



## **NEW PULPECTOMY MATERIALS IN PAEDIATRIC DENTISTRY AND ITS SUCCESS - A REVIEW**

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### **Abstract:**

**Aim:** The aim of this systematic review is to determine the success rate of newer pulpectomy materials for deciduous teeth.

**Materials and Method:** Systematic review of dental literature. Searches of PubMed database were performed using various combinations like "pulpectomy", "Primary teeth", "zinc oxide eugenol", "root canal filling", "calcium hydroxide", "iodoform", "endodontic treatment", "deciduous teeth", "necrosis", "pulp therapy". 800 articles were found and eventually 7 articles were selected.

**Result:** In the Clinical trials of the 7 main articles, 376 teeth were treated of children aged 2 years 6 months to 9 years and followed up from 3-24 months. We found that 2 articles showed a higher success rate for METAPLEX when compared to ZOE, while in one study we found a similar success rate between the two materials. ENDOFLAS showed 100% success rate when compared to ZOE. ZOE when compared to Calen showed a higher success rate.

**Conclusion:** There seems to be a moderate level of evidence to support the use of both ZOE and iodoform paste with calcium hydroxide as root canal filling materials for deciduous teeth. High quality clinical trials with at least 12 months of follow up are necessary before a reliable conclusion can be drawn as to the best root canal filling material for endodontically treated deciduous teeth.

### **Introduction:**

Pulp therapy for deciduous teeth is directed to preserve the patient's health and to maintain the deciduous teeth where pulp tissue is affected by caries, dental trauma, or other causes in a functional state until they are replaced by the permanent teeth [1]. When the pulp has become irreversibly infected or necrotic, a root canal treatment is indicated in the case of permanent tooth [2, 3]. However, the complex morphology of the root canal system in deciduous teeth makes it difficult to achieve proper cleansing by mechanical instrumentation and irrigation of the canals [4]. So, in order to increase the chance of success of the endodontic treatment, which is either pulpotomy or pulpectomy, substances with antimicrobial properties are frequently used as root canal filling materials in deciduous teeth. Pulpectomy is a conservative treatment approach to prevent the premature loss of primary teeth that can result in loss of arch length, insufficient space for erupting permanent teeth, impaction of premolars, and mesial tipping of molar teeth adjacent to the lost primary molar.[5] In addition, pulpectomy is advantageous for retained primary molar teeth. [6] A major requirement for the success of pulpectomy is that the root canal material should resorb at the same rate as the physiologic resorption of the roots; the other factors are that the root canal material should be radiopaque, nontoxic to the periapical tissue and tooth germ, should not coagulate any organic remnants in the canal, should be easy to insert and remove, and non-shrinkable and also not discolour the tooth, also it should have disinfectant properties. [7, 8] Zinc oxide eugenol is one of the most used root canal filling in case of primary teeth. Nevertheless, ZOE cannot be considered as the ideal root canal filling material because it not only presents limited antimicrobial action [9] but also tends to resorb at a slower rate than the deciduous teeth [9,10]. Concerns about these shortcomings of ZOE led to a search for alternative root canal filling materials for deciduous teeth (e.g., pastes containing iodoform, calcium hydroxide, or both). While calcium hydroxide is considered to have some antimicrobial action and undergoes resorption easily.[11]The credit for the antimicrobial action of calcium hydroxide is associated to its ionic dissociation into Ca<sup>2+</sup> and OH<sup>-</sup> ions. For dissociation to occur the vehicle used in formulation of the paste plays a fundamental role. [12] Iodoform pastes have better resorbability and disinfectant properties [1, 9] than ZOE, but they may produce a yellowish-brown discoloration of the tooth crowns which may compromise esthetics [1]. Different formulations of root canal filling materials containing iodoform are now available. Therefore the aim of this research was to find newer and successful pulpectomy materials for paediatric dentistry.

**Materials and Method:** Systematic review of dental literature.

**Inclusion Criteria:** To be included in the present review, an article had to meet the following criteria.

- ✓ Participants: children of any age;

- ✓ Type of intervention: pulpectomy in deciduous teeth,
- ✓ Outcome measure: clinical and/or radiographic success rate at the end of the followup period,
- ✓ Language: English.

**Exclusion Criteria:** Articles that tested filling materials for Pulpotomy were excluded.

**Search Strategy:** Searches of PubMed database were performed using various combinations like “pulpectomy”, “Primary teeth”, “zinc oxide eugenol”, “root canal filling”, “calcium hydroxide”, “iodoform”, “endodontic treatment”, “deciduous teeth”, “necrosis”, “pulp therapy”. 800 articles were found and eventually 7 articles were selected.

**Result:**

In the Clinical trials of the 7 main articles, 376 teeth were treated of children aged 2 years 6 months to 9 years and followed up from 3-24 months.

REFERENCE	FILLING MATERIAL	SAMPLE	FOLLOW UP	SUCCESS RATE	P VALUE
Chawla et al., (2008)	zinc oxide with calcium hydroxide and sodium fluoride	25 mandibular molars (7- 1st primary molar, 18-2nd primary molars), 25 children, aged 4-9 yrs.	24 months (3-24)	80%	not reported
Ramar and Mungara (2010)	Calcium hydroxide with iodoform- METAPEX Zinc oxide Eugenol with Iodoform- RC FILL Zinc oxide Eugenol with Calcium hydroxide- ENDOFLAS	96 mandibular molars, 77 children, aged 4-7 yrs.	9 months (3,6)	METAPEX- 90.5% RC FILL- 84.7% ENDOFLAS- 95.1%	p=0.09
Nivedita et al., (2014)	Zinc Oxide Eugenol Zinc oxide Eugenol with Calcium hydroxide- ENDOFLAS	50 molars, aged 4-9 yrs.	9 months (3,6)	Zinc Oxide Eugenol- 83% ENDOFLAS-100%	p<0.05
Gupta and Das (2011)	Zinc oxide Eugenol Calcium hydroxide with iodoform-METAPLEX	42 molars, 34 children, aged 4-7 yrs.	3 and 6 months	Zinc oxide Eugenol-85.71% METAPLEX- 90.48%	not reported
Daniel Nunes Pinto et al., (2011)	Zinc oxide eugenol Calcium hydroxide and polyethylene glycol-based paste (Calen®) thickened with zinc oxide	31 molars, 26 children, aged 2 years and 6 months to 5 years and 10 months	18 months	Zinc oxide Eugenol- 93.3 Calen®- 87.5	p>0.05
Holan and Fuks (1993)	Zinc oxide eugenol Iodoform containing paste - KRI	78 molars.	12 months	Zinc oxide eugenol- 65% KRI- 84%	not reported
Trairatvorakul and Chunlasikaiwan (2008)	Zinc oxide eugenol Vitaapex	54 teeth (12 1st left lower molars, 10 1st right lower molars, 13 2nd left lower molars, and 19 2nd right lower molars) 42 children 3-7 years	12 months	Zinc oxide eugenol- 85% Vitaapex- 89%	not reported

Table 1: Results of the clinical trails of the articles included

Each study compared different filling materials. Study by Chawla et al.,[13] showed a combination of Zinc oxide with calcium hydroxide and sodium fluoride; Ramar and Mungara [14] showed comparison between METAPEX, RC FILL, ENDOFLAS; Nivedita et al.,[15] showed comparison between ZOE and ENDOFLAS; Gupta and Das[16] showed a comparison between ZOE and METAPEX; Daniella et al.,[17] showed comparison between ZOE and Calen®; Holan and Fuks [8] compared ZOE with KRI and Triairtvorakul and Chunlasikaiwan [18] compared ZOE with METAPEX. [Table 1]

CLINICAL PROCEDURE	Chawla et al.,	Ramar and Mungara	Nivedita et al.,	Gupta and Das	Daniel Nunes Pinto et al.,	Holan and Fuks	Trairatvorakul and Chunlasikaiwan
NUMBER OF APPOINTMENT	One	One or more. Uncooperative children received a two-sitting procedure.	One	One	One	One	One
ROOT CANAL IRRIGATION	2.5% sodium hypochlorite	2.25% sodium hypochlorite solution (1.5 ml) and 0.12% chlorhexidine gluconate (1.5 ml)	2.5% sodium hypochlorite alternatively with saline.	2.5% sodium hypochlorite alternatively with saline.	2.5% sodium hypochlorite.	Saline	2.5% sodium hypochlorite.
INSTRUMENTATION	H-files (30-35 size)	H-files(30-35 size)	H-files till 35 size	H-files (21-30)	H- files (21-30)	H-files (30-35 sizes)	K files
RESTORATION	Stainless steel crowns	Stainless steel crowns	Stainless steel crowns	Silver amalgam or Glass Inomer Cement or Stainless steel crowns.	Glass Inomer Cement or Stainless steel crown	Stainless steel crowns	Stainless steel crowns

Table 2: Characteristics of the techniques for deciduous tooth pulp therapy used in the studies included in this review

### **Discussion:**

The lack of treatment of a deciduous tooth with irreversible pulpitis or pulpal necrosis can cause damage to the underlying permanent tooth and thereby produce negative impacts on the child's oral health. Therefore, teeth presenting these conditions should be extracted or subjected to root canal treatment [4]. Various techniques for the endodontic treatment of deciduous teeth have been described [19]. Traditionally, ZOE had been the material of choice for filling the root canals of deciduous teeth [20], and until 2008 it was the only material explicitly recommended in the clinical guidelines developed by the American Academy of Paediatric Dentistry (AAPD) [2]. In 2009, the AAPD guidelines began to cite iodoform based pastes as suitable alternatives to ZOE [3]. This may be due to concerns about the possible detrimental effects of residual ZOE filler particles on the underlying permanent teeth [21]. All the trials included only deciduous molars and all the trials reported similar inclusion and exclusion criteria, number of appointments but used different treatment techniques, especially in relation to the type of root canal irrigating solution, instrumentation and restorative material used. [Table 2] None of the reviewed articles reported how sample size was calculated. Study findings were assessed in terms of their statistical significance, and only 1 article [14] provided the actual P value. All the clinical trials were considered successful clinically if there was absence of pain, tenderness on percussion, pathology, and absence or decrease in the mobility. The cases were considered successful radiographically, when the radiolucency demonstrated signs of resolution, or arrest. In all clinical trials the success rates were equal to or above 65%. [Table 1]

To overcome the draw backs of calcium hydroxide (faster rate of resorption from within the canals) and ZnOE (slow rate of resorption), Chawla et al. [12] used a mixture of calcium hydroxide and zinc oxide as a root canal filling material, but this material also got depleted from the canals earlier as compared to the physiologic root resorption. In a study by Chawla et al., [13] study, a mixture of calcium hydroxide, zinc oxide powder, and sodium fluoride (10%) was used, combining the advantages of both calcium hydroxide and zinc oxide. In the study by Ramar and Mungara [14] they compared the three materials, for its clinical and radiographic properties, METAPEX - Calcium Hydroxide with Iodoform had the highest success rate and can be recommended as a root canal filling material when the tooth to be treated is free of any abscess or chronic infections. In the study by Daniella et al., [17] after eighteen months of treatment, the teeth obturated with ZOE and Calen®/ZO presented statistically similar success rates. Study by Nivedita et al., [16] reported high clinical as well as radiographic success of ENDOFLAS over zinc oxide eugenol. One study by Triairvorakul and Chunlasikaiwan [18] found significant statistical differences between the frequency of radiographic success in the test and control groups, at the 6-month followup, but by 12 months this difference had disappeared. However, in all of the studies, sample sizes were small and this may have resulted in a very low power to detect clinically meaningful treatment effects.

### **Conclusion:**

There seems to be a moderate level of evidence to support the use of both ZOE and iodoform paste with calcium hydroxide as root canal filling materials for deciduous teeth. High-quality clinical trials with at least 12 months of follow up are necessary before a reliable conclusion can be drawn as to the best root canal filling material for endodontically treated deciduous teeth.

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