Healing of the periapical lesion in posterior teeth with mineral trioxide aggregate using orthograde technique - Two case reports

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Abstract

Conventional root canal treatment (RCT) of the teeth has long shown high success rate. However, the endodontic treatment of a pulpless tooth with periapical radiolucency of a considerable size always has a question of success. In modern days, surgical exploration is avoided, especially in the posterior teeth. These types of cases may be successfully managed by orthograde Mineral Trioxide Aggregate (MTA) placement in the apical third of the root followed by proper obturation. The objective of our present case reports was to evaluate the periapical pathology of posterior teeth clinically and radiographically by using MTA in orthograde way and avoiding traumatic surgical exploration. In the first case, the patient reported with intraoral sinus and pus discharge related to tooth #45. On radiograph, open apex (blunderbuss) was found along with periapical radiolucency. In the second case, the patient reported with pain and swelling related to tooth #26, having large periapical radiolucency related to the palatal canal. On vitality test, both the teeth responded negative, i.e., non-vital. Conventional RCT was planned in both the cases with orthograde MTA- Angelus (Angelus, Londrina, PR, Brazil) apical plug followed by the proper obturation with gutta-percha (G.P.), and after that the patients were kept on periodic follow-up and the outcome-based clinical and radiographic criteria were assessed. The post-obturation assessment at 1-month interval showed changes in the size of radiolucency with a gradual decrease, and after 6 months a remarkable decrease of radiolucency or the defect was almost filled with bone formation visible around the roots.

Keywords: Apical third, MTA, orthograde technique, periapical lesion, posterior teeth

Introduction

Endodontic treatment of a pulpless tooth with periapical radiolucency of a considerable size either cyst or granuloma always has a question of success. For such cases, earlier the endodontic treatment followed by surgery, i.e., apicectomy was the treatment procedure to be done to remove the pathology. However, in modern days, this surgical process is avoided, and this may be successfully managed by orthograde root-end filling material placement in the apical third of the root followed by obturation.

An ideal root-end filling material is necessary to seal the pathway between the root canal and its' periapical tissues. These materials should be biocompatible and should not easily disintegrate. Moreover, it should be strong enough for obturating the rest of the root canal later on. Otherwise, this root-end filling material may be displaced to the periapical region during condensing forces. Placement of this material in the apical third area is also crucial; that is why conventionally we are placing the material in retrograde way and the apicectomy procedure is mandatory. However, in case of maltreated teeth and posterior teeth, this procedure is troublesome or cumbersome. In this respect, the choice of root-end filling material should be as such that it is an ideal endodontic repair material and it will seal the pathway of communication between the root canal and surrounding tissues.

Currently, mineral trioxide aggregate (MTA) is one of the best root-end filling materials amongst the available materials that is used for this purpose.[1,2] Amalgam, super ethoxy benzoic acid (EBA), intermediate restorative material (IRM), glass ionomer cement (GIC), and composite resins are also used as retrograde filling materials.[3] Disadvantages of these materials are moisture sensitivity, percolation, and to some extent the cytotoxicity.[4]

It is also in practice to place the $Ca(OH)_2$ in the apical third area of the root canal by orthograde method in these types of cases. Considering different studies and review of literatures, it has been established that MTA is the best root-end filling material. This material is almost non-resorbable and non-toxic, having bacteriostatic properties to heal, and offers a good apical seal.[5]

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Histological examination showed the stimulation of cementum and hard tissue formation with minimal inflammatory response after using this hydrophilic material MTA.[6] A recent investigation comparing MTA with $Ca(OH)_2$ showed that the calcified barrier in the former group is more tubular than in the later one.[7]

An intra-group comparative evaluation revealed that MTA healed the periapical radiolucency in a significantly shorter time in comparison to $Ca(OH)_2$.[8] On the basis of available information, it appears that MTA can be used as root-end filling material with high success rate.[9,10]

MTA is a hydrophilic material and it needs moisture for its setting reaction. The manufacturer recommends sealing a moistened cotton pellet into the root canal for at least 4 h. Many studies supported this recommendation.[11-13]

Therefore, here in our study we used the MTA in the apical third of root having considerable size of periapical pathology, which was diagnosed on IOPA radiographs. To evaluate the periapical pathology of posterior teeth using MTA in orthograde way and avoiding traumatic surgical exploration, i.e., apicectomy was the prime object of our study.

Case Reports

Case 1

An 18-year-old female patient reported to our Department of Conservative Dentistry and Endodontics, Dr. R. Ahmed Dental College and Hospital, with the chief complaint of swelling and pus discharge related to lower right back tooth. Patient gave history of trauma while biting a hard object 6 years back in that region. On examination, a clear intra-oral sinus with pus discharge was found in relation to the tooth #45. Tooth vitality test showed negative response. IOPA radiograph detected blunderbuss apex along with clear periapical radiolucency [Figure1]. There was no vertical or other fracture visible on radiographs but could not deny the possibility of some fracture line due to superimposition of calcified structures.

After careful observation and considering the various factors, we made the treatment plan and decided to do the endodontic procedure with orthograde MTA (Angelus) root-end placement in the tooth #45. After access opening made, working length determination was done [Figure 2]. After that, BMP was completed followed by intra-canal dressing of $Ca(OH)_2$ for two weeks [Figure 3].

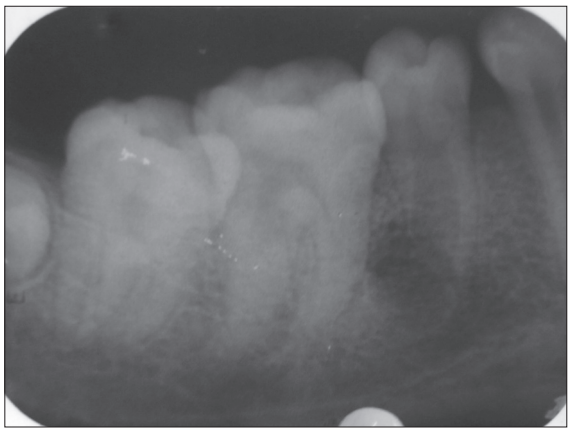

Figure 1: IOPA radiograph (pre-op) showing blunderbuss apex and large periapical radiolucency in relation to #45

Figure 2: Working length determination of tooth #45

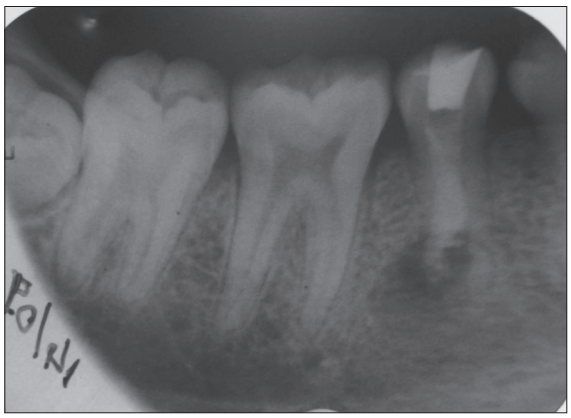

Figure 3: Intra-canal $Ca(OH)_2$ dressing given for 2 weeks

Figure 4: MTA placement within the root canal with thickness 7 mm

After 2 weeks, intraoral discharging sinus disappeared. MTA was mixed according to the manufacturer's instructions and placed in orthograde manner in the root canal up to a length of 7 mm [Figure 4] and moist cotton placed for setting completion and access cavity closed with ZnOE. On the next visit, MTA was checked for its hardness and we then sealed the cavity with the composite resin.

After that, the patient was evaluated at the periodic check-up at the interval of 4 weeks for consecutive 6 months [Figure 5].

Case 2

In the second case, a young adult patient aged 28 years reported with pain and swelling in relation to upper left back tooth. On examination, tooth #26 was found deep carious. Vitality test was negative. On examining IOPA radiograph, large periapical radiolucency was present in relation to the palatal root of maxillary first molar [Figure 6]. Patient very much desired for conservative treatment as tooth #16 had already been extracted.

The treatment options for this tooth were to go either for apicoectomy or conventional endodontic treatment with MTA placement in the apical third of the palatal canal by orthograde way. The patient did not agree with the surgical procedure.

RCT was started, BMP done with crown down technique along with the copious irrigation of the root canals, and palatal canal was enlarged up to F3 file. Intra-canal $Ca(OH)_2$ dressing was given for disinfecting the canal. Patient was recalled after 7 days.

In the next appointment, MTA (Angelus) was placed in the apical third of the palatal root [Figure 7] following the manufacturer's instructions and we also placed a wet cotton pellet in the palatal canal for better setting of MTA. Other two canals were obturated with gutta-percha (G.P.) points at the same visit. Next day, we checked that MTA was hardened and remaining part of the canal was obturated with G.P. points. Temporary restoration of cavit given in the tooth.

The patient was evaluated at the periodic check-up after placement of the MTA in the palatal root canal.

Results

For both the cases, post-obturation radiographs were taken at the interval of 4 weeks for consecutive 6 months and gradual

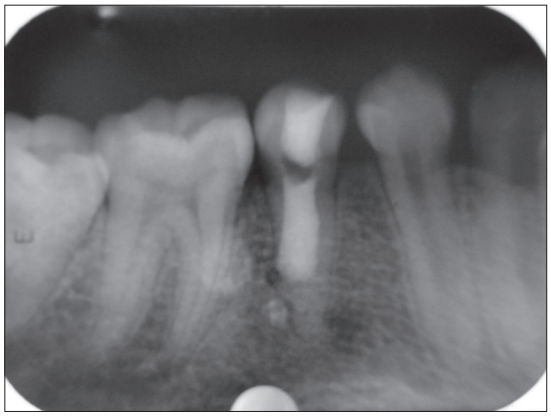

Figure 5: IOPA radiograph (post-op) of after 6 month follow-up showing apex formation along with new bone formation

Figure 6: IOPA radiograph (pre-op) showing large radiolucency in relation to palatal canal of tooth #26

Figure 7: MTA placement within the apical third of palatal root canal

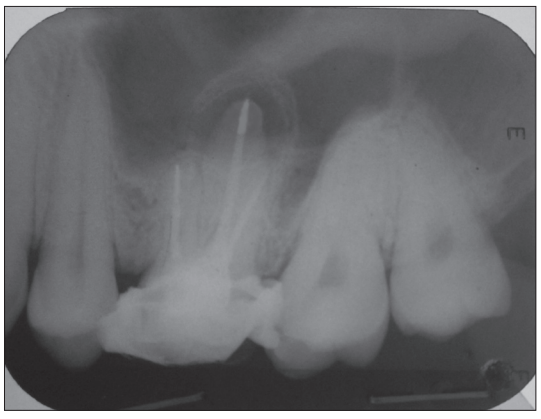

Figure 8: IOPA radiograph (post-op) at 1 month follow-up

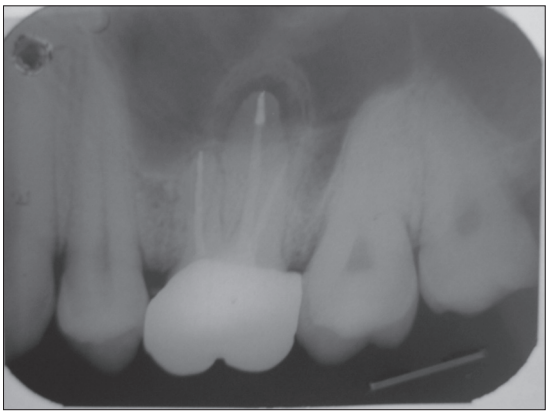

Figure 9: IOPA radiograph (post-op) at 3 month follow-up

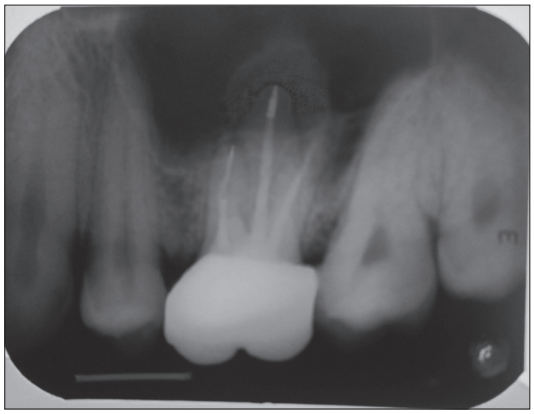

Figure 10: IOPA radiograph (post-op) of after 6 month follow-up showing almost complete healing of the lesion

changes in the size of periapical radiolucency were noticed [Figures 5, 8, 9, 10].

Clinically, patients were asymptomatic at their follow-up visits and the post-obturation radiographs after 1 month interval showed changes in size of radiolucency with gradual reduction in size while after 6 months, a considerable change of radiolucency or the pathological defects almost filled with the bone formation was observed, i.e., no periapical radiolucency was as such visible around the root canals after MTA placement [Figures 5 and 10].

Results were very much satisfactory as it showed complete healing of the periapical pathology both clinically as well as radiographically, and the patients were completely satisfied with their treatments.

Discussion

Pathophysiology of periapical cysts is the sequelae of endotoxin liberated by the bacteria harboring in the necrotic pulp and periradicular tissue of a non-vital tooth. Due to osteoclastic effect, rarefaction of the bone takes place. After successful endodontic treatment along with three-dimensional obturation and using good sealer, the chances of these types of problems may not happen. On the other hand, if there is persisting periapical pathology of a non-vital tooth, some materials like $Ca(OH)_2$ has been widely used in the apical third region of the tooth along with hermetic seal of the canal, which may resolve the problem. However, $Ca(OH)_2$ is not hard enough and the microleakage may happen all around as a result of seepage or percolation of fluid, and microorganisms in the canal may create problems.

Previously, $Ca(OH)_2$ had been tried for a long period of time as the orthograde material and the results were unpredictable. $Ca(OH)_2$ has some inherent problem, i.e., its strength and it dissolves easily. Instead of $Ca(OH)_2$, the use of MTA in the apical third resolves such problems.

MTA is one of the most widely investigated materials in dentistry and it has an outstanding clinical outcome. Results after MTA placement have shown gradual reduction in size of periapical radiolucency that signifies new bone formation. Calcium silicate is one of the ingredients of MTA and the apatite formation is a characteristic of calcium silicate containing material.[14,15]

On the basis of different studies, it shows that MTA is a bioactive material and it has five classical characteristics to produce the apatite crystals and, hence, the formation of new bone. In that way, enhancing healing of the lesion[16] –

- Forms CH that releases calcium ions for cell attachment and proliferation
- Creates an antibacterial environment by its alkaline pH (12.5)
- Modulates cytokine production
- Encourages differentiation and migration of hard tissue producing cells, and
- Forms HA (or carbonated apatite) on the MTA surface and provides a biologic seal.

In this study, we have included two posterior teeth having considerable periapical radiolucency. Both the cases after MTA placement did not show any sorts of problems with inflammatory effect. These results also corroborate with previous studies, which showed no such problem with MTA. Here in the study, regular monitoring was done by clinical and radiographical evaluation on a monthly basis.

Results were very much satisfactory to our expectations. Size of radiolucency gradually decreased, rendering significant improvement in the prognosis of the teeth treated with MTA. Placement of this material is difficult in the apical third through the canal, i.e., by orthograde technique, but when provided the proper technique for placement of MTA its result of healing is magical.

Conclusion

MTA is a promising material for the root-end filling, apical

barrier formation and many other clinical applications for the teeth with necrotic pulp, open apices, etc. and this result supported the management of teeth with necrotic pulp along with periapical radiolucency of considerable size, especially in posterior teeth. Avoiding the surgical exploration, orthograde placement of MTA at the apical third of the canal showed excellent prognosis without any deleterious effect.

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