



Clinical and Periapical Radiographic Evaluation of TheraCal and Calcium Sulphate Versus Formocresol as Pulpotomy Agents in Primary Molars



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Abstract:

Aim: was to evaluate, clinically and radiographically, the effect of TheraCal, calcium sulphate and formocresol as pulpotomy medicaments in primary molars.

Methods: Sixty carious mandibular second primary molars of 60 children, indicated for vital pulpotomy were selected from Pediatric Dental Clinic, Faculty of Dentistry, Mansoura University. Profound local anesthesia, isolation by rubber dam was performed. Caries was completely removed, coronal pulp tissue was amputated using sharp spoon excavator, after blood clot establishment, pulp medicaments were applied over the pulp stump according to manufacture instructions. Teeth were classified into 3 equal groups according to the type of medicament; formocresol, TheraCal and calcium sulphate. Final restoration was performed with stainless steel crowns. Both clinical and radiographic evaluation were done for all teeth at 3, 6,9,12 months.

Results: After one year, from clinical and radiographic records, TheraCal group showed the higher success rate than calcium sulphate group followed by formocresol group. The clinical success rate was 88.9% for TheraCal, 81.2% calcium ferric sulphate, and 73.3% with formocresol. Radiological success rates in TheraCal, calcium sulphate, and formocresol groups were 88.9%, 87.5%, and 80%, respectively.

Conclusion: TheraCal and calcium sulphate are successful substitutes to formocresol as pulp medicaments for primary molars pulpotomy.

Keywords: Pulpotomy, TheraCal, calcium sulphate.

Introduction

Dental caries represents the greatest problem in pediatric dentistry. It is a multifactorial disease, resulting from the interplay between environmental, behavioral and genetic factors. It is a disease characterized by demineralization of dental hard tissues by organic acids produced by bacterial fermentation of dietary carbohydrates, especially sugars. Primary teeth have anatomical characteristics different from permanent teeth. Caries lesions in primary teeth progress more quickly and affects the pulp.^{1,2}

Pulpotomy is the complete removal of the coronal portion of the dental pulp followed by placement of a suitable medicament that will promote healing and preserve vitality of the tooth; it is a universally accepted treatment to retain primary teeth with pulp exposure due to caries.⁵

MATERIALS AND METHODS:

Sixty children at the age of four to seven years selected from Pediatric Dental Clinic, Faculty of Dentistry, Mansoura University. The study performed on carious mandibular second primary molar. The children were divided into three treatment groups; TheraCal, calcium sulphate and FC. (20 each)

Local anesthesia was given, isolation by rubber dam was done. Caries was completely removed, coronal pulp was amputated by sharp spoon excavator, then application of pulp medicaments on the amputated pulp according to manufacture instructions. TheraCal group: material was placed over pulp stump directly on the preparation then cured for 20 seconds with woodpecker light cure. Calcium sulphate group: powder was mixed with saline and placed

on the pulp. Formocresol group: A sterile foam pellet, first saturated with formocresol, later compressed twice between gauze to remove excess solution, was placed for five minutes on amputated pulp stumps. The amputated pulp was capped with creamy mix of zinc oxide Eugenol cement. For all groups, Glass ionomer was then stainless steel crowns, then immediate post-operative radiographs were done.

Evaluation: postoperative recall visits was carried out for all patients at three months, six months, nine months, twelvemonths. In each follow up both clinical and radiographic appearance were evaluated, based on the criteria of Coll and Sadrian.⁶

RESULTS:

Clinical results:

At the last observation period, there were 2 teeth (11.1%) treated with TheraCal had pain and the success rate was (88.9 %). Another 3 teeth (18.8%) in calcium sulphate group and 4 teeth (26.7%) in formocresol group showed pain.

As regarding gingival swelling or sinus tract: Calcium sulphate group recorded the higher success rate at this follow up observation period (93.7%). While in TheraCal group the success rate was (88.9%) and in formocresol the success rate was (93.3%).

Concerning abnormal mobility, the material that showed the higher success rate at this follow up period was calcium sulphate (100%). TheraCal recorded 94.4% success rate, while formocresol was 94.4 %. Statistically, no significant difference between three materials. **Table (1)**

Table (1): Clinical data among the studied groups at 12 month

Clinical	At 12 month				P-value
		TheraCal group(18)	Calcium sulphate group(16)	Formocresol group(15)	
Pain	Yes	2 (11.1%)	3 (18.8%)	4 (26.7%)	0.52
	No	16 (88.9%)	13 (81.2%)	11 (73.3%)	
Gingival swelling or sinus tract	Yes	2 (11.1%)	1 (6.3%)	1 (6.7%)	0.85
	No	16 (88.9%)	15 (93.7%)	14(93.3%)	
Mobility	Yes	1 (5.6%)	0 (0%)	1 (6.7%)	0.59
	No	17 (94.4%)	16 (100%)	14(93.3%)	

Radiographic results:

For internal root resorption: TheraCal group and calcium sulphate group recorded the same number of affected teeth with success rate of (88.9%) and (87.5%) respectively. While formocresol group showed no internal root resorption with (100 %) success.

For interradiolucency: Each group showed 2 affected teeth with success rate of (88.9%), (87.5%) and (86.7%) for TheraCal, calcium sulphate and formocresol respectively

For periapical radiolucency: TheraCal group recorded the higher success rate (88.9%), while calcium sulphate showed (87.5%) success rate and (80%) success rate for formocresol group. The comparison between groups at this follow up revealed no significant difference between them. Table (2)

Table (2): Radiographic results among the studied groups at 12 month

Radiographic	At 12 month				P-value
		TheraCal group	Calcium sulphate group	Formocresol group	
Internal root resorption	Yes	2 (11.1%)	2 (12.5%)	0 (0%)	0.37
	No	16 (88.9%)	14 (87.5%)	15 (100%)	
Interradiolucency	Yes	2 (11.1%)	2 (12.5%)	2 (13.3%)	0.98
	No	16 (88.9%)	14 (87.5%)	13 (86.7%)	
Periapical radiolucency	Yes	2 (11.1%)	2 (12.5%)	3(20%)	0.75
	No	16 (88.9%)	14 (87.5%)	12 (80%)	

DISCUSSION

Preservation of an intact primary dentition till the eruption of their permanent successors is the key for maintaining the arch form. In this study pulpotomy was performed to preserve the vitality of primary teeth that have suffered pulpal insult from dental caries. Consequently, aid in the prevention of aberrant tongue habits, prevent possible speech problems and maintain normal masticatory function.^{5,6}

The age group selected for this study was from four to seven years old to ensure sufficient amount of root length of the primary molars. Also, the caries is common in this age.^{7,8}

No published study has investigated the clinical performance of TheraCal and calcium sulfate as a pulpotomy agent in primary teeth. Therefore, this study, aimed to clinically and radiographically evaluate and compare the efficacy of TheraCal and calcium sulphate as pulp-dressing materials versus formocresol following pulpotomy in human primary molars.

In the present study, the formocresol cotton was not soaked with FC. This is in agreement with *Havale et al* (2013)⁹ who used the same concentration of FC. This is concentration used to decrease the cytotoxicity of formaldehyde, which is the most toxic constituent of formocresol.

In this study conventional glass ionomer cement was placed over the pulpotomy medication before permanent restoration to avoid bacterial leakage through the final restoration. Moreover, the final restoration was performed with stainless steel crowns to provide good seal as an additional protection against marginal microleakage.¹⁰

The study demonstrated the relative success of TheraCal, clinically and radiographically, as a pulpotomy agent in primary teeth, followed by calcium sulphate and formocresol. It was interesting to notice that TheraCal recorded the higher clinical success rate during the all month observation periods. It was 100% at 3, 6 months, while at 9, 12 months was 94.7%, 88.9% respectively.

The clinical success rates of calcium sulphate at 9, 12 month observation periods were 84.2% and 81.2% respectively. This is in agreement with *Ulusoy et al* (2014)¹¹, who reported 75% success when calcium sulphate used as direct pulp capping material.

The success rate of formocresol pulpotomy group in our study at 9 and 12 months, regarding the clinical results, was 73.3%, 78.9% and this is comparable to *Havale et al* (2013)⁹ as they reported success rate of 86.7% at 12 month. This results come in disagreement with *Ruby et al* (2012)¹², who reported 100 % success at 9 and 12 month follow up periods. In comparison to *Ruby et al*, The lower success rate of formocresol in this study may be attributed to the small number of cases encountered in this study.

The radiographical success rate in this study was reduced when compared to the clinical success rate in all groups. In most cases, the failure was detected radiographically while clinically no sign of failure were clear. The first sign of radiographic failure was internal resorption of the root adjacent to the pulpal medicament. This is come in agreement with *Havale et al* (2013)⁹ who reported the same conclusion.

The radiographical success rate was 88.9 % in TheraCal group. In calcium sulphate group the success rate was 87.5% comparable to *Ulusoy et al* (2014)¹¹, who reported 75% radiographical success. In the FC group, the radiographical success was 80% comparable to *Ansari and Ranjpour* (2010)¹³ who reported 85% radiographical success, this come in disagreement with *Havale et al* (2013)⁹ and *Thaliyath et al* (1996)¹⁴, they reported 56.6% and 67.75% success rate respectively, this may be due to they used thick mix of zinc oxide eugenol as final

restoration while in this study stainless steel crowns were used which provide better seal than ZoE.

Concerning the internal root resorption, in our study there were 3 teeth in TheraCal group, 4 teeth in calcium sulphate group and no internal resorption in FC group over the course of a 12 month follow up period. In this study, the possible explanation for that may be due to transformation of mesenchymal cells into odontoclastic cells in response to these medicaments.¹¹ The present study reported the internal root resorption as a failure, and the teeth exhibiting internal root resorption were extracted.

In the present study, the TheraCal group recorded least pathological Interradicular and periapical radiolucencies through the follow up periods. At 12 month, TheraCal group represented 2 teeth (11.1%) with interradicular and periapical radiolucencies. However, 2 teeth (12.5%) in the calcium sulphate group comparable to *Ulusoy et al* (2014)¹¹. While in formocresol group there were 2 teeth (13.3%) with interradicular radiolucency and 3 teeth (20%) comparable to *Badran et al* (2018)⁸. So, FC showed the highest failure concerning interradicular and periapical radiolucencies.

The interradicular and periapical failures in the formocresol group can be attributed to the smaller molecular size of formocresol, which may cause seepage into the apical region through the pulpal canals or into the furcation area via accessory canals or the pulpal floor, as it is thin, porous and permeable in nature, in primary molars.^{15,16} Also, in the current study, the formocresol was in contact with vital pulp tissue for 5 minutes. *Havale et al* (2013)⁹ reported, as suggested by previous study (*Berger JE, 1972*)¹⁷, that this period is too short to produce complete devitalization. This in turn may lead to half dead, half vital, and/or chronically inflamed pulp tissue. The resulting pulp can be susceptible to abscess formation.

The failure in TheraCal group could related to the acrylic monomers in the material that is cytopathic to pulpal cells. The manufacturer has recommended curing depth of about 1 mm, but complete curing of the material in pulpotomy is difficult to be achieved. The uncured monomers leach to the pulp and have cytopathic effect on pulpal cells.^{18,19} While the calcium sulphate failure may be due to its rapid resorption so leave tunnel for bacteria between restoration and the pulp.²⁰

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