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MTA - A Friend Indeed: A Case Series

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Abstract

Mineral Trioxide aggregate was developed as a bioactive material that has the ability to create an ideal environment for healing of dental tissues. MTA is recommended for various uses in dentistry including pulp capping, pulpotomy, apical regeneration, repair of root perforations, root end filling and root filling.

When tissue fluid comes in contact with MTA it stimulates the formation of hydroxy apatite crystals. These crystals further act as nidus for the formation of calcified structures

In the case reported here, the various application of MTA in endodontics has been presented. MTA when used as a pulp capping material shows promising result for preserving tooth vitality. Also MTA produced favorable result when used as a root end filling material in term of healing and hard tissue formation. The biocompatibility property of MTA promotes predictable outcome in endodontic surgery. The case where MTA was used for repair of perforations showed that hard tissue was generated underneath the material. Open apices cases have also been successfully managed with MTA as an apical barrier.

On the basis of these cases, it appears that MTA is suitable repair material for various endodontic purpose, hence it can be concluded without doubt that MTA is the material of choice for healing, preserving vitality and regeneration of calcified tissue

Keywords: MTA, Pup Capping, Perforation Repair, Apexification, Regeneration

Introduction

Mineral trioxide aggregate (MTA) is a bioactive endodontic cement (BEC) mainly comprised of calcium and silicate elements. The cement was introduced by Torabinejad in the 1990s [1].

MTA Composition

As stated in the patent, MTA is comprised primarily of Portland cement. The Material Safety Data Sheet (MSDS) of ProRoot MTA states that it is approximately 75 wt% Portland cement, 20 wt% bismuth oxide (Bi2O3), and 5

wt% calcium sulfate dihydrate or gypsum (CaSO4 · 2H2O). Additional minor trace elements may also be present as stated in the MSDS [2]

MTA (mineral trioxide aggregate) was developed as a bioactive material that has the ability to create an ideal environment for healing of dental tissues. It is a versatile dental material used extensively for

a. Vital pulp therapies (VPT), as protecting scaffolds during regenerative endodontic procedures
b. Apical barriers in teeth with necrotic pulps and open apices
c. Perforation repairs
d. Root canal filling and root-end filling during surgical endodontics.[1]

Indirect Pulp Capping

Indirect pulp capping is defined by the AAPD as "a procedure performed in a tooth with a deep carious lesion approximating the pulp but without signs or symptoms of pulp degeneration". This treatment is indicated in a permanent tooth diagnosed with a normal pulp with no signs or symptoms of pulpitis or with a diagnosis of reversible pulpitis [3].

CASE I

A 13 year old Female patient reported to the Department of Conservative Dentistry & Endodontics, Mahe Institute of Dental Sciences & hospital, with a chief complaint of pain on upper left back tooth while having food. On examination, a class I caries was noted on the maxillary left first molar. Radiographic examination revealed caries involving enamel, dentin and approximating the pulp. Electrical Pulp Testing revealed values within the normal limit and the tooth responded normally to cold test. Thus a diagnosis of Reversible Pupitis was made. The treatment of indirect pulp capping was done using MTA and a temporary restoration using Cavit G was given. The patient was recalled after 1 week for permanent restoration using composite

Figure 1: PRE OP

Figure 2: Immediate POST OP

Figure 3: Permanent Restoration

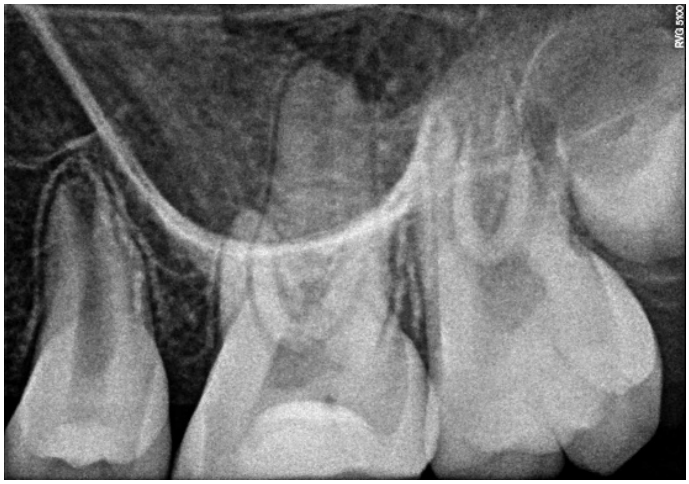

Figure 4: 3 Months Recall

Figure 5: 6 Months Review. Note the Apical Course of Palatal Root

Direct Pulp Capping

Direct pulp capping is defined as a procedure in which the exposed vital pulp is covered with a protective dressing or base placed directly over the site of exposure in an attempt to preserve pulpal vitality [4].

Case II

A 21 year old male patient reported to the Department of Conservative Dentistry & Endodontics, Mahe Institute of Dental Sciences & hospital, with a chief complaint of severe pain on upper left back tooth. Radiographic examination revealed caries involving enamel, dentin and the the pulp horns. The electric pulp test induced a response with a marked variation in current from the normal and a positive response to cold test. Thus a diagnosis of Reversible Pupitis was made. On excavation of caries, a pin point exposure of the pulp as noted. Direct pulp capping was done over the exposed site using MTA and a temporary restoration using Cavit G was given. The patient was recalled after 1 week for permanent restoration using composite.

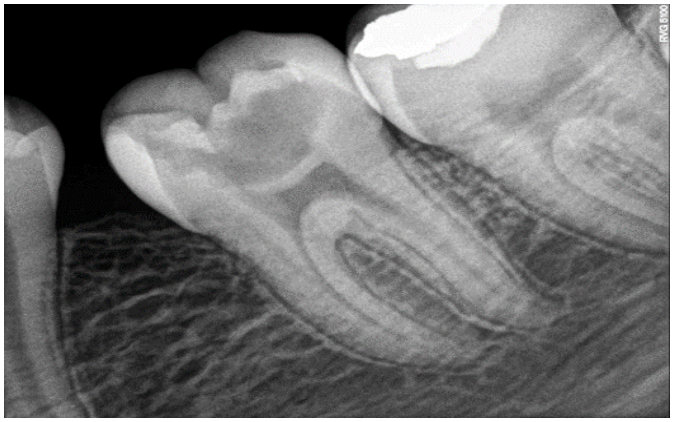

Figure 6: PRE OP

Figure 7: Caries Excavation

Figure8: MTA Placement

Figure 9: POST OP

Figure 10: Permanent Restoration

Perforation Repair

Perforation of the root surface may occur accidentally by misdirection of the bur while attempting to reach the pulp chamber or by a hand-operated or engine-driven instrument[4]. Perforation of the root creates a communication between the root canal system and the periodontal ligament. This may occur as a result of over instrumentation during endodontic procedures, internal or external root resorption, or caries invading through the floor of the pulp chamber. The prognosis for teeth with root perforation is usually determined by the location of the perforation, the time left unsealed, the ability to seal the perforation, the chance of building new attachments, and the accessibility of the remaining root canals [3].

Case III

A 46 year old male patient reported to the Department of Conservative Dentistry & Endodontics, Mahe Institute of Dental Sciences & hospital chief complaint of pain on lower front tooth which was RCT initiated elsewhere. On examination, mild bleeding a seen from the canal space of 41. Radiographic examination of 41 revealed a root peroration in the cervical third of the root. Sectional obturation of the root canal, followed by perforation repair with MTA was done.

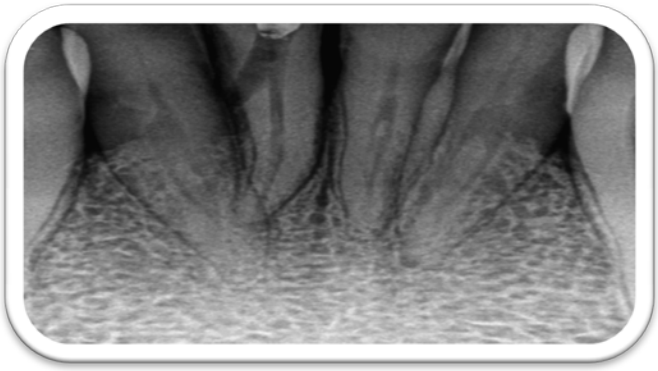

Figure 11: PRE OP

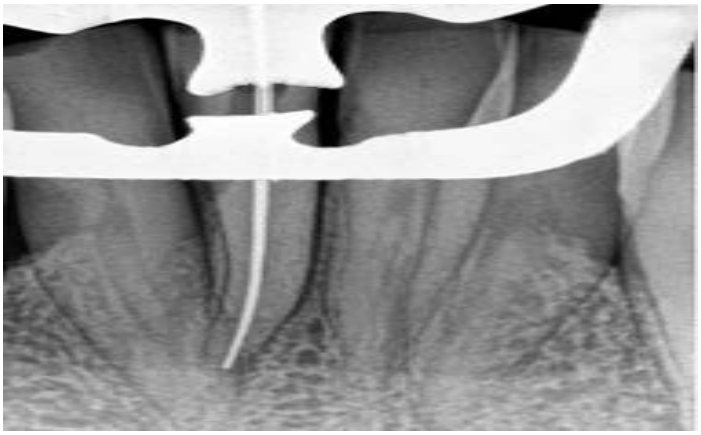

Figure 12: Working Length Determination

Figure 13: Obturation

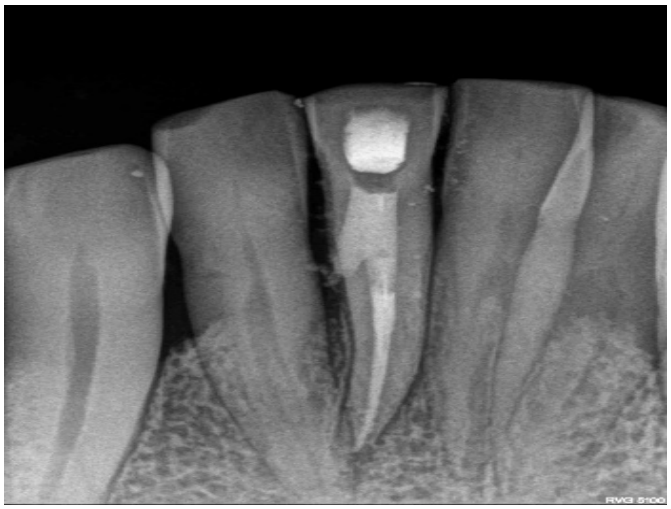

Figure 14: POST OP

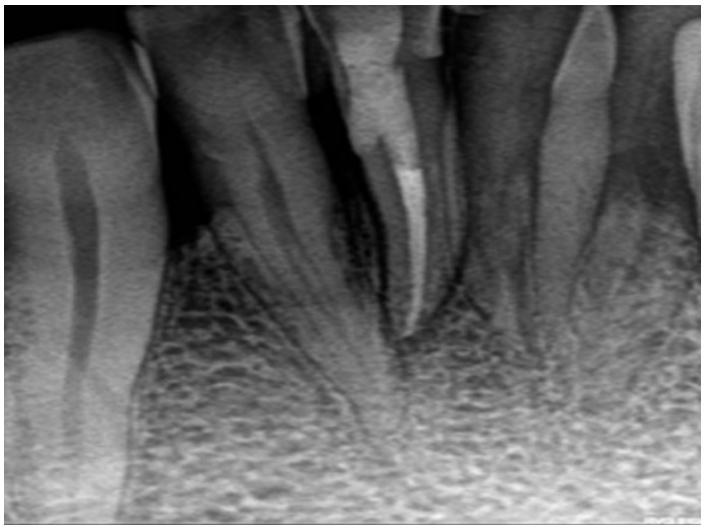

Figure 15: Permanent Restoration

Figure16: 3 Month Review

Apexogenesis

Treatment of an immature open-apex permanent tooth with pulp necrosis and apical pathosis is a big challenge for endodontists. Previous studies and case reports suggested that both calcium hydroxide– based apexification and apexogenesis procedures are acceptable for treating an immature permanent tooth with pulp necrosis and apical pathosis [5].

The intent of RET is to regenerate the pulp-dentin complex, which would promote root thickening and normal maturation of the root apex [6].

Case IV

A 16 year old male patient reported to the Department of Conservative Dentistry & Endodontics, Mahe Institute of Dental Sciences & Hospital, with a chief complaint of severe pain in the upper left back tooth. Pain was increased during heat test and the electric pulp test induced a response with a marked variation in current from the normal. Radiographic examination of 26 revealed caries involving enamel, dentin and pulp, with a palatal open apex. Access opening was done under local anesthesia. Working length was determined and cleaning and shaping was done using Protaper F2 in the mesiobuccal and distobuccal canals. Irrigation was done

with saline and 5.25% sodium hypochlorite. Mastercone was selected and obturation was done in mesiobuccal and distobuccal canal. Bleeding was induced in palatal canal. MTA was placed in the orifice of the palatal canal and permanent resoration ws given using composite.

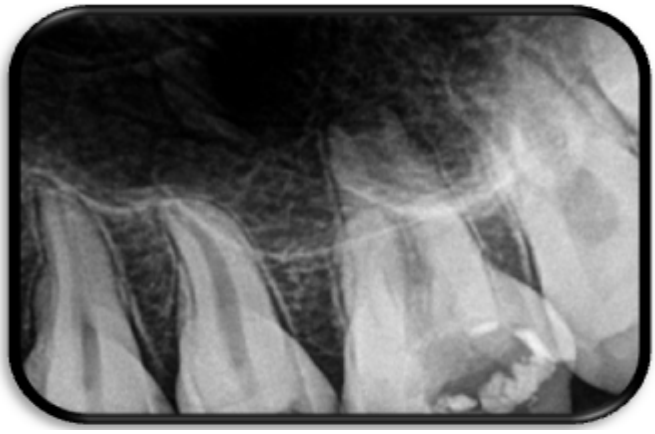

Figure 17: Pre OP Determined

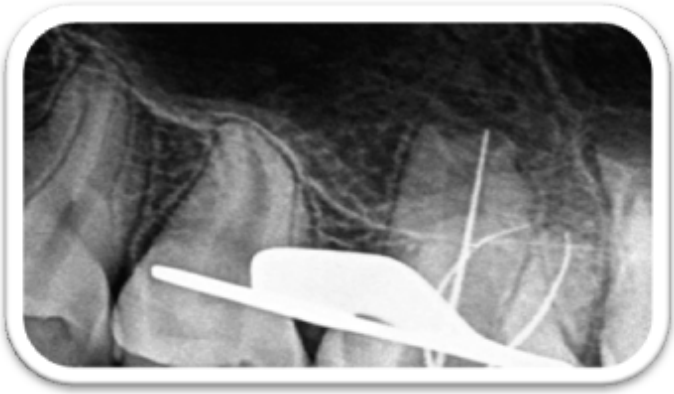

Figure 18: Working Length

Figure 19: Master Cone Seected In Mesiobuccal & Distobuccal Canals

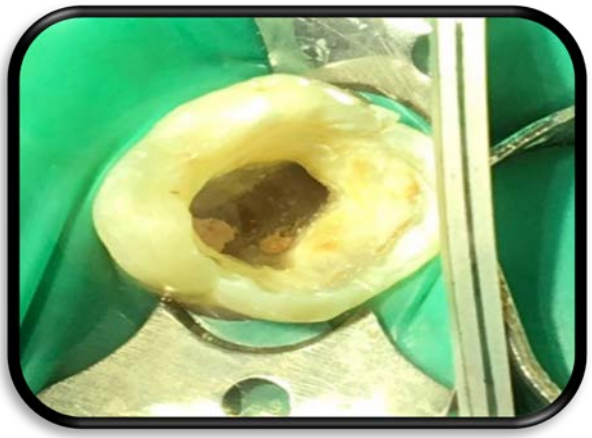

Figure 20: Obturated Mesiobucal & Disobbuccal Canals

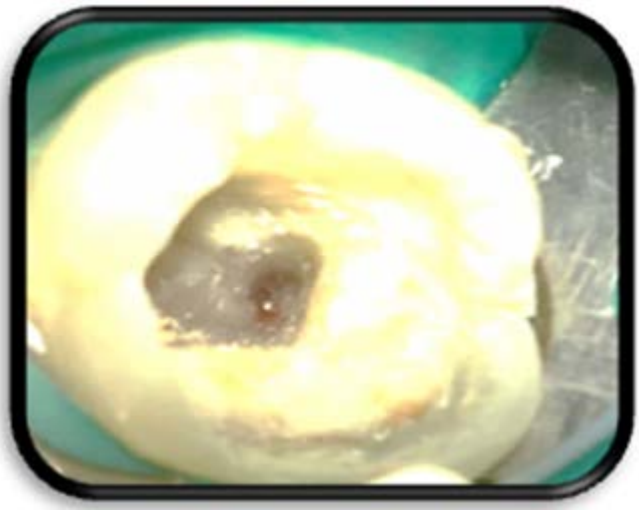

Figure 21: Bleeding Induced In Palatal Canal

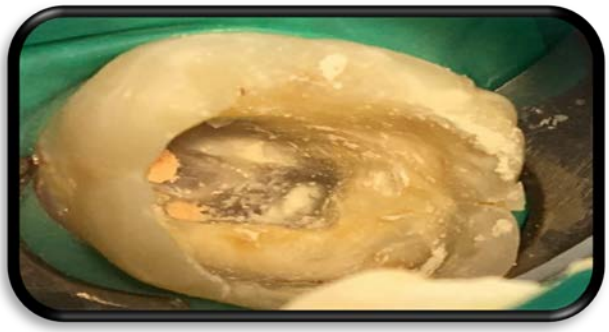

Figure 22: MTA Placement

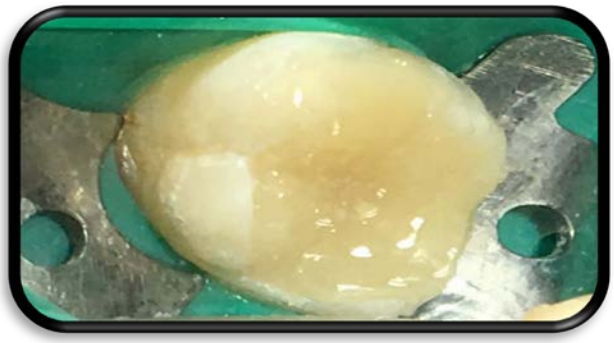

Figure 23: Permanent Restoration

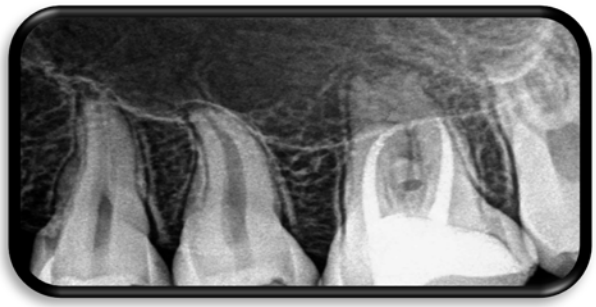

Figure24: POST OP

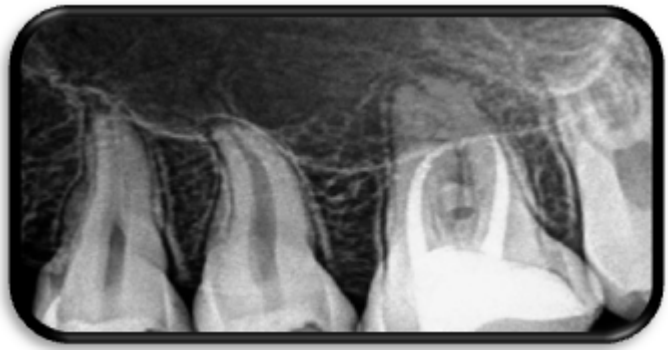

Figure 25: 4 Month Recall

MTA as an Obturating Material

In certain cases, MTA can be used for root canal obturation because of its bioactivity and superior physiochemical properties

Case V

A 24 -year-old female patient reported to the Department of Conservative Dentistry & Endodontics, Mahe Institute of Dental Sciences & hospital a chief complaint of discoloured upper front teeth. On clinical examination, 22 was seen to be discolured and root canal rtreatment had been initiated from elsewhere. Radiograpihic examination of 22 revealed short root, an open apex with a large periapical lesion and thin root dentin. Root canal treatment was reinitiated. Mild hand filing of the canal was done. Saline and chlorherxidine irrigation was done. Metapex intra canal medicament was placed. MTA obturation was done

Figure 26: PRE OP

Figure27: Intra Canal Medicament Metapex

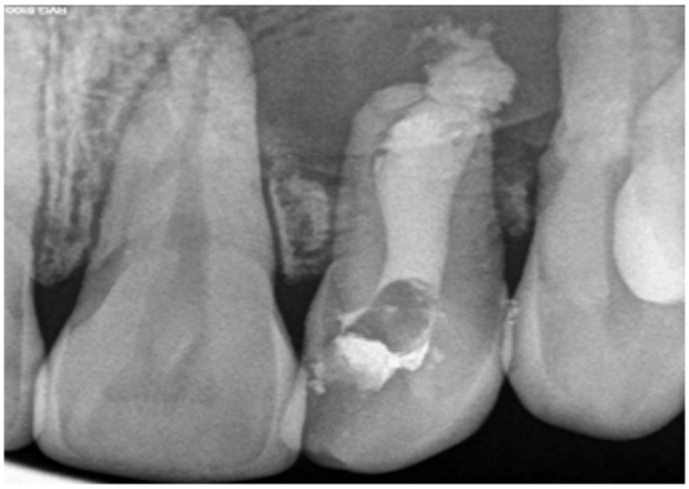

Figure 28: MTA Obturation

Figure 29: PRE OP

Figure30: Working Length Determination

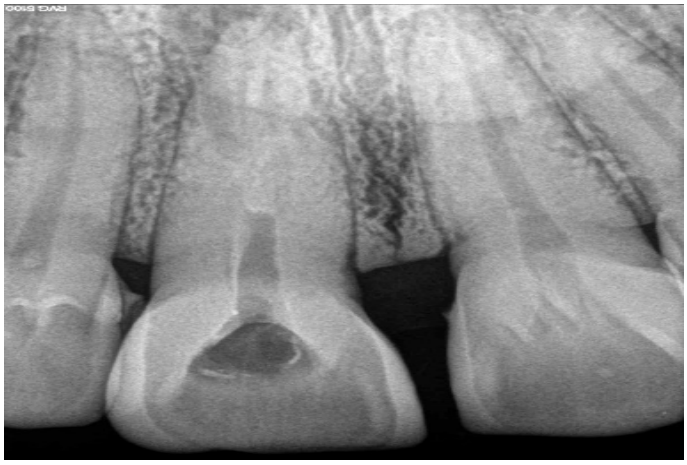

Figure 31: MTA Apical Plug Obturation

Figure 32: Thermo plasticized

Discussion

Several reports have illustrated successful outcomes using calcium-enriched mixture (CEM) cement as an indirect pulp-capping agent [9]. Randomized clinical trials and cohort investigations reported successful outcomes following the use of MTA, medical Portland cement, Biodentine and TheraCal LC as indirect pulpcapping agents in permanent teeth [10]

Numerous systematic reviews and meta-analyses that evaluated the clinical and radiographic outcomes of pulps that were directly capped with either various types of MTA or calcium hydroxide reported significantly higher success rates for MTA [11]. In fact, the frequency of success in both randomized clinical trials and retrospective nonrandomized studies in MTA-capped

pulps was significantly higher than in calcium hydroxide. From a histological standpoint, MTA was associated with significantly less inflammation and more frequent calcified bridge formation compared to calcium hydroxide [12].

The results of a systematic review and meta-analysis revealed that the overall success rate of nonsurgical perforation repair was 72.5%, without considering the type of repair material.When MTA was used as a perforation repair material, the success rate was 80.9% [8].

Mineral trioxide aggregate has been the most popular material for coronal plugs in revitalization procedures because of its biocompatibility, sealing ability and marginal adaptation. In fact, more than 85% of studies used MTA for this purpose. A very high success rate is seen in cases of Regenerative endodontic therapy with MTA as a coronal plug[13]. Mineral trioxide aggregate creates an intimate contact with the dentine of the pulp chamber and stimulates the production and/or release of signalling molecules, which are necessary for the formation of new tissue in the pulp space [14].

The use of MTA as an obturation material might ultimately provide long-term benefits that enhance the prognosis and retention of the natural dentition in conventional and complex therapies [15]. MTA forms an interfacial layer in the presence of phosphates, when compacted inside the root dentin [16]. On analysis with scanning electron microscopy (SEM) and when examined under x-ray diffraction, this layer resembles hydroxyapatite in composition and structure [17]. MTA not only fulfills the ideal requirement of being bacteriostatic, but it might have potential bactericidal properties. The release of hydroxyl ions, a sustained high pH for extended periods the formation of a mineralized interstitial layer might provide a challenging environment for bacterial survival [18]. These antibacterial properties can be a potent inhibitor of bacterial growth against species such as Entercoccocus faecalis [19], a microorganism prevalent in root canal failures

Conclusion

With the advent of a bioactive material like MTA, the scope of clinical dentistry has improved by many folds. The versatile nature of MTA, makes it possible to be used for different purposes like direct and indirect pulp capping, perforation repair, and even as an obturation material. Further long term studies are required to establish the use of MTA in various areas in conservative dentistry and endodontics.

Ethical Clearance: Taken from the ethical committee of Mahe Institute of Dental Sciences & hospital

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