



Obturation Techniques in Primary Teeth using Endoflas as Obturation Material – A Systematic Review

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ABSTRACT

A pulpectomy is the treatment of choice for pulpally involved primary teeth. Pulp therapy prevents the premature loss of primary teeth which could result in loss of arch length, an altered pathway of the eruption of primary teeth, development of aberrant habits. It also restores the dentition to a functional state. Endoflas is a newer obturation material which has a proven clinical success rate. There are various obturation techniques available in the literature. The systematic review aimed to extract and systematically identify the existing literature, which compares different obturation techniques used in the root canal treatment of primary teeth using endoflas as obturation material. The search was done using the MeSH terms and keyword search in the electronic databases, including PubMed, Cochrane, LILAC, Sigle, Science Direct and Google scholar. A total of 13 articles were chosen after the initial screening of the title. Then based on the inclusion and exclusion criteria and the availability of the full texts, a total of 3 articles were included. This systematic review concludes that there is a need to update the existing literature to find out the best ideal obturation technique which can provide void-free and ideal obturation of the root canal of the primary teeth using Endoflas.



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INTRODUCTION

Dental caries, a most common infectious disease, affects the oral health of humans despite numerous advances in the field of preventive dentistry (Law *et al.*, 2007). Primary teeth are usually more prone to dental caries. This could be due to variations in the morphological characteristics and improper oral

hygiene practices which lead to early involvement of the pulp (Mahajan and Bansal, 2015). Primary teeth are essential not only for the normal development of jawbone and musculature but also for the guidance of eruption of succedaneous permanent teeth and phonation, mastication and esthetics. Early and premature loss of primary teeth can lead to alteration in the eruption pathway of permanent teeth, development of aberrant habits, altered phonation, etc. Hence, endodontic treatment and preservation of primary teeth are essential (Pinky *et al.*, 2011; Takushige *et al.*, 2004). A pulpectomy is considered to be the choice of treatment for the tooth in which the pulp tissue is irreversibly affected (Moskovitz *et al.*, 2005). According to AAPD guidelines, the steps in pulpectomy should include debridement, shaping of the canals with hand and/or rotary files, irrigation with irritants like sodium hypochlorite and/or chlorhexidine, drying of the canals and obturation/filling of the canals with a resorbable material. Finally, a coronal restoration is given to seal

the tooth from microleakage ([American Academy of Pediatric Dentistry Clinical Affairs Committee–Pulp Therapy Subcommittee, & American Academy of Pediatric Dentistry Council on Clinical Affairs, 2005](#)). Thorough aseptic preparation and hermetic seal of the root canal system is essential for the clinical success of the pulpectomy ([Rodd *et al.*, 2006](#)). This is achieved by thorough chemo-mechanical preparation and obturation with an ideal obturating material with minimal voids in the root canal system. The success is also influenced by appropriate case selection, mixing of the obturation material and usage of proper technique for obturation ([Mahajan and Bansal, 2015](#); [Nagar *et al.*, 2011](#)).

The prime objectives of the root canal fillings are to adapt and fill the root canal obturation material to the entire length of the root canal without extrusion of the material and to avoid the creation of voids ([Sari and Okte, 2008](#)). The three-dimensional fluid-tight seal of the root canal system hinders the microleakage and cuts off the nutrient supply to any surviving microorganism.

The 3D seal is also necessary to prevent recurrence of infection ([Nagaveni *et al.*, 2017](#); [Singh *et al.*, 2017](#)). To achieve good obturation, various obturation techniques have been proposed ([Gandhi *et al.*, 2017](#); [Mahajan and Bansal, 2015](#); [Memarpour *et al.*, 2013](#)).

Different authors have compared different obturation techniques, and the outcome of their studies vary with each other, and there is no standard gold technique for the obturation of primary teeth. Hence, the main aim of this systematic review is to find out the best obturation technique among the various obturation techniques that are being used ([Nagar *et al.*, 2011](#); [Nagaveni *et al.*, 2017](#); [Singh *et al.*, 2017](#)).

MATERIALS AND METHODS

This review was done under the guidelines given by the Cochrane Handbook of Systematic Reviews.

Structured Question

What is the ideal obturation technique following the root canal treatment of the primary teeth using Endoflas as obturation material?

PICO Analysis

1. Population: primary teeth undergoing pulpectomy
2. Intervention: Obturation using any technique and using Endoflas as obturation material
3. Outcome: Quality of obturation

Inclusion criteria

Studies were selected using the following inclusion criteria.

1. All studies reporting obturation using Endoflas as obturation material and any technique
2. All studies reporting the quality of obturation in primary molar teeth
3. Studies published in the English language
4. In vivo studies

Exclusion criteria

Studies were excluded based on the following exclusion criteria.

1. Studies for permanent teeth
2. Studies which uses obturation material other than Endoflas
3. Animal studies
4. In vitro studies
5. Reviews, case reports, abstracts, letters to editors

Search method

A literature search was done to identify the studies to be included in the following databases

1. PubMed (Till September 2018)
2. The Cochrane Central Register of Clinical Trials (Till September 2018)
3. Science Direct
4. LILACS
5. SIGLE

All the MeSH headings, word variants and text words for “primary teeth”, “pulpectomy”, “obturation techniques” which were combined using Boolean operator for the search. Only those articles in the English language and those with human studies were only included. Bibliography of the included studies was also checked for any additional studies which were not included in the electronic search databases (Chart 1).

Search Strategy

PubMed Strategy

Advanced search of PubMed search engine using the following keywords was used:

((((((((primary teeth) OR primary tooth) OR deciduous teeth) OR deciduous tooth) OR milk teeth) OR milk tooth)) AND (((((((((pulp therapy) OR pulpectomy) OR endodontic treatment) OR endodontic therapy) OR root canal treatment) OR root canal therapy) OR obturation) OR root canal filling) OR obturation technique) OR endoflas)) AND (((((obturation quality) OR quality of obturation) OR under obturation) OR over obturation) OR optimal obturation)

This search yielded 82 studies. Figure 1 shows the PubMed search strategy.

Selection of studies

One author carried out the search strategy for the individual databases. All the titles obtained were scanned and evaluated independently by two authors to identify the relevant studies. The studies which were duplicated in different databases were excluded. In case of any disagreement between the two authors, the final decision was made after the discussion of the two authors. Abstracts of the studies were evaluated when complete information regarding the study sample, and groups included were not mentioned in the title. The evaluation of the abstract was carried out independently by the same two authors to identify the studies that have to be included for final evaluation based on the inclusion and exclusion criteria. Full-text articles were evaluated if the information available in the abstract regarding the groups compared was not sufficient. The reference list of all the full-text articles was evaluated to identify any studies which were not included in the electronic search.

Data synthesis

Data extraction from the selected studies

Data were extracted independently by the two authors using a data extraction form. The data extracted were

1. Name of the author and year of publication
2. Study design
3. Population group
4. Total sample size and age group
5. Obturation technique used
6. Criteria used to assess the quality of obturation.

Quality Assessment

The final studies that were included after the discussion between the two authors were subjected to quality assessment following the guidelines given by the Cochrane Handbook of a systematic review

1. Random sequence generation
2. Allocation concealment
3. Blinding of participants and personnel
4. Blinding of outcome assessment
5. Free of incomplete outcome data assessment
6. Selective reporting
7. Other bias

The final risk of bias of individual study was determined as low risk if all the studies showed a low risk for the individual parameters. In case of high or unclear risk for anyone or two parameters, then study was considered to be at moderate risk. In case of high risk in more than two parameters, the included study was considered to have a high risk of bias.

Characteristics of the included studies and general information of the included studies were mentioned in Table 1 and Table 2, respectively.

Quality of assessment of the included studies was mentioned in Table 3. Risk if bias was mentioned in Figure 2 and Figure 3. Characteristics of the excluded studies were mentioned in Table 4

RESULTS

Study Selection

The systematic search from PubMed, Cochrane Library, Science Direct, LILACS, SIGLE and hand search revealed a total of 109 studies. On title screening, 96 articles were eliminated. After abstract screening and reviewing of full articles, three were included for the systematic review. A total of 3 articles met the inclusion criteria and were selected for the area of the intended research.

Study characteristics

Mahima Gandhi compared the efficacy of disposable syringe, lentulo spiral, and past inject. The study was conducted in forty-one patients consisting of 13 females and 28 males between the age of 4-9. Sixty teeth indicated for single sitting pulpectomy were involved in the study. Optimally filled canals were frequently observed in Past inject Group. (18.3%). Underfilled canals was frequently observed in Lentulospiral group. (25%). Overfilled canals were frequently observed in Disposable Syringe Group (10%). Significant differences($p < 0.05$) was observed among the three comparison groups. Lentulo spiral exhibited the highest incidence of voids of 20%, and past injects, and

Search	Add to builder	Query	Items found	Time
#4	Add	Search (((((((primary teeth) OR primary tooth) OR deciduous teeth) OR deciduous tooth) OR milk teeth) OR milk tooth)) AND (((((((pulp therapy) OR pulpectomy) OR endodontic treatment) OR endodontic therapy) OR root canal treatment) OR root canal therapy) OR obturation) OR root canal filling) OR obturation technique) OR endoflas)) AND (((obturation quality) OR quality of obturation) OR under obturation) OR over obturation) OR optimal obturationn	82	10:57:52
#3	Add	Search (((obturation quality) OR quality of obturation) OR under obturation) OR over obturation) OR optimal obturationn	366350	10:57:38
#2	Add	Search (((((((pulp therapy) OR pulpectomy) OR endodontic treatment) OR endodontic therapy) OR root canal treatment) OR root canal therapy) OR obturation) OR root canal filling) OR obturation technique) OR endoflas	38432	10:55:53
#1	Add	Search (((primary teeth) OR primary tooth) OR deciduous teeth) OR deciduous tooth) OR milk teeth) OR milk tooth	23363	10:53:31

Figure 1: Image showing the PubMed search strategy

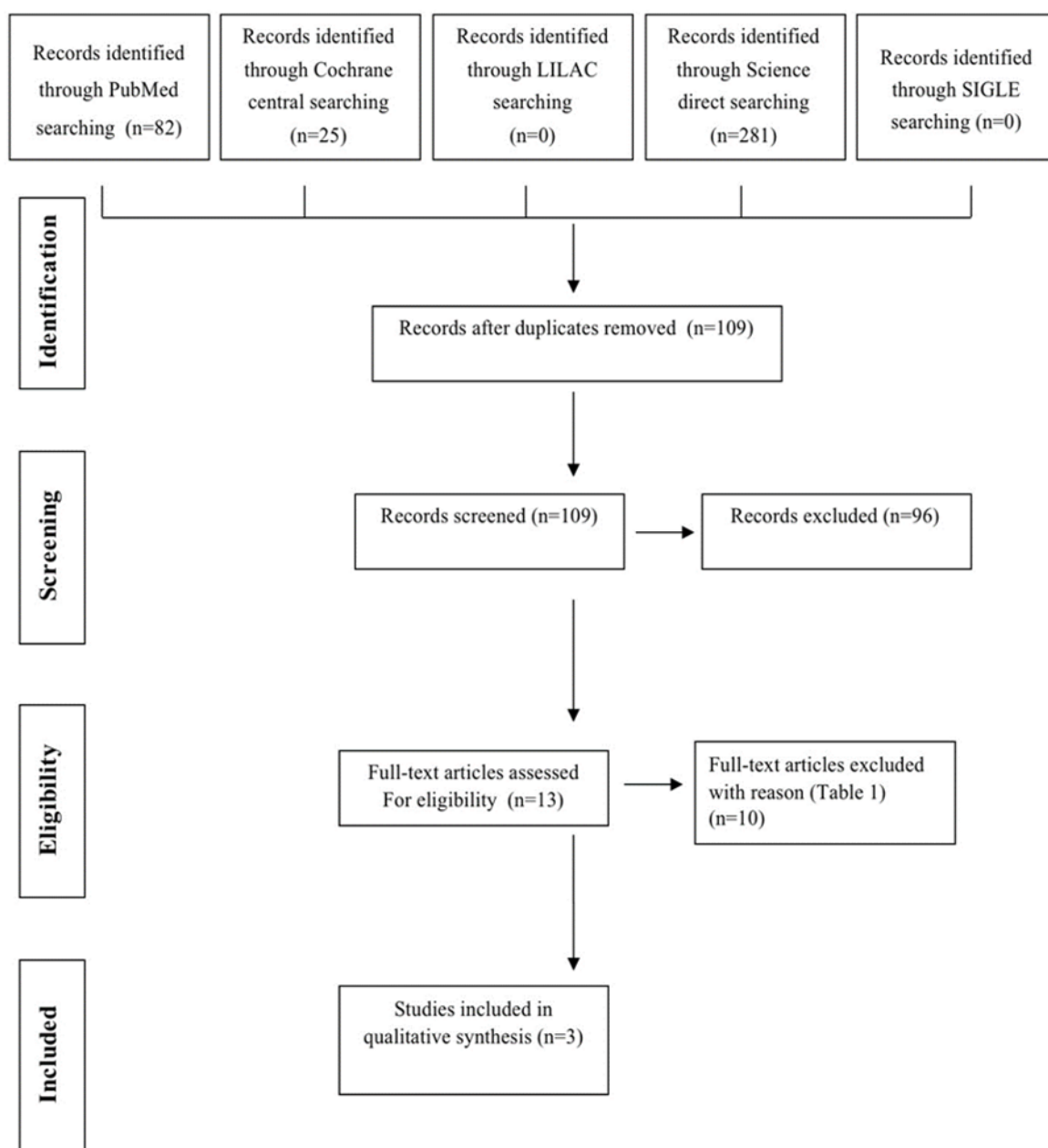


Chart 1: Search Flowchart

Table 1: Characteristics of included studies

Author and year	Study population	Sample size	Teeth	Obturation technique used	Outcome assessment
(Gandhi <i>et al.</i> , 2017)	41 children (4-9 years)	60 primary teeth; 20 Teeth in each group	32 mandibular 1 st molar 28 mandibular 2 nd molar	Disposable syringe Lentulospiral Past inject	Level of canal obturation Voids
(Pandranki <i>et al.</i> , 2017)	38 children (4-9 years)	45 teeth; 15 teeth in each group	45 mandibular molar	Endodontic pluggers Lentulospirals Navi Tips	Level of canal obturation Voids
(Vishwanathan <i>et al.</i> , 2018)	60 children (4-8 years)	60 teeth; 30 teeth in each group	7 and 15 maxillary 1 st and 2 nd molar respectively 17 and 21 mandibular 1 st and 2 nd molar respectively	Handheld lentulo spiral Modified disposable syringe	Level of canal obturation Voids

Table 2: General information on the results of the included studies

Author and year	Obturation technique used	Level of canal obturation			voids	
		Underfill	Overfill	Optimal fill	present	absent
(Gandhi <i>et al.</i> , 2017)	Disposable syringe	15%	10%	8.3%	25%	8.3%
	Lentulospiral	25%	5%	3.3%	13.3%	20%
	Past inject	11.7%	18.3%	3.3%	26.7%	6.7%
(Pandranki <i>et al.</i> , 2017)	Endodontic pluggers	31.1%	6.7%	62.2%	31.1%	68.9%
	Lentulospirals	26.7%	8.9%	64.4%	31.1%	68.9%
	Navi Tips	28.9%	22.2%	48.9%	46.7%	53.3%
(Vishwanathan <i>et al.</i> , 2018)	Hand held lentulospiral	10%	30%	60%	66.7%	33.3%
	Modified disposable syringe	10%	23.3%	66.7%	50%	50%

pressure syringe exhibited 6.7% and 8.3 % respectively. (Gandhi *et al.*, 2017).

Jayalakshmi Pandranki compared plugger, lentulo spiral and NaviTips for delivery of Endoflas in the root canals of 45 primary molar teeth in thirty-eight children between the age group of 4-9 years of age. Pluggers (62.2% optimal fills) and lentulo spirals (64.4% optimal fills) showed best and acceptable results with Endoflas compared to NaviTip system (48.9%). No significant difference was seen among the three experimental groups. Minor voids were reported with all the three groups. The frequency of voids was more in NaviTip system

(46.7%) compared to pluggers (31%) and lentulo spirals (31.1%), but no significant difference was found among the study groups ($P = 0.208$) (Pandranki *et al.*, 2017).

Vishwanathan *et al.* (2018) compared two different techniques viz.; handheld lentulo spiral and disposable syringe in 60 primary mandibular and maxillary molars in sixty children between the age group of 4-8 years. Increased percentage of optimal fillings in the modified disposable syringe group (66.7%) was seen as compared to the handheld lentulo spiral group (60%). In contrast, the modified disposable syringe group showed a decreased number of over-

Table 3: Quality of assessment of the included studies

Study	Random sequence generation	Allocation concealment	Blinding of participants and personnel	Blinding of outcome assessment	Incomplete outcome data assessment	Selective reporting of outcome	Other sources of bias	Risk of bias
(Gandhi <i>et al.</i> , 2017)	High risk	Unclear risk	High risk	Low risk	Low risk	Low risk	Unclear risk	High risk
(Pandranki <i>et al.</i> , 2017)	High risk	Unclear risk	High risk	Low risk	Low risk	Low risk	Unclear risk	High Risk
(Vishwanathan <i>et al.</i> , 2018)	Low risk	Low risk	High risk	Low risk	Low risk	Low risk	Low risk	Moderate risk

Table 4: Characteristics of excluded articles

Author and Year	Reason for exclusion
(Bawazir and Salama, 2006)	Endoflas is not used as an obturating material.
(Khubchandani <i>et al.</i> , 2017)	Endoflas is not used as an obturating material.
(Walia <i>et al.</i> , 2017)	In vitro study
(Fuks <i>et al.</i> , 2003)	Retrospective study
(Sachdev <i>et al.</i> , 2015)	Endoflas is not used as an obturating material
(Nagaveni <i>et al.</i> , 2017)	In vitro study using zinc oxide eugenol
(Mahajan and Bansal, 2015)	Review article
(Singh <i>et al.</i> , 2017)	Endoflas is not used as an obturating material.
(Memarpour <i>et al.</i> , 2013)	Endoflas is not used as an obturating material.
(Chandrasekhar <i>et al.</i> , 2018)	Tooth type is not mentioned.

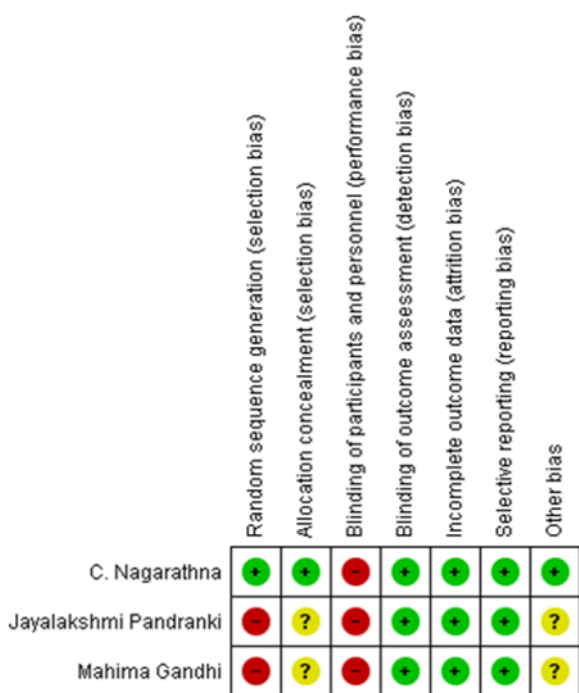


Figure 2: Risk of bias summary

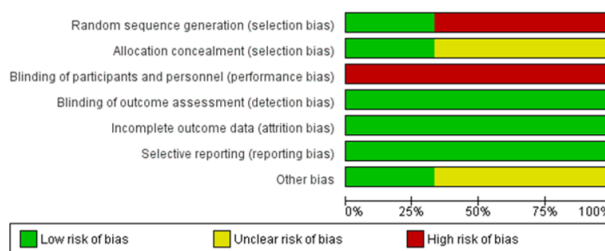


Figure 3: Risk of bias graph

filled canals when compared to the handheld lentulo spiral group. Voids were found in both the comparison groups. A significant difference was found in the apical third of the root canal ($P = 0.01$) while coronal and middle thirds showed no statistical difference for voids (Vishwanathan *et al.*, 2018).

DISCUSSION

Dental caries is considered to be the most common oral health concern found among children and also in adults. To maintain the arch spaces, integrity, occlusion and normal development of jaw and mus-

culature, it is essential to retain primary teeth in the dental arch. For a tooth which is pulpally involved with irreversible pulpitis or necrosed, pulpectomy is considered as the treatment of choice.

Among the different obturation materials available, Endoflas is a hydrophilic material consisting of Z.O.E. (56.5%), iodoform (40.6%), calcium hydroxide (1.07%), barium sulfate (1.63%), eugenol, and pentachlorophenol. It provides a good seal with the root canals. The broad-spectrum antibacterial activity helps in disinfection of the hard to reach dentinal tubules and accessory canals (Jha *et al.*, 2011). Since the resorption rate of Endoflas is similar to that of the physiological root resorption rate, the resorption is limited to the obturation material that is extruded beyond the apex extra without the resorption of the material inside the root canal (Rewal *et al.*, 2014). Endoflas has a high success rate when compared to that of zinc oxide eugenol (Rewal *et al.*, 2014). It has a clinically proven success rate of 93.3%–95.1% (Moskovitz *et al.*, 2005; Ramar and Mungara, 2010; Subramanian and Gilhotra, 2011). However, the success rate is lower (58%–76%) when extruded beyond apex (Fuks *et al.*, 2003; Moskovitz *et al.*, 2005).

The present systematic review includes three studies. The outcome was assessed based on the level of canal obturation and presence/absence of voids. Coll and Sadrian criteria (Coll and Sadrian, 1996), Guelmann's criteria (Guelmann *et al.*, 2004) and Memarpur's scoring criteria (Memarpour *et al.*, 2013) were used to assess the level of obturation.

The quality of assessment was done based on the Cochrane database with seven criteria of assessment to have a standardized method. Among the three articles included in this systematic review, two articles (Gandhi *et al.*, 2017; Pandranki *et al.*, 2017) showed a high risk of bias and one article (Vishwanathan *et al.*, 2018) showed a moderate risk of bias. Blinding of personnel and participants was not satisfactory in all the three articles. In the study by Mahima Gandhi *et al.*, and Pandranki *et al.* randomization were not adequate, and allocation concealment was not apparent. This shows the need for more high-quality studies free of any source of bias.

There are various obturation techniques available in the literature. But there are only a few clinical studies which compare the different obturation techniques for the primary teeth using Endoflas. The studies included in this systematic review compare only a few obturation techniques while there are so many techniques which can be used for obturation of primary teeth.

CONCLUSION

This systematic review concludes a lack of existing literature on the *in vivo* efficacy of different obturating techniques for primary teeth using Endoflas as obturating material. This research also advises updating the existing literature to find out the best obturation technique that can provide void-free and ideal obturation of the root canals of primary teeth using Endoflas.

Ethical Clearance

Taken from Institutional Review Board, Saveetha Dental College and Hospitals, Chennai, India (IHEC/SDC-PEDO1703/19/006)

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Conflict of Interest

The authors declare that they have no conflict of interest for this study.

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