radiographic findings consistent with stabilization; measures were also taken to minimize risk to the permanent tooth germ. Trepanation facilitated decompression of the acute infection, and 2.5% NaOCl irrigation provided effective antimicrobial debridement. However, it is important to emphasize that these conclusions represent lessons learned from a single clinical case. Because a single case without a comparator cannot demonstrate “accelerated” healing, and the short follow-up period does not establish definitive radiographic resolution or long-term reduced risk to the permanent tooth germ, the outcomes must be interpreted cautiously. Further prospective or longitudinal clinical studies are recommended to validate these early findings and establish definitive long-term efficacy.

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