

Case Report: An Alternative Treatment for Non-Vital Deciduous Molars Using Lesion Sterilization and Tissue Repair: Literature Review and Report of Three Cases With One-Year Follow-Up

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ABSTRACT

Introduction: An alternative method for the treatment of non-vital deciduous teeth is Lesion Sterilization and Tissue Repair (LSTR) technique in which instead of instrumentation of the root canals and obturating them with Zinc Oxide Eugenol (ZOE), the root canals are treated with a 3-Mix paste.

Case Report: In the current case report, the therapeutic outcomes of LSTR technique are presented in 3 patients with 3-month, 6-month, and 1-year clinical and radiographic follow-ups. The subjects consisted of patients referring to the Department of Pediatric Dentistry, School of Dentistry, Kerman, Iran.

Conclusions: Considering the successful outcomes of this treatment modality that was comparable to the standard pulpectomy procedure and its advantages such as one-visit treatment, no pushing of necrotic debris toward the buds of succedaneous permanent teeth and absence of ZOE in the root canals absorbed at a lower rate compared to the deciduous tooth roots were observed; hence, the technique might be an alternative technique for the standard pulpectomy procedure.

Keywords:

Necrosis, Pulpectomy,
Deciduous teeth

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1. Introduction

One of the routine treatments in pediatric dentistry is the pulpectomy of deciduous teeth. This treatment is recommended for the inflammation of the root pulp [1, 2]. Under such circumstances, the root pulp is infected or necrosed, and may be associated with the involvement of the periapical area. The aim of the pulpectomy procedure of deciduous teeth with a necrotic pulp is to eliminate microorganisms from the root canal system, which is especially important in patients with chronic periapical lesions [3, 4]. On the other hand, it is not practically possible to cleanse the root canals of deciduous teeth because these teeth have very variable root canal anatomy and such treatment has its difficulties and specific considerations [5].

A part of the success of pulpectomy procedure depends on root canal irrigation solutions, which should have antibacterial properties. Considering the fact that the majority of bacteria in the necrotic pulps are anaerobic and the success of treatment depends on the material used to obturate the root canals; such materials should exhibit long-lasting antibacterial activities [6, 7]. The preferred sealer is Zinc Oxide Eugenol (ZOE) all over the world; however, its major disadvantage is the lower absorption rate compared with that of the root [8, 9]. The pulpectomy procedure does not involve simple debriding and obturating the root canals; rather, a successful treatment requires a long-lasting stability of the disinfecting used agent [10].

The use of ZOE for the pulpectomy of deciduous teeth decreased since 1997 and it was replaced with other materials such as calcium hydroxide paste, iodoform, and some commercial products such as Sealapex, Endoflas, Metapex, and Vitapex. There is still no consensus on the better absorbance of these materials compared with that of ZOE [11-14]. The success rate of the pulpectomy of nonvital deciduous teeth with an abscess was reported about 85%. In the routine pulpectomy techniques, pathologic resorption in the tooth apex might continue.

Use of instruments in pulpectomy procedures, which may trespass the apex, can damage the bud of the permanent tooth that is developing; on the other hand, in more than 40% of the cases the bacterial culture is still positive after mechanical and chemical debridement of the root canal system. Such finding prompted researchers to evaluate the disinfecting effect of antibiotics in the root canal system. Cariologists in the Nigatal Faculty of Dentistry in Japan introduced an unconventional technique for pulpectomy procedures or extraction of nonvital de-

ciduous teeth, which is referred to Lesion Sterilization and Tissue Repair (LSTR).

It is an endodontic treatment without using any instruments, but the application of a 3-antibiotic combination in propylene glycol solvent. This combination disinfects the root canal system, dentinal tubules, and the periapical lesions, finally resulting in the repair of lesions. In order to select the antibiotics in the LSTR technique, a pathologic evaluation was carried out, in which a true anaerobic condition was created to identify the target bacteria. The first administered antibiotic was metronidazole, which is commonly used in the treatment of anaerobic infections in oral cavity. However, even high concentrations of metronidazole cannot eliminate all the bacteria from the lesion; therefore, other antibiotics, i.e. ciprofloxacin and minocycline (3-Mix) were added in order to remove the bacteria found in the endodontic lesions of deciduous teeth. Incorporation of Propylene glycol (P) and Macrogol (M) as carriers increases the penetrability of the applied Paste (P), which is referred to 3-Mix dental paste or 3-Mix MP [15-17].

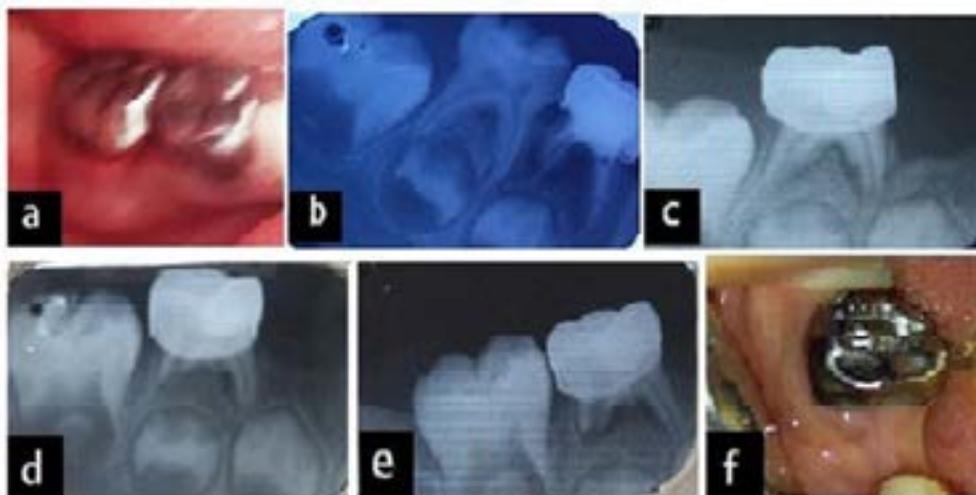
The pulpectomy procedure of a nonvital deciduous tooth was carried out in 2 sessions. During the first session, formocresol or calcium hydroxide was used to eliminate nearly all the infections and bacteria from the root canals. In the second session, after removal of the cotton pellet impregnated with formocresol and removal of calcium hydroxide from the root canals, the root canals were obturated with ZOE and the tooth was restored. However, in the LSTR technique, the treatment was rendered in 1 session, which is very important in the treatment of children considering their behavior control. In addition, there is a decrease in the cost of employed materials and the costs inflicted on the patients, compared with the 2-visit treatment modality and currently the parents prefer 1-session techniques for their children, which is the case with the LSTR technique.

Inclusion and Exclusion Criteria were Pulpectomy publications from peer-reviewed journals published in English from 1990 to 2015 were included in the current review. Studies did not meet the inclusion criteria were excluded. An electronic search was conducted in the PubMed and Google Scholar databases with appropriate MeSH headings and keywords related to the treatment for non-vital deciduous molars.

2. Case Descriptions

Case 1

A 5-year-old male referred to the Postgraduate Section of the Department of Pediatric Dentistry, School of



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Figure 1. A 5-year-old male: a) The initial clinical view with a vestibular abscess after treatment; b) The initial radiographic view with radiolucency in the furcal area and the external resorption of the root; c) The radiographic view 3 months after treatment; d) The radiographic view 6 months after treatment; e and f) Clinical and radiographic views of the tooth 1 year after treatment

Dentistry, Kerman University of Medical Sciences, Iran, with a chief complaint of swelling on the lower right side of the face. The patient had moderate pain that awakened him from sleep. The patient's medical and familial history did not reveal any diseases. In the clinical examination of the oral cavity, an abscess was detected adjacent to the lower second deciduous molar tooth on the right side (Figure 1a). The tooth was sensitive to percussion and palpation, and exhibited mobility was greater than the physiologic level. However, no sinus tracts or flow of pus was detected. A periapical radiograph revealed furcal area radiolucency. The pulpectomy procedure of the first deciduous molar tooth was unsuccessful, which resulted in a large radiolucency of the furcal area and accordingly an external root resorption up to half of the length of the distal root was detected (Figure 1b).

Partial necrosis of the second deciduous tooth was detected after isolation with a rubber dam, removal of caries, and preparation of an access cavity. To stop hemorrhage, a cotton pellet impregnated with 5.25% NaOCl was used for 30 seconds and 37% phosphoric acid was placed in the pulp chamber for 30 seconds to disinfect it. After placing the 3-Mix paste in the orifice area, the pulp chamber was sealed with light-cured glass-ionomer and the tooth crown was restored with stainless steel crown (SSC). The patient was given antibiotics for 1 week. The patient had no symptoms at 1-month and 3-month follow-ups. The clinical examination after 1 month showed resolution of the vestibular soft tissue abscess.

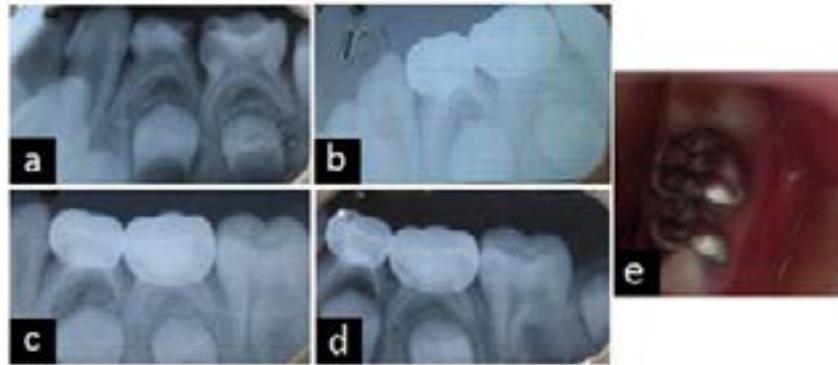
The tooth was not sensitive to percussion and palpation, had no pathologic mobility, and the patient did not

complain of pain. In the 1-month and 3-month (Figure 1c) follow-ups, the size of the radiolucency in the furcal area decreased or remained unchanged radiographically. In the 6-month follow-up, the tooth was normal in relation to clinical signs; radiographically, periapical radiolucency and pathologic external root resorption was detected, with no involvement of the permanent tooth bud (Figure 1d). In the 1-year follow-up, the clinical signs were normal (Figure 1e) and radiographic evaluation showed cessation of external root resorption process compared with previous follow-ups with no involvement of the permanent tooth bud (Figure 1f).

Case 2

A 6-year-old female, with moderate pain in the lower deciduous second molar area referred to the Specialty Section of the Department of Pediatric Dentistry, Kerman School of Dentistry. Clinical examination revealed petechia on the buccal mucosa of the affected tooth. The tooth was not sensitive to percussion and palpation, and had no pathologic mobility. No abscess formation, swelling, sinus tracts, and flow of pus were observed. Back-to-back caries was observed on the first and second deciduous molars. Radiographic examination of this carious area revealed the exposure of the pulp horn in the first and second deciduous molars (Figure 2a).

Radiolucency was detected only in the furcal area of the first deciduous molar and no signs of internal and external root resorption were detected. To treat the tooth with the LSTR technique, the patients had good cooperation. After isolation with rubber dam, removal of caries,



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Figure 2. A 6-year-old female: a) The initial radiograph shows back-to-back caries of the deciduous molars; b and c) Radiographs 3 and 6 months after treatment; d and e) Clinical and radiographic views 1 year after treatment

and preparation of access, the root canal pulp of the second deciduous tooth exhibited partial necrosis. After irrigation of the pulp chamber with normal saline solution, 37% phosphoric acid was placed in the pulp chamber for 60 seconds, followed by a cotton pellet impregnated with NaOCl solution for 60 seconds to stop hemorrhage. The 3-Mix antibiotic paste was placed on the canal orifices; the pulp chamber was sealed with self-curing glass-ionomer, and the tooth was resorted with SSC.

The first deciduous molar tooth underwent a standard pulpectomy procedure with ZOE in the next session and then, Zonalin and a SSC were placed on the tooth. Then, the tooth was followed up at 1- and 3-month postoperative intervals. At 1- and 3-month intervals the 2 deciduous molar teeth treated with the standard and LSTR techniques did not exhibit any pathologic symptoms and signs. Radiographic comparisons of the 2 teeth at 1-, 3-, and 6-month intervals showed the success of both treatment modalities

(Figure 2b and 2c). At 1-year follow-up the teeth were clinically and radiographically normal (Figure 2d and 2e).

Case 3

A 6-year-old male with moderate pain lasting for 1 minute referred to the Specialty Section of the Department of Pediatric Dentistry, School of Dentistry, Kerman University of Medical Sciences, Iran. The patient was systemically healthy. Clinical examination revealed swelling and an abscess in the left lower first deciduous molar area, along with a sinus tract, which did not exhibit active discharge of pus. The tooth was not sensitive to percussion and palpation and had no pathologic mobility. There was a wide radiolucent area in the furcal area on the periapical radiograph, with no involvement of the permanent tooth bud.

The second deciduous molar had already undergone partial pulpectomy with ZOE and was restored with



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Figure 3. A 6-year-old male: a) The radiographic view after treatment; b) The radiographic view 6 months after treatment; c and d) The clinical and radiographic views of the tooth 1 year after treatment

amalgam. A chronic abscess was observed clinically and a wide radiolucency on the radiograph indicated complete necrosis of the tooth. The tooth underwent treatment with the LSTR technique (Figure 3a). In the 3-month clinical follow-up, although there was no abscess and the tooth was not sensitive to percussion, it had a little mobility in association with mild pain. In the 3- and 6-month radiographic follow-ups, there was radiolucency in the furcal area in association with pathologic root resorption; however, no impingement on the follicle of the succedaneous tooth bud was observed (Figure 3b). In the 3-month clinical follow-up, there was a little tooth mobility; however, at 6-month clinical examination, the tooth was clinically normal. In the 1-year clinical follow-up, the tooth was clinically normal. Radiographic evaluation showed cessation of the pathologic root resorption with no involvement of the permanent tooth bud (Figures 3c and 3d).

3. Discussion

LSTR technique for the treatment of deciduous teeth with infected pulps is a new technique and only a few studies evaluated it. Contrary to the standard pulpectomy of nonvital teeth carried out in 2 sessions, this technique can be completed in 1 session, which is justifiable for the behavioral control of children because children experience anesthesia for tooth treatment purposes. Burrus et al. carried out LSTR in 3 children. The clinical signs selected to this end consisted of a history of 1-week-old pain, swelling on the face, vestibular abscess, sensitivity to percussion, tooth mobility, and spontaneous pain; the radiographic signs consisted of furcal area radiolucency and loss of lamina dura.

The clinical and radiographic findings showed the presence of irreversible pulpitis in association with pulpal necrosis. The LSTR treatment in these teeth was followed for 3 months to 1 year. The patients were asymptomatic after treatment and normal physiologic resorption of the root occurred in all the 3 subjects [15]. Nanda et al. carried out LSTR treatment on 40 subjects. Clinical evaluations of these teeth were carried out at 3-, 6-, and 12-month intervals, which showed a clinical success rate of 100% [16].

Takushige et al. carried out LSTR treatment in order to disinfect root canals of 56 patients aged 4 to 18 years. A total of 87 selected deciduous teeth had periradicular radiolucent lesions. In all the subjects, the clinical symptoms and signs such as gingival abscess, sinus tracts, and severe and spontaneous pain were relieved after the treatment. In 4 cases, the signs disappeared after repetition of the treatment. The succedaneous teeth erupted

without any problems, except for 1 case in which the succedaneous tooth was absent congenitally. The mean duration of follow-up period was 680 days [17].

Panzanini et al. used the root canals of dog teeth for endodontic treatment of teeth with necrotic pulps in order to eliminate microorganisms from the root canal system with the use of calcium hydroxide and metronidazole, especially in cases with chronic periapical lesions. The animals were sacrificed after 90 days and histological evaluation showed that this mixture could effectively disinfect the root canals [6]. Trairatvarakul et al. carried out pulpectomy without instrumentation with 3-Mix antibiotic paste in 80 lower deciduous molars in 58 children aged 3 to 8 years, with a 2-year follow-up period.

The results showed that although the clinical success rate of treatment was high, the radiographic follow-up showed success rates of 75% and 36.7% at 24- and 27-month postoperative intervals respectively, with internal root resorption visible on radiographs. Therefore, the 3-Mix antibiotic paste cannot be considered as a routine treatment alternative for root canal therapy for a long-term [18]. Pinky et al. carried out pulpectomy in 40 necrotic deciduous molars in 2 groups. In group 1 (n=20), a 3-antibiotic paste including ciprofloxacin, metronidazole, and minocycline, and in group 2 (n=20), an antibacterial paste of ciprofloxacin, ornidazole, and minocycline were used. At 3-, 6-, and 12-month clinical and radiographic follow-ups, no significant differences were found between the 2 groups. However, the results were better in the group 2 compared with the group 1 [19].

Nakornchal et al. carried out root canal treatment in 40 deciduous molars in 37 patients aged 3 to 8 years with the 3-Mix paste and Vitapex in a single-bind design. The success rates were 100% and 96% at 6- and 12-month clinical follow-ups, respectively. The radiographic follow-up showed success rates of 84% and 78% in the 3-Mix groups after 6 and 12 months, with success rates of 80% and 56%, respectively, in the Vitapex group. The difference between the 2 groups was not significant and both materials were recommended for the root canal therapy of deciduous teeth [20].

The herein reported cases had deciduous teeth with infected root canals or partial or necrotic pulps considering their symptoms and signs. The LSTR procedure was carried out in 1 session, which is believed to be favorable for parents considering the treatment costs compared with the standard 2-session treatment. In the first case, the 1- and 3-month follow-ups showed radiographic and clinical success of the treatment; however, in the later

one the tooth did not respond to the LSTR treatment modality at 3-month follow-up and the pathologic signs of treatment failure appeared slowly.

The current preliminary study was a part of a larger project in which more LSTR procedures were carried out in order to compare the outcomes with those of routine 2-session pulpectomy procedure for nonvital deciduous teeth or those with partial necrosis. Such a new technique requires more clinical trials with longer follow-up periods in order to be established as a standard treatment. For this purpose, the plan was presented as a case report and a clinical trial followed by follow-up periods are recommended. Since LSTR technique did not involve any instruments, there was no possibility for debris and necrotic agents being pushed into the periapical area so that possible injuries to the underlying permanent tooth bud could be avoided. In addition, the duration of treatment was significantly shorter compared with the routine treatment modality. The 1-session nature of the procedure subjects the child to less psychological traumas resulting from anesthetic procedures for the treatment. In addition, the treatment cost was decreased in 1 session, which might be favorable for parents.

Why this clinical report is important to pediatric dentists?

LSTR technique is an endodontic treatment without using any instruments. LSTR technique is rendered in 1 session, which is very important in the treatment of children considering their behavior control and the patients experience anesthesia once. LSTR technique decreases the costs imposed on the patients compared with the 2-session treatment modality.

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Conflict of Interest

The authors declared no conflicts of interest.

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