

CLINICAL AND RADIOGRAPHIC EVALUATION OF MTA BASED ZINC OXIDE EUGENOL VERSUS FORMOCRESOL PULPOTOMY IN PRIMARY MOLARS

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ABSTRACT

Pulpotomy is a therapeutic technique that can be used on healthy root pulp tissue with the ability to heal after surgical amputation of the infected or affected coronal pulp.

Aim: Evaluation of the clinical as well as radiographic reaction of the pulp in primary molars using both MTA based zinc oxide eugenol compared to Formocresol pulpotomy was the aim of this study.

Patient & Methods: 20 children aged (4-7 years old) who required pulpotomy using the split mouth technique and who were divided into two groups randomly. The teeth were separated into two groups after the removal of coronal tissue in random and equal manner, depending on the radicular pulp medication used. Group A (Formocresol /zinc oxide eugenol), Group B (MTA based zinc oxide eugenol). Following a procedure of pulpotomy of conventional type with either Formocresol or MTA based zinc oxide eugenol, entire teeth were crowned with stainless steel crown. Pain assessment was done at 0,1,3,7 days, clinical evaluations was on 1, 3, 6, 9 months and radiographic evaluations was on 6 and 12 months.

Results: Regarding group A (Formocresol/ zinc oxide eugenol) Pain assessment showed that after the third day none of the patient reported pain. FC group show 100% success rate after the third day .There was no significant difference between two groups from the third day till the day 7. Clinically at the end of 9 months FC showed 85% success rate, while the radiographic success at the end of 12 months was 65%.

Regarding group B (MTA based zinc oxide eugenol): Regarding pain assessment MTA group showed no pain at all-time intervals with success rate 100%. Clinically at the end of 9 months MTA group showed 100% success rate, while radiographic assessment at the end of 12 months showed 85% success rate.

Conclusion: MTA-based zinc oxide eugenol may serve as a safe substitute to FC for pulpotomies on cariously exposed primary molars.

KEYWORDS: Formocresol, MTA based zinc oxide eugenol , primary teeth, pulpotomy

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INTRODUCTION

The term “pulpotomy” refers to the coronal pulp’s removal from a primary tooth and the remaining important radicular portion is underwent treatment with a long-lasting, clinically effective medication.

⁽¹⁾ The objective of pulp therapy is preserving the pulp vitality as well as the integrity and health of the teeth and the tissues that support them. ⁽²⁾

The ideal medication for pulpotomy would have antibacterial and anti-inflammatory properties, promote healing of the radicular pulp tissue, be biocompatible, and not interfere with natural root resorption.⁽³⁾ Formocresol (FC), zinc oxide eugenol, ferric sulphate, calcium hydroxide, laser application, electro surgical techniques, and MTA are various medicaments and treatments have been used for pulpotomy reasons. ⁽⁴⁾

A devitalizing and fixing agent is called formocresol which has been used in dentistry since 1904 with full concentration of Buckley’s formula (19% formaldehyde, 35% cresol, and 15% glycerin in distilled water). Connective tissue cells have been shown to be toxic to this mixture. ⁽⁵⁾ The use of formocresol in dental treatment was a subject of intense discussion despite its high success rate, accessibility, and cost effectiveness due to its potential for mutagenic, carcinogenic, and toxic effects. According to a study, FC is probably no longer appropriate for use in dentistry up to the point where the International Agency for Research on Cancer declared in June 2004 that – drugs containing- formaldehyde should not be used on humans. ⁽⁶⁾

However a considerable number of additional studies showed no evidence of significant risks of using formocresol in pulp therapy for primary teeth, also the American Academy of Pediatric Dentistry still recommend its use for pulp therapy. ⁽⁷⁾ As a result of this discussion surrounding FC, several medications were suggested and used for pulpotomy.

Mineral Trioxide Aggregate (MTA) has demonstrated high rates of success as pulpotomy agent. ⁽⁸⁾ MTA studies revealed that it had excellent long-term prognosis, good biocompatibility, and good sealing ability in addition to favouring tissue regeneration. MTA based zinc oxide eugenol is a newer material that contains a blend of zinc oxide, MTA, calcium oxide, calcium hydroxide, calcium carbonate, silicon oxide, aluminum oxide, copper oxide, cresols and eugenol. MTA based zinc oxide eugenol is a unique antiseptic, anti-inflammatory formulation which is Arsenic free and Aldehyde free. It potentiates the natural pulp healing process and reduce pulp inflammation.

The objective of this study was to bring into comparison the effectiveness of a new type of dental cement that contains MTA based zinc oxide eugenol to a more traditional approach as formocresol-pulpotomy with regards to clinical as well as radiographic rates of success.

The null hypothesis demonstrated that the two materials were identical.

PATIENT AND METHODS

Children between the ages of 4 and 7 who attend the outpatient clinic at the Pediatric Dentistry Department of the Faculty of Dentistry at Minia University in Egypt. Every patient who matched the inclusion criteria was taken into account. After getting a thorough description of the clinical procedure, the expected results of the treatment, and any potential complications, the parents signed the informed consent form.

Twenty patients in all, employing the split mouth technique, were involved in this study. Each patient had two teeth, which were evenly divided into two groups based on the material applied. Both formocresol pulpotomy and MTA-based zinc oxide eugenol were used to repair 20 teeth bilaterally.

Sample Size Calculation:

Prior to the study, a power calculation using the data from the pilot study was used to establish the number of patients needed in each group. In that study, we found the rate of pain in group A (Formocresol/ zinc oxide eugenol group) was 33.3% and in group B (MTA based zinc oxide eugenol group) was 0%. Using G Power 3.1 9.2 software, it was found that a sample size of 20 patients would offer 80% power for the Fisher's exact test at the level of 0.05 significance.

The children were chosen according to the following inclusion criteria: Patient and parents cooperation, Patient had at least bilateral carious primary first molar or primary second molar, with signs of reversible pulpitis that need vital pulp therapy. The patient also agreed to all procedures for treatment in accordance with their informed consent. Bleeding time after amputation of the coronal pulp tissue within normal limits (5 minutes). The exclusion criteria were as follows: Tenderness to percussion, Pathologic mobility, Radiographic evidence of internal and external root resorption, pulp stones and interradicular or periapical lesion. Presence of systemic condition that may contraindicate pulp therapy as abnormal pulp shape (Taurodontism).

Children were split in to two groups: ten of children were given formocresol in their right side of the mouth while MTA-based zinc oxide eugenol was given in their other side. Other ten of children received MTA based zinc oxide eugenol in their right side and other side formocresol. A rubber dam is used to isolate the tooth after local anaesthesia has been administered. The pulp chamber was exposed after all caries were eliminated and coronal access was established. The coronal pulp was amputated using a sharp spoon excavator. One or more sterile cotton pellets that had been soaked in saline were used to cover the pulp stumps, and mild pressure

was given for two to three minutes in order to achieve hemostasis.

- **For Group A: (Formocresol / zinc oxide eugenol group):**

After removing the coronal pulp and all pulp tissue, the manufacturer's instructions state that the pulp orifices should be covered with a wet cotton pellet until hemostasis occur, then a diluted cotton with formocresol was applied over the pulp orifices for five minute until fixation occur, then a mix of Reinforced zinc oxide eugenol (Zinconol) powder and liquid was mixed in proper ratio. A thick glass ionomer mixture was utilised to fill the cavity before a stainless steel crown was used to finish the restoration.

- **For Group B : (MTA based Zinc oxide eugenol group):**

Following the removal of all pulp tissue from the coronal pulp, a mix of MTA-based zinc oxide eugenol, Mix powder and matching liquid, was placed over the pulp orifices until hemostasis occurred, in accordance with the manufacturer's recommendations. For interim filling, a 2.5:1 powder to liquid ratio is advised. The mixing process was done gradually. A thick glass ionomer combination was utilised to fill the cavity before a stainless steel crown was used to finish the restoration.

Assessment

All cases were clinically assessed for evaluation of pain at the time of examination and after 1, 3, 7 days. Clinically at 1, 3, 6, and 9 months by the presence of any signs such as spontaneous or nocturnal pain, gingival inflammation, tenderness to percussion or palpation, abscess, swelling, and fistula. Moreover, digital x-rays taken radiographically at 6 and 12 months to look for any signs of pathologic external or internal root resorption as well as periapical or inter-radicular radiolucency and widening of the periodontal membrane space.

RESULTS

Regarding pain assessment

Regarding pain assessment at 0 day, Formocresol group showed that 10 of the patients had no pain while other 10 showed mild pain with 50% success rate ,while MTA group had no pain with success rate 100%, There was significant difference ($p=0.0001^*$) between Formocresol group and MTA group. (**Figure 1**)

At 1 day, Formocresol group showed mild pain with 50% rate of success, while MTA group had no pain with success rate 100%, A significant difference ($p=0.0001^*$) was evident between both group. (**Figure 2**)

At 3 and 7 days, Both Formocresol and MTA group had no pain. There was no significant difference ($p=0.5$) between Formocresol and MTA group.

Regarding pain assessment between 0 and 7 day, Formocresol group showed mild pain from the first and second day but the pain disappeared after the third day till the day 7. MTA group showed no pain on the first day till the day 7 , There was significance difference of pain assessment at 0 day and at 7 day in Formocresol group.

Regarding clinical assessment

Regarding clinical assessment at 1 ,3 ,6 months. Both of groups were asymptomatic, No clinical signs and symptoms were noted. There was no significant difference ($p=0.5$) between Formocresol group and MTA group .

At 9 month, In Formocresol group, 3 teeth showed pain with gingival swelling that indicate major discomfort according to the clinical scoring table and lead to extraction. In MTA group no clinical signs and symptoms were noted. There was significant difference between Formocresol group and MTA group in major discomfort. (**Figure 3**)

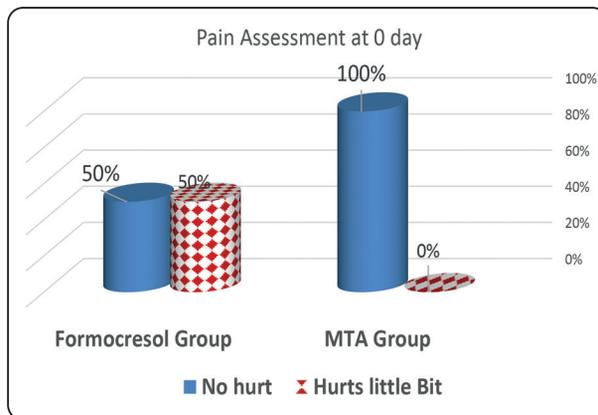


Fig. (1)

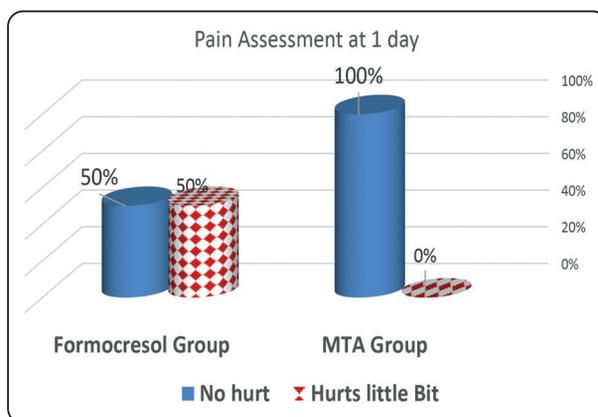


Fig. (2)

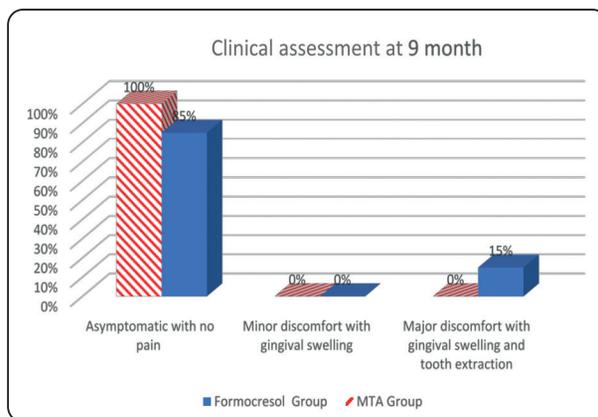


Fig. (3)

3.3. Regarding Radiographic assessment

At 6 months, In Formocresol group 3 cases showed periapical radiolucency with widening of periodontal membrane space and other 3 cases showed periodontal membrane space widened in

conjunction with external root resorption. In MTA group no presence of periapical radiolucency and external root resorption, one case with internal root resorption and widening of periodontal membrane space was noted There was significant difference between Formocresol and MTA group. (**Figure 4**)

At 12 months. In Formocresol group, additional one tooth showed external root resorption to be totally 4 teeth that showed external root resorption. In MTA group additional one case showed presence of periapical radiolucency. There was significant difference between Formocresol and MTA group. (**Figures 5,6,7**)

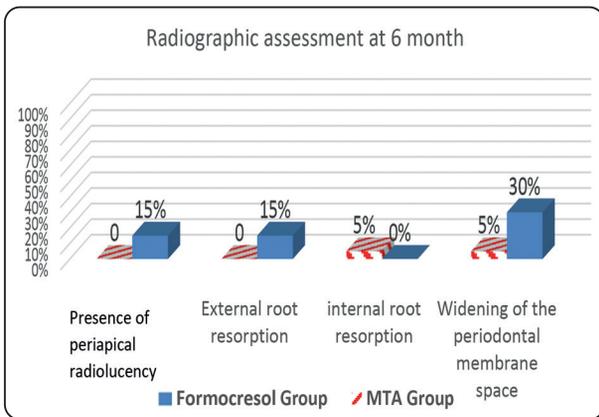


Fig. (4)

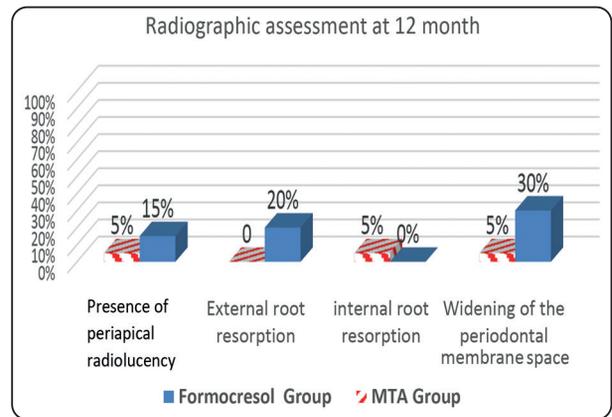


Fig. (5)



Fig. (6): Radiographic evaluation of the Formocresol/ zinc oxide eugenol group, Preoperative radiograph, b) 6 month postoperative, c) 12 month postoperative



Fig. (7): Radiographic evaluation of the MTA based zinc oxide eugenol a) Preoperative radiograph, b) 6 month postoperative, c) 12 month postoperative

DISCUSSION

Formocresol, one of the most often utilised vital pulp therapy materials for primary teeth, has long been recognised as the gold standard to which other materials are compared. It is a bactericidal agent with reported effectiveness rates of 70% to 97% in clinical and radiographic studies. However, despite formocresol concerns being raised, there are still high success rates.⁽⁹⁾

To overcome the disadvantages of formocresol, Newer, nontoxic, biocompatible pulpotomy materials made of tricalcium/dicalcium (tri/dicalcium) silicate-based cements have been introduced. Although these products don't contain formaldehyde, they have worked just as well to treat pulpotomies in primary teeth.

MTA based zinc oxide eugenol is a unique antiseptic, anti-inflammatory formulation which is Arsenic free and Aldehyde free. Formaldehyde has been classified as a hazardous substance.⁽¹⁰⁾ Histological studies of the use of formocresol in pulpotomies have shown that it may result in chronic inflammation and necrotic tissue instead of preserving vital pulp tissue.⁽¹¹⁾ Information about potential cytotoxic and mutagenic effects of formaldehyde use has been reported.

MTA based zinc oxide eugenol maintain the vitality of the tooth and promote healing of the pulp. MTA was attributed to its excellent sealing ability, biocompatibility and superior physical properties⁽¹²⁾, antibacterial effect, MTA based zinc oxide eugenol is currently being used in pulp therapy and had provided an enhanced seal over vital pulp and is non resorbable. It has shown long-term success as a medicament for pulpotomies, less cytotoxic than other pulpal materials.

The material has been demonstrated to reduce inflammation of the pulp and provide immediate pain relief with a reasonable cost, short setting time, easy of handling and manipulation of both powder

and liquid. MTA based zinc oxide eugenol has been claimed to be one of the most biocompatible biomaterials that can be used in pulpotomies of deciduous teeth and temporary cementation and base with low cytotoxicity.⁽¹³⁾

CONCLUSION

MTA-based zinc oxide eugenol may serve as a safe alternative to FC for pulpotomies on cariously exposed primary molars.

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