

## **Clinical Management of External Apical Root Resorption Using MTA Plus: A Case Series**

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### **Abstract**

Some of the pathological factors found responsible for stimulation of external apical root resorption are pressure, pulp space infection and sulcular infection. Pulp space infection when extends peri-apically causes damage to the external root surfaces resulting in peri-radicular root and bone resorption and continues to be in active state as long as the pulpal stimulus (infection) remains untreated. Root canal therapy disinfects the pulp space and therefore prevents periapical resorption process that leads to the formation of new healthy tissue. This case reports describes the conservative management of three cases presenting teeth with pulpal necrosis and associated external root resorption that were treated using triple antibiotic paste and mineral trioxide aggregate.

**Keywords:** *External Apical Root Resorption; Mineral Trioxide Aggregate; Triple Antibiotic Paste*

### **Introduction**

Periapical infection with associated root resorption is one of the reasons for therapeutic extraction of the tooth even in early ages and it is a major concern in endodontic therapy. Physiological root resorption is a process that involves resorptive activity followed by periods of attempted repair, thus resulting in variable tooth mobility in deciduous teeth before exfoliation. But the process of root resorption in the permanent dentition is usually pathological resulting in loss of dentin, cementum or bone [1].

External inflammatory root resorption is goes symptomless unless it is detected on radiographic screening. Root resorption of permanent teeth is usually the result of trauma; chronic inflammation of the pulp or periodontal tissues or both; or orthodontically induced pressure in the periodontal ligament associated with orthodontic tooth movement, tumors or tooth eruption [2]. In majority of cases pathological root resorption of dental origin is inflammatory in nature. It can occur as a single entity or a combination of internal and external resorptions. It can occur simultaneously on the same tooth and can appear as separate or joined defects.

Of all types of external root resorptions the one most common is external inflammatory root resorption. When the pulp turns necrotic due to trauma, the bacterial toxins and byproducts thus produced penetrate peri-apically through dentinal tubules and initiate an inflammatory response [3]. This can result in root and bone resorption and formation of granulation tissue which harbors the inflammatory infiltrate including polymorphonuclear leukocytes, lymphocytes, macrophages and plasma cells. Multinucleated giant cells continue to resorb the root surface as long as the stimulus persists [4]. However, successful correction of inflammatory root resorption through non-surgical intervention has been well reported [5].

The treatment of external inflammatory root resorption arising due to pulpal necrosis aims to attain asepsis, remove or destroy bacteria that allow healing to occur in the peri-radicular space. Nonsurgical root canal treatment using calcium hydroxide as dressing material is recommended by Andreasen [3]. Calcium hydroxide as an intracanal medicament best destroys the bacteria harbouring in the root canal. But calcium hydroxide if used for long term is known to weaken the root structure in immature teeth and it also does not effectively disinfect the root canals associated with persistent endodontic infections [6,7].

Various combinations of antibiotics have also been used to disinfect the root canal system and among them a mixture of ciprofloxacin, metronidazole and minocycline has proved to be very effective in eliminating endodontic pathogens [8]. This combination is referred to as Triple Antibiotic Paste. Ozan and Er have found that the combination of these antibiotic drugs, when used as antibacterial intracanal dressing is successful in healing large cyst-like peri-radicular lesions [8].

Mineral trioxide aggregate is well known for its great biocompatibility and has demonstrated excellent sealing ability in studies using dye penetration and bacterial leakage even under blood contamination conditions [9]. MTA is widely applied in root-end filling, perforation repair and pulp capping. It has the ability to induce regeneration of peri-radicular tissues such as bone and cementum.

The following clinical case reports demonstrate the nonsurgical root canal treatment of severe external apical root resorption, using triple antibiotic paste as intra-canal medicament and MTA to form an apical plug with aim to promote repair and regeneration of hard tissues. Clinical as well as radiological outcomes evaluated for a period of four years demonstrated periapical healing, normalisation lamina dura with cementum deposition in each case.

### Case Reports

Three teeth with external apical root resorption associated with bone resorption were treated with nonsurgical root canal therapy. After isolation with rubber dam, access cavities were prepared and removal of the necrotic pulp tissues was done after establishing the working length at 1 mm short of the radiographic apices. The canals were instrumented with # 15 - 40 K-Files (Maillefer Instruments S.A., Ballaigues, Switzerland). Irrigation were carried out with warm 3% sodium hypochlorite solution (Vishal) which were ultrasonically activated (Irrisafe Ultrasonic Tips, Satellac) and normal saline. Triple antibiotic paste consisting of Ciprofloxacin, Metronidazole and Minocycline in 1:1:1 ratio mixed with macrogol ointment was used as intracanal medicament for three weeks. Sealing of the access cavities were carried out with temporary cement Cavit (3M ESPE). During second visit the final rinse were carried out with 17% EDTA solution (Prevest DenPro Ltd, Jammu) for 1 minute. The canals were filled with MTA Plus (Prevest Denpro Ltd, Jammu) followed by placement of moist cotton pellet over MTA and the access cavities were sealed using cavit. Patients were recalled next day and the access cavities were sealed with composite resin.

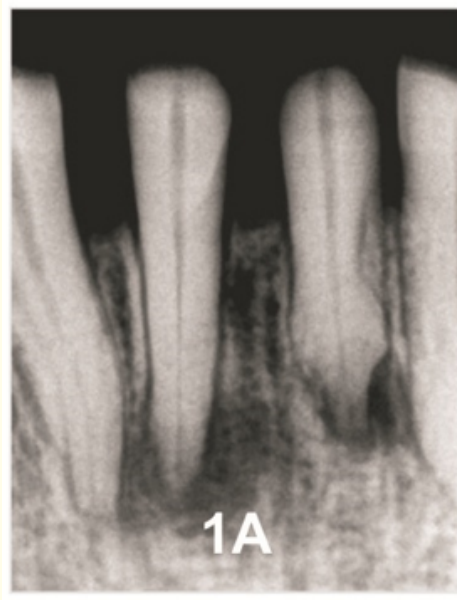
### Case I

A 57 year old female reported with a chief complaint of intermittent mild pain in mandibular anterior region and discoloration of the mandibular central incisors. Clinical examinations revealed partially attrited mandibular central incisors teeth with no appreciable mobility. Palpation and percussion tests induced slight discomfort in teeth 31 and 41. Trauma from occlusion was major intraoral finding. Thermal and electric pulp tests revealed that teeth were non-vital. Intra oral periapical radiograph of the involved area revealed radiolucency and irregular root outline in the apical area with respect to teeth 31 and 41 with associated bone resorption (Figure 1a). A provisional diagnosis of chronic irreversible pulpitis with external apical root resorption of teeth 31 and 41 were made.

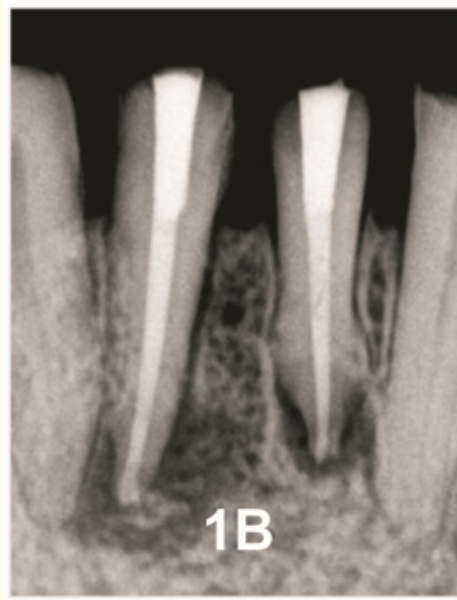
Following isolation with rubber dam, adjustments of occlusal interferences were done and access cavities were prepared on the mandibular central incisors and the working length determined. Canals were cleaned and shaped using K-Files upto size #40. Warm 3% sodium hypochlorite solution was used as irrigant which was ultrasonically activated. The files were coated with EDTA gel throughout instrumentation. Triple antibiotic paste was placed in the canals as intracanal medicament and access cavities were sealed with cavit for

three weeks. During next visit the canals were again cleaned with warm 3% sodium hypochlorite solution and final rinse of 17% EDTA followed by normal saline was given. The canals were dried and obturated with MTA. Moist cotton pellets were placed over it and the access cavities were sealed with cavif (Figure 1b). The very next day temporary restorations were removed and the access cavities sealed with composite resin.

Regular follow-ups were done after three months (Figure 1c), six months (Figure 1d), one year (Figure 1e), two years (Figure 1f), three years (Figure 1g) and four years (Figure 1h).



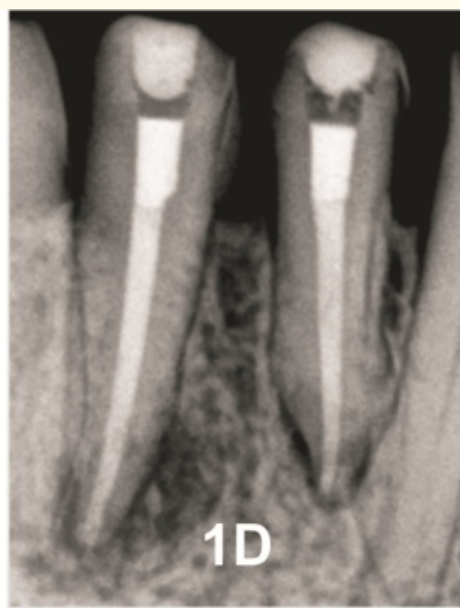
**Figure 1a:** Pre-operative Radiograph.



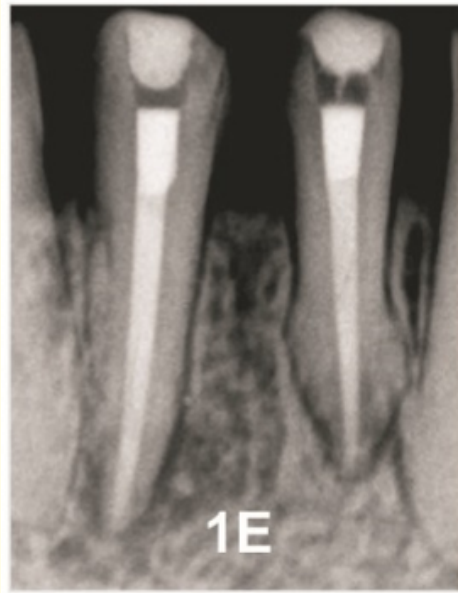
**Figure 1b:** Radiograph showing MTA obturation.



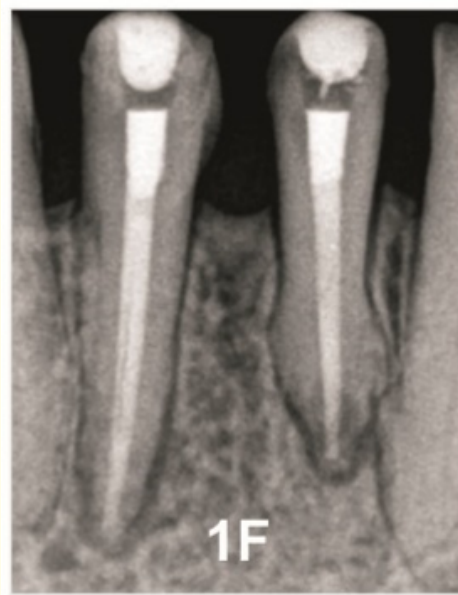
**Figure 1c:** Follow-up radiograph of three months.



**Figure 1d:** Follow-up radiograph of six months.



**Figure 1e:** Follow-up radiograph of one year.



**Figure 1f:** Follow-up radiograph of two years.



**Figure 1g:** Follow-up radiograph of three years.



**Figure 1h:** Follow-up radiograph of four years.

### Case II and III

A 17 year old male reported with chief complaint of mild to moderate intermittent type of pain in the mandibular posterior regions. Clinical examinations revealed large carious lesion involving teeth 36 and 46 with caries extending upto the floor of pulp chamber. He gave a history of root canal opening in teeth 36 and 46 two years back. Palpation and percussion tests induced no pain with teeth 36 and 46. Thermal and electric pulp tests conducted on teeth were non-responsive. Intra oral periapical radiographs of the involved teeth revealed irregular outline of the root in the apical third along with radiolucent lesions around the root apices (Figure 2a and 3a). A provisional diagnosis of pulpal necrosis with periapical pathologies and external apical root resorption were made for each tooth.

After isolation with rubber dam, access cavities were refined on both teeth. Necrotic tissues, debris and soft caries were removed from the pulp chamber. Working lengths were determined and cleaning and shaping done in the similar manner as in case I. After placement of triple antibiotic paste for three weeks as intracanal medicament, the canals were cleaned again with warm 3% sodium hypochlorite solution and rinsed by using 17% EDTA followed by normal saline. The canals were dried and obturated with MTA. A layer of MTA was also placed at the floor of pulp chamber considering chances of communication between pulp chamber and periodontal tissue in furcal area. Moist cotton pellet were placed over it and the access cavities sealed with cavite (Figure 2b) Next day cavite were removed and the access cavities were sealed with composite resin.

Follow-ups were done after three months (Figure 2c and 3b), six months (Figure 2d and 3c), one year (Figure 2e and 3d), two years (Figure 2f and 3e), three years (Figure 2g and 3f) and four years (Figure 2h and 3g).



**Figure 2a:** Pre-operative Radiograph.



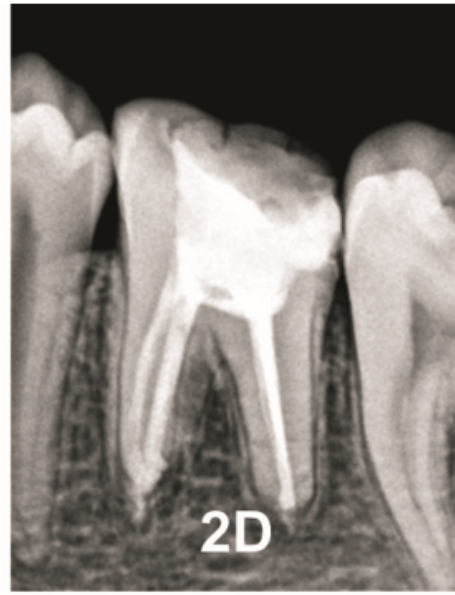


**Figure 2b:** Radiograph showing MTA obturation.



**Figure 2c:** Follow-up radiograph of three months.

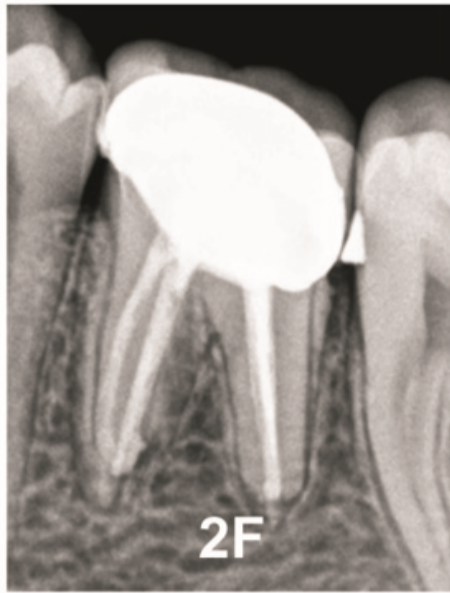




**Figure 2d:** Follow-up radiograph of six months.



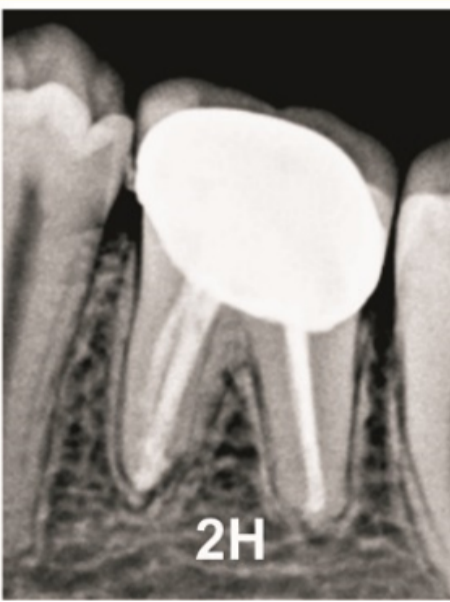
**Figure 2e:** Follow-up radiograph of one year.



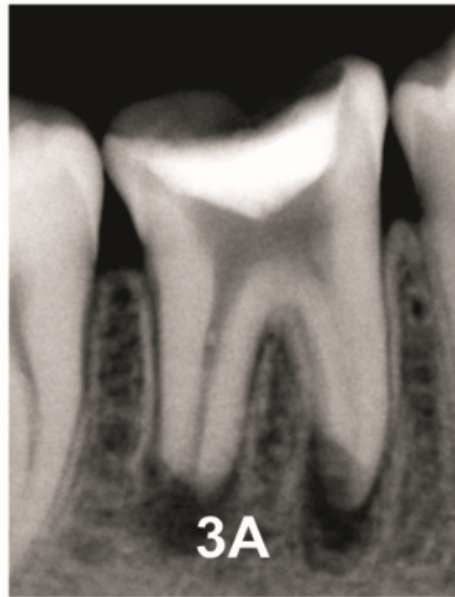
**Figure 2f:** Follow-up radiograph of two years.



**Figure 2g:** Follow-up radiograph of three years.



**Figure 2h:** Follow-up radiograph of four years.



**Figure 3a:** Pre-operative Radiograph.



**Figure 3b:** Follow-up radiograph of three months.



**Figure 3c:** Follow-up radiograph of six months.



**Figure 3d:** Follow-up radiograph of one year.



**Figure 3e:** Follow-up radiograph of two years.



**Figure 3f:** Follow-up radiograph of three years.



**Figure 3g:** Follow-up radiograph of four years.

During follow ups clinical and radiographic examination of all the above cases demonstrated that the patients were asymptomatic with healing of peri-radicular areas and the teeth demonstrated cementum deposition in the previous areas of resorption, regeneration of periodontal fibers adjacent to healthy cementum and regeneration of new bone and establishment of new lamina dura.

### Discussion

External root resorption of the permanent dentition is a condition which is sometimes diagnosed during routine radiographic examination. The most common cause of external root resorption is trauma particularly in cases where the injury results in pulpal necrosis. Bacteria, bacterial byproducts and tissue breakdown products from within the root canal system stimulate inflammation in the adjacent periodontal tissues and lead to aggressive and progressive inflammatory resorption of the root [10].

According to Fuss., *et al.* to 'render proper treatment' of root resorption invariably rely on 'removing the etiological factor' [10]. If adverse occlusal loading or occlusal trauma is suspected, then adjustment of occlusal interferences is indicated. Treatment of inflammatory resorption is based on removal or reduction of the source of infection. Conservative non-surgical root canal therapy is advocated in case where the resorption is due to pulpal necrosis.

The etiology in case I was trauma from occlusion, so it was relieved by grinding the labio-incisal angle. In Case II and Case III the etiology was pulp space infection where patient gave a history of root canal opening two years back. On examination pulp cavities were found open which might have caused extension of infection into periapical area, leading to external root resorption.

Elimination of bacteria from the root canal system is the most important factor for the successful endodontic treatment. Irrigants and intracanal medicaments aid in reducing the microbial flora of infected root canals. Irrigating solutions help in reducing the microbial flora by dissolution and elimination of necrotic tissue. Efficacy of 3% warm sodium hypochlorite as an irrigating solution can be enhanced by activating it ultrasonically [11].



The role of intracanal medicament cannot be underestimated as chemomechanical preparation alone is not enough to predictably eliminate all the bacteria [12]. Studies have questioned the use of calcium hydroxide as intracanal medicament because of the prolonged time required for its action that can promote root fractures or allow re-infection to occur between treatment sessions [13]. Bacteria associated with persistent apical infections have the ability to invade the dentinal tubules and buffer the high pH produced by calcium hydroxide. The use of triple antibiotic paste consisting of ciprofloxacin, metronidazole and minocycline for disinfection is highly advocated. It is shown that this combination of drugs can kill any bacteria in the carious lesions, necrotic pulp, infected root dentin and periapical lesions. Clinically, this material has been used to promote periapical healing in non-vital teeth associated with periapical lesion [14]. Even in the present cases, there was a remarkable reduction in the symptoms with the use of triple antibiotic paste.

Hermetic seal and three dimensional root canal filling is yet another critical factor that determines the success of endodontic treatment [15]. MTA as a root end filling material provides a superior apical seal than materials such as amalgam, IRM, gutta-percha, and Super EBA. For this reason MTA was chosen to obturate the canal. Due to alkaline pH it creates an ideal antibacterial environment for healing. When placed in direct contact with human tissues, MTA is found to release calcium ions and induce cell attachment and proliferation. MTA promotes biologic repair and regeneration of the periodontal ligament by stimulating the proliferation of hard tissue producing cells and forming a hydroxyapatite-like layer [16].

MTA Plus from Prevest Denpro Ltd., India, was used in this case as studies have shown that it has low washout property when mixed with the gel instead of water which means it exhibits less tendency to disintegrate upon early contact with physiological fluids. MTA Plus mixed with anti-washout gel is also found to have lower initial porosity [17].

Similar to the present case report, several other longitudinal clinical reports with root resorption associated with peri-radicular lesions have confirmed the effectiveness of MTA [18]. Most of these studies have suggested that the characteristics of MTA, including its biocompatibility and its ability to induce mineralized tissue, have contributed to the success of treatment [16].

In the present cases despite the serious damage to the root by external apical root resorption, non-surgical root canal therapy not only arrested the external root resorption but also regenerated the periapical tissue. Layering and repair of cementum with new cementum into and across the apical foramen were evident. Osseous repair were also evident with newly formed bone in the peri-apical area. In the follow-up period of four years no radiographic and clinical evidence of further root resorption were observed and the teeth were in function.

### Conclusion

Root resorption is a pathologic condition which still remains a mystery in many aspects. Complete disinfection of the necrotic root canal system is the key to successful treatment. This case series shows that success can be achieved by a well planned and executed treatment, wherein disinfection is achieved with triple antibiotic paste and hermetic seal with mineral trioxide aggregate. After four years follow-up of these cases, no signs or symptoms of persistent pathologies were present. Complete radiographic healing with visible lamina dura and normal periodontal ligament space were seen. This case series shows that the teeth with external apical root resorption can be successfully managed by a more conservative non-surgical endodontic approach rather than a more traumatic surgical approach.

### Source(s) of Support

Nil.

### Conflicting Interest

No conflict of interest.



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