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Mini Review

LSTR - A New Technique for Treating Deciduous Teeth with Pulpal Infections

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Abstract

Dental caries is one of the common problems in primary dentition. Dental caries when left untreated may cause pulpal infections which may lead to pain and discomfort. In such cases these teeth can be treated with conventional endodontic treatment. However, these conventional treatments cannot be used in teeth where external or internal resorption or extensive periapical or furcational radiolucency is present. LSTR is a new procedure designed to retain such teeth in a healthy and functional state until exfoliation using a mixture of antibiotics.

Keywords: *Lesion Sterilization and Tissue Repair (LSTR); Non Instrumentation Endodontic Treatment (NIET); Deciduous Teeth; Pulpal Infections; Dental Caries*

Introduction

Primary teeth in children act as natural space maintainers. The loss of primary teeth due to dental caries often leads to space loss and may result in malocclusions. Moreover, the loss of primary teeth prematurely may lead to loss of esthetics, phonetics and may affect the child psychologically. Modern pediatric dentistry has the ultimate goal of preventing premature tooth loss in children. Various pulpal therapies have been designed in pediatric dentistry like indirect pulp capping, direct pulp capping, pulpotomy and pulpectomy to prevent premature tooth loss [1]. Inspite of such pulpal therapies successful pulpal treatment is difficult in deciduous teeth because of morphology of the root canals, resorption, porosity of the pulpal floor, successful debridement of the root canal and delay of the patients in seeking treatment. Sometimes because of these problems a dental practitioner may choose to extract the particular tooth due to poor prognosis. To prevent space loss and to restore function and esthetics a practitioner may advocate a fixed or removable space maintainer. These appliances too have some inherent disadvantages such as patient non co - operation, maintaining oral hygiene and frequent breakage. Thus, there is a need for a more efficient pulpal therapy through which a pulpally involved tooth showing internal resorption can be successfully treated and maintained in the dental arch as a natural space maintainer.

Rationale of LSTR

It has been seen that inspite of following proper pulpectomy protocol and good obturation techniques, many pulpectomy flare ups or failures are seen due to the presence of bacteria which remain in the deep layer of root canal dentine or islands and accessory canals. To

sterilize such lesions antibiotic may be administered locally or systemically. Often it has been seen that a single antibiotic may not be effective against all bacteria present in the root canals [2]. Hence a combination of antibiotics is recommended for patients with periapical infections. To sterilize the deeper layers of infected dentin the antibiotics should penetrate the root canal dentin. To improve the penetrative ability of the antibiotic mixture, they are mixed with propylene glycol and macrogol to form an ointment.

History of LSTR

The Cariology research unit of Niigata University school of dentistry has developed a technique called Lesion sterilization and tissue repair (LSTR) or Non instrumentation endodontic Treatment (NIET) that employed a mixture of antibiotics to sterilize the infected root canal systems and periapical lesions [3].

Since the majority of bacteria present in the deeper layers of infected root canal walls are obligate anaerobes, metronidazole was selected as the first choice. However, metronidazole at its highest concentration is not able to kill all the bacteria present in the root canal systems, hence a combination of antibiotics minocycline and ciprofloxacin was added to metronidazole to make it more efficient [4].

Ratio of the antibiotics

LSTR uses a combination of three antibiotics namely ciprofloxacin, metronidazole and minocycline. However, there is a controversy regarding the ratio of drugs used. Takushige., *et al*. used ciprofloxacin, metronidazole and minocycline in the ratio 1:3:3 mix whereas Garcia., *et al*. endorsed a ratio of 3:1:3 mix while others like Hoshino recommended a 1:1:1 mix [5]. The reason for the variation of the antibiotics mix is unknown but it might be that a lesser amount of antibiotics usage is more preferable to attain clinical effectiveness.

Vehicle used - The effectiveness of the antibiotic mixture seems to increase with the addition of macrogol and propylene glycol as a vehicle due to its penetration properties. Takushige., *et al.* used a combination of macrogol and propylene glycol to mix the 3 antibiotics (3 mix) hence their medicament was referred to as 3 mix MP.

Different combination of antibiotics in 3 mix

1. Sato., *et al*. carried out a series of *in vitro* experiments using the 3 mix with and without Rifampicin. They also tried out various combinations of ciprofloxacin and metronidazole with a third antibiotic namely amoxicillin, cefaclor, cefroxadine, fosfomycin or rokitamycin [6].
2. Ruparel., *et al*. substituted minocycline with cefaclor and called it the modified 3 mix. They also tried a double antibiotic paste or 2 mix consisting only of ciprofloxacin and metronidazole [7].
3. Pinky., *et al*. and Nanda., *et al*. tried a mix where metronidazole was replaced with ornidazole [8].

Minocycline when used for revascularization of young permanent teeth caused discoloration. Another area of concern was its effect on developing successor tooth when used in a deciduous tooth indicated for LSTR [9].

Advantages of 2 mix over 3 mix

Ruparel was the first to prepare a combination of ciprofloxacin and metronidazole known as the double antibiotic paste or 2 mix. Algarni., *et al*. found that the 2 mix had comparable biofilm inhibition as 3 mix. They also found that the biocompatibility of 2 mix was more than 3 mix. They concluded that the residual antibacterial effect of 2 mix was greater than 3 mix. Kim., *et al*. confirmed that a 1 mg/ml of 2 mix had fewer negative effects on attachment and proliferation of dental pulp stem cell (DPSCS) to dentin [10].

Mechanism of action of 2 mix and 3 mix

The mechanisms of both antibacterial mixture's are the same i.e. both sterilizes the infected pulpal and periapical tissues.

Preparation of 3 mix paste

Preparation of the antibiotic paste is one of the most important step of LSTR. The entire coating of the tablet is removed by scraping the coating with a blade and for the capsule the capsule material is removed. The three antibiotics are than mixed together with propylene glycol in a ratio of 1:1:1. A creamy consistency is prepared. This mixture is then rolled into a ball of 1 mm approximately [11].

Procedure of LSTR

After the preparation of triple antibiotic paste, access cavity is prepared. The tooth is isolated with a rubber dam and access opening is done with a #4 round bur and necrotic tissue is removed along with irrigation with normal saline. EDTA can be used to clear the smear layer leading to clean and patent dentinal tubules. If hemorrhage is present, it can be controlled with sodium hypochlorite. Sodium hypochlorite does not interfere with pulp healing. Next step is the preparation of medication cavity using a round bur at the canal orifice which is 2 mm deep and 1 mm wide and is meant for releasing the triple antibiotic paste mixture. After proper drying 1mm ball of the mixture is placed in the medication cavity prepared in each canal and permanent restoration is done using GIC and is followed by placement of a stainless steel crown.

Factors affecting the success of triple antibiotic paste [3]

1. **Concentration** - The concentration of the TAP should be optimum. If the concentration is less there will be no elimination of bacteria.
2. **Biocompatibility** - The medicaments used should be biocompatible and should not damage the host cells.
3. **Smear layer** - The smear layer should be removed with EDTA to allow proper diffusion of the medicament.
4. **Presence of infection** - Pulpal infection is polymicrobial in nature, hence combination of medicaments are required.

Concerns and issues against the use of 3 mix for LSTR [12]

1. Toxicity or allergy.
2. Antibiotic resistant strains may result.
3. Gene transfer maybe encouraged from resistant to nonresistant microbes.
4. The possible leakage of antibiotic paste into the oral cavity and resultant change in the microflora of the oral cavity.

Clinical application of LSTR [13,14]

In primary teeth:

1. Primary teeth which are tender on percussion.
2. Primary teeth with grade I and II mobility.
3. Primary teeth with an abscess or draining sinus.
4. Radiolucency in the furcation area of multi rooted primary teeth.
5. In haemophilic patients, where the primary tooth is indicated for extraction.
6. In non vital primary tooth.
7. In primary teeth where pulpectomy procedure has failed.
8. In uncooperative patients.
9. Unnegotiable root canals in primary teeth.

Conclusion

LSTR is a simple, cost effective and time saving procedure that can provide relief procedure that can provide relief from symptoms in a community based dental programmes and in children who are uncooperative or in cases where the canal's of primary teeth are non negotiable. It can be used as an alternate therapeutic procedure in cases where pulpectomies have failed due to various reasons. For LSTR to be successful proper case selection followed by proper isolation techniques should be followed.

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