Management of Compromised First Permanent Molar with Triple Antibiotic Paste in a 12-year-old Child: A Case Report

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Authors’ contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

ABSTRACT

In teeth with pulpal and periapical infection, various group of microorganisms are present. Inhibition of the growth of these microorganisms and suppression of their antimicrobial activity play a crucial role in the success of the endodontic management. Triple antibiotic paste has been reported to have an excellent antimicrobial efficacy and it can be useful in management of teeth with severe infection. A 12-year-old female child reported with pain and swelling in relation with a lower left first permanent molar. Clinical examination of the tooth revealed deep occlusal caries and dentoalveolar abscess. Radiographically, the carious lesion was seen involving the pulp with periodontal ligament widening and inter-radicular bone loss was observed (endo-perio lesion). Considering the position of the tooth and its strategic importance, a conservative approach to salvage the tooth using Triple Antibiotic Paste (TAP) as a medicament was employed with complete radiographic healing by 12 weeks. Subsequent obturation using lateral condensation with gutta percha followed by composite restoration and preformed stainless steel crown was performed. This case report focuses on the endodontic management of perforated first permanent molar with compromised periodontal support and significant bone loss TAP as medicament and

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Mineral Trioxide Aggregate (MTA) as perforation repair material. Based on the results it can be concluded that Triple Antibiotic Paste (TAP) can be effective in the disinfection and sterilization of the root canals and repair of complex lesions.

Keywords: Triple antibiotic paste; iatrogenic perforation; intracanal medicament; compromised tooth; healing.

ABBREVIATIONS
IANB: Inferior Alveolar Nerve Block
TAP: Triple Antibiotic Paste
LSTR: Lesion Sterilization and Tissue Repair
IOPA: Intraoral Periapical
MTA: Mineral Trioxide Aggregate

1. INTRODUCTION

First permanent molars play a major role in mastication, development of occlusion, dentoalveolar growth and maintaining dentofacial and skeletal harmony. First permanent molars, also known as six-year molars (since they erupt at the age of six years), are susceptible to caries due to factors like difficulty in plaque control during eruption due to the less accessible location, deep and uncoalesced fissures, and sometimes hypomineralization [1]. It is often challenging to manage such teeth especially in children because of child cooperation difficulties, local anaesthesia-related fear and anxiety, difficulty in achieving adequate anaesthesia with IANB and also, the spread of infection. [1,2].

There are various challenges associated with first permanent molars presenting for endodontic management in pediatric dentistry. Factors such as incomplete root development, thin dentin and larger dentinal tubules and wider root canals pose a significant challenge to achieve adequate disinfection of canals and a three dimensional obturation. The anatomical and physio-biochemical aspects of young permanent teeth can lead to overinstrumentation and perforations, especially with young, inexperienced operators [1,2]. Also, endodontically treated permanent molars aid to maintain a stable occlusion, as a missing molar can affect the arch dimensions, masticatory system and also the proper development of the jaws [1].

The aim of endodontic therapy is the elimination of all the bacteria from the root canals and achievement of a hermetic seal with the coronal and radicular filling. Removal of infected, necrotic and inflamed tissue with appropriate cleaning and shaping, is the most important step prior to filling the canals [3].

The concept of Lesion Sterilization and Tissue Repair (LSTR) was given by Nigata University School of Dentistry (Hoshino 1990, Iwaku et al. 1996) [4]. TAP of Ciprofloxacin 200mg, Metronidazole 500mg, Minocycline 100mg (3 Mix) was introduced by Hoshino and Takushige in [4]. The TAP regimen was first tested by Sato et al. [5]. TAP can sterilize carious lesions, infected root dentine and periapical and periradicular infections [6,7].

The aim of the present case report is to describe the endodontic management of first permanent molar with carious and iatrogenic perforation with compromised periodontium using TAP as an intracanal medicament followed by perforation repair and obturation.

2. CASE REPORT

A 12-year-old girl reported to the Department of Pediatric and Preventive Dentistry, with the chief complaint of pain and intraoral swelling in the left lower back jaw region. The medical history was non-contributory and there was no past dental history of the tooth receiving any treatment. On clinical examination, tooth number 36 (FDI system of notation) presented with deep occlusal caries and dentoalveolar abscess with gingival overgrowth and furcal radiolucency around mesial and distal roots suggestive of a endo-perio lesion (Fig. 1).

On radiographic examination, 36 presented with occlusal radiolucency due to caries, external resorption, periodontal ligament widening and furcal radiolucency around mesial and distal roots suggestive of a endo-perio lesion (Fig. 2).

Based on the clinical and radiographic examination, the diagnosis of the tooth was Symptomatic irreversible pulpitis with apical periodontitis and the prognosis of the tooth was deemed to be poor. After the discussion with parents regarding the same, a decision was made to attempt saving the tooth with endodontic intervention. For the management of the endo-
perio lesion, it was decided to use TAP as an intracanal medicament. The patient was prescribed an antibiotic (Amoxycillin+Clavulanic acid 457 mg BID for 5 days) and an analgesic (Ibuprofen 400 mg SOS up to three times a day if pain started).

After local anaesthesia administration (IANB), curettage of the gingival overgrowth was performed with hand curette and haemostasis was achieved. Rubber dam could not be placed initially as the clamp would have irritated the buccal gingiva (Fig. 3). Access opening was done using large round bur (BR 31). During the preparation, inadvertent removal of floor of the pulp chamber lead to an iatrogenic perforation near furcation that was confirmed with a radiograph (Fig. 4). The perforation was sealed with (MTA) with the aim that during biomechanical preparation the infected debris should not irritate the furcation tissues. Cleaning and shaping of root canals was initiated under rubber dam with working length determination (Fig. 5). Canal preparation was started with conventional hand files, but due to transportation, the preparation was completed using hand protaper system till F2 file size as they are more flexible than conventional stainless-steel files and are more resistant to torsional failure. The lesion appeared to increase after the perforation before placement of TAP.

2.1 Triple Antibiotic Paste Preparation

Triple antibiotic paste was made using commercially available Tab. Ciprofloxacin 500 mg, Tab. Metronidazole 400mg and Tab. Minocycline 100 mg. The materials and armamentarium for the preparation of TAP: Tab. Ciprofloxacin 500mg, Tab. Metronidazole 400 mg, Tab. Minocycline 100 mg, Metronidazole I.P, mortar and pestle.

After removing the enteric coatings, tablets were crushed into a powdered form with the help of mortar and pestle. Equal amount of crushed tablet powders by volume were dispensed. Metronidazole I.P. liquid 500 mg/100 ml was used as the solvent. Powder and liquid were mixed to form a creamy consistency which could be carried into the canals with ease followed by a thicker consistency to condense the canals and coat the floor (Fig. 6). Prepared mixture was carried into the canals with the help of k-files. Temporary restoration of the access cavity was done with zinc oxide eugenol cement (Fig. 7).

Follow up to assess the healing and reinsertion of the triple antibiotic mixture was done at 3 weeks interval i.e. at 3 weeks, 6 weeks, 9 weeks and 12 weeks (Figs. 7, 8, 9 and 10). Adequate healing of the periapical tissue and bone formation was observed at 12th week; therefore, canals were obturated with gutta percha (Fig. 11) and access cavity was restored with composite resin.

On further follow up over next 3 months, the tooth continued to remain clinically asymptomatic during the function or otherwise. Radiographic signs of healing were seen with complete disappearance of radiolucency in the periodontium and evidence of healthy bone formation evident as the emergence of trabecular pattern and establishment of lamina dura (Fig. 13).

Other treatments, apart from that of 36, were carried out in a well planned manner during the course of infection resolution and follow-up; as shown in Table 1.

### Table 1. Treatment summary

| Visit  | Work done                                      |
|--------|------------------------------------------------|
| 1st visit | Oral prophylaxis                              |
| 2nd visit | 16, 26- Pit and fissure sealant application done |
| 3rd visit | 75- extraction of over retained root piece    |
| 4th visit | 36- Access opening                            |
| 5th visit | 36- Iatrogenic perforation sealed with MTA    |
| 6th visit | 36- Working length determination, biomechanical preparation, preparation and insertion of TAP in canals |
| 7th visit | 3 weeks recall and check up                   |
| 8th visit | 36-6 weeks recall and check up, reinsertion of TAP |
| 9th visit | 36-9 weeks recall and check up                |
| 10th visit | 36-12 weeks recall, obturation with gutta percha |
| 11th visit | 36- Stainless steel crown cementation.        |
| 12th visit | 3 month recall and follow-up of 36            |
Fig. 1. 36 – Pre-operative view of the tooth with deep occlusal caries with dentoalveolar abscess and gingival overgrowth

Fig. 2. Pre-operative Intraoral Periapical Radiograph (IOPA) showing a) carious exposure, external resorption, b) PDL widening and c) interradicular bone loss

Fig. 3. Photograph showing excised granulation tissue and access opening done
Fig. 4. Iatrogenic perforation during access cavity preparation

Fig. 5. Working length determination

Fig. 6. Preparation of triple antibiotic paste

Fig. 7. Recall at 3 weeks interval after intracanal medication with triple antibiotic paste
Fig. 8. Recall at 6 weeks interval, condensing osteitis seen

Fig. 9. Recall after 9 weeks interval, normal trabecular bone pattern evident

Fig. 10. Recall after 12 weeks
3. DISCUSSION

There has been a paradigm shift in the various treatment modalities and management approaches over the last few decades in restorative dentistry and endodontics. Contemporarily, emphasis is given to the tissue-preservation and reversal of the disease, and
regeneration of the associated cells or tissues. Biological materials and improved understanding of repair have made this possible in a minimally invasive and cost-effective manner [1,8,9]. Only if these approaches fail or lack the successive progression towards positive results, a surgical approach should be taken into consideration [9].

The success of the endodontic treatment is directly dependent upon certain factors which include appropriate access, biomechanical preparation, cleaning and shaping of the root canals for the elimination of all the viable bacteria and their byproducts from the canals and periapical area using the intracanal medicaments [10,11].

There have been published reports on the use of triple antibiotic paste in the non-surgical management of the teeth with pulpal and periapical pathologies [11]. Different combinations have been used such as Grossman’s polyantibiotic paste which consisted of penicillin and bacitracin, Ledermix paste which is the mixture of triamcinolone, streptomycin and demeclocycline and Chlorhexidine paste; however the most widely used combination is 3-mix paste which is comprised of three drugs i.e. ciprofloxacin, metronidazole and minocycline [4]. 3-mix paste can sterilize carious lesions, necrotic pulp as well as the infected root dentin. With the use of calcium hydroxide as an antimicrobial agent, which also induces necrosis of healthy tissues and promotes dystrophic calcification, regeneration/repair of healthy tissues is not possible [12,13,14]. Repair of damaged tissues and complete disinfection can be expected from the use of the TAP as an intracanal medication [15,16,17].

In the present case, the affected tooth presented with poor prognosis as clinically periodontal involvement was seen and on the radiographic examination, periodontal ligament widening, active root resorption and significant bone loss was present along with pathologic mobility. Iatrogenic perforation while attempting to locate the canals and transportation of mesiobuccal canal in apical third further complicated the case. Triple antibiotic therapy was carried out using the regimen of tab. ciprofloxacin 500 mg, tab. metronidazole 400 mg and tab. minocycline 100 mg [4,5,18,19]. The mechanism of action of this triple antibiotic paste or 3-mix paste is the inhibition of collagenases and matrix metalloproteinases and increase in the level of interlukin-10 and anti-inflammatory cytokinin by minocycline and in addition, generation of fibroblasts by metronidazole and ciprofloxacin [20,21].

After the initial intracanal medication with TAP, reinserterion of the paste and subsequent follow up was done at every 3 weeks interval. Significant changes in the clinical and radiographic assessment were observed at every recall. At 6 weeks interval condensing osteitis was observed which could be robust inflammatory response to the infection, in subsequent visit, normal trabecular bone pattern was observed. In final visit, absence of pain and swelling was reported by the patient, clinically and radiographically signs of healing were observed, formation of interradicular bone with dense trabecular pattern was observed, periodontal ligament widening was reduced and resorption was inhibited. This was indicative of success of triple antibiotic paste therapy.

The authors, based on their search through literature may suggest that this paper may be the first to discuss role of TAP in management of pulpal and periodontal infection wherein there was pathologic mobility, furcation involvement, root resorption, iatrogenic perforation, apical transportation. It further outlines the role of disinfection in management of complications and successful healing outcomes, especially in younger individuals owing to stern disinfection protocols and robust host immune responses. The present findings are in accordance with reports in literature about the use of TAP in endodontic infection control. Vijayraghvan et al in [1] presented a review on role triple antibiotic paste in root canal therapy, Utneja et al. [8] presented a case report on the non-surgical endodontic management of tooth with external root resorption with the use of TAP and MTA. The clinical effectiveness of the TAP in the disinfection of immature teeth with apical periodontitis has been reported by Reynolds et al in [22].

There are certain disadvantages associated with the use of TAP which includes the discoloration which is mainly caused by minocycline; and retardation of the growth of bones, and bacterial resistance; the safety and efficacy of minocycline has not been established for children under the age of 8 years [14]. The former is thought to be a photo-initiated reaction and to control the same, the application should be limited to the root canal. This however, was not of much
significance in the present case as the treated tooth was a posterior tooth presenting not much of aesthetic concern to the patient and the staining as such being minimal.

The conservative non-surgical endodontic management such as the use of TAP for endo-perio lesions has limitations w. r. t. child cooperation, frequent recall visits, possibility of loss of temporary restoration, repeated radiographs, etc. [14]. However, considering the limitations of surgical endodontics in the molar region and parents willingness to save the tooth, extraction were deferred.

Finally, the successful outcome cannot be attributed solely to the TAP; rather it is a result of meticulous work on the part of the clinician and more importantly the patient response in terms of both compliance and repair. Also, this report may be the first of many to explore challenges and complications in endo-perio management of permanent teeth in young individuals, promoting an ideological shift with deference of extraction and surgical interventions, and an attempt at conservative management till another suitable prosthetic alternative may be available until completion of jaw growth.

The stainless steel crown on 36 may be replaced later once permanent occlusion is achieved with a suitable metallic or aesthetic extracoronal restoration (such as a porcelain-fused to metal crown) depending on the choice of the patient and other considerations (crown height, gingival health, costs, etc.

4. CONCLUSION

Successful endodontic treatment depends on the elimination of all the bacteria and maintaining the aseptic environment for healing in the form of regeneration/ repair to happen. Based on the present case, we conclude that the Triple Antibiotic Paste (TAP) can be effective in the disinfection and sterilization of the root canals and repair of complex lesions. Proper case selection and regular follow-ups are essential in the successful management.

DISCLAIMER

The products used for this research are commonly and predominantly use products in our area of research and country. There is absolutely no conflict of interest between the authors and producers of the products because we do not intend to use these products as an avenue for any litigation but for the advancement of knowledge. Also, the research was not funded by the producing company rather it was funded by personal efforts of the authors.

CONSENT

As per international standard, parental written consent has been collected and preserved by the author(s).

ETHICAL APPROVAL

As per international standard or university standard written ethical approval has been collected and preserved by the author(s).

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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