Non-surgical endodontic therapy using triple-antibiotic paste

* Manuel S.T., ** Abhishek Parolita, *** Kundabala M., **** Mannu Vikram

Abstract

Microorganisms within the root canal system should be eliminated for the successful outcome of root canal treatment. This case report describes a successful non-surgical endodontic management of a periapical lesion with sinus tract resistant to calcium hydroxide intra-canal medicament using a combination of antibiotic drugs. A 19-year-old girl presented at the Department of Conservative dentistry and Endodontics with a chief complaint of dull continuous pain with respect to her upper anterior teeth. On examination, the maxillary left central incisor was non-vital and there was a draining labial sinus tract with respect to it. Conventional endodontic treatment using calcium hydroxide as an intra-canal medicament did not resolve the sinus tract. Hence triple-antibiotic (metronidazole/ ciprofloxacin/ minocycline) paste was used as an intra-canal medicament. The patient when recalled after 4 weeks revealed significant healing with the disappearance of the sinus tract. When recalled after 1 year, the patient had no symptoms and radiograph showed complete resolution of the radiolucent lesion. The results indicate that triple-antibiotic paste is effective in managing teeth with persistent symptoms which are resistant to calcium hydroxide therapy.

Introduction

Endodontic success and failure is related to the absence or presence of signs and symptoms of apical periodontitis. Root canal treatment can be considered as the prevention or cure for this disease. Apical periodontal lesions include apical granuloma and radicular cyst as well as acute manifestations of inflammation. The role of microorganisms in the development and perpetuation of periapical diseases is well documented. It is shown that sterilization of the root canal and periapical region results in good healing of periapical diseases. Therefore for the successful outcome of root canal treatment, the microorganisms within the root canal system should be eliminated.

Persistence or development of clinical signs (e.g. swelling or sinus tract) or symptoms (e.g. dull continuous ache or mastication sensitivity) or the persistence or development of pathosis radiographically (radiolucent lesion remaining the same, has enlarged or has developed since treatment) after the completion of the endodontic treatment suggests failure. The main cause for failure is the presence of inflammation because of the inability of the operator to completely clean the root canal. Studies show that mechanical instrumentation along with antibacterial irrigation alone cannot predictably eliminate the bacteria within the root canal system. Hence, to ensure complete elimination of root canal bacteria, placement of an effective antimicrobial agent in the root canal is required for a predetermined time period to predictably eradicate or destroy any remaining bacteria.

Calcium hydroxide is the most commonly used endodontic intra-canal medicament. Based on the current best available evidence, calcium hydroxide has limited effectiveness in eliminating bacteria from human root canals. Therefore, for the effective removal of bacteria from within the root canal system, antibiotics or combination of antibiotics have been tried as intra-canal medicament. Because of the complexity of the root canal infection it is unlikely that any single antibiotic could result in effective sterilization of the canal. More likely a combination would be needed to address the diverse flora encountered. The Cariology Research Unit of the Niigata University developed the concept of ‘Lesion sterilization and tissue repair (LSTR)’ therapy that employs the use of a combination of antibacterial drugs for disinfection of oral infectious lesions, including dental, pulpal, and periapical lesions.

Metronidazole has a wide bactericidal spectrum against anaerobes, which are common in oral sites. However, some bacteria in lesions are resistant to metronidazole and, thus, two other antibacterial drugs, e.g., ciprofloxacin and minocycline, are mixed with metronidazole in an effort to eliminate all the bacteria. Extensive in vitro and in situ studies have been conducted showing the mixed drugs to be effective against oral bacteria. Hoshino et al.14 in their in-vitro study on the antibacterial efficacy of these drugs alone and in combination against the bacteria of infected dentin, infected pulps, and periapical lesions show that none of the drugs is capable in complete elimination of bacteria, when used alone. However, in combination, these drugs are able to consistently sterilize all samples. An in situ study by Sato et al.15 point out that this drug combination is very effective in killing bacteria in the deep layers of root canal dentin. Thus the drug mixture can eliminate all the possible bacteria from lesions,
indicating that LSTR therapy may be useful in endodontic management of infected teeth.

This case report describes a non-surgical conservative method to manage teeth with persistent sinus tract using triple-antibiotic (metronidazole/ ciprofloxacin/ minocycline) paste.

Case report

A 19-year-old girl presented to the Department of Conservative dentistry and Endodontics, Manipal College of Dental Sciences, Mangalore with a chief complain of dull continuous pain with respect to her upper anterior teeth. Patient gave a history of trauma to her front teeth seven years prior to her visit. The medical history of the patient was non-contributory. No previous endodontic therapy had been performed on any of the teeth. Clinical examination showed that her maxillary left central incisor displayed grayish discoloration and had a fractured mesial incisal angle. There was a draining labial sinus tract with respect to the maxillary left central incisor. The maxillary left central incisor was slightly tender on percussion and exhibited normal mobility. The maxillary left central incisor failed to respond to thermal and electric pulp testing, whereas the other maxillary incisors responded within normal limits. A periapical radiograph demonstrated a large radiolucent lesion around the apex of the maxillary left central incisor with an ill-defined margin. Radiographically there was no sign of root fracture. A non-surgical endodontic therapy of the mandibular left central incisor was planned.

<table>
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<tr>
<th>Drawbacks</th>
<th>Probable cause</th>
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<tr>
<td>Unable to eliminate microorganisms completely from the root canal system</td>
<td>• Inhibition by dentinal protein buffering, particularly in terms of the ability of hydroxyl ions to reach the apical third and have an antibacterial effect</td>
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<td>• The low solubility and diffusibility of calcium hydroxide may make it difficult to gain a rapid increase in pH to reach the level necessary to eliminate or kill bacteria within the dentinal tubules and anatomical variations</td>
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<td>• The varying alkaline potential of different formulations</td>
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<td>• Dense biofilms of bacteria located within the dentinal tubules can protect those located deeper inside the tubules</td>
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<td></td>
<td>• Necrotic tissue in ramifications, isthmuses and irregularities may protect bacteria from the action of calcium hydroxide</td>
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<td>• The ability of Enterococcus faecalis to colonize within dentinal tubules and thus evade the hydroxyl ions</td>
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|                                                | • Calcium hydroxide promotes the adhesion of bacteria to collagen (the main organic component of dentine) which increases the extent of tubule invasion and thereby resistance to further
disinfection |

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<tr>
<th>Interfere with the sealability of root canal filling</th>
<th>Difficult to remove intra canal calcium hydroxide from the root canal wall. Zinc oxide based root canal sealers in contact with calcium hydroxide were brittle in consistency and granular in structure</th>
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<tr>
<td>Long-term calcium hydroxide as a root canal dressing may increase risk of root fracture</td>
<td>• Disruption of the link between the hydroxypatite crystals and the collagenous network in dentin</td>
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<td>• Reduced organic support due to denaturation and hydrolysis can influence the mechanical properties of dentin</td>
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Table 1 Possible disadvantages of calcium hydroxide as an intra-canal medicament.
Commerially prepared chemotherapeutic agents namely, ciprofloxacin (Cifran 500 mg, Ranbaxy Laboratories Ltd., India), Metronidazole (Metrogyl 400 mg, J.B. Chemicals and Pharmaceuticals Ltd., India) and Minocycline (Minoz 50 mg, Ranbaxy Laboratories Ltd., India) were used. After the removal of the enteric coating and the capsule that encloses the drug products, each of the drugs were pulverized using porcelain mortar and pestle. The drug mixture and propylene glycol were thoroughly mixed to form triple antibiotic paste. Propylene glycol has efficient penetration into the dentin as a vehicle carrying the drug.16 The prepared triantibiotic paste was spun down the canal with a lentulo spiral instrument (Dentsply-Maillefer, Ballaigues, Switzerland). The paste was further condensed using sterile cotton pellets before sealing the coronal access.

The patient when recalled after 4 weeks revealed significant healing. The sinus tract had healed and the tooth was non-tender to percussion. At this appointment the tooth was reopened, the antibiotic paste removed and the canal was obturated with gutta percha (Dentsply-Maillefer, Ballaigues, Switzerland) and AH plus sealer (Dentsply, De Trey, Konstanz, Germany) using the lateral compaction technique. The patient was recalled at 3, 6 and 12 month intervals. Clinical examinations showed no sensitivity to percussion or palpation, and the soft tissues were healthy. Post-operative radiographs showed the progressive process of healing (Fig 1).

Discussion

Sinus tracts are paths of drainage for abscesses and can occur both intraorally and extraorally. It is a fact that sinus tracts can heal with proper endodontic treatment. However, there are those types that are persistent and will not respond to any treatment. In these perplexing cases, it may be necessary to resort to surgical endodontic therapy. But in the present case as the patient was not willing for any surgical procedure, a more conservative method to manage was considered. The advantages of non-surgical endodontic therapy in the following case are as follows;17

- The risk of jeopardizing the vitality of the neighbouring teeth by inadvertent cutting off of their blood supply is eliminated
- Possibility for damage to anatomic structure such as the nasal cavity can be avoided
- During surgery, bone support of the neighbouring teeth is not compromised.
- Pain and discomfort during or after surgery are avoided.
- Beneficial for patients who has dislike or phobia for blood and surgery.
- It avoids the cost of surgery for the patient
- Non-surgical approach removes the etiological factor from the root canal.

Conventional endodontic treatment with the use of calcium hydroxide as an intra-canal medicament failed to resolve the problem. The probable reasons the limited effectiveness of calcium hydroxide in disinfecting the root canal system as well as other potential disadvantages are given in Table 1.18,21 Therefore a combination of metronidazole, ciprofloxacin and minocycline was
introduced into the root canal as an intra-canal medicament.

Whilst, systemic antibiotics appear to be clinically effective as an adjunct in certain surgical and non-surgical endodontic procedures, their administration is not without the potential risk of adverse systemic effects, such as allergic reactions, toxicity and the development of resistant strains of microbes. In addition, the systemic administration of antibiotics relieves patients' compliance with the dosing regimens followed by absorption through the gastro-intestinal tract and distribution via the circulatory system to bring the drug to the infected site. Hence, the infected area requires a normal blood supply which is no longer the case for teeth with necrotic pulps and for teeth without pulp tissue. Therefore, local application of antibiotics within the root canal system may be a more effective mode for delivering the drug.

Infections of the root canal system are considered to be polymicrobial consisting of both aerobic and anaerobic bacterial species. Because of the complexity of root canal infections, the use of a single antibiotic may not result in effective disinfection of the root canal system. A combination of antibiotics may be needed to address the diverse flora encountered. A combination of antibiotics might also decrease the likelihood of the development of resistant bacterial strains.

Radiographic signs such as density change within the lesion, trabecular reformation and lamina dura formation confirmed healing, particularly when associated with the clinical finding that the tooth was asymptomatic and the soft tissue was healthy. Thus it is demonstrated in this case report that the use of a combination of antibiotic drugs in tooth with persistent sinus tract gives excellent clinical results. Previous studies have clearly demonstrated that this combination is capable of eliminating bacteria from infected dental tissues.

Caution should be taken in general when dentists give local or systemic drugs. Although the volume of the drugs applied in this therapy is small and there were no reports of side effects, care should be taken if patients are sensitive to chemicals or antibiotics.

Conclusion

Non-surgical endodontic treatment using a triple-antibiotic (metronidazole/ciprofloxacin/minocycline) paste as an intra-canal medicament can result in successful healing of chronic periapical lesions resistant to calcium hydroxide dressing.

References


