

LESION STERILIZATION & TISSUE REPAIR-A VIABLE TREATMENT OPTION IN THE MANAGEMENT OF INFECTED PRIMARY MOLARS

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Abstract

The purpose of this report was to review an emerging alternative treatment to pulpectomies and extractions for nonvital primary teeth called lesion sterilization and tissue repair (LSTR) and provide the results of three clinical case applications. LSTR is a non-instrumentation endodontic treatment that involves a triantibiotic mixture in a propylene glycol vehicle, which is used to disinfect root canal systems. This article reviews the development, the technique, clinical procedures required for the technique, three clinical applications and radiographic documentation and follow-up, and a show literature review of the current evidence supporting its application in clinical practice.

Keywords: Sterilization, Lesion, Caries, Root canal, LSTR

Introduction

Early childhood caries is a specific form of rampant decay of the primary teeth, defined as a lesion of acute onset involving many or all of the erupted teeth, rapidly destroying coronal tissue and leading to early involvement of the dental pulp.¹ Atypical anatomy of the primary teeth, such as increased permeability, reduced hardness and strength and decreased enamel and dentin thickness, further promote quick spread of infectious processes in the pulpal tissue, thereby initiating root resorption and inflammatory process.² The acute onset of the disease in the deciduous dentition is a prominent feature, presenting a young child with gross destruction of all maxillary incisors and four first deciduous molars and it is a regular occurrence in pediatric dental practice.¹ Advanced coronal destruction with pulpal infection and associated chronic abscesses can progress towards complete destruction of the primary dentition.

However, infected teeth with significant loss of tooth structure, lack of adequate bone support, excessive pathologic root resorption, increased external or internal resorption, furcation involvement or infection in the periapical area near the crypt of the succedaneous tooth should be considered for extraction.^{3,4,5} But premature loss of deciduous dentition may lead to various problems, such as drifting of erupted teeth, ectopic eruption, disturbed eruption sequence, loss of space for the successor permanent teeth, development of aberrant habits such as tongue thrusting, speech alterations, and impaired function.⁶ Hence, it becomes necessary to maintain primary dentition and making them disease free and capable of normal functioning. Primary teeth with poor prognosis have been advocated for extraction followed by placement of space maintainers. But there are some disadvantages of these appliances, like cost effectiveness, lack of oral hygiene care and being non-functional in nature. Successful sterilization and restoration of an intact tooth clinically, is definitely superior to any other space maintainer.⁷

In infected primary teeth for which extraction is not the aim, pulpectomy is generally recommended as a treatment of preference.⁸ The procedure involves removing coronal and radicular pulp tissues, debridement, enlargement and filling the root canal with intracanal medicament.⁹ Residual infection in root canal system has always been an area of penumbra for the pediatric dentists. The main aim of endodontic therapy is to diminish the microbial load in the root canal. Microbial load diminution is not only important before obturation but also in

long run so as to decrease the chances of refractory periapical pathosis. Conventionally, microbial load present in the root canals is diminished by mechanical means (dentin removal) and by chemical means (irrigation). Nevertheless, in the deeper layers of infected root canal dentine, microbes often persist even after conventional root canal treatment, which may occasionally lead to recurrence of periapical complications. In this situation, complete elimination of bacteria should be ensured for a successful outcome of endodontic treatment.⁷

The technique can be very challenging given the continuous changes in the apical foramen as a result of physiologic and pathologic resorption. Over instrumentation may injure the developing permanent tooth bud. Sjogren et al¹⁰ observed the presence of positive bacterial cultures in more than 40 percent of the root canals even after sufficient chemo-mechanical preparation. These findings led researchers to investigate the use of antibiotics for disinfecting the root canal systems. The ideal intracanal medicament for pulpectomy in primary teeth should be antiseptic, not harm the periapical tissues and permanent tooth germ, easily fill the root canal, having similar rate of resorption to the primary root, resorb automatically after extrusion beyond the apex, adhere to root canal walls, not shrink, be radiopaque, and not to discolor the tooth.¹¹⁻¹³

However, no single material meets all the requirements of an ideal intracanal medicament for a primary tooth.¹¹⁻¹³ Microbial flora of the infected root canal consists of both aerobic and anaerobes with predominantly the anaerobic bacteria. Hence cleansing of the root canals should be performed to get rid of both groups of organisms. Various medicaments are used, that can decrease the load of bacteria. It was reported that the sterilization with antibiotics or antiseptics result in approximately 20-40% additional cleansing / augmenting the conventional root canal debridement. In this regard, various medicaments like antibiotics and antiseptics have been tried.⁶ Sato et al¹⁴, formulated the use of the combination of antimicrobials- Metronidazole, ciprofloxacin and minocycline, which produced effective destruction of all kinds of endodontic pathogens (aerobic as well as anaerobic). Ever since, this combination has been popularly known as 3-mix paste/ Triple Antibiotic paste. Cruz et al¹⁵ in 2002 showed that the addition of propylene glycol and macrogol (MP) as a carrier vehicle greatly improved the penetration ability of 3-mix paste/ Triple Antibiotic paste.

In cases where prognosis is poor and indicated for extraction, an optional therapy has been developed in 2004 i.e. non-instrumentation endodontic treatment 'LSTR', by the Cariology Research Unit of Niigata University School of Dentistry, Japan.¹⁶ Lesion sterilization and tissue repair (LSTR) therapy is simple and less time consuming, has no mechanical instrumentation; thus, prevents over instrumentation of root canal and unnecessary irritation of periapical tissues. This procedure uses a mixture of three antibacterial drugs (3Mix MP) as a root canal medicament to eliminate the remaining bacteria in endodontic lesions. The medicament consists of metronidazole, ciprofloxacin and minocycline – with macrogol (M) as the ointment base and propylene glycol (P) as the carrier. The repair of damaged tissues can be expected if lesions are disinfected.¹⁶

Takushige et al¹⁶ evaluated the clinical success of LSTR therapy in endodontic treatment of primary teeth. In all cases, after treatment they noted disappearance of clinical symptoms like gingival swelling, sinus opening, induced pain, impulsive mild pain and pain on biting. LSTR therapy successfully treated primary teeth with periradicular infections with or without root resorption. The concept of LSTR was thus established in 2004. Windley et al¹⁷ noted decrease in the development of resistant bacterial strains by using mixture of antibiotics. In vitro and in situ studies^{7,16,18-20} have demonstrated the efficacy of mixture (3-Mix) of metronidazole, ciprofloxacin, and minocycline against oral bacteria, involving primary teeth pulpally and endodontically. Furthermore, the same antibiotic combination has been successful in permanent tooth disinfection and regenerative endodontic treatments. This therapy further expanded with isolated studies carried by Pinky et al⁷, Jaya et al²¹, Trairatvorakul et al²², Saskianti et al²³, Divya et al²⁴ who have showed success using different types of antibiotics in primary teeth. From the existing literature, it is evident that LSTR therapy can be effectively used for sterilization of canal and healing of periapical pathology.

The purpose of this literature review and report of cases is to inform dental practitioners of lesion sterilization & tissue repair therapy for nonvital pulp therapy in primary teeth.

Case Description

A five-year-old female, 6 years old male and 5 year male presented to the department of Pedodontics and Preventive Dentistry, Teerthanker Mahaveer Dental College and Research Center, Moradabad. They reported with the chief complaint of a toothache in 65, (74, 75) and 75 teeth respectively for one week. The patient reported spontaneous waking pain and elicited pain with eating and drinking. No significant medical or family history was reported.

A clinical examination revealed a large, purulent, vestibular abscess adjacent to the primary molar. The tooth exhibited pathologic mobility and was depressible to occlusal forces. The patient was highly sensitive to percussion, and on palpation there was pain and exudate. A periapical radiograph revealed. The tooth was diagnosed with necrotic pulp and an acute apical dentoalveolar abscess. The patient was prescribed systemic antibiotics and scheduled for a treatment appointment.

Following a systemic antibiotic course, the clinical procedure of LSTR using 3-Mix-MP was completed. On clinical examination, the teeth were negative to percussion and palpation, absence of abscess and had physiologic mobility at one month follow up. The patient was asymptomatic at 12 months post-LSTR and showed nothing remarkable during a clinical exam. Radiographic

findings revealed bone stability in case-1, 2 and normal physiologic root resorption by the permanent mandibular left second premolar in case-3.



Figure 1a: Initial periapical radiograph showing furcation radiolucency.

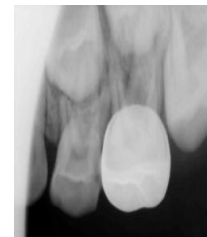


Figure 1b: Twelve months post-op, a periapical radiograph showed continued stability and no increase in periradicular radiolucency.



Figure 2a: Initial periapical radiograph showing periradicular radiolucency.

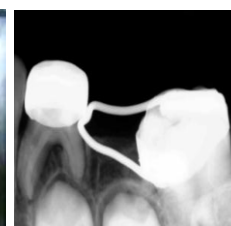


Figure 2b: Twelve months post-op, a periapical radiograph showed continued stability and no increase in periradicular radiolucency.



Figure 3a: Initial periapical radiograph showing furcation radiolucency.

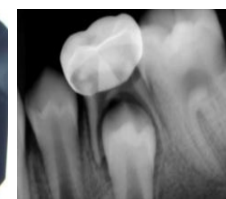


Figure 3b: Twelve months post-op, a periapical radiograph showed normal root resorption.

Discussion

Excellent clinical results of LSTR (NIET) in the treatment of infected primary teeth may be ascribed by the bactericidal efficacy of the mixture of drugs (3 mix). Previous studies^{6,7,16,18-26} have clearly demonstrated that 3 mix is capable of eliminating bacteria from infected dental tissues in both permanent and primary teeth. It was also demonstrated in situ that the drug mixture could be carried quickly and efficiently by propylene glycol¹⁵ and thus penetrated in the endodontic lesions of primary teeth and killed all the cultivable bacteria within 1 day, indicating that lesions can be sterilized by topical application of the 3 mix paste³⁸ as well as permanent teeth also.¹⁴ Gomes-Filho et al²⁷ concluded in their study that the triantibiotic paste is biocompatible in nature.

Takushige et al¹⁶ evaluated the efficacy of poly-antibiotic paste comprising of ciprofloxacin, metronidazole, and minocycline, on the clinical outcome of "Lesion Sterilization and Tissue Repair," (LSTR) therapy in primary teeth with periradicular lesions and concluded that primary teeth with periradicular lesions with or

without physiologic root resorption were treated successfully by the LSTR endodontic therapy. The root canal treatment without mechanical instrumentation may be more advantageous, especially in teeth with preoperative root resorption. For primary teeth, the presence of accessory canals, porosity, and permeability in the pulpal floor region indicate a probable connection between pulpal and periodontal tissues. Polyantibiotic paste can easily distribute through these regions and induce a sterile zone, expected to promote tissue repair.¹⁹

Slots et al²⁸ found that the ciprofloxacin/ metronidazole association was more effective against enterobacteria collected from periodontal pockets than ciprofloxacin used alone. For cases of resistance to antimicrobial agents, the use of alternative medications, or the combination of antimicrobial agents is suggested to increase the spectrum of action and act particularly on the facultative anaerobic microorganisms.^{29,30} Pinky et al⁷ replaced metronidazole with ornidazole as it had longer duration of action, better efficacy and slower metabolism when compared with metronidazole. The study concluded that there was no statistical difference between metronidazole and ornidazole groups, group containing ornidazole was reported to exhibit better results during the evaluation period of 3, 6 and 12 months in infected primary teeth.

Given the positive results of the three completed cases, further controlled clinical trials are warranted with long-term follow-up to assess the exfoliation of the treated teeth and to determine the implications, if any, to the succedaneous teeth. Additionally, for LSTR to become a reliable treatment option, the selection criteria and protocol need to be continually redefined and updated to yield the best predictable outcomes.

Conclusion

Clinical cases of LSTR therapy show exciting and promising results for the future of pediatric dentistry. LSTR therapy is particularly favorable for young patients because it can potentially avoid extraction and is relatively non-traumatic to the patient. In addition, the restored tooth is more stable in the dental arch than a space maintainer and the procedure time is shortened. With continued research and consistent favorable results. LSTR certainly has the potential to be a revolutionary therapy for the treatment of abscessed primary molars.

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