MTA: The New Material of Choice for Pulp Capping

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The use of MTA (Angelus, Brazil/ Clinical Research Dental, London, ON) (Fig. 1) has revolutionized endodontics, since its introduction to dentistry in 1993[1] (it has been on the dental market since about 1998) In the years since, it has proven to be an exceptional material with a wide range of clinical uses, all scientifically and clinically proven.[2-4]

Initially recommended as a material for filling root end surgical preparations and for perforation repair, this material is also advocated for immediate apical sealing in teeth with open apices,[5] pulpotomies, apexification or apexogenesis in vital teeth with open apices,[6-9] and other endodontic and reparative procedures. The extraordinary success in perforation repair since its introduction has motivated its use in these many other areas. This article will look at the success, practicality, and scientific basis for use in pulp capping procedures, particularly in permanent teeth, as MTA has been described very recently as "the material of choice"[10] for this treatment.

PROPERTIES OF MTA

MTA stands for mineral trioxide aggregate, denoting the three dominant oxides in the material's composition, namely — calcium, aluminum and selenium. Its particle sizes are strictly controlled during manufacturing, as they all need to be less than 10 microns, so that the material may be completely hydrated. MTA has a similar mechanism of action to Calcium Hydroxide[11] in that the main component of the material, calcium oxide, when in contact with a humid environment, is converted into calcium hydroxide.[12] This results in a high Ph of 12.5, making its surroundings inhospitable for bacterial growth, and producing an anti-bacterial effect for a long period of time. But unlike calcium hydroxide products, such as DYCAL® (Dentsply, York, PA), MTA Angelus (Angelus, Londrina, Brazil/Clinical Research Dental, London, ON) has very low solubility, so it maintains a hard, excellent marginal seal. Finally, unlike most dental materials, MTA actually NEEDS moisture to set so it thrives in a moist environment. Of the commercially available MTA products, MTA Angelus is well suited for pulp capping procedures due to its setting time

FIGURE 1—MTA Angelus (Clinical Research Dental).

of 10 minutes, compared with the four hour setting time of the other commercially available MTA. It is also packaged in air-tight bottles, allowing the practitioner to use only what is exactly needed, without introducing undue moisture into the remainder.

USE OF MTA FOR DIRECT PULP CAPPING

This combination of desirable qualities makes MTA “the material of choice” for cases of pulp exposure in both primary teeth and permanent teeth[13,14] (Figs. 2-4). Pulpal exposure is inevitable when excavating many large carious lesions. While many dentists are hesitant to perform direct pulp capping procedures due to previously unpredictable results with conventional materials, MTA is a more predictable and reliable material for direct pulp capping teeth, with reversible pulpitis, as borne out by numerous clinical and histological studies.[15-19] Mente et al recently concluded “MTA appears to be more effective than calcium hydroxide for maintaining long-term pulp vitality after direct pulp capping.”[20] Numerous other studies show much promise in the long term health of pulps that have been capped using MTA, and years of clinical use have demonstrated the superlative ability of this material in dentin bridge formation (Figs. 5-7).[21,22]

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MTA CLINICAL CASE PRESENTATION

A young female patient presented to the dental office with a large carious exposure on the distal of tooth number 46, as evidenced by the radiograph in Figure 8. Since there was no evidence of periapical rarefaction and no spontaneous pain, it was decided to place

FIGURE 2—Pre-operative radiograph of carious pulp exposure on tooth #46.

FIGURE 3—Radiograph of periapical radiolucency.

FIGURE 4—One year follow-up with healthy pulp and resolution of the periapical lesion.

FIGURE 5—Pre-operative radiograph of pulp exposure.

FIGURE 6—MTA placed after caries removal and pulp exposure.

FIGURE 7—Dentin bridge formation after 40 days.

FIGURE 8—Pre-operative radiograph of clinical case.

FIGURE 9—Clinical presentation of the lesion after rubber dam isolation.

FIGURE 10—Initial rough cavity outline.

FIGURE 11—Use of short shank bur interferes with vision.

FIGURE 12—Relative lengths of short vs. long burs.

FIGURE 13—Increased visibility of lesion with long shank bur.

FIGURE 14—Photo of pulp exposure.

FIGURE 15—NaOCl placed over pulp exposure.

FIGURE 16—Cotton used to dry area.

FIGURE 17—Bleeding of the pulp exposure controlled.

a direct pulp cap, if after excavating the caries, the bleeding could be controlled without the use of hemostatic agents. After delivering a mandibular block, and isolation with the rubber dam (Paro Dam – Clinical Research Dental) the clinical photograph of the distal caries is shown in Figure 9. The initial outline form was created using a pear-shaped 332 carbide bur followed by removal of the soft caries with a round carbide bur (Fig. 10). When excavating deep caries and using a regular length bur (Fig. 11) the head of the hand-piece interferes with adequate vision of the caries removal process. As evidenced by Figure 12, the use of a long shank bur (Fig. 13) may complicate access for distal molars, but the distancing of the head of the hand-piece from the occlusal cavo-surface margins allows better visualization of the caries removal process. The final removal of the caries is accomplished with the use of a new sterile diamond round bur, which causes less tissue damage to the pulp than the round carbide bur (which also will be contaminated by the caries excavation). The initial carious pulp exposure is shown in Figure 14. A cotton pledget soaked in

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FIGURE 18—MTA is placed by ultrasonic vibration of plastic instrument.

FIGURE 19—First increment of MTA placed.

FIGURE 20—Second increment of MTA fully covers pulp exposure.

FIGURE 21—LC Glass Ionomer is placed with a Skini syringe.

FIGURE 22—Initial placement of the light cured glass ionomer.

FIGURE 23—Valo LED curing light used to set the glass ionomer.

FIGURE 24—Triodent V3 ring used to create separation for tight contact.

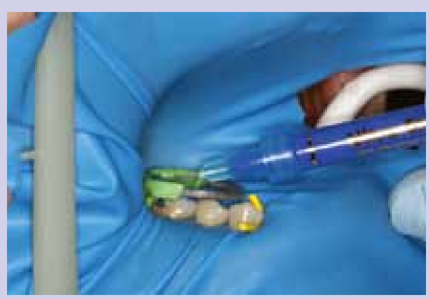

FIGURE 25—UltraEtch is placed on enamel first.

FIGURE 26—Then the entire cavity is flooded by phosphoric acid.

5½% NaOCl is placed over the pulp tissue and removed when the bleeding has stopped (Fig. 15). The area is delicately dried with the use of tissue in cotton pliers (Fig. 16). At this point in the procedure the area is not washed, nor air dried. With the area decontaminated with the bleach and the bleeding stopped (Fig. 17), the MTA (Angelus, Brazil/Clinical Research Dental) is prepared by mixing the powder and liquid according to the manufacturer's instructions. The MTA is picked up by a plastic instrument, carried to the exposure site, and is deposited by vibrating the plastic instrument with an ultra-sonic tip (Fig. 18). Figure 19 shows the first increment placed. Similarly a second increment is carried to the exposure site, and is deposited by the vibration of the ultrasonic (Fig. 20). The vibration simplifies the placement of the MTA with the material smoothly flowing from the plastic instrument and adapting well to the tooth structure facilitating a good seal. To protect the MTA during its setting, a light cured glass ionomer (Fuji 2 LC GC America, Alsip, IL) is injected precisely over the MTA site with a Skini Syringe and Endo-Eze canula (Ultradent/Clinical Research Dental) (Figs. 21, 22) and fully light cured with

At this point in the procedure the area is not washed, nor air dried

FIGURE 27—MPa bonding agent is placed as a single coat and light cured.

FIGURE 28—Initial fill with Cosmedent Nano.

FIGURE 29—Initial trimming with 7802 multi-fluted finishing bur.

FIGURE 30—After occlusal adjustment, a Groovy polishing point is used.

FIGURE 31—Final clinical result.

FIGURE 32—Post-operative radiograph of MTA pulp cap.

a Valo broad spectrum curing light (Fig. 23). After careful cut-back of the glass ionomer cement and a cleaning of all the margins, a Triodent contoured matrix band was placed, followed by the insertion of a Wave-Wedge. The Wave-Wedge does not cause separation but only serves to adapt the matrix gingivally. A Triodent V3 green molar ring (Triodent/Clinical Research Dental) was placed to create tooth separation and the band was burnished with a ball burnisher to confirm contact with tooth 47 (Fig. 24). Ultra-Etch was placed for 15 seconds over the glass-ionomer, remaining dentin, and enamel margins (Figs. 25, 26), gently washed and lightly dried. A single coat of the Fifth Generation bonding agent MPa (Clinical Research Dental) was applied with a micro-brush (Fig. 27), air thinned and the ethanol solvent evaporated. After light curing with the Valo, the A2 Cosmedent Nano composite (Cosmedent/Clinical Research Dental) was incrementally placed, first laterally to decrease the C factor vectors, light cured, and then the centre valley filled in, adapted and light cured (Fig. 28). After initial recapitulation of the occlusal anatomy with a 7802 bur (Fig. 29), the rubber dam was removed, and a diamond impregnated Groovy Occlusal polishing point (Fig. 30) was used to create the final polish of the nano-filled composite. The final restoration is shown in Figure 31 with the final post-operative radiograph (Fig. 32) showing the close adaptation of the MTA, glass-ionomer and the Cosmedent Nano.

> A single coat of the Fifth Generation bonding agent MPa was applied with a micro-brush, air thinned and the ethanol solvent evaporated

SUMMARY STATEMENT

The clinical and research evidence clearly support the use of MTA as the "new" pulp capping material of choice. OH

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Oral Health welcomes this original article.

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