

Comparative Evaluation of Three Different an Obturating Materials in Pulpectomy; An *In Vivo* Study

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Abstract

Objectives: The aim of this study was to clinically evaluate, radiographically zinc oxide eugenol (ZOE) paste, metapex, and *Alo vera* gel with zinc oxide powder as root canal filling material in primary teeth. **Methodology:** In the present study, pulpectomies were performed on 51 primary second molar in 55 children, aged between 4 and 9 years, of these, 24 children were randomly divided into three groups of 17 teeth each selected for endodontic treatment. Obturation was done with a mixture of ZOE paste, metapex and *A. vera* gel with ZOE powder. Clinical, radiographic evaluation was done after 3 months, 6 months, and 12 months. Data were analyzed using Fisher's exact test and Cochran's Q-test, and the value of *P* was set at 0.05. **Results:** The three pastes achieved convergent clinical and radiographic success within the three observation periods (*P* > 0.05). ZOE paste was the slowest in its resorption. **Conclusion:** Zinc oxide powder with *A. vera* gel can be used as alternatives to ZOE and metapex.

Keywords: *Alo vera* gel, metapex, primary teeth, pulpectomy, zinc oxide eugenol

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INTRODUCTION

Pulp therapy for pulpally involved primary teeth continues to be a challenge to clinicians. The success of pulpectomy depends on accomplishment of all operative procedures following specific treatment guidelines and the choice for biocompatibility materials. It can also produce negative impacts on the child's oral health-related quality of life through pain, difficulty in mastication, and absentia from school.^[1]

An obturating root canal filling material for primary teeth should be antibacterial, resorbable at the same rate of the root, non-inflammatory and non-irritating to the underlying permanent tooth germs, and harmless to the periapical tissues and successive developing tooth buds, easy to insert, must adhere to walls, must not shrink, must readily resorb if passed beyond the apex, be easily removed when needed, be radio-opaque, and cause no discoloration of the tooth. At present, there is no such ideal material that meets all the requirements.^[2,3]

Conventionally, zinc oxide eugenol (ZOE) has been the material of choice for filling the root canals of deciduous teeth,^[4] and until 2008, it was the only material explicitly recommended in the

clinical guidelines development by the American Academy of Pediatric Dentistry (AAPD).^[5] In 2009, based on studies recently published, the AAPD Guidelines currently, there is a growing preference for using iodoform paste and Ca (OH)₂ (metapex and Vitapex)^[6,7] instead of ZOE paste^[8] probably because of its irritant to potential to periapical tissues and slow resorption.^[2]

Numerous *in vitro* studies have proved the efficacy of *Alo vera* as a good antibacterial agent against resistant microorganisms found in pulp space and its effective role in bone regeneration. Hence, *A. vera* has shown to be a promising obturate material in primary teeth.^[9-11]

However, there is a paucity of studies on *A. vera* and its prognosis as an obturating material. Hence, the purpose of this study was to evaluate the role of *A. vera* gel with zinc oxide powder as an alternative to other traditional obturating material by comparing it with ZOE and metapex in primary molars.

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Objectives

1. Clinical evaluation of the ZOE, zinc oxide powder with *A. vera* gel, and metapex in primary second molars as an obturating material in pulpectomy at different time intervals
2. Radiographic evaluation of the ZOE, zinc oxide powder with *A. vera* gel, and metapex as an obturating material in pulpectomy at different time intervals.

METHODOLOGY

The study design was approved by the Institutional Ethical Committee; the purpose of the study was explained to the parents and written informed consent was obtained from parents before start of the study. A total of 51 primary second molars with chronic infection were included from 50 child patients, aged between 4 and 9 years, who attended the pediatric dentistry department from March 2017 to May 2018.

Clinical characteristics, defined as spontaneous pain and the presence of a deep carious lesion with pulp exposure and bleeding that did not halt within five minutes following removal of the coronal pulp tissue. Gingival abscesses or fistula openings were absent or present. Abnormal mobility was requested. On radiographic evaluation, there were discontinuing in lamina dura, limited furcation, or apical radiolucency which were included in the study. The intake of antibiotics within 2 weeks before the treatment, presence of a fistula, extensive root resorption, inadequate bone support, or hypermobility, medically compromised children, and any history of drug allergy were exempted from the study. The selected samples were randomly assigned into the following three groups:

- Group 1 (17 teeth): The root canals of patients of this group were obturated with ZOE paste. (Vishal Dentocare Pvt., Ltd., Gujarat) (control group)
- Group 2 (17 teeth): The root canals of patients of this group were obtained with *A. vera* gel with zinc oxide powder (DPI, Mumbai, India, 0.2 g arsenic free) (experimental group)
- Group 3 (17 teeth): The root canals of patients in this group were obturated with metapex. (Meta Biomed/Korea), (experimental group).

Procedure

Baseline preoperative clinical and radiographical signs and symptoms were recorded. The teeth were anesthetized using 2% lignocaine with 1:80,000 adrenalin and isolated with a rubber dam. The preparation of zinc oxide powder and *A. vera* gel was mixed on a mixing pad with the help of stainless steel spatula and the mixing ratio of zinc oxide powder and *A. vera* gel was 1:2 [Figure 1].

Access opening was performed using round bur and both coronal pulp and radicular necrotic pulp were extirpated using barbed broaches [Figure 2]. Biomechanical preparation was done using K-files from size $\neq 10$ to $\neq 25$. The root canals were chemically cleaned with 5.25% sodium hypochlorite solution and distilled water and dried with paper points (size 25). Then, the filling paste was inserted in the root canals according to each group: ZOE and

A. vera gel with zinc oxide powder and metapex group with the help of pluggers and reamers. Radiographic confirmation was done. Then, access cavity was restored with Type 11 glass ionomer cement (GC Corporation, Tokyo, Japan) and further reinforced by placing stainless steel crowns (3M/USA). Patients were recorded after 3 months, 6 months, and 12 months [Figures 3-6].

Criteria for success

Further, these treated teeth were reevaluated both clinically and radiographically at 3rd, 6th, and 12th month intervals postoperatively. During reevaluation, the clinical success was based on the presence of normal mucosa without abnormal mobility, pain, or sensitivity to percussion. Radiographic success was associated with a decrease in the size of radiolucency and the presence of bone regeneration. If the radiolucency remained stable without remarkable changes, the treatment was classified as suspected and required further observation.

Treatment failure was classified into two degrees as (a) the radiolucency slightly increased in size, but it was separated from succeeding bud with adequate bone and (b) the radiolucency threatening the succeeding buds, so the tooth was extracted.^[12]

The treated molars were evaluated double blindly by three observers, and the result was determined by an agreement of at least two observers.

Statistical analysis

Statistical analysis of the results for the clinical and radiographic evaluation between the three groups was analyzed using Fisher's exact test and Cochran's Q-test using Microsoft Excel software (SPSS-17.0, SPSS Inc., Chicago, IL, USA). A $P < 0.05$ was considered statically significant.

RESULTS

Comparison of clinical outcome with three materials

Table 1 and Graph 1 represent the comparison of clinical outcome with three materials; at the end of 12 months, ZOE and metapex showed 100% clinical success. There were no significant differences between the groups ($P = 1.00$).

Comparison of radiological outcome with three materials

Table 2 and Graph 2 represent the comparison of radiological outcomes with three materials. At the end of 12 months, ZOE, *A. vera*, and metapex showed 75%, 50%, and 68.75%, respectively, radiographic success. The differences between the groups were not statistically significant ($P = 0.306$).

Table 1: Comparison of clinical results with the three materials

	Success	Failure	Total	Chi-square test (P)
ZOE	16 (100)	0 (0)	16 (100)	1.00
<i>Alo vera</i>	15 (93.75)	1 (6.25)	16 (100)	
Metapex	16 (100)	0 (0)	16 (100)	
Total	47 (97.92)	1 (2.08)	48 (100)	

ZOE: Zinc oxide eugenol



Figure 1: Mixing of ZnOE and *Alo vera* gel

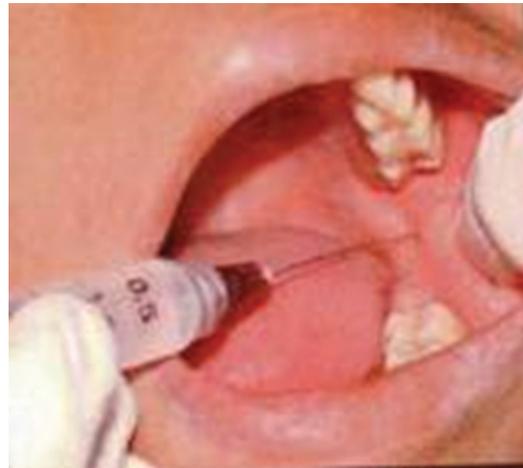


Figure 2: Local anesthesia



Figure 3: Radiological evaluation of ZnOE group after 3, 6, and 12 months



Figure 4: Radiological failures seen in ZnOE group



Figure 5: Radiological evaluation of *Alo vera* and ZnOE group

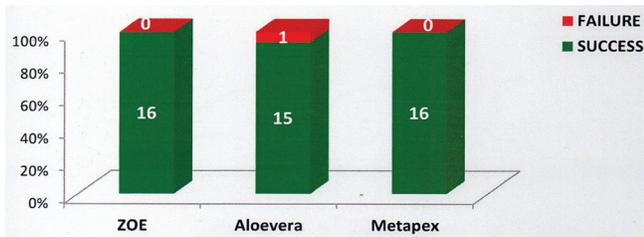
Comparison of resorption of the filling pastes compared with root resorption

Table 3 represents that *A. vera* gel with zinc oxide powder was corresponding with root resorption in 43.8% of the cases and

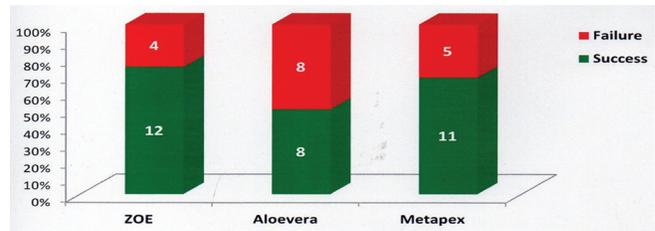


Figure 6: Radiological failure seen in *Alo vera* and ZnOE group

faster than root resorption in 56.3%. Hence, ZOE resorption was most appropriate for comparing with the other pastes in this study.



Graph 1: Comparison of clinical outcome with the three materials



Graph 2: Comparison of radiographic outcome with the three materials

Table 2: Comparison of radiographic out come with the three materials

	Success	Failure	Total	Chi-square test (P)
ZOE	12 (75)	4 (25)	16 (100)	0.306
<i>Alo vera</i>	8 (50)	8 (50)	16 (100)	
Metapex	11 (68.75)	5 (31.25)	16 (100)	
Total	31 (64.58)	17 (35.42)	48 (100)	

ZOE: Zinc oxide eugenol

Table 3: Resorption of the filling pastes compared with root resorption

Filling resorption	Filling paste		
	ZOE (%)	Aloveragel (%)	Metapex (%)
Slower than root	5 (31.3%)	0 (0%)	0 (0%)
Correspondent with root	10 (62.5%)	7 (43.8%)	7 (43.8%)
Earlier than root	1 (6.3%)	9 (56.3%)	9 (56.3%)
Total	16 (100)	16 (100)	16 (100)

DISCUSSION

The present study showed high clinical success, and there was no statistically significant difference between the three groups, which was similar to various studies done by Ozalp *et al.*^[13] Subramaniam and Endoflas^[14] Nurko and Godoy^[15] and Mortzavi and Mesbahi and Khairwa *et al.*^[16]

Across all studies, the clinical success rates were as follows: 70%–100% for Ca (OH)₂/iodoform, 77%–100% for ZOE, 57%–100% for ZOE/iodoform, and 88%–100% for ZOE/iodoform/Ca(OH)₂.

The radiographic success rates were 61%–100% for Ca (OH)₂/iodoform, 75%–100% for ZOE, 79%–100% for ZOE/iodoform, and 81%–100% for ZOE/iodoform with Ca(OH)₂.

The results of the present study show that ZOE was the most effective obturating material both clinically and radiographically; metapex, though is easier to dispense into the root canal, had least success rate with no clinical and five radiographic failures. Although ZOE success rate is very high, various disadvantages like cytogenecity, mutagenecity, soft-tissue irritation, and deflection of succedaneous teeth in overfilled teeth should be kept in mind.

Root canal filling material of primary teeth should be resorbed at an identical rate, or as similarly as possible, to that of physiological root resorption. This study used ZOE paste, Metapex and Alovera gel with Zinc oxide powder. Our results indicated that Alovera gel with Zinc oxide powder was substituted for Eugenol and reported that good clinical and radiographic success rates. Hence, these materials can be used as alternatives to ZOE paste, Metapex.

Barcelos *et al.* in their systematic review showed that ZOE pulpectomies success rate varied from 85% to 100%.^[8] Bahrololoomi and Zamaninejad showed that a two-visit pulpectomy in 76 primary molars with ZOE had an overall success rate of 93.4% in a follow-up study ranging from 6 to 59 months.^[17] Interestingly in the present study, clinical and radiographic success of ZOE was highest at 100%.

The high percentage of success for ZOE was independent of variables such as age of the patient, resorption stage of the root, and type of molar as more than two-third of ZOE pulpectomies were done in the higher age group of 4–9 years and in teeth with considerable amount of root resorption.

In 2009, the AAPD Guidelines cited iodoform-based pastes as suitable alternatives to ZOE.^[18] Metapex is a combination of 30.3% calcium hydroxide, 40.4% iodoform, and 22.4% silicone oil. The mixture can be dispensed into the root canals using disposable tips. The silicone oil content of metapex neutralizes the alkalinity of the paste to a certain extent, thereby causing lesser injury to the periapical tissues.^[19] Machida (1983) cited in Gupta and Das considered calcium hydroxide-iodoform mixture (metapex) to be an ideal pulpal filling material for primary teeth but reported that it resorbs a little faster than the rate of normal physiologic root resorption.^[12] Gupta and Das *et al.* showed overall success rates of 85.71% and 90.48% for ZOE and metapex pulpectomies, respectively, in children aged 4–7 years of age over a 6-month follow-up.^[12]

In the present study, metapex showed 100% clinical success and 68.75% radiographic success and the overall success was 92.1%. In the present study, no clinical failures (mobility) and five radiographic failures (internal resorption) were reported with metapex at the end of the study. Only 12 teeth of the total 17 belonged to the age group of 4–9 years and only 6 teeth showed one-third of root resorption in the metapex obturated group. The clinical success declined from 100% at 3 months to 89.4% at 6 months which was statistically significant ($P = 0.008$).

Similarly, the radiographic success declined from 100% at 3 months to 78.9% at 6 months which is highly statistically significant ($P < 0.001$).

Extrusion of the material was observed in six teeth obturated with metapex. Although it was beyond the scope of the study, it was observed that metapex resorbed both intra-radicularly and also when it extruded beyond the apex.

Limitations

However, further longitudinal study involving a larger sample size and longer follow-up period ranging from 12 to 18 months is necessary to confirm the clinical, radiological, and histological success of the three obturating materials until their eventual exfoliation.

CONCLUSION

Zinc oxide powder with *A. vera* gel can be used as alternatives to ZOE and metapex. ZOE and metapex can be recommended in daily practice as they have better antimicrobial property and resorption of only extruded materials.

Hence, based on the observations from the present study, this knowledge can be applied to our daily clinical practice and more randomized clinical trials should be conducted in the field of observation materials.

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Conflicts of interest

There are no conflicts of interest.

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