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CASE REPORT

Nonsurgical Endodontic Treatment of a Tooth with Open Apex and Large Periapical Lesion using Triple Antibiotic Paste and Mineral Trioxide Aggregate Apical Plug: A Case Report with 2-year Follow-up

[1]Sandeep Rudranaik, [2]Medha Babshet, [3]Moksha Nayak

ABSTRACT

The endodontic treatment gets complicated when the tooth is associated with a large periapical lesion with open apex, as obtaining an optimal apical seal is difficult in this case. The root canal infection is diverse with the presence of both aerobic and anaerobic bacteria, and it is unlikely that any single antibiotic could result in complete asepsis of the canal. A combination of antibiotics (metronidazole, ciprofloxacin, and minocycline) effectively acts against root canal infection. Mineral trioxide aggregate (MTA) has the advantage of achieving single-visit apexification wherein the root canal can be obturated immediately. This study describes the successful nonsurgical endodontic management of nonvital tooth with open apex and large periapical lesion using triple antibiotic paste and MTA apexification followed up for 2 years.

Keywords: Apexification, Endodontics, Mineral trioxide aggregate, Nonvital tooth.

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INTRODUCTION

The anterior teeth of young patients are frequently prone to trauma due to their position in the arch. Pulpal necrosis is a frequent sequel of trauma.[1] Furthermore, if trauma occurs during root development it leads to open apex. The effect of the intervention of microorganisms and their by-products into the root canals of untreated teeth may cause this intervention process to move apically, which leads to antigen–antibody reaction, and finally, periapical lesions may occur.[2]

The large periapical lesions with open apex can be treated by various treatment modalities. Recent concept for treating teeth with large periapical lesion includes initial nonsurgical endodontic management. However, in cases where endodontic treatment fails to resolve the periapical lesion, other treatment options like apical surgery or extraction should be considered.

The root canal infection is more intricate comprising both aerobic and anaerobic bacteria. The treatment with single antibiotic may not prove to be completely efficient in sterilizing the canals; however, a combination of antibiotics may be proficient. Triple antibiotic paste (TAP) containing metronidazole, ciprofloxacin, and minocycline has been reported to be a successful regimen in controlling the root canal pathogens and in managing nonvital young permanent tooth.[3]

Several procedures utilizing different materials have been recommended to induce root end barrier formation that include calcium hydroxide, freeze-dried allogenic dentin powder, bone ceramic, tricalcium phosphate, osteogenic protein, collagen, and recently mineral trioxide aggregate (MTA).[4] Apexification using MTA has several advantages as it neither gets resorbed nor weakens the root canal dentin and also sets in wet environment. Satisfactory compaction of filling material can be achieved as MTA forms hard and nonresorbable apical barrier.[5]

Therefore the present case report highlights the successful nonsurgical management of a nonvital necrotic tooth with open apex and large periapical lesion using TAP and MTA apexification.

CASE REPORT

A 10-year-old male patient reported with complaint of fractured and discolored left maxillary central incisor. There was a history of trauma to the same tooth due to fall about 2 years back. On clinical examination, Elli's class III

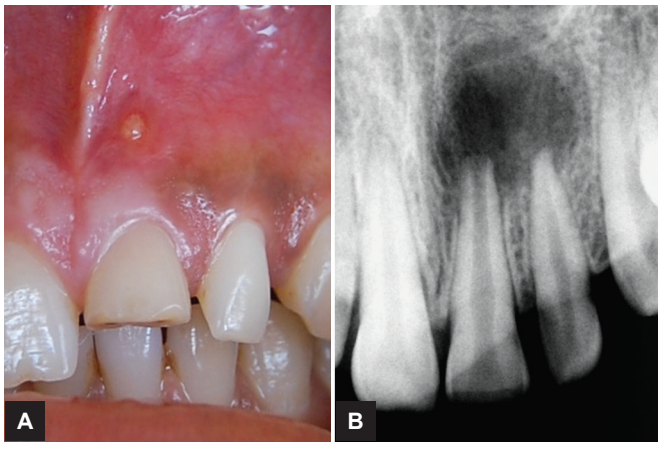
[1,2]Reader, [3]Principal

[1]Department of Conservative Dentistry and Endodontics, Sri Hasanamba Dental College & Hospital, Hassan, Karnataka India

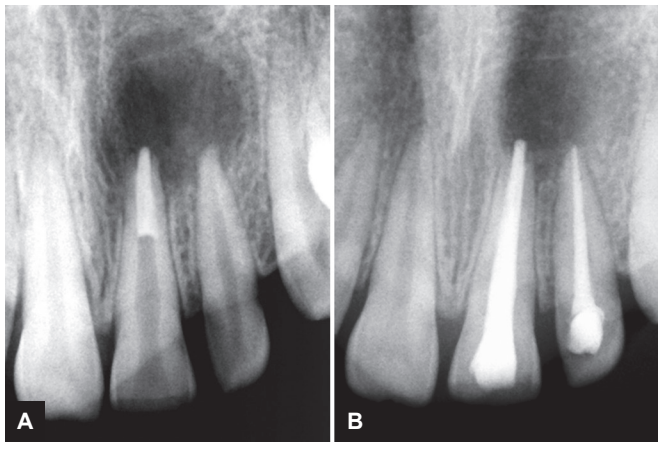
[2]Department of Oral Medicine and Radiology, Sri Hasanamba Dental College & Hospital, Hassan, Karnataka, India

[3]Department of Conservative Dentistry and Endodontics, KVG Dental College & Hospital, Sullia, Karnataka, India

Corresponding Author: Medha Babshet, Reader, Department of Oral Medicine and Radiology, Sri Hasanamba Dental College & Hospital, Hassan, Karnataka, India, Phone: +919901044655, e-mail: medhababshet@hotmail.com



Figs 1A and B: (A) Ellis class III fracture in 21 with sinus opening; and (B) preoperative intraoral periapical radiograph showing open apex in 21 and large radiolucent lesion involving 21 and 22

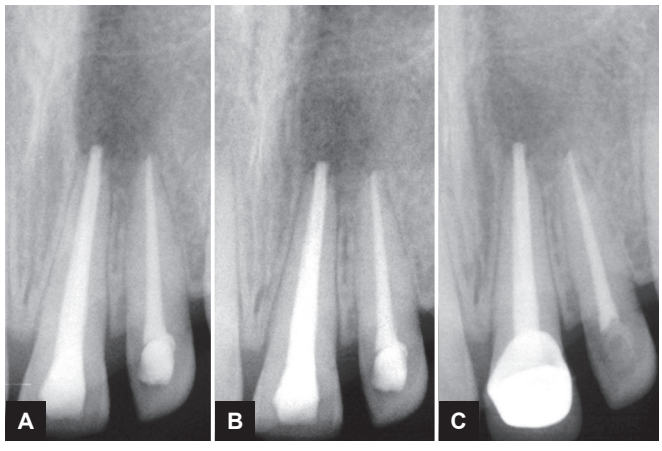


Figs 2A and B: (A) Mineral trioxide aggregate apical plug of 5 mm in 21; and (B) postobturation radiograph

fracture in relation to 21 was evident and an intraoral sinus tract was present (Fig. 1A). Thermal and electric vitality tests elicited a negative response in relation to 21 and 22. Periapical radiograph showed incomplete root formation with wide open apices in relation to 21 and a large radiolucent lesion with a well-defined margin around the apex of 21 and 22 (Fig. 1B).The patient and accompanying parent were informed about the diagnosis and treatment options. They opted for nonsurgical endodontic treatment and informed consent was taken. Thus endodontic treatment with apexification and TAP dressing was planned.

Rubber dam was applied and access cavity was prepared in 21 and 22. Necrotic pulp tissue was extirpated and the working length was estimated as being 1 mm short of the radiographic apex. Biomechanical preparation was done using no. 80 K-file using circumferential filing motion. Root canal debridement was done using alternate irrigation with 2.5% sodium hypochlorite (NaOCl) and saline. After drying with sterile paper points, a mixture of ciprofloxacin, metronidazole, and minocycline paste was prepared into a creamy consistency and spun down the canal with a lentulo spiral instrument. The paste was further condensed using sterile cotton pellets before sealing the coronal access. Intraoral sinus healed over a period of 2 weeks with no clinical symptoms. The paste was changed every month for a period of 3 months until the teeth revealed no symptoms.

After 3 months dressing was removed, canals were debrided with 2.5% NaOCl, followed by 17% ethyelenediaminetetraacetic acid and final rinse with 2% chlorohexidine. The canal was dried with paper points and MTA was placed with MTA carrier in the apical portion of the canal; subsequent increments were condensed with hand pluggers till 5 mm thickness of MTA was achieved in relation to 21 (Fig. 2A). A wet cotton pellet was placed and access cavity was sealed with temporary cement. Next day obturation was completed in relation to 21 and 22 and postobturation restoration was accomplished with composite resin (Fig. 2B).



Figs 3A to C: Intraoral periapical radiographs showing gradual resolution of periapical lesion taken after: (A) 9 months; (B) 1 year; and (C) 2 years

Radiographic follow-up for 9 months (Fig. 3A) and 12 months (Fig. 3B) showed good apical seal, reduction in size of periapical radiolucency, and bone regeneration in progress. After 2 years, the radiograph showed (Fig. 3C) complete bony healing of lesion with well-defined trabaculae.

DISCUSSION

A tooth when subjected to trauma undergoes pulpal necrosis usually. Necrotic pulpal tissue acts as a nidus for various pathological microorganisms, resulting in the progression of infection to periapical tissues. Moreover, when a tooth gets traumatized during root development and remains untreated for a very long time usually results in a large periapical lesion with open apex. In this case treatment options range from nonsurgical endodontic treatment to surgical approaches like apical surgery and extraction.

Recent accepted treatment modality for teeth with large periapical lesion includes initial nonsurgical endodontic management. However, in cases where endodontic treatment does not succeed to resolve the periapical lesion, other treatment options are considered.

In the present case a young boy reported with fractured left maxillary central incisor and a history of trauma to the same tooth 2 years back. The teeth (21 and 22) were tested to be nonvital and 21 had a draining sinus. The radiographs revealed a large uniformly radiolucent periapical lesion in 21 surrounded by fairly well-defined margin.

When treating nonvital teeth, the main issue is eliminating bacteria from the root canal system. As instruments cannot be used properly in teeth with open apices because of often divergent apices and thin dentinal walls, cleaning and disinfection of the root canal system rely on the chemical action of 2.5% NaOCl irrigant and an antibiotic intracanal dressing.[6]

The use of intracanal medication possessing antimicrobial properties may reduce or eliminate bacteria in the root canal system and significantly increase the success of root canal therapy.[7] The deeper layers of infected dentin of root canal are predominantly affected by obligate anaerobes,[8] and metronidazole being an efficient bactericidal in carious lesions[9] is considered to diffuse through the dentinal tubules.[10] However, metronidazole alone cannot destroy all the bacteria in the periapical lesion because of complex nature of the bacterial flora in the periapical infection,[11] thus indicating the need for other drugs for complete asepsis of the root canal system. The combination of metronidazole, ciprofloxacin, and minocycline is emerging to be extremely potential to achieve asepsis of root canal system.

Sato et al[12] investigated this drug combination *in vitro* and found it to be very effective in the sterilization of carious lesions, necrotic pulps, and infected root dentin of deciduous teeth. Hoshino et al[13] performed an *in vitro* study testing the antibacterial efficacy of these drugs alone and in combination against the bacteria of infected dentin, infected pulps, and periapical lesions. Alone, none of the drugs resulted in complete elimination of bacteria. However, in combination, these drugs were able to consistently sterilize all samples. Moreover, the TAP has been used successfully in regenerative endodontic treatments[14] and in healing of large periradicular lesions.[15]

The teeth with open apices can be best treated with MTA, which forms an apical barrier immediately. Such a treatment is superior to the conventional apexification treatment and can be achieved in a single appointment. Mineral trioxide aggregate as an apexification material represents a primary monoblock. Appetite like interfacial deposits formed during the maturation of MTA result in filling the gap induced during material shrinkage phase and improve the frictional resistance of MTA to root canal walls. Mineral trioxide aggregate has superior biocompatibility and is less cytotoxic due to its alkaline pH. The presence of calcium and phosphate ions in its formulation results in capacity to attract blastic cells and promote favorable environment for cementum deposition. Barrier of 5 mm is significantly stronger and shows less leakage than 2 mm barrier.[16] Torabinejad et al [17] and Xavier et al [18] suggested that MTA is the most biocompatible and bacteriostatic material with good sealing property, which stimulates cell growth, adhesion, and proliferation.

The large periapical cysts have been demonstrated to regress to smaller sizes and even complete healing after nonsurgical endodontic therapy because of a decrease in periapical inflammation. Calişkan stated that in approximately 70% of cases with periapical lesion, the healing was apparent within 2 years of treatment.[19] However, some case reports with periapical lesions in literature have shown complete resolution within 12 months after the treatment.[1,20] In the present case, successful healing was observed in a 2 years observation time (Fig. 3C).

CONCLUSION

Root canal treatment using a combination of antibiotic drugs as an antibacterial dressing was successful in healing large cyst-like periradicular lesions. Single-visit apexification with MTA is an effective management of teeth with open apex. This confirms that even large periapical lesions can respond favorably to nonsurgical endodontic treatment.

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