

# Discrete pulp canal calcification in a case of full pulpotomy: A 2-year follow-up case report

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## Abstract

Pulpotomy is recognized as a promising treatment option, especially for immature permanent teeth, as it prevents the unnecessary removal of radicular pulp tissue. The aim of the study was to evaluate the clinical and radiographic outcome of full pulpotomy using Biodentine in the young permanent tooth with symptomatic irreversible pulpitis. Full pulpotomy with Biodentine was performed on a 15-year-old male patient diagnosed with irreversible pulpitis in tooth #47. Follow-up was done at 6 months, 1 year, and 2 years postoperatively. The patient was asymptomatic throughout the follow-ups. 12-month postoperative radiograph revealed periapical healing and apical closure. 24-month radiographic follow-up revealed complete healing of the periapical lesion, but discrete pulp canal calcifications were also seen. Pulpotomy can be used successfully in the management of carious pulp exposure of fully erupted immature teeth to maintain pulp vitality and root maturation.

**Keywords:** Apical closure; Biodentine; periapical healing; pulp canal calcification; pulpotomy

## INTRODUCTION

Vital pulp treatment has been advocated for a long time, but as results obtained with traditional treatment methods were unpredictable, vital pulp treatment failed to gain popularity. However, in recent years with the advent of newer hydraulic material and a better understanding of pulpal biology, vital pulp therapy (VPT) has re-emerged as a treatment procedure not only for immature teeth but also in mature teeth and teeth with symptoms indicative of irreversible pulpitis.

Dental caries in immature permanent teeth causes irreversible damage to the underlying pulp tissue and inhibits root development. The conventional treatment for such cases included apexification followed by obturation. However, total removal of the vital pulp negatively impacts root growth and renders the tooth more susceptible

to fracture.<sup>[1]</sup> VPT has been increasingly performed to preserve the vital pulp tissues. Pulpotomy is recognized as a promising treatment option, especially for immature permanent teeth, as it prevents the unnecessary removal of radicular pulp tissue. The residual vital pulp tissue promotes apexogenesis, reduces the risk of root fractures of the affected tooth, and maintains the defensive mechanism and the proprioceptive functions of the tooth.

According to the *Glossary of Endodontic Terms*, full pulpotomy involves the removal of the coronal portion of the vital pulp, preserving the vitality of the remaining radicular portion. It may be performed as an emergency procedure or as a therapeutic measure.

The presence of spontaneous or severe preoperative pain does not always indicate that the entire pulp is incapable of repair,<sup>[2,3]</sup> and deep carious lesions are not always indicative of irreversible pulpitis involving the entire pulp.<sup>[4,5]</sup> Few clinical studies have reported the medium to long-term success of VPT in symptomatic permanent teeth with carious exposure and have recommended the procedure as an alternative to conventional root canal treatment (RCT).<sup>[6,7]</sup>

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Currently, mineral trioxide aggregate (MTA) is considered the optimum material for use in VPT of permanent teeth.<sup>[8,9]</sup> However, some practitioners report subjective difficulty in the handling and mixing of MTA in addition to reports of tooth discoloration after its use, which results in patients' dissatisfaction.<sup>[10]</sup> Consequently, newer hydraulic materials that retain the desirable properties of the original MTA but with easier handling properties causing no tooth discoloration have been introduced into the market. Biodentine (Septodont, Saint Maur des Fosses, France) is one such material having good sealing ability, adequate compressive strength, relatively short initial setting time (i.e., 12 min), and promoting reparative dentin formation with a positive effect on vital pulp cells.<sup>[11,12]</sup>

The aim of this study was to evaluate the clinical and radiographic outcome of full pulpotomy using Biodentine in young permanent teeth with symptomatic irreversible pulpitis.

## CASE REPORT

A 15-year-old male patient reported pain in the lower right back region of the jaw to the Department of Conservative Dentistry and Endodontics. He gave a history of spontaneous pain, which increased on lying down, and radiated to the ear and temples for 1 month. Chewing or cold liquids aggravated the pain. The patient's medical history was noncontributory.

Clinical examination revealed deep occlusal caries in relation to tooth #47. The surrounding periodontal tissues were intact, and there was no swelling, draining sinus, or excessive mobility. Cone-beam computed tomography (CBCT) and intraoral periapical radiograph (IOPAR) of #47 revealed a deep carious lesion involving pulp, immature roots, periodontal ligament space widening, and apical radiolucency. The vitality test of #47 was done by an electric pulp tester (EPT) (initial reading-27) and a cold test with refrigerant spray (Roeko Endofrost, Coltene). Based on signs and symptoms, a diagnosis of symptomatic irreversible pulpitis was made and a decision to perform VPT with Biodentine was made after obtaining patient's consent.

The tooth was anesthetized using 2% lidocaine with 1:80,000 epinephrine and isolated with rubber dam. After caries excavation, pulp chamber was deroofed and the coronal pulp was completely removed using high-speed diamond bur under water coolant. Postamputation hemorrhage was controlled with a sterile cotton pellet soaked in 2.5% sodium hypochlorite (NaOCl) and placed on the pulp stump with gentle pressure for 8 min. Next, following the manufacturer's instructions, Biodentine powder and liquid were mixed and introduced into the pulp chamber using a sterile plastic instrument. A sterile, dry cotton pellet was then used to

gently adapt the biomaterial to the clot-free pulpal wounds and simultaneously remove excess moisture from the cement, followed by Resin-modified Glass Ionomer Cement. Over this restoration, composite restoration was placed.

The tooth was assessed clinically and radiographically (with CBCT and IOPAR) immediately postoperatively and at 1, 3, 6, 12, and 24 months follow-up visits [Figures 1 and 2].

One month postoperatively, the tooth was found to be clinically asymptomatic.

Twelve-month follow-up, IOPAR and CBCT revealed healing of the periapical lesion. Scattered radiopacity was seen in both roots in the middle and apical 3<sup>rd</sup>. Apical closure was also seen.

Twenty-four month follow-up, IOPAR and CBCT revealed complete healing of periapical lesion, but there is further increase in canal calcification.

## DISCUSSION

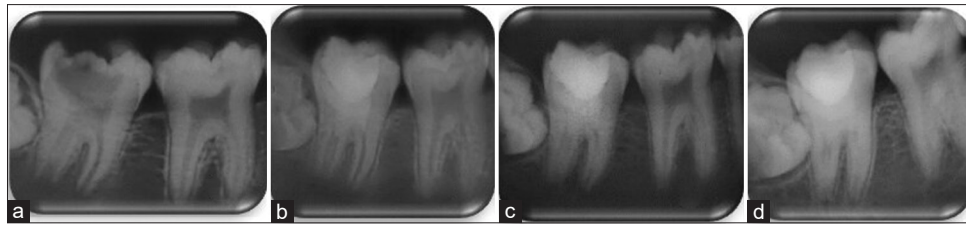
Pulp involvement is the most common consequence of untreated dental caries, but the extent of pulpal inflammation is unpredictable.<sup>[12]</sup>

Bacterial invasion of dental pulp through caries is a compartmentalized process, resulting in a peripheral area of infected pulp tissue with subjacent inflamed tissue next to healthy tissue/histologically, the pulpal conditions can vary from coronal to radicular areas and also from one root canal to other depending on the extent and location of bacterial intrusion, the time of exposure, and the innate and adaptive defense mechanism.<sup>[5]</sup>

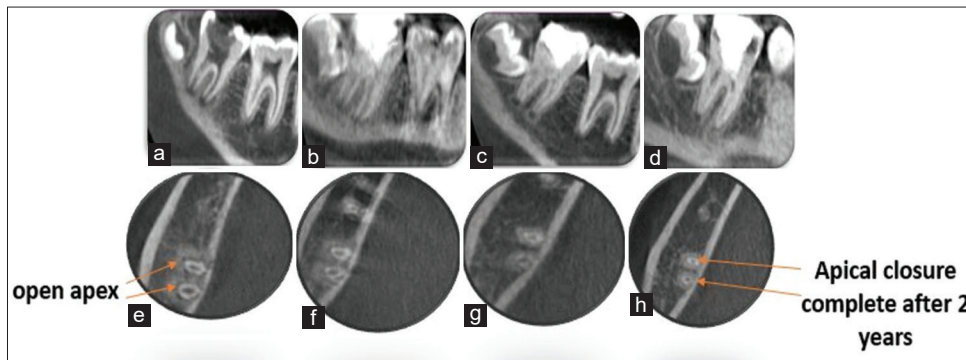
Pulp sensibility testing and clinical signs and symptoms alone cannot divide between reversible and irreversible pulpitis.<sup>[13]</sup> *In situ* clinical diagnosis based on the color of pulpal bleeding and the time taken to arrest bleeding can be considered an important factor in diagnosing the inflammatory state of the pulp.

According to Lejri *et al.*, color of bleeding after access opening indicates the stage of pulp inflammation to some extent. A bright red bleeding that stops within 5 min indicates reversible pulpitis, very abundant cherry red bleeding indicates irreversible symptomatic pulpitis, low cherry red bleeding, and/or fibrous white aspect of the pulp indicates irreversible asymptomatic pulpitis.<sup>[14]</sup>

According to several studies, degree of pulpal bleeding upon carious pulp exposure also reflects the severity of pulpal inflammation. Profuse bleeding that is difficult to stop indicates that the pulp tissue is severely inflamed.



**Figure 1:** Intraoral periapical radiographs of #47 (a) preoperative (b) immediate postoperative (c) 1 year follow up (d) 2 years follow up



**Figure 2:** Cone-beam computed tomography of #47 (a) preoperative (b) postoperative (c) 1 year follow up (d) 2 years follow up (e-h) cross-sectional view of apical 3<sup>rd</sup> #47 (e) preoperative, (f) postoperative, (g) 1-year follow-up (h) 2-year follow-up

Several studies used the “time to stop bleeding” as a parameter to discriminate between the reversible and irreversible condition of the pulp. If the bleeding could not be stopped within 5–10 min, the pulp was considered severely inflamed, and pulpectomy was recommended.<sup>[15]</sup>

In this case, following pulpotomy, bleeding from the pulp stump was cherry red and was controlled in 8 min.

NaOCl (2.5%) is an antimicrobial solution that provides hemostasis, disinfection of the dentin pulp interface, biofilm removal, chemical removal of the blood clot, and fibrin and clearance of dentinal chips along with damaged cells at the mechanical exposure site without compromising pulp integrity. Hemorrhage must be controlled to allow clinical assessment under microscope of inflammatory level of pulp and identify potential necrotic tissues that require removal before application of an appropriate biomaterial.

Hemostasis here was achieved by bathing the resected pulp tissue for 8 min with a NaOCl-soaked cotton pellet.

Biodentine has been suggested as a suitable pulp-capping agent. The literature indicates that Biodentine induces growth factor release from the dentin matrix which signals mesenchymal stem cells in the pulp to differentiate into odontoblast-like cells and produce dentin bridges. Biodentine locally increases transforming growth factor- $\beta$ 1 secretion from the injured pulp tissue and has a partially stimulant effect on dentine–pulp complex

regeneration. Thus, the use of Biodentine as a pulpotomy agent in the present study has been attributed to the positive outcome observed. After the removal of superficial inflamed pulp, a favorable environment for pulp healing was created which is evident by the apical closure and periapical healing seen in follow-up radiographs.<sup>[12]</sup> The patient’s age may play an important role in the success of vital pulp therapies and healing, as younger pulps are more cellular and have a greater blood supply.<sup>[16]</sup> In this study, the patient was 15 years old. At 12-month follow-up, some calcification was seen in the root canals which further increased at 24 months. Revascularization-associated intracanal calcification has often been reported, but such reports involving pulpotomy cases are rare. Calcification may have occurred due to the innate differentiation potential of the dental pulp stem cells and can be considered a complicating factor in case future retreatment is required.

## CONCLUSION

Pulpotomy can be used successfully as an alternative to RCT in the management of carious pulp exposure of fully erupted immature teeth to maintain pulp vitality and root maturation. Pulp space calcification may be a complicating factor. More long-term clinical studies will help us determine its causative factors.

## Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form, the patient has given

his consent for his images and other clinical information to be reported in the journal. The patient understands that name and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

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### Conflicts of interest

There are no conflicts of interest.

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