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Review Article

Lesion Sterilization and Tissue Repair: A Review

[1]Sumant Ashok Demanna, [2]Humera Khatri, [3]Maheen Shaikh, [4]Nisha Vijayrao Chavan, [5]Maryam I Undre, [6]Milind Rajan

[1,2,4]Postgraduate Student, Department of Pediatric and Preventive Dentistry, M. A. Rangoonwala College of Dental Sciences and Research Centre, Pune, Maharashtra, India;
[3,6]Assistant Professor, Department of Pedodontics and Preventive Dentistry, M A Rangoonwala College of Dental Sciences and Research Centre, Pune, Maharashtra, India;
[5]Department of Dentistry, Masina Hospital, Byculla, Mumbai, Maharashtra, India

ABSTRACT:
LSTR presents itself as "a new biologic technique in the treatment of carious lesions with or without pulpal and periapical involvement employing a mixture of 3 antibiotics." It is sometimes referred to as non-instrumental endodontic treatment, or NIET. This concept was developed in 1988 by the Cariology Research Unit at the Niigata University School of Dentistry. Usually, triple antibiotic paste is used to eliminate the microbial flora that is filling the sick pulpal cavity in order to justify the LSTR procedure. The conventional inclusion of ciprofloxacin, metronidazole, and minocycline in a propylene glycol and macrogol vehicle has been replaced by various authors.
Keywords: LSTR, Lesion Sterilization and Tissue Repair, Pulpectomy, Antibiotics

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Corresponding author: Sumant Ashok Demanna, Postgraduate Student, Department of Pediatric and Preventive Dentistry, M. A. Rangoonwala College of Dental Sciences and Research Centre, Pune, Maharashtra, India

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INTRODUCTION

For primary teeth with pulp-related carious lesions, pulp therapy—which includes pulpotomy and pulpectomy—is the recommended course of treatment. However, in certain cases, pulpectomy may not be an option due to factors including substantial root resorption and/or furcal radiolucency, leaving extraction as the only option. To prevent any possible loss of space, a space maintainer should be issued whenever an extraction is performed. Primary teeth's root canal structure is infamously intricate. The narrow, flared-out roots make it impossible to perform constant, full mechanical debridement. The employment of caustic chemicals and chelating agents is still up for debate. In order to prevent irrigants from penetrating the periapical tissues excessively, the presence of resorbing roots places a premium on careful irrigation practises. All these elements cast doubt on whether the root canal system of primary teeth has been completely disinfected.[1]

Since pulpectomy has been deemed contraindicated for primary teeth, lesion sterilization and tissue repair (LSTR) appears to be a viable substitute. Using a mix of antibacterial drugs, lesion sterilisation and tissue regeneration therapy was developed by the Cariology Research Unit of the Niigata University School of Dentistry to treat dentinal, pulpal, and periapical lesions on teeth. It is probable that damaged tissues will recover if lesions are cleaned. The polymicrobial nature of an infected root canal means that a single antibiotic is not enough to disinfect it. As a result, a variety of antibacterial drugs are used. Numerous studies on the separation of bacteria from oral sites, particularly endodontic disorders of primary teeth, have influenced the selection of antibacterial drugs.[2,3] This article reviews the method, its indications, its use, and the clinical steps required to carry it out.

EVOLUTION OF LSTR

Antibiotics have been used in endodontic treatment since the middle of the 20th century. The method for preventing and treating infections in endodontics was completely changed in 1951 when Grossman created a poly-antibiotic paste that included penicillin,

bacitracin, streptomycin, and sodium caprylate. Likewise, Ledermix paste, another noteworthy innovation, surfaced as a pulp capping agent that contained the antibiotic demethylchlortetracycline and the corticosteroid triamcinolone. When it came to treating pulpal irritation in deciduous teeth, this combination worked especially well.[1,4,5]

Building on these discoveries, Sollier and Cappiello introduced the first obturating material with antibiotics in 1959. They did this by combining tetracycline, chloramphenicol, and zinc oxide eugenol in their formula. With the removal of contaminated tissue, obturating materials are used to fill and seal root canals. This development aims to improve the antimicrobial qualities of these materials.[2,3]

Many years later, in 1990, Hoshino and associates made important advancements in the field of antibiotic therapy for endodontics by creating a 1:1:1 mixture of metronidazole, ciprofloxacin, and minocycline. As a member of the nitroimidazole group, metronidazole was chosen due to its capacity to attach to DNA and impede the growth and synthesis of anaerobic bacteria, both gram-positive and gram-negative. Because of its ability to prevent DNA gyrase, the fluoroquinolone ciprofloxacin was added to help eradicate gram-negative bacteria. By blocking the synthesis of proteins and the actions of collagenases and matrix metalloproteinases, minocycline, a broad-spectrum antibiotic, offered an extra line of protection against spirochetes and a variety of gram-positive and gram-negative bacteria.[1-4]

By changing the ratios to 1:3:3, Takushige et al. (1998) improved the formulation's therapeutic effect with antibiotics. Minocycline did have one significant side effect, though, which was the possibility of tooth discoloration brought on by photo-induced reactions. The prolonged staining of dental structures is caused by the insoluble complexes that minocycline forms with calcium ions.[5]

Alternative antibiotics like amoxicillin, cefaclor, cefroxadine, fosfomycin, or rokitamycin were taken into consideration in an effort to lessen this problem. These substitutes attempted to preserve the antimicrobial effectiveness without causing the undesired side effect of discoloration, giving clinicians more options for individualized and efficient endodontic care.[1]

Preparation of triple antibiotic paste: The formulation of triple antibiotic paste represents the most critical stage in the process conducted by LSTR. The combination of metronidazole, ciprofloxacin, and minocycline is the most commonly utilized. Initially, the outer capsule material is eliminated, followed by the removal of the enteric coating from the tablet, which is achieved by scraping the coating with a blade. Subsequently, each ingredient is individually ground in a clean mortar and pestle. It is essential to ensure that the powder remains dry, necessitating careful handling. To prevent exposure to light and moisture during this phase, the powder should be stored separately in tightly sealed porcelain containers and kept in a dark environment or refrigerated.To prepare antibiotic paste each ingredient is placed in a clean glass mixing pad or slab after being well ground. The solvent is then released in a portion. A soft ball-like structure with a 1 mm diameter will be the final preparation. If the mixture is too soft, add more three mix powder. More solvent should be used if the preparation starts to flake, dry, or get too hard.[1,6-9]

Rationale of using antibiotics: The formulation of triple antibiotic paste represents the most critical stage in the process conducted by LSTR. The combination of metronidazole, ciprofloxacin, and minocycline is the most commonly utilized. Initially, the outer capsule material is eliminated, followed by the removal of the enteric coating from the tablet, which is achieved by scraping the coating with a blade. Subsequently, each ingredient is individually ground in a clean mortar and pestle. It is essential to ensure that the powder remains dry, necessitating careful handling. To prevent exposure to light and moisture during this phase, the powder should be stored separately in tightly sealed porcelain containers and kept in a dark environment or refrigerated.[9-12]

Table no. 1: Indication and Contraindication of LSTR[1,6,13]

Indication	Contraindication
1. Patients exhibiting a lack of cooperation Teeth of strategic significance. 2. Significant bone loss and mobility issues. 3. Radiolucent areas observed in the furcation 4. Teeth demonstrating Grade I and II mobility 5. Presence of a sinus tract 6. Non-vital primary teeth in a hemophilic patient 7. Underdeveloped primary teeth with necrotic pulp and partially formed roots	1. Children who have a documented allergy to the substances utilized. 2. Radiographic findings indicating significant internal and external resorption. 3. Primary teeth approaching the stage of exfoliation. 4. Instances involving a perforated pulpal floor. 5. Children diagnosed with infective endocarditis Teeth that cannot be restored.

ADVANTAGES OF LSTR[1-5]

1. **Minimally Invasive:**LSTR avoids the need for complex surgical procedures, preserving more of the natural tooth structure.
2. **Effective Infection Control:** The use of antibiotic mixtures can effectively eliminate a broad spectrum of pathogens within the root canal, addressing infections that might remain after mechanical cleaning.
3. **Promotes Natural Healing:** By sterilizing the infected tissues and allowing the body's natural healing mechanisms to take over, LSTR can facilitate the regeneration of periapical tissues.
4. **Pain Reduction:** The antibiotics used can help reduce inflammation and pain associated with infections, providing patient relief more rapidly than some traditional methods.
5. **Cost-Effective:** LSTR can be less expensive than surgical interventions or other more complex endodontic treatments.
6. **Time Efficiency:**Treatment typically requires fewer appointments compared to traditional root canal therapies, making it convenient for patients.

LIMITATIONS OF LSTR[1-5]

1. **Antibiotic Resistance:** Repeated use of antibiotics carries the risk of developing resistant strains of bacteria, which can complicate future infections and treatments.
2. **Incomplete Disinfection:** While antibiotics can significantly reduce bacterial load, they may not completely sterilize the canal, potentially leading to recurrent infections.
3. **Allergic Reactions:**Some patients may have allergies to the antibiotics used, necessitating alternative treatments or additional precautions.
4. **Not Suitable for All Cases:**LSTR might not be appropriate for all types of endodontic infections, particularly complex or severe cases that require more conventional interventions.

CONCLUSION

The complexity of primary teeth is well-known.Contributing factors encompass the presence of thin dentinal walls, divergent root structures, resorbing apices that can amplify the impact of irrigants, complex canal systems, and the unpredictability of young patients. These obstacles may prompt practitioners to consider options other than the immediate extraction of the teeth. In addressing these issues, the lesion sterilization and tissue repair technique emerges as an effective alternative, promoting a favorable outcome for the compromised tooth. This method aids both dental professionals and patients in effectively managing these challenging circumstances.

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