International Journal of Aquatic Science
ISSN: 2008-8019
Vol 12, Issue 03, 2021

An Overview Of The Role Of Mineral Trioxide Aggregate In Endodontics. Running Title: MTA- A Review

Alemete Suriyanarayanan Kamali[1], Ramachandran Tamilselvi[2], Alagarsamy Venkatesh[3], Dhakshinamoorthy Malarvizhi[4],

[1]B.D.S., First yr Postgraduate student Department of Conservative Dentistry and Endodontics.
[2]M.D.S, Reader Sree Balaji Dental College and Hospital,
[3]M.D.S, Professor Bharath Institute of Higher Education and Research,
[4]M.D.S., Professor Narayanapuram, Pallikaranai,Chennai-600 100.

Email:[1]kamya7076@gmail.com, [2]drtamil_chandran@yahoo.co.in
[3]denvenkat@gmail.com, 4drmalarendo@gmail.com

ABSTRACT: In endodontics, MTA has proven to be a game-changer. Several studies have shown its use in a number of clinical applications since its introduction in the 1990s. MTA has been thoroughly researched and is now used for perforation repairs, apexifications, regenerative treatments, apexogenesis, pulpotomies, and pulp capping. This article will review the composition, history, clinical application and research findings of this versatile material

KEYWORDS :regenerative material, biocompatible, apexogenesis

1. INTRODUCTION:

Mineral Trioxide Aggregate is what MTA stands for. MTA has been one of the most researched endodontic products over the last two decades. A–three Calcium, aluminum, and selenium make up the trioxide aggregate contained in MTA. Biocompatibility, bioactivity, hydrophilicity, radiopacity, sealing performance, and low solubility are all desirable properties of MTA**.**Optimal healing responses are encouraged by high biocompatibility.This has been seen histologically with new cementum formation in the peri radicular tissues and a low inflammatory response with bridge formation in the pulp space.The high resistance to marginal leakage and bacterial migration into the root canal system is due to its expansion and contraction properties, which are very similar to dentin. One of the most significant factors in clinical success is a stable barrier against bacterial and fluid leakage.[1]
MTA has the advantage of setting in the damp atmosphere that is so typical in dentistry. MTA sets in a moist setting, unlike many other dental products. As calcium oxide comes into contact with moisture, it turns into calcium hydroxide, which many clinicians are familiar with. As a result of this conversion, a high pH microenvironment is formed, which has antibacterial properties. This material, unlike calcium hydroxide, has a very low solubility and retains its physical integrity after placement.
The Portland cement parent compound is used to produce MTA products. Portland cement and MTA are not identical, despite their similarities in certain ways. Additional processing and purification were performed on MTA materials. MTA products have a smaller mean

particle size and contain less toxic heavy metals as compared to Portland cements. MTA was first published in the dental literature in 1993, and it was approved by the FDA in 1998.The first commercially available MTA product in the United States was Pro Root MTA (Dentsply Tulsa Dental Specialties, Johnson City, TN) introduced in 1999. MTA Angelus (Angelus, Londrina, Brazil / Clinician's Choice, New Milford, CT) was approved by the FDA in 2011, enabling it to be marketed in the United States.[2] MTA Angelus has a faster setting time, comes in containers that allow for more precise dispensing, and has all of the benefits of conventional MTA. While the original ProRoot MTA comes in single-use packages, the newer MTA Angelus comes in airtight bottles that allow practitioners to dispense a small amount of powder while resealing the rest for future use. It takes around 2 to 3 hours for traditional ProRoot MTA to set. MTA Angelus is ready to go in under 15 minutes. The shorter setting time is sometimes advantageous because clinicians can ensure that the material is set at the time of placement and continue with their restorative procedures without fear of MTA washout.
MTA Angelus has a faster setting time because the concentration of calcium sulphate has been decreased, which was the cause of the longer setting time in the initial formulation. MTA is available in two colours: white and grey. The first MTA products were grey, and this formulation was the subject of much of the early testing. The difference between the two colors is mostly due to a decrease in the concentrations of aluminium, iron, and magnesium oxides in white MTA. The major difference is in the relative proportion of iron oxide where white MTA was found to have 90.8% less when compared to the original grey MTA variety. Even with these modifications, white MTA.[3] In 2002, the white form of MTA was introduced to the market in response to staining issues raised when MTA residues were left in the clinical crown. While white MTA has a lower staining potential, clinicians should still be careful to remove all traces of MTA before restoring coronal access to teeth in the aesthetic region. Similar to grey MTA cement, it has similar properties.
Owing to its wet sand-like nature, unlike most other traditional dental products, clinicians had trouble handling MTA when it was first introduced. The handling and application of this material has become more predictable since the introduction of many customized application devices onto the market.[4]

2. CLINICAL APPLICATIONS

In the United States, over 24 million endodontic procedures are performed each year, with innovative treatments including periapical microsurgery, perforation replacements, and apexification treatments accounting for 5.5 percent of these procedures. The availability of MTA has significantly aided both of these endodontic procedures, as well as certain operative procedures, which are discussed in turn.[5]

3. PULP CAPPING

When dealing with massive carious lesions, pulpal exposure is often unavoidable. While some dentists are reluctant to conduct direct pulp capping procedures because of their reported unpredictability as a definitive treatment choice, MTA may help to increase the treatment's outcome in the future. MTA is less soluble than calcium hydroxide and provides a better seal due to its setting extension, which hermetically seals the pulp space and prevents bacterial contamination from the outside. MTA pulp capping has been shown to be a feasible treatment choice in asymptomatic cases or cases with reversible pulpits (infections that have not spread into the pulp chamber proper).[6] As compared to traditional pulp capping with calcium hydroxide, histological studies indicate that MTA causes less inflammation and more dentinal bridging. The rapid 15-minute set time of MTA Angelus allows for immediate placement of the final restoration in direct contact with the set MTA in pulp capping.

4. VITAL PULP THERAPY (PULPOTOMY AND APEXOGENESIS)

In cases of persistent pulpitis caused by bacteria infiltrating the pulp chamber, a pulpotomy procedure may be considered. two or three Apexogenesis is the term used to describe the technique's ultimate goal of promoting the full development of the apex and root. This procedure is used on teeth with vital pulp tissue that are still forming their roots.[7,8] The radicular pulp is kept in place since it is largely free of inflammation. Odontoblasts will distinguish, dentin will be laid down, and root development will begin on a histological level as a result of this.

5. CLINICAL PROCEDURE

Clinicians can use a diamond bur until they are in the pulp chamber since it cauterizes the tissue and reduces bleeding. After that, disinfect the area with an antimicrobial agent (sodium hypochlorite or chlorhexidine), then rinse it with saline. A damp cotton pellet is used to achieve hemostasis with light pressure. After a couple of minutes, the pellet is removed, and the area is ready for MTA to be applied.

6. APEXIFICATION

Since an immature root lacks an apical stop, treating a necrotic pulp has always been difficult for clinicians. Long-term calcium hydroxide therapy has traditionally been used to remedy this, which can take many years, require several visits, and potentially increase the root's fracture risk. By making a biocompatible apical plug in just one visit, 24 MTA has become an excellent predictable option to fix these issues.

7. CLINICAL PROCEDURE

If there is apical bone loss, a collagen/gelatin sponge such as Gelfoam may be inserted apically to deliver the MTA to the optimal working length. This is accomplished by using an endodontic file to transfer a small piece of Gelfoamdown to and through the root apex. MTA is then loaded into a custom-fitted cone and driven down the canal. A rubber stopper on the clinician's gutta percha cone may be used to determine the exact length of MTA inserted in the apical third. The remaining coronal canal space can be backfilled using a warm gutta-percha technique once the apical third has been sealed with 3–5mm of MTA.[9,10]

8. REGENERATION

Because of the high risk of root fracture, treating a necrotic pulp in an immature root with extremely thin walls is difficult. Dentin-pulp complex regeneration is a modern technique that includes disinfecting the root canal system with a triple antibiotic paste, then tissue repair and regeneration. Deposition of new dentin-like hard tissue should allow for continued thickening of the lateral dentinal walls. More study is required to determine whether and how this newly deposited dentin-like hard tissue strengthens the thin root.

9. CLINICAL PROCEDURE

For cases with very thin dentinal walls and a radiographically open apex greater than 1mm in diameter, endodontic pulp space regeneration is recommended. Sodium hypochlorite irrigation is used to clean the root canal system, which is accompanied by a one-week application of a triple antibiotic paste dressing.[11] At the second visit, EDTA is used to condition the dentin walls (leading to the release of growth factors), and bleeding is stimulated in the periapical tissues (where stem cells are found), with the aim of filling the pulp space with a healthy blood clot (serving as the scaffold).

10. ROOT PERFORATION

Iatrogenic conditions under which a contact between the pulp canal and the periradicular tissue occurs during access preparation or canal forming procedures are the most common causes of perforations. Internal root resorption, in which the entire thickness of the root is affected by the resorption process, may also result in perforations. MTA has been used to patch root perforations with predictable performance, thanks to its excellent sealing capacity and biocompatibility.

11. CLINICAL PROCEDURE

After a perforation has occurred, the degree of the perforation must be determined. If a bony defect is present, it should be filled with an osteoconductive or ostoinductive substance first. A bone graft, calcium sulphate, or collagen/gelatin sponge may all be used to accomplish this. MTA is used to repair the perforated dentinal part of the tooth.[12]

12. ROOT-END FILLING

Where an extra-radicular microsurgical approach to endodontic pathology is needed, a root-end filling (also known as a retrofilling) is performed in endodontics. Owing to complicated canal anatomy or iatrogenic misadventures during root canal procedures, the majority of surgically treated cases cannot be reliably treated by orthograde traditional root canal approaches.[13] MTA has outstanding physical sealing properties, and the proliferation of cells directly on the cementum during the healing process results in an additional biological seal.

13. CLINICAL PROCEDURE

The canal system is opened and cleaned with surgical ultrasonic tips to establish the retro-preparation after the apical 3mm of the root has been resected . The retro-preparation is then dried, and MTA is put and condensed in that space to create the retro-filling.[14]

14. CONCLUSION

Traditional MTA has been shown to work in a variety of endodontic procedures in scientific studies. This review paper discusses MTA's history, chemical structure, and clinical applications. There is no other dental material on the market that is comparable to MTA in terms of sealing efficacy and biocompatibility. MTA-based products are likely to remain at the heart of good dental practice for many years to come, particularly with the introduction of a fast-setting MTA that also has excellent handling properties.

Source Of Funding**:** nil
Ethical Clearance**:** not required for review manuscript
Conflict Of Interest**:** nil

15. REFERENCES:

[1] Parirokh M, Torabinejad M. Mineral trioxide aggregate: a comprehensive literature review—part I: chemical, physical, and antibacterial properties. Journal of endodontics. 2010 Jan 1;36(1):16-27.
[2] Torabinejad M, Parirokh M. Mineral trioxide aggregate: a comprehensive literature review—part II: leakage and biocompatibility investigations. Journal of endodontics. 2010 Feb 1;36(2):190-202.
[3] Parirokh M, Torabinejad M. Mineral trioxide aggregate: a comprehensive literature review—part III: clinical applications, drawbacks, and mechanism of action. Journal of endodontics. 2010 Mar 1;36(3):400-13.
[4] Tawil PZ, Trope M, Curran AE, Caplan DJ, Kirakozova A, Duggan DJ, Teixeira FB. Periapical microsurgery: an in vivo evaluation of endodontic root-end filling materials. Journal of endodontics. 2009 Mar 1;35(3):357-62.
[5] Faraco Jr IM, Holland R. Response of the pulp of dogs to capping with mineral trioxide aggregate or a calcium hydroxide cement. Dental Traumatology. 2001 Feb;17(4):163-6.
[6] Prakash V, Darsini J H, Karthick A, Venkatesh A. Mineral Trioxide Aggregate (MTA)– an overview. European Journal of Molecular & Clinical Medicine. 2020 Dec 4;7(3):2115-20.
[7] Dammaschke T, Gerth HU, Züchner H, Schäfer E. Chemical and physical surface and bulk material characterization of white ProRoot MTA and two Portland cements. Dental Materials. 2005 Aug 1;21(8):731-8.
[8] Islam I, Chng HK, Yap AU. Comparison of the physical and mechanical properties of MTA and Portland cement. Journal of endodontics. 2006 Mar 1;32(3):193-7.
[9] Lee SJ, Monsef M, Torabinejad M. Sealing ability of a mineral trioxide aggregate for repair of lateral root perforations. Journal of endodontics. 1993 Nov 1;19(11):541-4.
[10] Menezes R, Bramante CM, Letra A, Carvalho VG, Garcia RB. Histologic evaluation of pulpotomies in dog using two types of mineral trioxide aggregate and regular and white Portland cements as wound dressings. Oral Surgery, Oral Medicine, Oral Pathology, Oral Radiology, and Endodontology. 2004 Sep 1;98(3):376-9.
[11] Koulaouzidou EA, Economides N, Beltes P, Geromichalos G, Papazisis K. In vitro evaluation of the cytotoxicity of ProRoot MTA and MTA Angelus. Journal of oral science. 2008;50(4):397-402.
[12] Lolayekar N, Bhat S, Hegde S. Sealing ability of ProRoot MTA and MTA-Angelus simulating a one-step apical barrier technique-an in vitro study. Journal of Clinical Pediatric Dentistry. 2009 Jul 1;33(4):305-10
[13] Ioannidis K, Mistakidis I, Beltes P, Karagiannis V. Spectrophotometric analysis of coronal discolouration induced by grey and white MTA. International endodontic journal. 2013 Feb;46(2):137-44.

[14] Asgary S, Parirokh M, Eghbal MJ, Brink F. Chemical differences between white and gray mineral trioxide aggregate. Journal of endodontics. 2005 Feb 1;31(2):101-3.