

Case Report

Application of Inflammatory Vital Pulp Therapy in the Treatment of Apical Periodontitis in a deciduous Molar: A Case Report

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Abstract

Due to the distinct anatomical characteristics of deciduous teeth, they are particularly susceptible to apical periodontitis when afflicted by deep caries or other endodontic diseases. Conventional, root canal therapy (RCT) has served as the standard treatment protocol all the time by the most pediatric dentists. However, researchers try to find another possible alternative methods because of its some drawbacks. Hence this report introduces a groundbreaking therapeutic modality - inflammatory vital pulp therapy (IVPT) - which has proven effective in treating apical periodontitis in a deciduous molar. The objective of this study was to assess the practicality and efficacy of IVPT in managing apical periodontitis in deciduous teeth. Through rigorous patient examination and evaluation, IVPT was adopted as the treatment plan, followed by meticulous long-term follow-up observations. The outcomes revealed remarkable clinical improvements, with the periapical lesion healing seamlessly without any complications. Notably, the development of the permanent tooth embryo remained undisturbed and progressed as expected. In summary, this study validates the efficacy of IVPT in treating apical periodontitis in deciduous teeth, opening a new avenue for the management of deciduous tooth diseases. The clinical utilization of this method is anticipated to enhance treatment experiences and prognostic outcomes for patients with deciduous tooth pathologies.

Keywords

Inflammatory Vital Pulp Therapy, Apical Periodontitis, Deciduous Tooth, Root Canal Therapy

1. Introduction

The main purpose of RCT is to remove as much pulp tissue as possible from the root canal, and then fill the root canal with anti-inflammatory and antibacterial drugs [1]. As RCT has a acceptable success rate in deciduous teeth with apical periodontitis, which is 56-96%, most pediatric dentists prioritize RCT for them [2, 3]. Although RCT is commonly employed for treating apical periodontitis in deciduous molars [4,

5], part of children and their parents may harbor reservations towards it, stemming from its intricate nature, prolonged treatment period, significant financial burden, and the prerequisite of children's active participation. As a result, pediatric dental researchers are actively seeking out more efficient and child-centered alternative therapeutic approaches.

With the development of pulp treatment and the advance-

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ment of pulp biology research, researchers have come to realize that residual vital pulp tissue may still be present within the root canal of teeth with apical periodontitis [6]. As researchers did in permanent teeth [7], we have observed that when probing the canal orifice or canal in deciduous molars with apical periodontitis, most children report pain, a clinical experience that suggests the presence of vital pulp tissue. It is believed that this tissue may be in an inflammatory state rather than necrotic, and thus has the potential to recover its proliferative and differentiative capabilities following the resolution of inflammation, leading to the restoration of pulp function [8]. Therefore, it is very important for us to do our best to preserve these still vibrant dental pulp [9]. Besides, some case reports have shown that, in young permanent teeth, preserving these pulp tissues can promote the continued physiological development of roots already affected by apical periodontitis, a treatment approach known as IVPT [6, 10]. Notably, this technique has heretofore been applied only to young permanent teeth. This case report presents its application in a deciduous molar.

2. Case Presentation

2.1. Case Summary

A 7-year-old male patient of Han nationality presented to our department in December 2021 with a gingival abscess and pain in the upper right molar teeth area that had persisted for nearly a week. His parents mentioned that they had noticed dental caries in the affected tooth several months ago but had not sought treatment. The patient was in good general health and his parents denied that he had any history of systemic diseases, drug allergies, or family history of dental problems.

Examination of the patient's craniofacial region and mouth opening revealed no abnormalities. Clinical examination showed caries lesions on the adjacent and occlusal surfaces of teeth 54 and 55. Tooth 54 had a pulp chamber exposed and exhibited mild pain on percussion, with no signs of mobility. An abscess and bleeding were observed on the buccal gingival margin (Figure 1). Tooth 55 was asymptomatic on percussion, and exhibited no gingival abnormalities. Radiographic examination revealed caries lesions that had destroyed the pulp chamber of tooth 54, with root resorption not exceeding 1/3 of its length and a prominent low-density shadow around the apex (Figure 2). Tooth 55 had caries lesions that had not approached the pulp chamber, and no other abnormalities were observed.



Figure 1. Clinical examination before treatment.



Figure 2. Radiographic examination before treatment.

2.2. Diagnosis

Deep caries and chronic apical periodontitis in tooth 54; shallow caries in tooth 55.

2.3. Treatment Plan

For tooth 54, the treatment options included RCT if no vital tissue was present in the canal or IVPT if vital tissue was present. Tooth 55 would receive routine restoration. Regular follow-up visits were scheduled for the child. After explaining the advantages and disadvantages of each treatment option to the child and his parents, they consented to the proposed plan.

2.4. Treatment Procedure

The child and his parents were informed about the condition, treatment plan, cost, and prognosis, and a consent form was signed. The area around teeth 54 and 55 was disinfected, and topical anesthesia with minimal local anesthesia was administered. A rubber dam (KSK, Japan) was placed. Tooth 54 was removed carries, and pulpotomy was performed to expose all canal orifices. A small amount of blood was observed emanating from the canal orifices, and the child reported mild pain when probed with a size 15 K-file (MANI HANOI, Japan). The pulp chamber and canal orifices were irrigated with 3% sodium hypochlorite (Zhongding, China) until debris-free. A small cotton ball soaked in 3% sodium hypochlorite was placed for 5 minutes, resulting in cessation of bleeding from the canal orifices. The area was then rinsed with saline (Kelun, China), and a layer of iRootBP Plus (Innovative Bioceramix, Canada) thicker than 2mm was placed over the canal orifices and pulp chamber floor. Glass ionomer cement (SHOFU, Japan) was used as a base, followed by the application of light curing composite resin (SHOFU, Japan; 3M ESPE, USA) for restoration. Tooth 55 was removed carries and restored using light curing composite resin. Finally, the rubber dam was removed, the teeth were received occlusal examination, adjustment, polishing, and the patient and his parents were informed of postoperative precautions.

2.5. Post-Operative Following up

The patient and his parents were followed up through phone interview at one month after treatment, clinical visits at one-year after treatment, and digital communication interview at two-year after treatment. The one-month phone interview revealed that the patient reported no abnormality in teeth 54 and 55, and that he was able to eat normally.

During the one-year follow-up visit, the patient reported feeling comfortable, and clinical examination showed that the fillings in teeth 54 and 55 were intact. The abscess in tooth 54 had resolved (Figure 3), and there was no pain or loosening. Tooth 55 also exhibited no abnormalities. Radiographic examination demonstrated that the low-density shadow around the apical region of tooth 54 had disappeared, the tooth root was normally absorbed, and the permanent tooth embryo was progressing normally (Figure 4). Teeth 55 and its permanent tooth embryo also showed no abnormalities.



Figure 3. Clinical examination at one year after treatment.



Figure 4. Radiographic examination at one year after treatment.

At the two-year follow-up through digital communication interview, the patient again reported feeling comfortable and there was no pain or loosening, and tooth 55 remained normal. Digital photo taken by his parents revealed that there was no recurrence of the abscess in tooth 54 (Figure 5).



Figure 5. Digital photo at two year after treatment.

3. Discussion

This report presents an illustrative case of apical periodontitis affecting a deciduous molar tooth, a condition commonly triggered by dental caries. Through the innovative application of IVPT, we achieved acceptable therapeutic outcomes. Follow-up assessments revealed a complete eradication of the pain on percussion, the abscess on the buccal gingival margin and the pathological low-density shadow at the apical region of the infected tooth, indicating successful treatment. Additionally, the permanent tooth embryo was observed to develop and close to erupt normally, further validating the effectiveness of the therapy.

While RCT remains the conventionally accepted treatment for apical periodontitis in deciduous molars, its associated drawbacks such as high cost, extended treatment duration, and the requirement for numerous instruments often lead to a negative treatment experience for children and low acceptance among parents [11]. This has prompted us to explore alternative treatment modalities, leading to the application of IVPT in the management of deciduous molars.

The large or open apical foramen characteristic of deciduous molars contributes to an abundant blood supply within the root canal [12]. This rich blood supply is endowed with antibacterial factors and stem cells, enabling most deciduous molars affected by apical periodontitis to retain partial pulp vitality [13]. This biological phenomenon underlies the success of IVPT. However, most research in this field has primarily focused on young permanent teeth [14, 15], with limited reports on its application in the treatment of deciduous molars. Hence, this case report not only demonstrates a significant degree of innovation but also serves as a valuable source of inspiration for future research endeavors.

4. Conclusions

Since RCT is commonly employed for treating apical periodontitis in deciduous molars, this case report preliminary indications that IVPT might be curable for them. The feasibility of IVPT lies in its indications, which might only be applied to deciduous teeth with residual vital pulp tissue. However, for deciduous teeth with confirmed complete pulp

necrosis, we believe that traditional RCT is more appropriate.

Abbreviations

RCT: Root Canal Therapy

IVPT: Inflammatory Vital Pulp Therapy

Author Contributions

Qianer Chen: Writing-original draft, Analysis

Jiahui He: Methodology, Investigation

Yun Liu: Resources, Supervision

Jin Sun: Writing-review & editing, Treatment operating

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Data Availability Statement

The data supporting the outcome of this research work has been reported in this manuscript.

Conflicts of Interest

The authors declare no conflicts of interest.

References

- [1] Pedrotti D, Bottezini PA, Casagrande L, Braga MM, Lenzi TL. Root canal filling materials for endodontic treatment of necrotic primary teeth: a network meta-analysis. *Eur Arch Paediatr Dent*. 2023 Apr; 24(2): 151-166. <https://doi.org/10.1007/s40368-022-00766-y> Epub 2022 Nov 24
- [2] Nakornchai S, Banditsing P, Visetratana N. Clinical evaluation of 3Mix and Vitapex as treatment options for pulpally involved primary molars. *Int J Paediatr Dent*. 2010 May; 20(3): 214-21. <https://doi.org/10.1111/j.1365-263X.2010.01044.x>
- [3] Coll JA, Vargas K, Marghalani AA, Chen CY, AlShamali S, Dhar V, Crystal YO. A Systematic Review and Meta-Analysis of Nonvital Pulp Therapy for Primary Teeth. *Pediatr Dent*. 2020 Jul 15; 42(4): 256-461.
- [4] Yu Y, Zhou X, Zheng LW. [Advanced research on root canal therapy for primary teeth]. *Hua Xi Kou Qiang Yi Xue Za Zhi*. 2020 Apr 1; 38(2): 205-210. Chinese. <https://doi.org/10.7518/hxkq.2020.02.016>
- [5] Tofangchiha M, Ebrahimi A, Adel M, Kermani F, Mohammadi N, Reda R, Testarelli L. In vitro evaluation of Kedo-S and RaCe rotary files compared to hand files in preparing the root canals of primary molar teeth. *Front Biosci (Elite Ed)*. 2022 Jun 2; 14(2): 14. <https://doi.org/10.31083/j.fbe1402014>
- [6] Xiao W, Shi WT, Wang J. Study of vital inflamed pulp therapy in immature permanent teeth with irreversible pulpitis and apical periodontitis. *Zhonghua Kou Qiang Yi Xue Za Zhi*. 2022 Mar 9; 57(3): 287-291. <https://doi.org/10.3760/cma.j.cn112144-20211223-00563>
- [7] Wigler R, Kaufman AY, Lin S, et al. Revascularization: a treatment for permanent teeth with necrotic pulp and incomplete root development [J]. *J Endod*, 2013, 39(3): 319-326. <https://doi.org/10.1016/j.joen.2012.11.014>
- [8] Huang GT, Sonoyama W, Liu Y, et al. The hidden treasure in apical papilla: the potential role in pulp/dentin regeneration and bioroot engineering [J]. *J Endod*, 2008, 34(6): 645-651. <https://doi.org/10.1016/j.joen.2008.03.001>
- [9] Zanini M, Meyer E, Simon S. Pulp Inflammation Diagnosis from Clinical to Inflammatory Mediators: A Systematic Review. *J Endod*. 2017 Jul; 43(7): 1033-1051. <https://doi.org/10.1016/j.joen.2017.02.009> Epub 2017 May 17.
- [10] Xiao W, Wang J. Immature permanent teeth with apical periodontitis treated with vital inflamed pulp therapy: report of 3 cases [J]. *Chin J Stomatol Contin Educ*, 2019, 22(5): 299-302.
- [11] Achanta A, Reche A, Dakhale R, Bharate RR. A Comprehensive Review of Lesion Sterilization and Tissue Repair: An Alternative for Pulpectomy in Deciduous Teeth. *Cureus*. 2023 Nov 3; 15(11): e48218. <https://doi.org/10.7759/cureus.48218>
- [12] Alobaid AS, Cortes LM, Lo J, et al. Radiographic and clinical outcomes of the treatment of immature permanent teeth by revascularization or apexification: a pilot retrospective cohort study [J]. *J Endod*, 2014, 40(8): 1063-1070. <https://doi.org/10.1016/j.joen.2014.02.016>
- [13] Ragab RA, Lattif A, Dokky N. Comparative study between revitalization of necrotic immature permanent anterior teeth with and without platelet rich fibrin: a randomized controlled trial [J]. *J Clin Pediatr Dent*, 2019, 43(2): 78-85. <https://doi.org/10.17796/1053-4625-43.2.2>
- [14] Tsukiboshi M, Ricucci D, Siqueira JF Jr. Mandibular Premolars with Immature Roots and Apical Periodontitis Lesions Treated with Pulpotomy: Report of 3 Cases. *J Endod*. 2017 Sep; 43(9S): S65-S74. <https://doi.org/10.1016/j.joen.2017.06.013>
- [15] Xiao W, Chi Z, Shi W, Wang J. Modified pulpotomy procedure in immature permanent teeth with apical periodontitis: a randomised controlled trial. *BMJ Open*. 2022 Dec 29; 12(12): e057714. <https://doi.org/10.1136/bmjopen-2021-057714>