IEJ
Iranian Endodontic Journal

Tampon Pulpotomy: Long-term Successful Results of a Molar with Irreversible Pulpitis and Previous Vital Pulp Therapy Failure

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Article Type: Case Report

Received: 06 May 2023
Revised: 03 Jun 2023
Accepted: 10 Jun 2023
Doi: *10.22037/iej.v18i3.42508*

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Minimally invasive vital pulp therapy (VPT) techniques have become increasingly popular for treating mature permanent teeth with irreversible pulpitis. However, in cases where less invasive VPT approaches, such as miniature pulpotomy, fail to provide symptom relief and desired outcomes, alternative treatment strategies need to be explored. This case report presents the successful application of tampon pulpotomy, a modified full pulpotomy technique, in a vital molar tooth with irreversible pulpitis, after a previous miniature pulpotomy failure. The tampon pulpotomy procedure involved the placement of an endodontic biomaterial (*i.e.* calcium-enriched mixture cement) over the pulpal wound to stop bleeding and create a favorable environment for pulpal healing/regeneration. The patient was followed up for a period of 10 years, during which the tooth remained asymptomatic, functional, and exhibited normal periodontal ligament. This case report highlights the potential effectiveness of tampon/full pulpotomy as a retreatment option in cases where more conservative VPT techniques have shown limited success, offering a conservative approach to preserve tooth structure and pulpal vitality.

Keywords: Calcium-enriched Mixture Cement; Endodontics; Irreversible Pulpitis; Tampon Pulpotomy; Tricalcium Silicate; Vital Pulp Therapy

Introduction

Minimally invasive vital pulp therapy (VPT) approaches have gained significant attention in the treatment of mature permanent teeth presenting with various features of irreversible pulpitis (IP) [1-3]. As an alternative to conventional root canal therapy (RCT), VPT has demonstrated several advantages, including increased success rates, enhanced accessibility, improved affordability, wider availability, and enhanced safety [4]. The various techniques encompassed within VPT include non-invasive stepwise excavation of decayed tissues, direct/indirect pulp capping [5-7], as well as miniature/partial/full pulpotomies [8-10]. These VPT procedures aim to preserve the vitality of the pulp while effectively managing irreversible pulpitis.

Despite the success of VPT techniques, there remains a gap in the literature regarding the appropriate management when VPT fails to alleviate pulpal symptoms while the pulp remains vital. It is logical to consider that if VPT techniques with minimal or no tissue removal do not yield satisfactory treatment outcomes, the next step would involve a new VPT procedure with a more extensive removal of pulpal tissue. However, to date, there are no reports in dental literature discussing such an approach.

In light of this gap, the present case report aims to present a unique and innovative approach in VPT by introducing the concept of tampon pulpotomy [2, 11] after the complete removal of the diseased coronal pulp tissue. This modified VPT approach involves the placement of an endodontic biomaterial as a plug over the pulpal wound to arrest hemorrhaging and create a situation conducive to pulpal healing.

Therefore, this report describes the successful application of tampon/full pulpotomy in a patient with irreversible pulpitis, highlighting its potential as an effective treatment modality in vital teeth/cases where a more conservative VPT technique such as miniature pulpotomy (MP) has failed.

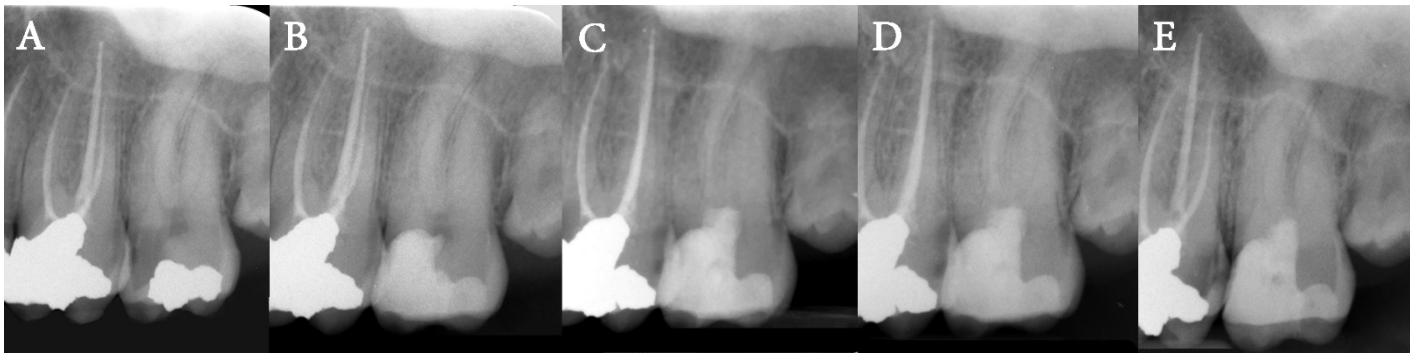

Figure 1. Illustrations of the periapical radiographs of the reported maxillary left second molar throughout the treatment process: *A)* In the preoperative radiograph, mesial recurrent caries can be observed, which extended to the pulp chamber; *B)* The initial treatment of miniature pulpotomy (MP) and composite restoration; *C)* Afterwards, the patient experienced pain and discomfort leading to the subsequent full pulpotomy (FP) procedure performed 11 months later; *D)* The one-year follow-up radiograph demonstrates a functional tooth with a normal periodontal ligament; *E)* Remarkably, the ten-year follow-up radiograph shows the long-term successful outcome of vital pulp therapy, utilizing a calcium-enriched mixture (CEM) biomaterial

Case Report

A 45-year-old female patient was referred for the treatment of a symptomatic upper left second molar. The clinical examination revealed lingering pain upon cold testing, sensitivity to percussion, and a normal probing depth (≤3 mm). Radiographic evaluation demonstrated mesial recurrent caries extending deeply into the dental pulp (Figure 1A). The final pulp/periapical diagnosis was symptomatic IP associated with symptomatic apical periodontitis. The treatment plan involved VPT, and the patient provided informed consent.

Following administration of local anesthesia, the dental pulp was exposed after complete removal of the carious tissue. To perform a minimally invasive pulpotomy, a ~1-mm-deep cavity was prepared using a round-end sterile diamond bur, with continuous irrigation. Hemostasis was achieved by placing a sterile cotton pellet soaked in normal saline solution gently over the pulp for ~2 min. Subsequently, a calcium-enriched mixture (CEM) cement (BioniqueDent, Tehran, Iran) was prepared as the pulp covering biomaterial. The exposed pulp area was sealed with a ~2 mm thickness of CEM cement. The remaining cavity was then restored with resin composite material (Z250; 3M/ESPE, St Paul, MN, USA) (Figure 1B).

During routine follow-up visits, the symptoms subsided. However, at the 11-month recall, the tooth presented with lingering pain upon cold stimuli again, but no sensitivity to percussion, and a normal periodontal ligament. Considering the continued pulp vitality, a decision was made to perform a full pulpotomy (FP). After administering local anesthesia, an access cavity was prepared, and the coronal pulp tissue was completely removed; but adequate hemostasis was not achieved after applying a sterile cotton pellet soaked in normal saline solution gently over the pulp for ~5 min or even applying 5.25% sodium hypochlorite for ~1 min. Therefore, using CEM cement, a tampon pulpotomy procedure carried out. The coronal cavity was then filled with the resin composite material (Figure 1C). One day post-treatment, the tooth was asymptomatic. At the 12-month follow-up, the tooth remained asymptomatic and functional (Figure 1D). Ten years later, during a recall examination, the tooth continued to be symptom-free, functional, and exhibited a normal periodontal ligament (PDL) response (Figure 1E).

Discussion

When semi-invasive VPT techniques, resembling MP, prove ineffective in providing symptom relief and desired outcomes, a more invasive VPT approach, known as FP, may be considered for endodontic retreatment. The rationale behind this retreatment strategy is to preserve pulpal vitality by removing a slightly larger portion of pulpal tissue compared to the initial attempt. This conservative approach ensures the maintenance of the structural integrity/functionality of teeth while keeping the pulp within the root canals viable, thereby avoiding the necessity for more extensive and costly RCT procedures.

FP as a retreatment option in cases of semi-invasive VPT failure provides several notable advantages. Firstly, it avoids the unnecessary removal of tooth structure, thereby preserving the natural tooth and its inherent functions. This conservative approach is particularly beneficial as it retains the vitality of the remaining dental pulp, allowing for the potential of healing/regeneration. Furthermore, this alternative minimizes the time and financial burden associated with conventional RCT, making it a more accessible and cost-effective option for patients.

In addition to exploring FP as a potential retreatment option following the failure of semi-invasive VPT techniques, an innovative and modified approach known as tampon pulpotomy has emerged as a promising strategy for managing irreversible pulpitis while preserving pulpal vitality. Tampon pulpotomy addresses cases characterized by excessive and prolonged hemorrhage by utilizing an endodontic biomaterial as a plug placed over the pulpal wound. This technique aims to achieve hemostasis using mechanical pressure and establish an optimal atmosphere that promotes pulpal healing/regeneration.

The decision to employ a more invasive VPT technique, such as tampon/full pulpotomy, should be based on careful clinical evaluation and consideration of the patient's unique conditions. Factors such as the extent of the remaining vital pulp tissue, the severity of symptoms, and the patient's preferences should be taken into account when determining the most appropriate treatment approach [12].

The physical/mechanical/chemical properties of the pulp-covering agent have a significant role in the treatment outcomes; previous studies revealed that endodontic biomaterials such as MTA and CEM cement due to their biocompatibility and sealing ability highly contributed to the outcomes of VPTs [13-18].

Conclusion

The utilization of more invasive VPT techniques, specifically full pulpotomy, combined with the innovative approach of tampon pulpotomy, offers a viable retreatment option for cases where semi-invasive techniques have shown limited success. This conservative approach not only preserves the integrity of the tooth structure but also maintains pulpal vitality, avoiding the need for more extensive and costly root canal treatment procedures.

Conflict of Interest: 'None declared'.

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Please cite this paper as: Asgary S, Roghanizadeh L. Tampon Pulpotomy: Long-term Successful Results of a Molar with Irreversible Pulpitis and Previous Vital Pulp Therapy Failure. Iran Endod J. 2023;18(3): 165-7. *Doi: 10.22037/iej.v18i3.42508.*