Original Article

Success Rate of Formocresol Pulpotomy versus Mineral Trioxide Aggregate in Human Primary Molar Tooth

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ABSTRACT

Background: In spite of long time and broad use of formaldehyde derivates (Fixation agent) in primary tooth pulp treatment, There is some concerns about these derivates such as variability, inconsistency success rate, mutagenicity, cytotoxicity, alergenicity, and some other potential health hazards of them. Therefore other alternative pulpotomy procedures like Bioactive glass (BAG), Glutaraldehyde (2%), Hydroxyappetite (HA), Bone dried freezed (BDF), ferric sulfate (15%), laser, Electrosurgery (ES), Bone Morphogenic proteins (BMP), recombinant protein-1 (RP1), and Mineral Trioxide Aggregate (MTA) have been compared. The purpose of this clinical trial is to assess radiographic and clinical success rate of Formocresol (FC) pulpotomy in compare with MTA in human primary molar teeth.

Methods: 64 molars were pulpotomized equally and randomly with mineral trioxide Aggregate and Formocresol. Prior to trial, we defined a case as failure, when one or more of the events such as external root resorption, internal root resorption, periapical and furca lucency, pain, swelling, mobility, dental abscess, or early extraction appeared. Every treated tooth was defined as successful, if any noted evident was not shown.

Results: Totally, 60 teeth treatment (92.2 percent) were successful and 7.8 percent were failed. Failure and success rates for MTA group were 6.3 and 93.7 percent, respectively. Failure and success rates in FC group were 8.4 and 90.2 percent respectively. The difference between MTA and FC treatment methods was not significant (Fisher Exact test).

Conclusion: Findings of this study show that mineral trioxide aggregate can be an alternative procedure for FC pulpotomy of primary tooth.

Key words: Mineral trioxide aggregate, formocresol, pulpotomy, success and failure rate.

Pulpotomy, a therapeutic procedure, is used in reversible inflammation of pulp of primary and immature periapex permanent teeth, when the radicular pulp tissue has remained healthy and is capable to serve healthy for long term until normal exfoliation[1, 2, 3].

Pulpotomy is regarded as failed if one or more of following pathologic events such as pain, abnormal mobility, fistula, periapical and furca lucency, Internal root resorption, and external root resorption is observed[4, 5]. Formaldehyde derivates have been used as acceptable, high successful, and the most common capping material for the fixation of the pulp for many years[6, 7]. Success rate of pulpotomy with formocresol has been comprised with sulfate ferric[8, 9, 10, 21], electrosurgery[8, 11, 12, 13, 18], hydroxyappatite and bone freeze[14, 15], bioactive glass[16, 17], glutaraldehyde [18,19], bone morphogenic proteins[20], laser[21, 22], and mineral trioxide aggregate[23, 24]. Success rate of Formocresol pulpotomy has been between 70-97 percent in last decades[25, 26].

The major concerns cause seeking for alternatives for formaldehyde derivates are their potential mutagenicity, carcinogenicity, cytotoxicity, alergenicity and the other possible health hazards which have been attributed to them[1, 2, 23, 24]. The failures in primary teeth pulpotomy are attributed to (a) incorrect diagnosis of the extension of inflammation and contamination of the pulp, (b) irritative effects of

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mechanical amputation procedure and chemical effects of capping and dressing materials and type of pulp manipulations, (c) improper sealing properties of temporary and permanent restorations and coronally leakage, ingress of oral fluid and debris into remaining pulp[13, 23, 25].

The purpose of this study was to evaluate and compare the success rate of Formocresol pulpotomy with mineral trioxide aggregate in primary molar teeth.

Materials and Methods

The procedures, may cause discomfort and their benefits were explained fully to the parents of the participated children. The informed courtesy was obtained. Sixty-four primary molars of children aged 5-8 years old, attending to the undergraduate and graduate pediatric ward of school of dentistry of Isfahan were pulpotomized by Formocresol (FC) and Mineral trioxide aggregate (MTA). The selected teeth were evaluated by clinical assess and radiographic periapical X-ray examination to be suitable for pulpotomy. The selection criteria were (a) primary molar tooth with dental caries, (b) no any clinical or radiographic sign and symptom such as excessive bleeding from canal pulp, internal root resorption, interradicular and/ or periapical bone destruction, periodontium involvement, swelling, or sinus tract, (c) possibility of proper restoring of the tooth, and (d) child have not been had any systemic disorders.

Technique

Teeth were randomly assigned to each group by a toss of a coin. After this, each tooth was anesthesied, isolated, and excavated caries. Then cavity access to the pulp was obtained with a 330 carbide bur accompanying with water cool spray and then extirpate coronal pulp. Following the coronal pulp amputation with sharp spoon excavator and stasis, the orifice of the pulp was covered with Densply pro-root MTA paste (3: 1; powder and Normal saline) and in other teeth group, a moisten cotton pellet with DP Brazilian tricresoformalin (FC) was placed on orifices for 5 minutes. The pulp chamber in two groups filled with hard setting zonaline paste. Then all teeth restored with 3M stainless steel crowns. The 6 and 12-month follow-ups were arranged for examination of radiographic and clinical outcomes. Two pedodontist blindly interpreted clinical and radiographic findings. All data in follow-ups and patient name, type of tooth treatment, gender, and patient's age were recorded. The distribution and number of teeth and their treatments in order were 64 teeth; sixteen first primary molars and sixteen second primary molars were treated in MTA group and sixteen first primary molars and sixteen second primary molars were treated in FC group. Periapical X-Ray graphies of each treated tooth were taken in months 6 and 12 after treatment. Finally the data were collected and analyzed.

Results

64 teeth in MTA pulpotomy and FC pulpotomy groups were examined during follow up. Two of second primary molars in MTA group and three of them in FC group showed internal root resorption. After 6 and 12 months, 60 teeth with MTA pulpotomy and FC pulpotomy did not show any clinical or radiographic sign and symptom. Success rate in MTA group was 93.75 percent and in FC group was 90.6 percent after one year. Average success and failure rates in two groups were 92.8 and 7.8 percent. Average differences between success and failure rates of two treatment methods were not significant (Fisher exact test at level 5%) (table1).

Table 1. Cumulative Distribution of Successes and Failures in Formocresol and Methyl trioxide Aggregate Pulpotomy in Primary Molar teeth

	Month 6		Month 12	
	Success	**Failure**	**Success**	**Failure**
FC pulpotomy	29	3	29	3
MTA pulpotomy	31	1	30	1
Total	60	4	59	4

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Discussion

One year after treatment, the average success rate was 92.18 percent in FC and MTA groups. Findings of this study is coincide with Eidelman[26], Eliot, Gidon Holn et al[27], Nathanaal salako[28], and less conformity with Dean, Rolling[10], Burnet, Jabbarifar, et al[18],Fuks et al, and Tajic et al[8].

The most common failing sign in this study was internal root resorption, like Eidelman and Magnesson studies[29, 30]. One probable reason is attributed to the reversibile fixative effect of Formocresol, and irritative pH, chemical and physical effects of ZOE on connective pulp tissue. The greater success rate of MTA rather than FC pulpotomy in this study is attributed to biocompatibility, and sealing ability of MTA cement, compared to formocresol and ZOE as base.

An advantage of MTA paste over formocresol is the less time needed for procedures. One of the disadvantages of formocresol, compared to MTA paste is its bad smelling for patient and clinician. Previous investigations on ZOE alone, as a pulpotmy medicament have shown increased pulpitis and subsequent internal root resorption. However, a recent study has categorized internal root resorption successfully. Internal root resorption subsequent to pulp treatment occurres slowly. In this study internal root resorption appeared in initial $^1/_3$ of orifice in distal root of second primary mandible molar. Pulp canal obliteration has reported in MTA and FC pulpotomy studies[9, 27]. In this study, no calcify metamorphosis is observed in two groups. Several study have shown that MTA prevent leakage in orifice and periapex[28, 29]. MTA promotes regeneration of original pulp tissue[29]. In this study formocresol was selected, since it is still considered as the gold standard in primary tooth pulp treatment. Using proper restoration material, sound amputated pulp techniques, excavation of involved pulp tissue, and applied biocompatible dressing, are important issues in pulpotomy in primary dentition.

A reason for MTA experiment success is attributed to dentinal bridge formation in orifice entrance while normal and innocent pulpal tissue responses simultaneously[30].

Findings of this study show that MTA paste can be an appropriate alternative procedure in pulp therapy of primary teeth.

Authors suggest a clinical trial study of pulpotomy with MTA and formocresol with long time follow-up.

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