M.T.A. Wonder Material for Retrograde Filling: A Four Years Follow-up

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Abstract

The aim of this case report is to assess the healing outcome of MTA as a retrograde filling material over a time span of four years.

A 16 years old male patient reported in the dental office with pain & swelling in the mucosa overlying 21 & 22. The patient was treated surgically & MTA was used as a retrograde filling material. Crown lengthening of 22 was also done as it was barely visible in the oral cavity. After initial healing of the surgical wound, post & core procedure was done in 22 then prosthesis was cemented over 21 & 22. The patient was followed up for four years and the healing was observed radiographically.

During all follow up radiographs, healing was quite good. The patient had no complaints what so ever.

Introduction

The main objective of all endodontic procedures is to obtain a hermetic seal between the periodontium and root canal foramina. When this is not possible by an orthograde approach, root end filling technique is used. [1]

Periradicular surgery includes surgical debridement of pathological periradicular tissue, root-end resection, root-end preparation and the placement of a root-end filling to seal the root canal. An ideal root-end filling material would adhere and adapt to the walls of the root-end preparation, prevent leakage of microorganisms and their toxins into the periradicular tissues, be biocompatible, be insoluble in tissue fluids and be dimensionally stable, and remain unaffected by the presence of moisture. For practical purpose it should be easy to use, radiopaque and recognized on the radiograph. [2]

A number of materials have been evaluated for use as root-end fillings. They include amalgam, gutta-percha, zinc oxide-eugenol cement, composite resins, glass ionomers, polycarboxylate cement, ethoxybenzoic acid (EBA) cement, and mineral trioxide aggregate (MTA). [3] MTA seal off the pathways between the root canal system and surrounding tissues significantly reducing bacterial migration. 5 It can thus be used as a root-end filling, as an apical stop to close immature apices, perforation repair material, and also as pulp capping agent.6 There are no known contraindications for its use, any known side effects or interactions with other dental materials.

Case Report

A 16 years old male patient with a non contributory medical history reported to the OPD of Department of Conservative Dentistry and Endodontics, Govt. Dental College and Hospital Jaipur, India with the chief complaint of swelling with pain in the mucosa overlying 21 and 22, fractured incisal edge of 21 and 22 which was fractured at the level of CE J. Patient gave history of RCT in 21, 2yrs back. Intraoral examination revealed fractured incisal edge of 21 which was discoloured due to trauma 4 years back while playing in school. 21 and 22 were sensitive to percussion and palpation, however they failed to respond to thermal [cold test (pulfofluorange, Pharma Dental Handelsges)] and electric pulp testing (Parkell Farmingdate) as compared to the adjacent teeth which responded within normal limits. Periapical radiograph demonstrated 21 RCT treated, obturated with Gutta Percha & 22 was left untreated. A large periapical lesion approximately 5mm X 6mm in diameter around the apices of 21 and 22 was also seen. Another evident diagnosis was that the crown of 22 was barely visible in the oral cavity & the crown length wasn't sufficient for prosthesis placement (ferrule effect).

After the above diagnosis was made, surgery was planned with MTA retrograde filling.

Surgical Procedure

At the initial presentation we assessed the level of oral cleanness (assessment of dental plaque or gingivitis) prior to surgery & the patient was referred for improvement of oral hygiene to the periodontology department. Procedure was performed under local anesthesia. Infiltration buccally over the apices of the tooth to be treated and the adjacent teeth was undertaken using 1.8 ml of 2% lignocaine with 1:100,000 epinephrine (Lignocain; Hindustan Pharmaceutical Barauni, India) followed by infiltration palatally with 3 ml of 2% lignocaine containing 1:100,000 epinephrine (Lidocaine) to involve the entire surgical site.

A full-thickness flap was retracted following an intramuscular incision using a 15 no. scalpel blade. A vertical incision was performed with a 15-scalpel blade to create rectangular flap. The tissues exposed by the reflection of the flap were kept moistened with sterile saline throughout the surgery to avoid the bone or the soft-tissue flap from drying out.

After retraction of the flap, the amount of facial bone associated with the tooth to be treated was assessed. A thin bony plate over the apex was removed gently with curettes.
An assessment was made for any bony defect at the apex of the tooth and soft-tissue debris was removed after root-end resection. A 3-mm root-end resection was

carried out almost perpendicular to the long axis of the root by means of a fissure bur in a low-speed hand-piece with copious irrigation using sterile saline and root-canal was prepared in a box-type manner with a No 33.5 inverted cone bur.

All preparations were undertaken with copious amount of coolant, using sterile normal saline solution. The water was allowed to run passively in the root-end cavity for 2 minutes to allow maximum opportunity for cleaning of the root canal wall.

The root end was dried with a low-pressure compressed air source and MTA (Proroot MTA White; Densply, Johnson City, TN) was mixed according to manufacturer's instructions and randomly filled in the cavities.

MTA was placed with a flat plastic instrument or a carrier and plugged into place with microplugger. Mineral trioxide aggregate (MTA) was mixed to a consistency that allowed the material to maintain its shape on the plastic instrument. When the root-end cavity was filled, the packing in the bony crypt was removed and the surface of the cut root end was cleaned with a cotton wall pledget dampened with sterile saline. The tissues at the surgical site were rinsed with sterile normal saline solution, avoiding washing the MTA from the root end.

Crown lengthening of 22 was done with surgical bur by removing 2 mm bone circumferentially around the crown.

The soft tissue was then approximated using either 3-0 black mersilk sutures. Firm pressure was applied to the tissues with a gauze swab dampened with sterile saline for 5 to 10 minutes to ensure close adaptation of the soft tissue to the bone and access cavity was filled with glass ionomer cement in 21 & 22 on the same sitting.

Postoperative management

Verbal postoperative instructions were given to the patient. Systemic oral Antibiotics (Ofloxacine 500 mg and Ornidazole 200 mg two times a day), NSAIDs (Ibuprofen 600 mg three times a day for 5 days) and multivitamins (once in a day) were prescribed. Patient was instructed to rinse mouth with a 0.2 % chlorhexidine solution two times a day for 1 week. Sutures were removed after 1 week.

Follow-up

Radiographic examinations were performed prior to surgery, 1 week after surgery with the simultaneous removal of the sutures. Radiographs were taken using the long-cone paralleling technique.

Clinical signs of healing were, lack of symptoms including pain and absence of signs including tenderness to percussion of the tooth, tenderness to palpation of the soft tissues buccally, swelling, absence of a fistula, and excess tooth mobility.

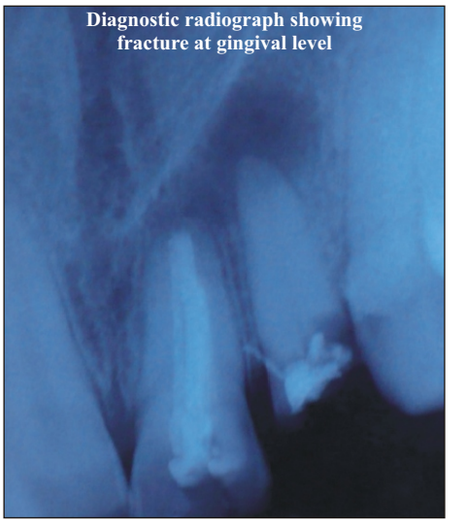
Radiologic signs of healing were absence of periradicular radiolucency and the formation of a periodontal ligament space of normal width.

Esthetic Rehabilitation

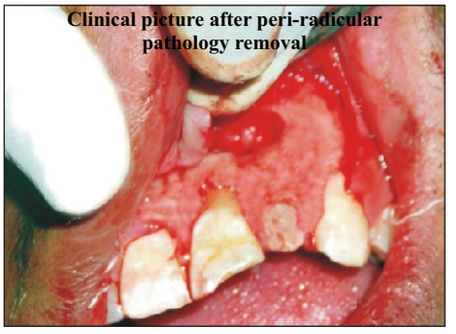
The patient was recalled after 1 month for esthetic rehabilitation & the post space was prepared by Peizo reamers (no.1, 2, 3, 4 in sequential order) by leaving 4 mm of GP pt. apically. Pre-fabricated Mani's stainless steel post (No.4) was selected for insertion & was cemented with GIC. Then the core build up was done with Composite cement. The crown cutting was then done for Ferrule build up. The impression was taken with rubber based impression material and it was sent to the lab. for further lab procedures. The prepared crown was cemented with Relyx.

Another radiograph was taken 6 months after the surgery which showed signs of trabaculae formation. Wound healing was also evidently seen. The periapical radiolucency had reduced.

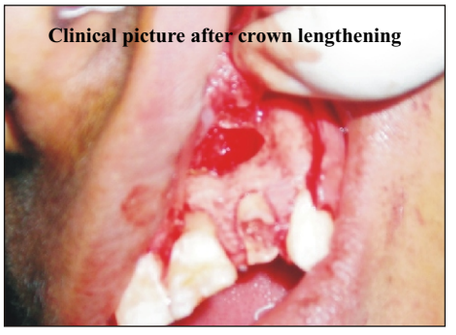
Final radiograph was taken 4 years after surgery. This radiograph showed that wound healing had been completed, there were no signs of any radiolucency, neither peri-apically or otherwise. Another important feature was the Lamina Dura could evidently be seen. The post was in perfect position & so was the prosthesis on it.



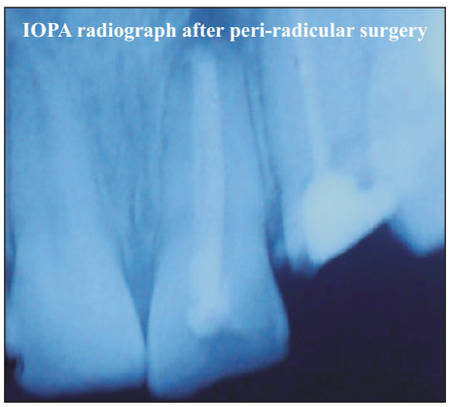
Diagnostic radiograph showing fracture at gingival level



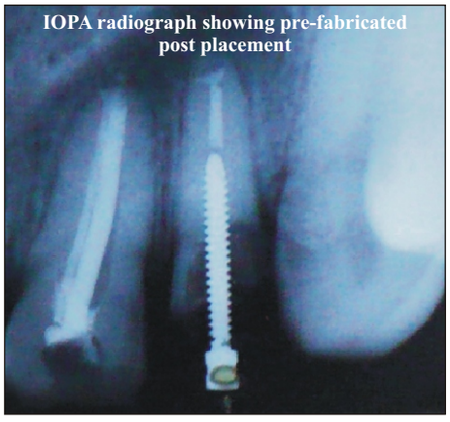
Clinical picture after peri-radicular pathology removal

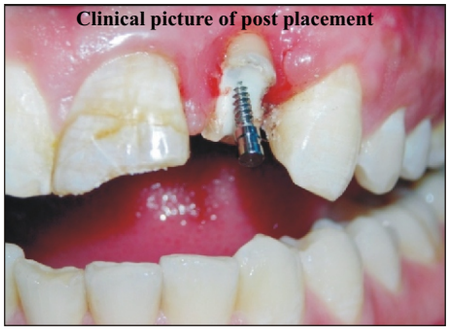


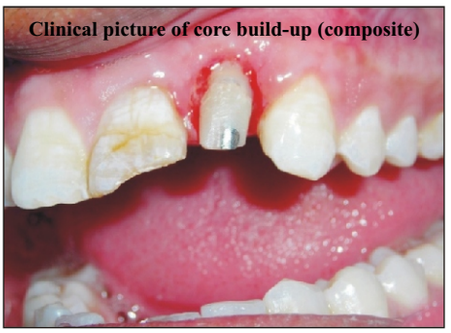
Clinical picture after crown lengthening

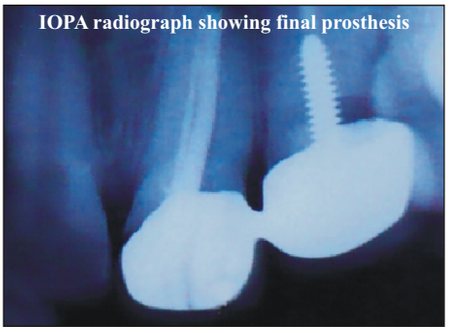

IOPA radiograph after peri-radicular surgery

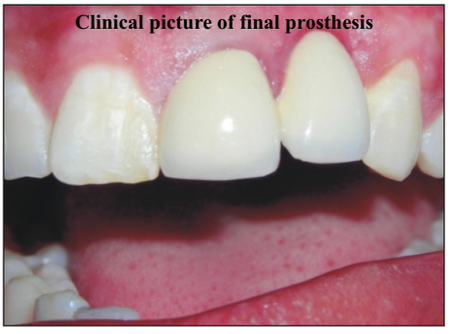

Clinical picture after healing

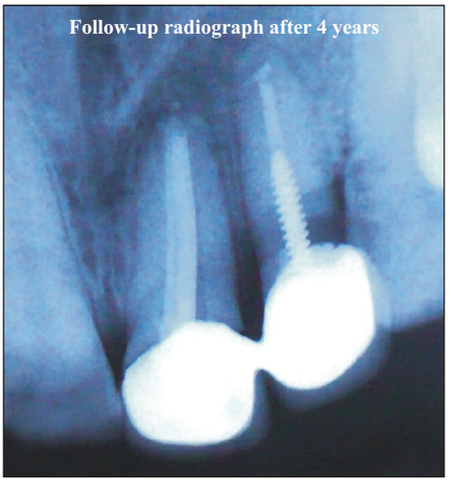

IOPA radiograph showing pre-fabricated post placement

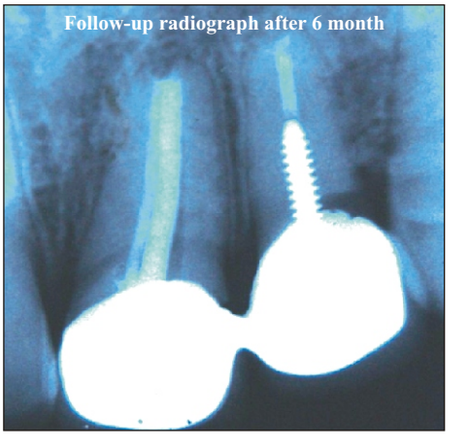

Clinical picture of post placement


Clinical picture of core build-up (composite)


IOPA radiograph showing final prosthesis


Clinical picture of final prosthesis


Follow-up radiograph after 4 years


Follow-up radiograph after 6 month

Discussion

The purpose of inserting a root-end filling material is to provide an apical seal that inhibits the leakage of irritants from the root canal system into the periradicular tissues.[...11]

Periradicular surgery includes surgical debridement of pathological periradicular tissue, root-end resection, root-end preparation and the placement of a root-end filling to seal the root canal.

A number of materials have been evaluated for use as root-end filling. They include amalgam, gutta-percha; zinc oxide-eugenol cements, composite resins, glass ionomers, polycarboxylate cements, ethoxybenzoic acid (EBA) cements and mineral trioxide aggregate (MTA).[...3] Ideal materials for sealing root-end cavities should prevent leakage.[...15] They should have dimensional stability, should adhere to the walls of the cavity, should be resistant to resorption, moisture resistant; non-toxic and biocompatible to promote healing.[...6] They should be insoluble in tissue fluids and dimensionally stable, and remain unaffected by the presence of moisture. For practical purpose it should be easy to use and radiopaque to be recognized on the radiograph.

Johnson[...16] reviewed the different root-end filling materials, highlighting the indications and contra indications of each one.

The choice of root-end filling material is

not the only factor that can influence the outcome of the surgical therapy; it also depends on the way the material is handled.

MTA was developed at Loma Linda University, California, U.S.A in 1993.This cement contains tricalcium silicate, tricalcium aluminate, tricalcium oxide, silicate oxide and other mineral oxides forming a hydrophilic powder, which sets in presence of water. The resultant colloidal gel solidifies to a hard structure within 4 hours. Initially the pH is 10.2 which rises to 12.5 three hours after mixing. It is found to be more opaque than EBA and IRM. MTA provides superior seal when compared with Amalgam, IRM and super EBA.[4] Adamo et al [9] compared MTA, Super-EBA, composite and amalgam and found statistically no significant difference in the rate of microleakage but studies of Fischer et al[8] proved MTA to be superior as compared to super EBA and IRM .The marginal adaptation of MTA was better with or without finishing when compared to IRM and Super EBA.[13]

MTA when used as a root-end filling material, showed evidence of healing of the surrounding tissues.[3,5,7] Most characteristic tissue reaction of MTA was the presence of connective tissue after the first postoperative week.[12] Studies have shown that osteoblasts have favorable response to MTA as compared to IRM and amalgam. With longer duration, new cementum was found on the surface of the material.[10] In a two year follow-up study with MTA as root-end filling material resulted in a high success rate.[14] Such studies support further development of MTA to reduce the long setting time and difficulty in manipulation for use as a root-end filling material.

With the introduction of MTA several in vitro studies have indicated excellent sealing properties, and animal experiments have supported the biological biocompatibility of MTA.[4,5] Torabinejad et al[6] suggested that MTA promotes healthy apical tissue formation more often than other materials, as confirmed by a lower incidence of inflammation.

Clinical success after surgical endodontics has been reported to range between 58% and 96%. This wide range reflects some of the variables inherent in most clinical investigations, such as improper or inconsistent diagnosis, nonrandomized samples, differences in operator skills, and lack of clear and consistent evaluation criteria.[16]

MTA has shown excellent sealing[7] and hard tissue repair (cementum) has been observed directly on the surface of the material a property not observed with other current root end filling materials. Cementum formation is a sign of regeneration may seal the root end exposed dentinal tubules.

In this particular case the use of MTA proved to be very successful, at the end of 6 months also signs of healing were clearly seen, the radiolucency had started to reduce. The radiograph taken after 3 years was even better, it showed lamina dura being formed, trabaculae were also seen quite clearly which meant the bone formation had been completed.

Clinically there was no pain, swelling, mobility, recession, or intra-oral sinus formation.

Conclusion

In our 3 years long observation MTA proved to be quite successful as a retrograde filling material as it is tissue friendly. Although its manipulation is a little bit cumbersome but due to its cementogenesis, osteogenesis and other characterstics, the end result was quite satisfactory. Hence it should be preferred as material of choice.

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