



# Minimal Pulpotomy in Cariously Exposed Mature Permanent Molar: Case Report with a 3-Year Follow-Up

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## Abstract

Partial pulpotomy is a pulp vitality therapy that consists of removing a 2mm depth of pulp tissue which corresponds to the average height of inflamed pulp tissue and filling it with a pulp capping material to promote healing and preservation of pulp vitality. Long used on immature permanent and traumatized teeth, this technique has shown high success rate on mature permanent teeth exposed to deep caries. This article describes a clinical management case of pulpal exposure on a mature mandibular second molar treated by partial pulpotomy with a clinical and radiographic follow-up of over more than 3 years. This case report demonstrates that if prognostic factors are favorable, partial pulpotomy can replace conventional invasive endodontic treatment.

## Subject Areas

Vital Pulp therapy

## Keywords

Partial Pulpotomy, Vital Pulp Therapy, Permanent Teeth, MTA

## 1. Introduction

Partial pulpotomy is a vital pulp therapy that involves the removal of 1 - 3 mm of inflamed pulp tissue under a pulp exposure after deep caries. The goal is to maintain pulp vitality of healthy coronal and root tissues that have better healing potential. Partial pulpotomy results in high success rates in the treatment of permanent posterior teeth exposed to caries for up to 2 years [1]. Several studies report that in cases of carious pulp exposure, partial pulpotomy is preferable to direct pulp capping. Indeed, the success rate after 3 years of follow-up is 72.9%

versus 99.4% for partial pulpotomy, as reported in the 2011 literature review by Aguilar *et al.* [2].

This difference can be explained by the fact that removal of the superficial part of the exposed coronal pulp allows for better control of the inflammation and thus for faster and more predictable healing. Additionally, partial pulpotomy allows the creation of a retentive cavity for the pulp capping biomaterial and ensures its correct placement in contact with the pulp.

The objective of this article is to present the success of a partial pulpotomy with MTA on a decayed permanent molar with irreversible pulpitis and its follow-up over more than 3 years.

## 2. Clinical Case Report

This case concerns a 26-year-old female patient who visited us for very recent pain in the left mandibular second molar.

The patient reports pain in the left mandibular area that worsened the day before the consultation.

Endobuccal examination revealed a defective old composite occlusal restoration. Sensitivity testing showed cold-induced pain that stopped 30 seconds after the stimulus was removed. Axial percussion was negative and transverse percussion was slightly positive.

Preoperative panoramic and retro-alveolar radiographs “**Figure 1** and **Figure 2**” showed radio-opacity of an old restoration in the pulpal vicinity but without



**Figure 1.** Pre-operative panoramic radiograph showing the radiopacity of the old restoration in left second mandibular molar.

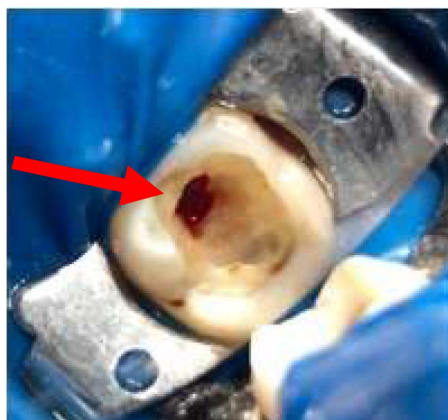


**Figure 2.** Retro-alveolar X-ray confirms the proximity of the restoration to the pulp. No sign of periodontal enlargement or periapical image.

desmodontal enlargement or periapical image. Pulpal biopsy and periapical status were established based on pain, cold test results and radiological analysis.

After an informed consent was obtained, the tooth was anesthetized, isolated by placing the operating field and disinfected with 5% sodium hypochlorite before caries curettage.

During the curettage of the deep caries, there was pulp exposure at the mesial pulp horn of more than 2 mm. A partial pulpotomy was then performed by amputating 2 mm of exposed pulp with a sterile diamond ball bur mounted on a turbine. Under copious irrigation, hemostasis was ensured by a small compression at the pulp exposure. The cavity was then disinfected with 3% hypochlorite, rinsed with water and dried with sterile cotton pellets “**Figure 3**” before placement of the MTA in contact with the pulp “**Figure 4**”. The immediate coronal filling was made with CVI and a post-operative retro-alveolar radiograph was taken “**Figure 5**”. The final composite restoration was performed one week later. Clinical and radiographic follow-up were performed at 3 months, 6 months, 1 year, 2 years and 3 years.



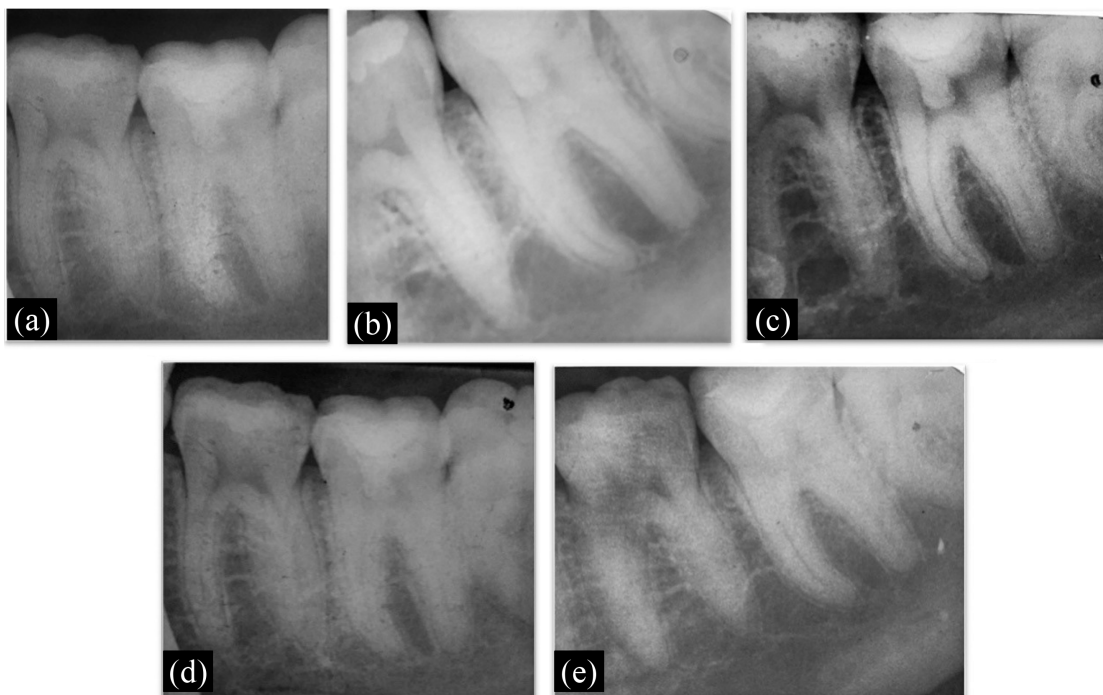
**Figure 3.** Removal of caries from the walls and bottom of the cavity. A partial pulpotomy encompassing the mesial horns of 37 (deep recurrence of caries). Hemostasis ensured by compression, the cavity is disinfected, rinsed and dried with sterile cotton.



**Figure 4.** Filling with MTA at the level of the pulp exposure.



**Figure 5.** Retro alveolar X-ray showing MTA obturation followed by immediate coronary obturation performed with CVI.



**Figure 6.** Post-operative radiological examination and follow-up at (a) 3 month; (b) 6 month; (c) 1-year; (d) 2-year; (e) 3-year recall showing normal periapex.

### 3. Discussion

Vital Pulp Therapy, which includes indirect pulp capping, direct pulp capping, partial pulpotomy and total pulpotomy, has gained importance in recent years for reasons related to its simplicity, cost-effectiveness and high success rate when using MTA as a capping material compared to endodontic treatment [3].

In the present case, the patient is a young woman who reported recent pain on the day of the consultation. The pulp cold sensitivity test was positive, with no periapical symptoms. As the tooth was in recent acute irreversible pulpitis, we chose to perform a partial pulpotomy. Indeed, the pulp status always conditions the choice of treatment as it is one of the most important prognostic factors [4].

For a very long time, it was assumed that in cases of irreversible pulpitis, endodontic treatment was indicated. However, studies have shown that in young teeth with spontaneous pain, it is possible to perform a partial pulpotomy on

teeth with deep caries. This therapy is a continuation of minimally invasive dentistry [5].

The technical difference between partial pulpotomy and direct capping is that the capping material is held a few millimeters high in the pulp space to provide sufficient surface area and volume for the pulp capping biomaterial.

**Capping material used:**

Pro-root MTA was used in this clinical case. This calcium silicate-based material increases the success rate of coronal pulpotomy at >2-year follow-up in mature permanent molars [6] [7]. Indeed, calcium silicate cements and other advanced biomaterials, such as Biodentine, are considered a new treatment modality in pulpotomy, and study results tend to favor the use of MTA over  $\text{Ca}(\text{OH})_2$ , although a recent systematic review concluded that there was insufficient evidence to support the superiority of MTA over calcium hydroxide in terms of promoting hard tissue formation after partial pulpotomy [3]-[8]. Regarding the type of MTA used, a randomized clinical trial comparing RetroMTA, iRoot BP and OrthoMTA with ProRoot MTA as a pulpotomy material showed similar responses in pulps exposed to caries (between 92.8% and 96%) [9].

**Origin of pulpal exposure:**

Regarding the treatment of deep caries with pulp vitality therapeutics, partial pulpotomy is an effective treatment for carious exposures of permanent posterior teeth. The success rate is 92% after 2 years for exposures on teeth with deep caries [1]. The prognosis is not as good as for traumatic pulp exposure, with a success rate ranging from 75% to 96% [10]. Bacterial contamination is lower and negligible for traumas, which are usually treated within 24 hours.

Although there is no established point in time to determine when a partial pulpotomy can be considered successful, it has a high success rate over the various follow-up periods. Matsuo *et al.* [11] considered 21 months to be the appropriate time frame for determining the prognosis for success of a direct pulp capping, with no significant difference between 3 months and 18 months for the provisional prognosis of these pulp capping. The same results of the systematic review on partial pulpotomy performed on decayed teeth [1] showed a high success rate in the different follow-up periods, with no statistical differences between the 3 evaluation periods (6 months, 1 year and 2 years). Thus, 6 months may be considered an appropriate time period to evaluate success after partial pulpotomy. Annual clinical and radiographic checks should be performed to ensure the success of this pulp vitality therapy [1].

**Patient age:**

In the systematic review by Elmsmari *et al.* [1], patient age and tooth maturity did not affect the prognosis of partial pulpotomy, but the studies included in this review included patients aged 6 to 52 years. Indeed, the five-year pulp capping survival rate decreases from 85% in younger patients (30 - 50 years) to 70% in older patients (50 - 80 years). The pulp of younger patients is considered to have a higher healing potential than that of older patients, which is more fibrous and

less vascularized, and whose reparative potential is reduced with degenerative changes that may be physiological and/or due to previous operative experiences [12] [13].

Though some studies support this view, others have not found a negative correlation between advanced age and the success rate of pulp vitality therapies.

It should be noted, however, that the age variable is more important after pulp exposure than it is when the pulp is not exposed, especially in selective curettage treatments of deep caries [14].

#### **Bleeding time:**

In the absence of clinically available molecular tests of inflammation, the color and intensity of pulp bleeding on exposure may be a surrogate marker of inflammation intraoperatively. But how can this test be trusted on a tooth that has just been anesthetized with a high concentration of vasoconstrictor?

If hemostasis cannot be controlled after 5 minutes, more pulp tissue should be removed (complete pulpotomy) and the wound surface flushed until bleeding stops [15]. Persistent bleeding may suggest that a layer of pulp tissue is still inflamed, and partial eviction should be continued until a healthy area of tissue is exposed.

#### **Sealing of the coronal restoration:**

The sealing of the restoration is very important but also the time of installation of the permanent restoration has been shown to be a factor affecting the treatment outcome especially for cameral pulpotomy. If the seal is lost, bacterial contamination can pass through the mineralized bridge, especially if the mineralized bridge is porous, as with calcium hydroxide, and reach the pulp [5].

The final objective is therefore to obtain a three-stage pulp seal: the coronal restoration, the capping material or mineral cement and a mineral barrier created by the dentin bridge [5]. Thus, a final coronal restoration is recommended as soon as possible after a complete pulpotomy.

## **4. Conclusions**

The strategy for managing pulp exposures has evolved due to advances in pulp biology research, evolution of biomaterials and pulp vital therapies.

Teeth with exposed carious pulp can be successfully treated with MTA pulpotomy. The success rate is high after 2-year of follow-up for vital teeth exposed accidentally or with reversible or irreversible pulpitis. This clinical case showed clinical and radiographic success after 3 years of follow-up.

Clinical signs of irreversible pulpitis should not be considered contraindications to partial pulpotomy.

The use of calcium silicate materials in pulp vitality therapy is also an important factor and a longer follow-up time of up to 5 years after treatment is recommended.

## **Conflicts of Interest**

The authors declare no conflicts of interest.

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