



**USE OF MINERAL TRIOXIDE AGGREGATE IN PAEDIATRIC
DENTISTRY: A REVIEW**

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ABSTRACT

Mineral trioxide aggregate is one of the most versatile new material of this century in the field of dentistry. It not only possesses good physical properties, but has ability to stimulate tissue regeneration as well as good pulp response. MTA has numerous clinical applications. In this article the MTA has been reviewed in field of pediatric dentistry.

KEYWORDS: MTA, GMTA, WMTA.

INTRODUCTION

Need for new materials are never ending in field of advancing dentistry. Various materials have been standardized for obtaining numerous benefits. One such material is MTA, which was introduced by M Torabinejad at Loma Linda University, California and first literature about material was introduced by Lee et al.^[1] Studies on MTA shows that not only exhibit good sealing ability, relative ease of manipulation, long term prognosis but it favors tissue regeneration too. In present article we will review availability, composition, properties and clinical applications in pediatric dental practice.

AVAILABILITY

In single use sachets 1 gram of fine MTA hydrophilic powder is usually available. Some commercially available MTA are ProRoot MTA (Dentsply), White ProRoot (Dentsply), MTA –Angelus (Solucos Odontologicas), MTA Plus (Avalon Biomed Inc. Bradenton, FL, USA).

COMPOSITION

MTA consists of tricalcium silicate, tricalcium aluminate, tricalcium oxide, silicate oxide and bismuth oxide. Its composition is similar to Portland cement except for the absence of bismuth oxide in Portland cement. Bismuth oxide is added (17-18 wt %) to improve the properties and the radioopacity. The MTA particles are smaller and uniform in size. MTA are of two types- grey (GMTA) and white (WMTA). They differ mainly in content of iron, aluminium and magnesium oxides. Asgary et al shown that these oxides are present in less quantity in white MTA whereas others claim total absence of these oxides in white MTA.^[2,3] White MTA contains smaller particles having a narrow range of size distribution than grey MTA.

MANIPULATION & SETTING REACTION

To obtain MTA paste of putty like consistency, mix 3 parts of powder with 1 part of water. Mixing is done on paper or on a glass slab using a plastic or metal spatula. Then it is placed in the desired location and condensed lightly with a moistened cotton pellet. Sluky et al reported mixing time of MTA should be less than 4 minutes.^[4] Mixing time is crucial for MTA because if prolonged it will lead to dehydration of the mix. According to Torabinejad setting time of GMTA is 2 hours and 45 minutes (+5 minutes) whereas Islam et al reported it as 2 hours and 55 minutes.^[5,6] It can be accelerated by adding some accelerators. Extended setting time is one of the main drawbacks of MTA.

MTA requires moisture to set; moisture improves flexural strength of set cement. Hydration of powder results in colloidal gel composing of calcium oxide crystals in an amorphous structure. There should not be the excess of moisture also because it will results in a ‘soupy’ mix which is difficult to use.^[7]

After mixing, it should be immediately used otherwise it will undergo dehydration. It is placed on desired location by hand condensation method or ultrasonic method.

PROPERTIES

1. **Compressive strength:** Within 24 hours it is 40 MPa and increases to 67.3 MPa after 21 days. GMTA has greater compressive strength than WMTA.^[8]

2. **Radio-opacity:** It is 7.17 mm of equivalent thickness of aluminium, which makes it visualize radiographically.^[9]

3. **Solubility:** Set MTA shows no signs of solubility; it may increase if excess of water is used while mixing.

4. **Sealing ability:** This property makes MTA to be used for root end filling purpose, repair of perforations, pulp capping, and pulpotomy procedures. It has excellent sealing properties. It prevents micro-leakage.

5. **Antibacterial and Antifungal property:** It is Antibacterial against *E. faecalis* and *S. sanguis*. It is also active against *S. mitis*, *S. mutans*, *S. salivarius*, *Lactobacillus* and *S. epidermidis*.^[10] Al-Hezaimi et al evaluated the antifungal effect of WMTA on *C. albicans* and revealed that the concentration of MTA is a significant factor in the antifungal effect of this material.^[11]

6. **Biocompatibility:** It is non mutagenic and is much less cytotoxic in comparison to Super EBA and IRM.^[12] It is hence used over formocresol in pulpotomy procedure. They induce tissue regeneration. It also shows good interaction with bone-forming cells.

7. **Tissue regeneration:** MTA is capable of activation of cementoblasts and also facilitates regeneration of periodontal ligament. MTA allows bone healing too.

8. **Mineralization:** MTA induces dentin bridge formation.^[13] Dentin bridge formed with MTA is much faster with good structural integrity than calcium hydroxide.

9. **Reaction with other materials:** MTA does not interfere with any other restorative material. Glass ionomer cement or composite resins, used as permanent filling material do not affect setting of MTA when placed over it.^[14]

CLINICAL APPLICATIONS OF MTA IN PEDIATRIC DENTISTRY

1. Pulp capping

Because of its excellent tissue compatibility, it is used for capping of pulps with reversible pulpitis. It is superior to routinely used calcium hydroxide.^[15] No inflammation or necrosis

was seen in pulp tissues after its application. Dentin bridge formed within 1 week which increased in length and thickness within 3 months .Pulp tissue heals faster with MTA .Bogen et al in a study of pulp capping using MTA reported a success of 97.6%.^[16]

2. Pulpotomy

Formocresol is routinely used for pulpotomy in deciduous teeth. But formocresol is criticized for its cytotoxic and mutagenic effects. MTA was tested and found to be ideal material with low toxic effects and non mutagenic nature.^[17] Jabbarifar et al found MTA as better pulpotomy agent when compared to formocresol.^[18] Discoloration was found in deciduous molars treated with MTA, but it's of little significance because tooth was later restored with stainless steel crown.

3. Root end filling of young permanent teeth

MTA when used as root end filling material after endodontic surgery was found to be more superior to routinely used amalgam because it provide good apical seal with no micro leakage and its biocompatible property.MTA treated teeth not only shows significant less inflammation and more cementum formation , also shows regeneration of periradicular tissues.^[19]

4. Apical plug

MTA treated teeth for the apexification procedure had shown that 4mm of MTA plug when placed over apical region leads to barrier formation and also seals canal from periapical area. It is superior to routinely used calcium hydroxide because calcium hydroxide requires extended time taken for the completion of procedure (3 to 54 months) as well as after 100 days showed a significant reduction in its fracture resistance.

5. Obturation of the canal

MTA can be used to obturate the canal of retained deciduous teeth where the succedaneous permanent tooth is absent. O'Sullivan and Hartwell reported one case of such application in retained primary mandibular second molar.^[20] This technique is not recommended for obturation of primary teeth which are expected to shed off.

6. Repair of perforation

Root perforation leads to communication between the root canal and the periodontium. Repairing such communication requires a material to be biocompatible, should withstand

moisture without dissolving and should have good sealing properties. Since MTA is having such properties, MTA is regarded as a material of choice for root perforation.

7. Repair of fracture

Schwartz et al in a case of upper central incisor with Class III mobility and horizontal fracture MTA was placed at fracture site and found that after 6 months recall tooth was asymptomatic.^[21] Torabinejad and Chivian has suggested the use of MTA in vertical root fracture cases.^[22]

CONCLUSION

MTA is an excellent material with innumerable qualities of an ideal material. One of important use of MTA in pediatric dentistry is management of non vital immature teeth. MTA cannot be used to save every tooth with pulpal involvement, however with meticulous technique it may serve as an advance pulp medicament to add to a clinician armamentarium. MTA needs to be explored by clinicians so that its beneficial properties can be extracted. MTA uses can be regarded as the current burning topic in field of research as well as in field of dental sciences.

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