



## IN VIVO COMPARISON OF TWO ROOT CANAL FILLING MATERIALS IN INFECTED DECIDUOUS TEETH

### Dental Science

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### ABSTRACT

**Study Design:** Prospective randomized controlled trial

**Aim:** The aim of the present study was to clinically and radiologically evaluate two root canal filling materials in infected deciduous teeth over a period of 6 months.

**Background data:** Pulp treatment in deciduous teeth is challenging due to the complex anatomy of the root canal system. The limitations in bio-mechanical preparation and root canal cleansing can be overcome by ideal root canal filling material.

**Materials and methods:** Twenty-two patients having 40 infected deciduous teeth in children between ages 3-8 years requiring pulpectomy were divided in two groups, group I (GI) and group II (GII) and filled with Zinc Oxide Eugenol (ZOE) paste and calcium hydroxide and iodoform (CHI) paste respectively. All the teeth were evaluated for clinical and radiological success at 6 months. The data obtained was tabulated and analyzed statistically.

**Results:** Clinical success rate of 90% and 95% while radiological success rate of 75% and 95% were recorded for GI and GII respectively. The overall success rate of 65% in GI and 90% in GII was recorded.

**Conclusion:** CHI paste showed a higher overall success rate than ZOE paste in infected deciduous teeth in single visit pulpectomies.

### KEYWORDS:

Infected, Pulpectomy, Calcium hydroxide with iodoform paste, Zinc oxide-Eugenol paste

### Introduction

Pulp therapy has been suggested as a method of maintaining pulpally compromised deciduous teeth in the dental arch until their normal physiological exfoliation.<sup>[1]</sup> The search for an ideal root canal filling material for deciduous teeth started long ago but no such material could be found yet satisfying the entire requirements to be an ideal root canal filling material. A deciduous tooth root canal material can be said ideal if it is bactericidal, harmless to developing permanent successors, resorbable at the same rate of root, easy to insert and remove, completely resorbed if pressed beyond the root apex, be radiopaque and causes no discoloration of teeth.

Zinc Oxide Eugenol (ZOE) has been widely used as root canal filling in primary teeth<sup>[2-6]</sup> for a long time but several disadvantages have been reported with its use. It is irritating to the peri-apical tissues and may produce necrosis of bone and cementum.<sup>[4]</sup> It can remain in the alveolar bone from months to even years and can cause a mild foreign body reaction.<sup>[3,7]</sup> It is not bactericidal unless mixed with drugs such as formacresol<sup>[5]</sup> and may deflect the path of succedaneous tooth.<sup>[6]</sup>

Garcia-Godoy emphasized the use of a resorbable iodoform paste instead of ZOE based on excellent clinical and radiographic findings<sup>[8]</sup> In his study, the extruded iodoform paste was resorbed within one to two weeks. Thomas AM et al<sup>[9]</sup> found iodoform paste a suitable root canal filling material for single visit treatment in chronic pulp infected deciduous teeth however Borer RF and Frank<sup>[10]</sup> noted yellowish brown discoloration in crowns of many maxillary teeth filled with iodoform paste. Carlos Nurko and Franklin Garcia Godoy used calcium hydroxide with iodoform (Vitapex) paste in primary teeth pulpectomies and reported high clinical and radiographic success rate. In his study, the extruded paste got resorbed from the periapical tissues in one week to two months depending upon the amount extruded, was apparently harmless to permanent tooth germs, was radiopaque, did not set to a hard mass, was easily inserted and removed if needed.<sup>[11]</sup>

The purpose of the present in vivo study was to clinically and radiologically compare and evaluate ZOE and calcium hydroxide with iodoform paste as root canal filling materials in infected deciduous teeth.

### Materials and methods

The present in vivo study was carried out on 22 Paediatric patients, between ages 3-8 years, having 40 pulpally involved deciduous teeth, visiting Outpatient Department of Paediatric and Preventive Dentistry, King George's Medical University, Lucknow. The patients were selected based on clinical signs and symptoms (gingival swelling, sinus tract, pain on percussion and spontaneous pain) as well as radiological findings (external root resorption, internal root resorption, bifurcation radiolucency and periapical radiolucency) recorded at the time of initial examination. These patients were selected irrespective of sex, socio-economical status; causative factors for pulp involvement and tooth type. Medically compromised patients, emotionally disturbed, highly apprehensive and uncooperative patients were excluded from the study. Parents and patients were informed about the procedure, recall visits and the prognosis for a successful outcome.

These 40 teeth were randomly divided into two groups, GI and GII, containing 20 teeth each. Local anesthesia was given to the patient and rubber dam was applied. Special care was excised to use rubber dam isolation and aseptic techniques throughout the procedure. All the carious lesions were excavated and access opening done using standard techniques. A working length radiograph was taken and working root canal length was determined. The pulp tissue was extirpated from pulp chamber using a sharp spoon excavator. Bio-mechanical preparation of teeth was done using standard techniques and as per recommendations of Garcia-Godoy that if the permanent tooth bud is below the apices of the primary tooth, the canals should be cleaned and filed for the entire length but if the permanent tooth bud is within the furcation area, instrumentation of the canals should be

limited to a level above the occlusal plane of the unerupted permanent tooth to avoid possible damages to the unerupted permanent tooth. Headstrom files were used for bio-mechanical preparation and simultaneous pulp removal from root canals. Copious intra-canal irrigation was done using 0.9% normal saline and 2.25% sodium hypochlorite. Root canals were dried using absorbent paper points following bio-mechanical preparation. The teeth were treated with ZOE paste in GI and Calcium hydroxide with iodoform paste in GII. These mixtures were carried to the root canals by hand lentulo spirals and pressed with cotton pellet for proper compaction of the pastes. The entire procedure was completed in a single visit. ZOE paste was prepared by mixing zinc oxide powder with eugenol. CHI paste was prepared by mixing calcium hydroxide powder with iodoform powder in a ratio of 1:1.5 in a glycerin base to a semi-solid consistency suitable for filling in root canals by hand lentulo spirals.

An immediate post-operative Intra Oral Peri Apical (IOPA) X-ray was recorded for each tooth and radiological findings were recorded. Posterior teeth were permanently restored with silver amalgam or miracle mix on subsequent visits. Severely decayed posterior teeth were restored with stainless steel crowns. Anterior teeth were restored with light cure composite and strip crowns. Follow up examination was done at six months. Clinical and radiological findings were recorded. The data obtained was subjected to statistical analysis (Chi Square test).

**Results**

A total of 22 patients having 40 pulpally involved teeth were examined for clinical and radiological findings. These teeth were randomly divided in two groups GI and GII and were treated with ZOE and calcium hydroxide-iodoform pastes respectively. Follow up clinical and radiological findings were recorded at 6 months. The majority of the patients presented with gingival swelling, pain on percussion and spontaneous pain at initial examination. These signs and symptoms were significantly reduced in both the groups at 6 months follow up examination (Table 1). None of the intergroup differences were statistically significant both at pre-operative and at 6 months intervals (p0.05) (Chi-square test)

	GI		GII	
	Pre-operative	At 6 months	Pre-operative	At 6 months
Gingival swelling	5	-*	4	-*
Sinus tract	3	-	4	-*
Pain on percussion	10	2*	9	1*
Spontaneous pain	11	-*	10	-*

\* Significant at p<0.05 as compared to pre-operative values (Chi-square test)

External root resorption, bifurcation and periapical radiolucencies present at immediate post-operative examination did not show any further progress in majority of teeth in both groups at 6 months follow up examination. In GI, the extruded paste was partially resorbed but in GII, the paste was resorbed completely. No statistically significant difference was found in between both the groups before and after the procedure (p0.05) (Table 2). Clinical success rates in GI and GII were found 90% and 95% respectively whereas radiological success rates of 75% in GI and 95% in GII were recorded. The overall success rate of 65% and 90% were recorded in GI and GII respectively.

	GI		GII	
	Pre-operative	6 months	Pre-operative	6 months
External root resorption	5	-*	3	-
Internal root resorption	1	-	2	-
Bifurcation radiolucency	7	1*	9	-*
Periapical radiolucency	9	1*	10	1*
Extruded filling material	3	3	4	0

\* Significant at p<0.05 as compared to pre-operative values (Chi-square test)

**Discussion**

The common primary tooth's root canal filling materials are ZOE, calcium hydroxide, iodoform or a combination of these. ZOE is the most economical of all the material used in primary teeth

pulpectomies. Camp stated that once the patient is free of all clinical signs and symptoms of infection, the canals can be filled with the ZOE paste.<sup>[13]</sup> Cullen stated that the material can be carried to the pulp chambers and canals by a lentulo spiral, placed in bulk and pushed into the canals with endodontic pluggers or pushed into the canals with a wet cotton pellet.<sup>[13]</sup> However several disadvantages have been reported with ZOE paste used in root canals of primary teeth. Erasquin and Muruzabal showed that ZOE paste is irritating to the periapical tissues and may produce necrosis of bone and cementum.<sup>[4]</sup> Also excess material forced through the apex during the filling procedure could remain in the apical tissues during the process of physiological root resorption and could take months or even years to resorb. With extruded ZOE pastes, disturbances to the succedaneous permanent teeth have been reported.<sup>[6,14]</sup> Barker and Lockett reported that the material; when extruded from the apex was not resorbed and caused a mild foreign body reaction.<sup>[5]</sup> Grossman studied the effect of the ZOE paste on microorganisms in the root canals of primary teeth and showed that ZOE pastes are not bactericidal unless mixed with drugs such as formacresol.<sup>[5]</sup> Kennedy DB reported that ZOE paste does not get resorbed from periapical tissues and may result in deflection of the succedaneous teeth because of its hardness.<sup>[6]</sup> Allen RK compared the difference between the resorption rate of ZOE paste and the tooth root.<sup>[2]</sup> The result showed that particles of ZOE paste may remain in the alveolar bone as the tooth root is resorbed by physiological resorption. Flaitz CM *et al* showed that ZOE paste does not get resorbed with the physiological resorption of the tooth root.<sup>[14]</sup> This may lead to the retention of the material after exfoliation of the primary tooth and can cause deflection of the path of eruption of the permanent successor. Coll JA and Sadrian R after a long follow-up found that the retention rate of ZOE paste after primary tooth pulpectomies was recorded to be higher.<sup>[15]</sup> They also stated that no pathology was associated with retained ZOE particles.

In the present study, the overall success rate of ZOE pulpectomies was found to be 65%. Two cases showed pain on percussion and one case each did not show any decrease in bifurcation and periapical radiolucencies at follow up examination. ZOE paste was extruded in the periapical area in three cases. Very little of this extruded material got resorbed and it was present in the periapical area even after 6 months. But the effect of this extruded material could not be seen on the permanent teeth because the permanent teeth had not erupted.

Calcium hydroxide has also been used frequently in primary teeth pulpectomies. Hermann showed that when placed in contact with pulp tissue, calcium hydroxide stimulates the formation of new dentin.<sup>[16]</sup> Calcium hydroxide produced favorable results as stated by Hendry who used calcium hydroxide to treat non vital primary teeth in dogs.<sup>[17]</sup> Ritta Rosendehl and Anne Weinert-Grodd advocated the use of calcium hydroxide as it produced favorable results.<sup>[18]</sup> Calcium hydroxide has shown good success rate but in some cases, it has been shown to resorb from the root canals earlier than the root of primary teeth during physiological resorption.<sup>[19]</sup> However, in terms of healing of peri-radicular radiolucencies, calcium hydroxide has shown an edge over ZOE because of its well proven antibacterial and osteo-inductive properties.

Iodoform is another common material used to fill the root canals of primary teeth. Iodoform is used either in pure form or is combined with other materials. Iodoform has produced good results both in pure form and when combined with other materials. Iodoform has good anti-bacterial properties and is resorbed rapidly if extruded beyond the root apex however in one study yellowish brown discoloration in crowns of many maxillary teeth filled with iodoform paste was reported.<sup>[10]</sup>

More recently the mixture of calcium hydroxide and iodoform is being used to fill root canals of primary teeth. Calcium hydroxide with iodoform mixture is also available in premixed syringes. A commercial product named Vitapex containing calcium hydroxide and iodoform is available pre-mixed in syringes. The main ingredients of Vitapex are iodoform 40.4%, calcium hydroxide 30.3% and silicone 22.4%. This mixture can be filled in the root canals using disposable tips delivered with the material. Several researchers reported excellent clinical and radiographic results with this combination.

Machida found calcium hydroxide with iodoform mixture (Vitapex) to resorb a little faster rate than the rate of root resorption.<sup>[20]</sup> He found the mixture to be easily applied, to have no toxic effects on permanent successors and radiopaque. Machida considered calcium hydroxide

with iodoform mixture to be a nearly ideal pulpal filling material for primary teeth. Carlos Nurko and Franklin Garcia Goday used calcium hydroxide/iodoform (Vitapex) paste in root canals of infected primary teeth.<sup>[11]</sup> They found excellent clinical and radiographs signs of success and no patient complained of pain or sensitivity after the treatment. The extruded paste got resorbed within a short period. The speed of the resorption of the excess paste forced through the apex during filling procedures depended on the amount of paste present. If a small amount of paste was extruded, it was resorbed within a few days and if a larger amount was extruded, it took few months to resorb. They found that the principal advantage of mixing iodoform with calcium hydroxide is that iodoform is bactericidal in root canals, resorb from the apical tissue, is apparently harmless to permanent tooth germs, is radiopaque, does not set to a hard mass and is easily inserted and removed.

Pre-mixed calcium hydroxide with iodoform paste delivered with long disposable tips produced excellent results in previous studies but it is quiet expensive. A fair amount of paste left in the tips, is wasted. This increases the overall expenditure of the treatment. In underdeveloped and developing countries, where dental treatment is not insured and not much awareness present about the importance of primary teeth due to various factors including the financial ones, it is justified to keep the treatment cost within the reach of most of the people. As dental caries is more commonly seen in children with low social economic status, the increased treatment cost may deprive them to have proper treatment and the consequences of untreated pulpal infections may be serious. The mixture of calcium hydroxide and iodoform powders mixed with glycerin in the present study is quite economical as compared with premixed syringes thus reducing the overall treatment cost. The results are also comparable with that obtained from the use of premixed syringes. In this study, the overall success rate of 90% was noted with the use of calcium hydroxide with iodoform paste. Only one case showed pain on percussion and one case did not show any decrease in periapical radiolucency at follow up examination. The paste, extruded beyond the apex in four cases showed almost complete resorption and was not seen in the radiograph taken at the time of follow up examination. The mixture was easily inserted in the canals by hand lentulo spirals.

In one study, it was shown that none of the succedaneous teeth in cases treated with iodoform pastes had enamel disturbances or other morphological defects.<sup>[21]</sup> In the present study, it was not possible to evaluate this aspect of calcium hydroxide with iodoform paste pulpectomy as the permanent teeth had not erupted.

Root canal instrumentation in infected primary molars or in molars with permanent successors within the furcation area should be performed with caution, as the resorptive process could have thinned the roots in the furcation area. These thinner roots could easily be perforated, if standard endodontic procedures are used to enlarge the canals. Garcia-Godoy recommended that in the case of primary molars, if the permanent tooth bud was within the furcation area, instrumentation of the canals be limited to a level above the occlusal plane of the unerupted permanent tooth.<sup>[8]</sup> If the permanent tooth buds are below the apices of the primary tooth, the canals should be cleansed and filed for the entire length. This technique may avoid possible damages to the unerupted permanent tooth, because instrumentation of the root canal is limited to a level above the occlusal plane of the unerupted permanent successors. In the present study this technique was followed and the Hedstrom files with a pullback direction were the only active instruments used.

## Conclusion

CHI paste showed a higher overall success rate when compared with ZOE paste. Moreover, CHI paste showed comparable results with commercially available paste used in the previous studies. Thus CHI paste made by mixing calcium hydroxide and iodoform powders with glycerin and carried to root canals with hand lentulo spirals can be used with a good success rate and low cost of treatment in infected deciduous teeth. Further studies with larger sample size and longer follow up are required to see the effect on permanent successors.

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