**Original Article**

# Clinical and Radiographical Evaluation of Mineral Trioxide Aggregate and Formocresol as Pulpotomy Agent in Primary Molar Teeth.

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## Abstract:

***Aim:***

The aim of this study was to compare the effect of Mineral Trioxide Aggregate(MTA) to that of Formocresol (FC) as pulp medicaments in pulpotomised primary molars.

***Methodology:***

30 primary molars were treated by a conventional pulpotomy technique. The teeth were randomly divided into groups: MTA (experimental) and FC (control). Following removal of coronal pulp and haemostasis, the pulp stumps of 15 teeth were covered with an MTA paste. In the remaining 15 teeth FC was placed with a cotton pellet over the pulp stumps. The teeth of both groups were finally restored by Glass Ionomer Cement. Clinical and radiolographic outcome of the teeth were evaluation after 3-months and 6-months following treatment.

***Result:***

At 6 months following treatment, All MTA treated teeth were clinically and radiographically successful. However, one teeth in FC group had spontaneous pain but it was radiographically successful.

***Conclusion:***

Based on this clinical and radiographical evaluation it can be concluded that MTA could be used as a safe medicament for pulpotomy in cariously and mechanically exposed primary molars and could be a substitute for FC.

***Keywords:***

Formocresol , MTA, pain, pulpotomy

***Introduction:***

Tooth preparation often causes over cutting of sound healthy dentine, sometimes leading to pulp exposure and even inflammation. In primary teeth, especially, there is high chances of pulp exposure because the thickness of dentine is thin in these teeth in comparison to permanent teeth. When pulp is exposed, several vital pulp treatments such as direct pulp capping and pulpotomy have been suggested by many of the previous studies.[1,2,3] Although, in young permanent teeth, indirect and direct pulp capping techniques are an accepted procedure, but in primary teeth it is contraindicated because of possibility of undetected avascular microscopic pulp exposure.[1,2,4] Therefore, Pulpotomy have been suggested for carious or traumatic pulp exposure in primary teeth. [1,2,4,5,6,7] This technique consists of removing the coronal pulp and then

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healing the radicular pulp with a medicament. Medicament is also used to remove the bacterial infection1 [4 5 6 8] and to preserve the tooth vitality.[9] This method is also considered as effective in permanent teeth with open apices.10

A wide range of medicaments such as Formocresol, Glutaraldehyde, Ferric sulphate, Zinc oxide eugenol, Polycarboxylate cement and Calciumhydroxide have been used in pulpotomy.9 Mineral Trioxide Aggregate (MTA) has been introduced by Torabinjad in 1993. MTA of grey variety consists of Tricalcium Silicate, Tricalcium Aluminate, Tricalcium Oxide, Silicateoxide, Tetracalcium aluminoferrite and Bismuthoxide but in composition of white variety of MTA Tretracalcium aluminoferrite is not present. MTA has been used as a pulpotomy medicament in primary molars and it was found to be a successful material.[7 11 12] Although it was developed with the purpose of serving as an apical root end filling material, but it has also proven to be successful in vital pulp therapy procedures both in animals[13 14] and humans.4 Many clinical studies have recommended that, MTA is a biocompatible material and its sealing ability is better than that of amalgam or zinc oxide eugenol.[4 15] Futhermore, its ability to stimulate cytokine release from bone cells has been demonstrated which means that it can actively promotes hard tissues formation.[4]

Although the use of MTA has been extended to pulp capping and pulpotomy of primary teeth there are only few studies have been published regarding its clinical success. Therefore, in the present study, the clinical outcome of MTA in pulpotomy of primary teeth was compared with that of Formocresol at 3 and 6-months follow-up periods.

***Materials And Methods***

Twenty eight children (11 males and 17 females) of 5-7 years old were selected for clinical and radiographic study who came to Department of Conservative Dentistry and Endodontics. Only those patients having carious or mechanical exposure of pulp in their vital primary molar and Class-I cavity having 3-4 mm depth were used. All selected teeth were analysed by radiographs. A total 30 numbers of teeth were selected for the study after clinical and radiographical evaluation.

Local anesthesia was administered and isolation of teeth with rubber dam was done. Surrounding infected caries was removed by using No.#4 round bur in a high-speed handpiece with adequate coolants. Then, roof of pulp chamber was removed with No. #2 or #4 round bur running at high-speed hand piece. Coronal pulp from pulp chamber was removed by using sterile excavator until the orifices of canal was reached. Finally, the pulp chamber was rinsed with normal saline and the orifices were covered with a small cotton pellet soaked in normal saline with pressure until blood clots or control of bleeding.

In MTA Group, Pro-Root MTA (Dentsply, Maillefer) was mixed according to the manufacture's recommendations using plastic spatula, in ratio 3: 1. Then, smooth mix of MTA was obtained and then applied over the pulp and into the base of the cavity. Then, by using a sterile cotton pellet moisten with distilled water MTA was condensed properly over the chamber. After the setting of MTA, the rest of the cavity was restored with Fuji-IX Glass ionomer cement and applied a coat of Varnish then, bite was check up and again a coat of Varnish was applied over the Glass ionomer restoration. Then, Post operative radiograph was taken.

In Formocresol Group after controlling bleeding, small cotton ball pellets was soaked in 1/5 dilution of Formocresol and inserted over the orifices of the canals. Where pulpal haemorrhage was not arrested within 3-mins, the teeth were excluded, on the account that prolonged bleeding is a sign of irreversible pulpitis. The orifices and the rest of the pulp chamber was restored respectively with a reinforced 2-mm thick layer of Zinc oxide eugenol paste and Glassionomer (Fuji-IX) Cement and a coat of Varnish was applied over the Glassionomer retoration. Post-operative radiograph was taken and was recalled on next day.On the following appointment, the restoration was polished and again a layer of Varnish was applied.

***Assessment Criteria:***

After initial Clinical and Radiographic examinations, patients were re-called after 3 and

6 months for the assessment of clinical signs (Spontaneous pain, swelling, pain on palpation or percussion and sinus tract formation) or radiographical signs of failure ( root resorption, periodontal ligament widening and apical, lateral or furcal radiolucency).After completion of the procedure, data were collected and the statistical analysis were done using Fisher' exact test.

***Results:***

The results of clinical and radiographic assessments following 3 months and 6 months have been shown in table I and II. Clinical photographs of MTA pulpotomy evaluated as clinically acceptable case are presented in Fig. 1; A. Preoperative, B. Postoperative, C. at 3-months, D. at 6-months. Fig. 2. Shows FC pulpotomy case; A. Preoperative, B. Postoperative, C. at 3-months, D. at 6-months. Fig. 3 and 4 shows radiographic photographs of MTA and Formocresol pulpotomy respectively; A. Preoperative, B. Postoperative, C. 3-months Follow-up, D. 6-months Follow-up.

At 3-months following treatment, all MTA and Formocresol pulpotomy showed 100% success rate both in clinical and radiographic assessments. Neither pain nor postoperative swelling, tenderness or mobility has detected in any cases. In radiographic examinations, there was also no sign of radiolucent area. However, one patient in Formocresol group reported spontantaneous pain in molar tooth but when examined by radiograph, there was no sign of radiolucency in apical and furcal area. Except this case, the overall assessment of MTA and Formocresol treatments were successful; there was no postoperative swelling or tenderness, mobility, sinus formation. Radiographic examination also showed no radiolucency in any cases.

**Table I: Pain status of the study teeth during 6 months follow-up (n=30)**

| Pain | Group I (n=15) | | Group II (n=15) | | P Value |
|---|---|---|---|---|---|
| | n | % | n | % | |
| Present | 0 | 0.0 | 1 | 6.7 | |
| Absent | 15 | 100.0 | 14 | 93.3 | 0.500$^{NS}$ |
| **Total** | **15** | **100.0** | **15** | **100.0** | |

Group I= MTA

Group II= Formocresol

At six months interval, one teeth reported spontaneous pain in group II in molar tooth, which may be due to zinc oxide eugenol paste. The results are shown in the table IV.

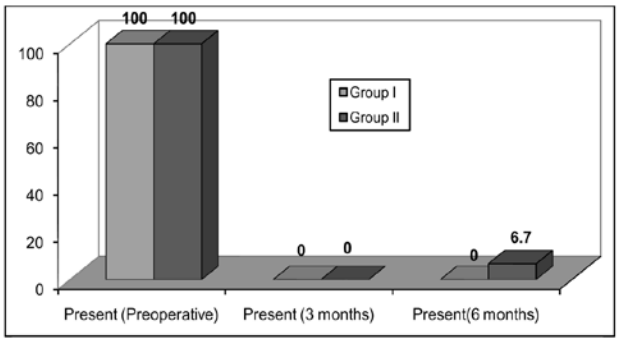



Figure 1: Bar diagram showing pain status of the study teeth during preoperative, 3 months and 6 months follow-up.

Table II: Clinical assessment of the two groups at

| Material | | Evaluation Periods | | |
|---|---|---|---|---|
| | | 3-months | 6-months | P Value |
| MTA | Success | 15(100) | 15(100) | - |
| | Failure | 0(0) | 0(0) | |
| | **Total** | **15(100)** | **15(100)** | |
| FC | Success | 15(100) | 14(93.3) | **0.500$^{NS}$** |
| | Failure | 0(0) | 1(6.7) | |
| | **Total** | **15(100)** | **15(100)** | |

Group I= MTA, Group II= Formocresol, S= significant, NS= not significant

Statistical analysis was done by fisher exact test

At three months interval both groups and at six months interval MTA group showed 100.0% success rate in clinical assessment where as at six months interval Formocresol group showed 93.3% success rate.

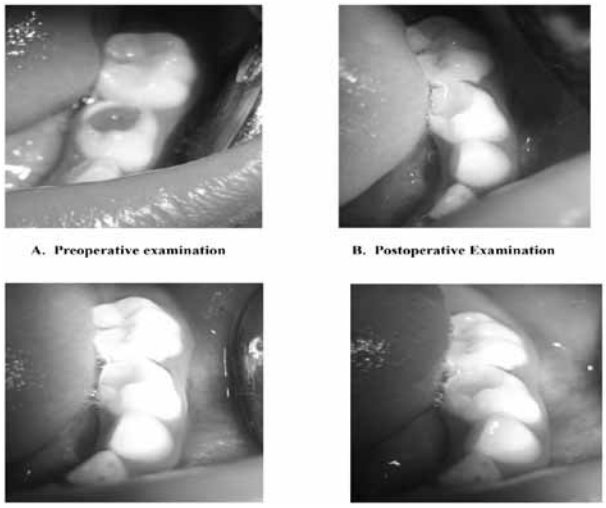
**Table III: Radiographic assessment of the two groups:**

| Material | | Evaluation Periods | |
|---|---|---|---|
| | | 3-months | 6-months |
| MTA | Success | 15(100) | 15(100) |
| | Failure | 0(0) | 0(0) |
| | **Total** | **15(100)** | **15(100)** |
| FC | Success | 15(100) | 15(100) |
| | Failure | 0(0) | 0(0) |
| | **Total** | **15(100)** | **15(100)** |

Three months and six months interval both groups showed 100.0% success rate in radiographic assessment.

**Figure-1.**

**Clinical pictures of MTA pulpotomy:**

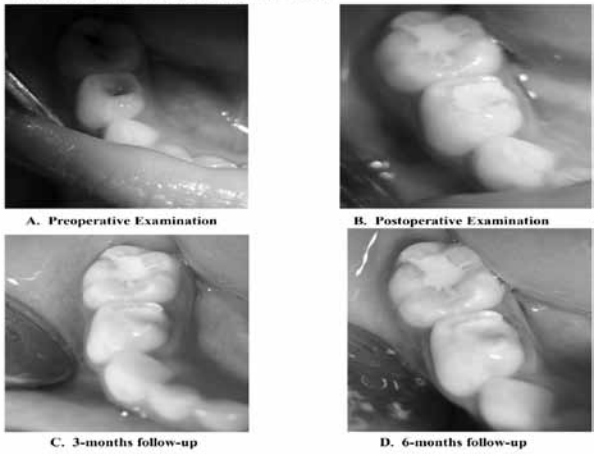


A. Preoperative examination B. Postoperative Examination

C. 3- months follow-up D. 6-months follow-up

**Figure-2.**

**Clinical pictures of formocresol pulpotomy:**

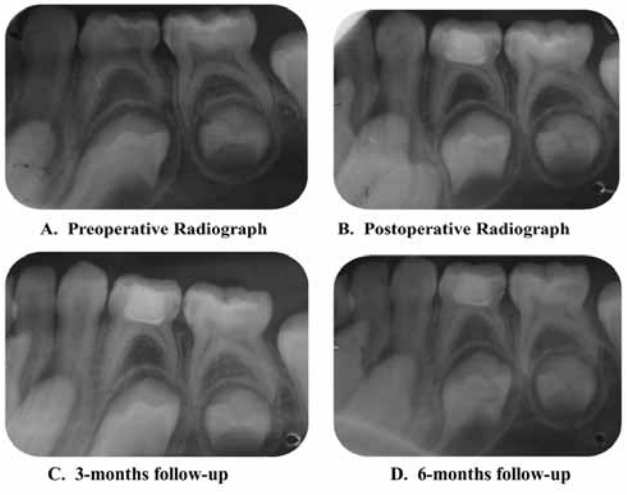


A. Preoperative Examination B. Postoperative Examination

C. 3-months follow-up D. 6-months follow-up

**Figure-3.**

**Radiolographical pictures of MTA pulpotomy:**

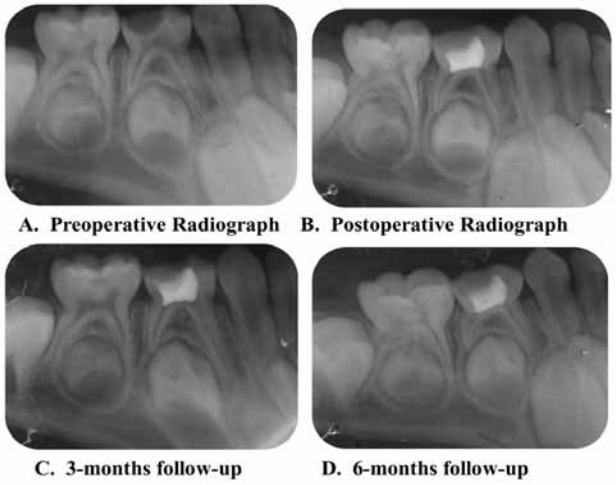


A. Preoperative Radiograph B. Postoperative Radiograph

C. 3-months follow-up D. 6-months follow-up

**Figure-4.**

**Radiographic Pictures of formocresol pulpotomy:**



A. Preoperative Radiograph B. Postoperative Radiograph

C. 3-months follow-up D. 6-months follow-up

## *Discussion:*

Previous studies have indicated that pulpotomy is effective for the treatment of carious or mechanical pulp exposure in primary teeth. [1, 2, 11] Due to its high success rate, it is an acceptable clinical technique for treating inflammation of coronal pulp. Treatment usually consists of removal of coronal pulp followed by application of medicament such as MTA, Formocersol, Calcium hydroxide, Ferric sulphate, Gultaraldehyde, and finally restoration. [11]

In the present study, 30 primary teeth were treated either by MTA or Formocresol and the clinical outcomes at 3 and 6-months intervals were examined. The assessment was performed according to clinical and radiographical evaluations. In clinical evaluation, pain, swelling,

tenderness, mobility, sinus was examined. On the other hand, radiographic examination was performed according to presence or absence of radiolucent area.

The result of the present study showed that regarding pulpotomy with MTA, all cases showed successful at 3 and 6-months following treatment. There was no postoperative pain or swelling throughout the follow up period. However, in Formocresol group, one patient reported spontaneous pain at 6-months. In this case pulpectomy was done. The exact reason of pain is not clearly understood. However, it may be due to direct contact of Zincoxide eugenol which was used as a base following formocresol treatment might irritant the pulp. Another cause may be due to internal resorption which is reported by Watts and Paterson, 1987.

During the last several years, many investigators assess the clinical outcomes of MTA and Formocresol in pulpotomy. Among them, Eidelman et al 2001 reported that, one case failed because of root resorption in the Formocresol group at 17 months follow-up, no failure was detected in MTA group following clinical and radiolographic evaluation. Aeinechchi et al 2007 reported that, no clinical failure in two groups at 3 months follow-up but radiographically one out of 57 cases in Formocresol group showed root resorption at 6-months 6 out of 57 cases of Formocresol group showed root resorption but in MTA group, no such features were observed.

Naik et al 2005 reported that both MTA and Formocresol groups did not revealed any clinical and radiographical findings at 3 and 6 months follow-up periods. Therefore, it can be said that the result of this study is same to the present study.

During manipulation of MTA we observed that the mix was messy when excess of moisture was present in the preparation which results in material becoming soupy and difficult to use. Similar observations have been also reported by Schwartz et al 1999 and Naik et al 2005. So, it is very important to follow the manufacturer's instructions as well as to follow some guidelines to prepare the site for MTA. All irrigation should be performed before material is placed because irrigation after placement will cause significant wash out of material. In contrast the placement of Formocresol as pulpotomy agent is very simple, neat and very economical.

There are reports that, in Formocresol procedure the cotton pellet sometimes adheres to the clot and bleeding reoccurs when pellet is removed. Such problems were encountered with Formocresol in some of cases of present study. However, this does not occurs with MTA which is directly applied over amputated pulp.

Present study is a primary investigation for assessment of clinical outcomes of MTA as it carried out in small samples and short periods because of inclusion criteria which includes Class-I caries and asymptomatic vital tooth which is less prevalence than Class-II caries and little awareness of patients for treatment of tooth before it becomes symptomatic.

Though clinically and radiographically the success rates of MTA in this study are quite promising, a histological evaluation of MTA and large samples with long period follow-up is necessary to reach sound conclusion. Clinical and radiological assessment of MTA showed almost same as that of Formocresol pulpotomy in primary molars after short term evaluation period and has a promising potential to become a replacement for Formocresol in primary teeth. Further, large sample with long period clinical evaluation of MTA as pulpotomy agent needs to be carried out.

**Conclusion:**

MTA has potential to serve a pulpotomy agent for primary teeth. Based on this Clinical and radiographic evaluation study of 3 months and 6 months follow-up MTA pulpotomy have comparatively similar success rate as Formocresol pulpotomy although further study is warranted.

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