

Lesion Sterilization and Tissue Repair in Primary Molars at the University College Hospital: Case Presentations

Olusola Ezekiel AYEBA MERU, **Omobola Morenike OLANLOYE, **Olubukola Bamidele POPOOLA, **Obafunke Olufunlayo DENLOYE, *Yewande I. ADEYEMO*

* University College Hospital Comprehensive Health Centre, Sepeteri, Oyo State.

**Paediatric Dentistry, University College Hospital, Ibadan, Oyo State

***Paediatric Dentistry, Aminu Kano Teaching Hospital, Kano and Lecturer, Bayero University Kano

Correspondence

Dr Olusola Ayebameru

University College Hospital-Comprehensive Health Centre, Sepeteri, Oyo State, Nigeria

Email Address: brodashow@yahoo.com

Olusola E. Ayebameru

<https://orcid.org/0000-0003-0686-008X>

Omobola M. Olanloye

<https://orcid.org/0000-0003-0496-5929>

ABSTRACT

The primary dentition is prone to dental caries, which if not treated early, will involve the dental pulp (both coronal and radicular). Pulpal infection is the most common problem in this set of teeth. Primary teeth serve as the best space maintainer for permanent teeth. As a result of the polymicrobial origin of root canal infections, a combination of antibiotics may be required to address the diverse microbial flora. To utilize the tooth as the natural space maintainer, such tooth can be treated using the Lesion Sterilization and Tissue Repair (LSTR) procedure. Lesion Sterilization and Tissue Repair is a technique that allows disinfection of dentinal, pulpal, and periradicular lesions using a combination of antibacterial drugs.

This study investigated the LSTR procedure using freshly prepared Triple Antibiotic Paste (Ciprofloxacin, amoxicillin and metronidazole paste) in some pulpally involved primary teeth and found it to be very useful in prolonging the lifespan of these teeth

Key words: Primary dentition, Pulp infection, Lesion sterilization and Tissue Repair, Triple Antibiotic Paste

Olubukola B. Popoola

<https://orcid.org/0000-0003-2037-9698>

Obafunke O. Denloye

<https://orcid.org/0000-0002-7024-580x>

Citation: Ayebameru OE, Olanloye OM, Popoola OB, Denloye OO, Adeyemo YI. Lesion Sterilization and Tissue Repair in Primary Molars at the University College Hospital: Case Presentations. J Paediatr Dent Res Pract 2021; 2(1&2): 1-7

Introduction

One of the major goals of Paediatric dentistry is to maintain the integrity of the primary dentition until normal exfoliation occurs^{1,2}. The teeth in the oral cavity of children are prone to dental caries, which if not treated early will involve both coronal and radicular pulp.¹

Pulpal infections are the most common problem in primary dentition². Tooth extraction with a space maintainer may be indicated if the infectious process cannot be arrested by the conventional treatment methods – when bony support cannot be regained, when there is inadequate tooth structure remaining for a restoration, or when excessive pathologic root resorption exists^{3,4}. Premature loss of primary teeth, without preventive measures, may lead to a number of problems, such as space loss which may lead to ectopic eruption of successor permanent teeth, disturbance of eruption sequence, drifting of erupted teeth, development of aberrant habits such as tongue thrusting, alterations in speech, and impairment of function¹. Primary dentition serves as the best space maintainer for permanent teeth⁵.

As a result of the polymicrobial origin of root canal infections, a combination of antibiotics may be required to address the diverse microbial flora⁶. In primary teeth with necrotic pulp, a mixture of ciprofloxacin, metronidazole and minocycline had been utilized in the past to sterilize root dentine, irrespective of the degree of root resorption⁷. Many other combinations have also been used in the past, including ciprofloxacin, metronidazole and amoxicillin^{8,9}.

In an attempt to save an otherwise unsalvageable tooth, the Cariology Research Unit of Niigata University School of Dentistry in Japan came up with the idea of Lesion Sterilization and Tissue Repair (LSTR) therapy of necrotic primary teeth. The therapy is a non-instrumentation endodontic treatment (NIET) which involves the use of a tri-antibiotic mixture to disinfect and obturate infected root canals². In LSTR, a combination of antibiotics are used to address the polymicrobial nature of a pulpal infection and these combinations vary^{6,8,9}. The most commonly used antibiotics for the disinfection of infected root canal system are Ciprofloxacin, Metronidazole, Minocycline and has been reported to be successful¹⁰. This therapy is indicated in carious primary teeth with pulpal exposure having evidences of external or internal root resorption, furcation

involvement not amenable to the conventional endodontic treatment².

Ciprofloxacin is a narrow spectrum antimicrobial agent belonging to fluoro-quinolone group which acts by inhibiting the DNA gyrase¹¹. Antibacterial effect is present during both duplication and latent stages of bacterial growth and it is effective against gram negative organisms¹². Metronidazole is a narrow spectrum antimicrobial agent of Nitroimidazole compound which permeates bacterial cell membranes and binds to the DNA, disrupting its helical structure, and leads to very rapid cell death¹¹. It is effective against anaerobic cocci, gram positive and gram negative bacilli, and few protozoa¹³.

Minocycline, on the other hand, is a broad spectrum antimicrobial agent which acts by inhibiting protein synthesis on the surfaces of ribosomes¹¹. It is effective against gram-positive bacteria, gram-negative bacteria and spirochetes. It also augments the growth of host cells on dentin by exposing the embedded collagen fibers or growth factors – allowing a successful revascularization¹⁴. Amoxicillin is a semi-synthetic antibiotic in the β -lactam group of penicillins, similar to ampicillin but different only by the hydroxyl group on the phenyl side chain¹⁵. It is effective against gram-positive and gram-negative microbes¹⁵. Macrogol, a recognized name for polyethylene glycol, acts as a solvent that enhances better diffusion of the medicaments deep into the dentinal tubules thus enhancing the antimicrobial action¹¹. Other carrier agents that have been used in the past for the composition of the triple antibiotic paste include distilled water, normal saline, and chitosan^{16,17}.

The success of this technique has been reported by a few authors. Takushige et al¹⁸ observed that 70 of 87 cases treated using LSTR were successfully completed in a single treatment. Divya and Retnakumari¹ presented three cases in which the symptoms; pain and abscess, were eradicated three months following treatment. Khalil et al¹⁹ discovered that LSTR-3mix antibiotics are sufficiently able to inhibit *E. faecalis* growth.

In our environment, the Paediatric Dentistry Unit of the University College Hospital (UCH), we attempted to salvage the teeth that would otherwise have been extracted (because of pathologic resorption, mobility and significant furcation involvement) using the LSTR to prolong the lifespan of such teeth. Some of these cases are hereby presented. The objective was

to evaluate the clinical outcome of endodontic treatment of infected primary teeth using triple antibiotic paste.

Prior to the commencement of this study, the authors obtained verbal and written assent from the patients and consent from their parents/guardians. In the forms, parents/guardians gave consent to have images and other clinical information of their children reported in the Journal. The patients/parents understood that their names and initials will not be published and that due efforts will be made to conceal their identity, though absolute anonymity was not guaranteed.

In this study, the Triple Antibiotic Paste (TAP) was freshly constituted for each case. Same brand of tablets of Ciprofloxacin 500mg, Metronidazole 200mg, and capsule of Amoxicillin 500mg were used throughout the study period. The enteric coating of the Ciprofloxacin was removed, and the Ciprofloxacin and Metronidazole were powdered separately in a sterile dental mortar and pestle. 100mg of each of the TAP was dispensed (ratio 1:1:1)¹⁸ and mixed with sterile water to produce a paste consistency. Tooth notation in this study is based on Fédération Dentaire Internationale (FDI) method²⁰.

All treated teeth were anesthetized with 2% xylocaine in 1:80,000 adrenaline and access cavity was prepared using an inverted cone bur on a fast handpiece. The coronal and accessible radicular pulp was extirpated using a barbed broach. The canal orifices were enlarged with a round bur to create adequate room for copious irrigation (using 1.25% sodium hypochlorite: NaOCl) and medication (using TAP).

Case 1

A 6-year-old girl presented with a two-week history of severe pain from tooth 85. The pain was spontaneous, intermittent, throbbing, aggravated by mastication and it disturbed her sleep. A diagnosis of acute apical periodontitis was made. Periapical radiograph showed coronal radiolucency communicating with the pulp, furcation involvement and the shortened roots, probably resulting from pathologic resorption.

Access cavity was made on tooth 85. The root canals were located and working length was determined radiographically. Fragmented pulp tissues were removed, and the root canals were copiously irrigated with 1.25% NaOCl solution. The root canals were dried with paper point and TAP was placed in

the canals with the aid of a size 30 file. The canal orifices were covered with cotton pellet and access cavity was temporarily restored with ZnPO₄.

On the second visit, the patient had no complaints. Procedure was repeated and canals obturated with the TAP. Access cavity was restored with Glass Ionomer Cement. Stainless Steel Crown (SSC) was later placed on the tooth (Figures 1-4). Patient was reviewed one week, 1 month, 3 months, 6 months and 12 months after the procedure without any complaints. Figure 5 shows the SSC still intact 18 months after placement.

Case 2

A 4-year-old boy presented with a week history of tooth ache from tooth 84. The pain was spontaneous, intermittent and disturbed his sleep. An assessment of irreversible pulpitis was made. Periapical radiograph revealed a coronal radiolucency communicating with the pulp.

Access cavity was prepared on the tooth and canals were located. Due to lack of cooperation, complete extirpation of the pulp could not be achieved. Cotton pellet with a medicament (Ledermix paste) was placed over the canals to prevent the inflammation of the un-extirpated pulp tissues. Access cavity was restored with Zinc phosphate cement.

On the second visit (one week after first visit), the tooth was no longer symptomatic. The temporary dressing was removed with a fast handpiece. The residual pulp tissue was extirpated; root canals irrigated with 1.25% NaOCl and normal saline alternately, and dried with paper-point. Obturation was done with the TAP. Access cavity was restored with GIC and a stainless-steel crown was placed 2 weeks after. Review was done after 1 week, 1 month, 3 months, 6 months and 12 months after treatment and the tooth remained asymptomatic.

Case 3

A 7-year-old girl presented with a one-month history of toothache. The pain was described as sharp, intermittent and throbbing, associated with a headache and earache and disturbed her sleep. There was a history of an associated swelling which was noticed a week before presentation. Sub-mandibular lymph nodes on the right were enlarged and tender but there was no obvious extraoral swelling. Intraorally, there was a discharging sinus tract in relation to tooth 65. An impression of periapical abscess was made. (Figure 6). Periapical radiograph revealed coronal radiolucency communicating with

Lesion Sterilization and Tissue Repair in Primary Molars

the pulp (Figure 7). A two-visit LSTR procedure was commenced. Access cavity was made and the canals were located. The necrotic pulp was extirpated from the canals and the canals were copiously irrigated with 1.25% NaOCl and dried with paper point. TAP was placed in the canals. Orifice of the canals was covered with cotton pellet and the access cavity was temporarily restored with Zinc Phosphate cement (Figure 8).

On a second visit, the tooth and the surrounding structures were assessed with no signs and

symptoms found. Temporary dressing was removed with fast handpiece. The root canals were assessed with paper point and found to be dry. The root canals were copiously irrigated with 1.25% NaOCl and normal saline alternately; they were dried with paper points and obturated with TAP. The access cavity was restored with GIC. Reviews after 1 week, 1 month, 3 months and 6 months revealed no signs and symptoms of infection.



Figure 1



Figure 2



Figure 3

Lesion Sterilization and Tissue Repair in Primary Molars



Figure 4



Figure 5



Figure 6

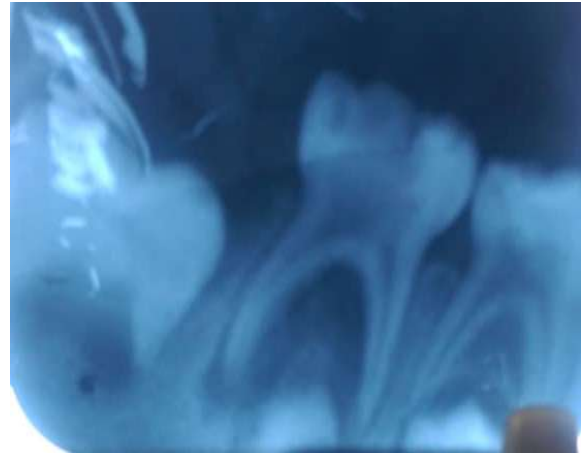


Figure 7



Figure 8

Discussion

Dental caries and the resultant pulpal diseases are the most common causes of early loss of deciduous teeth through extraction²¹. To prevent the occlusion challenges resulting from such early loss the use of a space maintainer is advocated⁴. However, some adverse effects are associated with the use of these space maintainers. These effects include plaque accumulation, increased oral microbial counts, increased periodontal index scores and dental caries²². Due to these possible deleterious effects of space maintainers, primary teeth are the best space maintainers for permanent teeth⁵. Therefore, efforts should be made to keep these teeth on the dental arch until the time of eruption of their succedaneous. To accomplish this goal of utilizing the tooth as the natural space maintainer, the LSTR procedure has been suggested as an alternative to extraction in a badly damaged, pulpally involved tooth.

A few studies have been carried out on this procedure and found to be successful. Ali M. et al²³ 2017, used a combination of ciprofloxacin, metronidazole and minocycline while this study combined ciprofloxacin, amoxicillin and metronidazole. The mixture was prepared only when needed. Also, the carrier agent in this study was either normal saline or distilled water whereas propylene glycol was used in some previous studies¹¹. Divya et al¹ presented three cases which were reportedly successful, similar to the number of cases in this study, and with excellent post-procedural follow up results. Furthermore, Prabakar et al²⁴ evaluated clinical and radiographic success of endodontic treatment of infected primary teeth. They found that endodontic treatment using antibacterial mix (a combination of ciprofloxacin, metronidazole, and minocycline mixed with propylene glycol) in primary teeth has shown good clinical and radiographic success. They also found that all the treated cases were clinically and radiographically successful with removal of necrotic coronal and accessible radicular pulp tissue³. Also, Burrus et al²⁵ observed completely resolved clinical symptoms with little or minimal changes radiographically.

The study carried out by Trairatvorakul and Detsomboonrat had good clinical successes but low radiographic success rate in their study²⁶. On the other hand, Takushige et al¹⁸ had appreciable success after treating peri-radicular lesions with or without physiologic root resorption. This study also had more clinical successes of the treated lesions with minimal changes radiographically.

Some of the previous cases were reviewed up to 12 months after treatment²⁵. The present cases were also followed up till 12 months after the procedure. All the three cases were successful.

In conclusion, Lesion Sterilization and Tissue Repair in pulpally involved carious primary teeth is useful in prolonging their lifespan using triple antibiotic paste.

REFERENCES

1. Divya S, Retnakumari N. Lesion Sterilisation and Tissue Repair in Primary Teeth with Periapical Pathosis – A Case Series. IOSR J Dent Med Sci. 2014; 13:7-11.
2. Jaya AR, Praveen P, Anantharaj A, Venkataraghavan K, Prathibha RS. In Vivo Evaluation of Lesion Sterilization and Tissue Repair in Primary Teeth Pulp Therapy Using Two Antibiotic Drug Combinations. J Clin Pediatr Dent. 2012; 37:189-92.
3. Clinical Affairs Committee. Guideline on Pulp Therapy for Primary and Immature Permanent Teeth. Am Acad Pediatr Dent. 2014; 6:244-252.
4. Horax S. Management of premature loss of primary first molar case with simple fixed space maintainer. Dentofasial. 2009; 8:23-6.
5. Setia V, Pandit IK, Srivastava N, Gugnani N, Sekhon HK. Space maintainers in dentistry: past to present. J Clin Diagnostic Res. 2013; 7:2402-2405.
6. Balasubramaniam R, Jayakumar S. Antibiotics in endodontics – A concise review. Int J Appl Dent Sci. 2017; 3:323-9.
7. Raslan N, Mansour O, Assfoura L. Evaluation of antibiotic mix in Endodontic Treatment of necrotic primary molars. Eur J Paediatr Dent. 2017; 18:285-90.
8. Jadhav G, Patil L, Patil S. A Review of Technique of Lesion Sterilization and Tissue Repair in Primary Teeth. Int J Dent Sci Innov Res. 2019; 2:123-6.
9. Singh N, Dwivedi R, Chaudhary UC, Singh R, Faisal S, Singh A. Lesion Sterilization and Tissue Repair therapy in primary teeth. Int J Curr Res. 2017; 9:56580-3.
10. Mehdi H El, Hakima C. Lesion Sterilization and Tissue Repair Therapy (LSTR) of Necrotic Primary Molars: Case Report. Int J Res Stud Med Heal Sci. 2017; 2:1-4.
11. Anila B, Murali H, Cheranjeevi J, Kapil RS. Lesion Sterilization and Tissue Repair (LSTR): A Review. J Sci Dent. 2014; 4:49-55.
12. Campoli-Richards D, Monk J, Price A, Benfield P, Todd P, Ward A. Ciprofloxacin. A review of its antibacterial activity, pharmacokinetic properties and therapeutic use. Drugs. 1988; 35: 373-447.

13. Sivakumar N, Anupam S, Kumar MS. Prescription of Metronidazole in Paediatric Dentistry-An Evidence Based Approach. *J Clin Diagnostic Res.* 2018; 12:8-11.
14. Yassen G, Chu T, Eckert G, Platt J. Effect of medicaments used in endodontic regeneration technique on the chemical structure of human immature radicular dentin_ an in vitro study. *J Endod.* 2013; 39:269-273.
15. Kaur SP, Rao R, Nanda S. Amoxicillin: A broad spectrum antibiotic. *Int J Pharm Pharm Sci.* 2011; 3:30-7.
16. Shaik J, Garlapati R, Nagesh B, Sujana V, Jayaprakash T, Naidu S. Comparative evaluation of antimicrobial efficacy of triple antibiotic paste and calcium hydroxide using chitosan as carrier against *Candida albicans* and *Enterococcus faecalis*: An in vitro study. *J Conserv Dent.* 2014; 17: 335-339.
17. Jadhav G, Shah N, Logani A. Comparative outcome of revascularization in bilateral, non-vital, immature maxillary anterior teeth supplemented with or without platelet rich plasma: A case series. *J Conserv Dent.* 2013; 16: 568-572.
18. Takushige T, Cruz E V, Moral AA, Hoshino E. Endodontic treatment of primary teeth using a combination of antibacterial drugs. *Int Endodontic J.* 2004; 37:132-138.
19. Khalil I, Islam KMM, Hossain Z, Shah AK, Badruddoza A, Moral AA. Original Article Lesion Sterilization and Tissue Repair (LSTR) -3mix MP Therapy showed Reliable Efficacy against the Most Resistant Endodontic Bacteria *Enterococcus faecalis*. *City Dent Coll J.* 2012; 9:3-6.
20. Akram A, Fuadfuad MD, Malik AM, Nasir ABM, Changmai MC, Madlena M. Comparison of the learning of two notations: A pilot study. *J Adv Med Educ Prof.* 2017; 5:67-72.
21. Alsheneifi T, Hughes C V. Reasons for dental extractions in children. *Am Acad Pediatr Dent.* 2001; 23:109-12.
22. Arikan V, Kizilci E, Ozalp N, Ozcelik B. Effects of Fixed and Removable Space Maintainers on Plaque Accumulation, Periodontal Health, Candidal and *Enterococcus Faecalis*. *Med Princ Pr.* 2015; 24:311-7.
23. Ali M, Moral AA, Quader SMA. Evaluation of Pain and Tenderness in Endodontic Treatment of Deciduous Teeth using (LSTR) 3-Mix MP therapy. *Updat Dent Coll J.* 2017; 7:9-14.
24. Prabhakar AR, Vishwanathaiah S. Endodontic treatment of primary teeth using combination of antibacterial drugs: An in vivo study Endodontic treatment of primary teeth using combination of antibacterial drugs: An in vivo study. *Indian Soc Pedod Prev Dent.* 2008 ;(Supplement): S5-10.
25. Burrus D, Barbeau L, Hodgson BD. Treatment of Abscessed Primary Molars Utilizing Lesion Sterilization and Tissue Repair: Literature Review and Report of Three Cases. *Pediatr Dent.* 2014; 36:240-244.
26. Trairatvorakul C, Detsomboonrat P. Success rates of a mixture of ciprofloxacin, metronidazole and minocycline antibiotics used in the non-instrumentation endodontic treatment of mandibular primary molars with carious pulpal involvement. *Int J Paediatr Dent.* 2012; 22:217-2