A Comparative Assessment of Different Techniques for Obturation with Endoflas in Primary Molars: An In vivo Study

Abstract

**Purpose:** The rationale of this in vivo study was to evaluate and compare different obturation techniques for the intracanal conveyance of Endoflas in the primary molars using conventional radiography. **Materials and Methods:** Thirty-eight children (4–9 years old) with total of 45 pulpally infected primary mandibular molars indicated for pulpectomy were categorized into three groups (i) endodontic pluggers, (ii) lentulospirals, and (iii) NaviTips, respectively, for obturation with Endoflas. The level of obturation and the presence of voids were evaluated radiographically, and the obtained data were statistically analyzed using Chi-square test. **Results:** The results showed no significant difference between the three techniques to deliver Endoflas. Motor-driven lentulospirals showed better results (64.4% optimal fillings) compared to the pluggers (62.2%), but NaviTips showed poor results (48.9%) for the level of obturation ($P > 0.05$). Voids were observed in all the techniques used. Pluggers and lentulospirals showed similar results with greater void-free canals, whereas NaviTip system showed more voids which was statistically not significant ($P > 0.05$). **Conclusion:** Motor-driven lentulospiral and pluggers were almost equally efficient to fill Endoflas to an optimal level, devoid of voids, and both were considered better compared to NaviTip system.

Keywords: Endoflas, obturation techniques, primary teeth, pulpectomy

Introduction

Bizarre and tortuous canals in the primary molars become major hindrance for biomechanical preparation in their endodontic therapy. Considering this anatomical diversity, the root canal filling material should be potential enough to fight against the residual microorganisms and provide fluid impervious seal for successful pulp therapy.

Endoflas, a biologically safe material with a combination of zinc oxide eugenol (ZOE), iodoform, and calcium hydroxide was introduced by Sanlor Laboratories in Colombia, South Africa. It can produce a perfect hermetic seal due to its hydrophilic property.[1] It showed significantly greater antimicrobial activity[2] with long-term substantivity over commonly used obturating materials such as ZOE[3] and Metapex.[4,5] The resorption pattern coincides with physiological root resorption limits only to the excess if extruded beyond apex without any intraradicular depletion.[6] The best method to transport any root canal filling material could be the one that results in perfect obturation with optimal fill with zero voids.

Wide range of obturation techniques have been introduced that includes disposable syringes,[7] reamers,[8] pressure syringes,[9,10] pluggers,[11] handheld lentulospirals,[12] motor-driven lentulospirals,[13-15] jiffy tubes,[16] tuberculin syringes,[17] insulin syringes,[8] and disposable syringe with NaviTip.[14] Endodontic finger pluggers are the most commonly used technique, simple and effective for incremental packing of thick consistency filling material into the canals.[11] Lentulospirals are another widely accepted and successful technique due to their flexibility.[4,18,19] It has been reported that motor-driven lentulospirals showed significantly better results than handheld lentulospirals.[13] A volumetric analysis of root canal fillings revealed dense fill with motor-driven lentulospiral in primary teeth.[20] Guellmann et al. used luer lock disposable syringes with NaviTip for obturation with ZOE.[14] NaviTip with thin, flexible metal canula allows flow of material even into the tortuous canals. Even though studies with NaviTips and luer lock

**How to cite this article:** Pandranki J, Chitturi RR, Vanga NV, Chandrabhatla SK. A comparative assessment of different techniques for obturation with endoflas in primary molars: An In vivo Study. Indian J Dent Res 2017;28:44-8.

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DOI: 10.4103/ijdr.IJDR_507_16
Quick Response Code:

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disposable syringes combination were rare, ample success rate was reported to deliver obturating material. The present in vivo study aimed to assess the effectiveness of pluggers, motor-driven lentulospirals, and NaviTip system to fill Endoflas material into the root canals of primary mandibular molars.

**Materials and Methods**

Thirty-eight healthy, cooperative children within the age group of 4–9 years who reported to the Department of Pedodontics and Preventive Dentistry were included in the present in vivo study. The study protocol was approved by the Institutional Ethical Committee. Written informed consent was obtained from parents before study execution. Forty-five primary mandibular molars indicated for pulp therapy were selected based on the following inclusion and exclusion criteria.[6,8,10]

**Inclusion criteria**
- Primary mandibular molars with signs of chronic irreversible pulpitis and pulpal necrosis
- Teeth having adequate bone support with at least two-third intact root length
- Teeth with radiographic evidence of minimum bone degeneration.

**Exclusion criteria**
- Grossly decayed teeth which cannot be restored
- Teeth with pathological mobility
- Teeth with extensive external/internal root resorption.

**Method of allocation of patients**

Forty-five selected primary molars were equally and randomly assigned into three groups to obturate with Endoflas.

- **Group I**: 15 teeth obturation using pluggers
- **Group II**: 15 teeth obturation using lentulospiral mounted in slow speed handpiece
- **Group III**: 15 teeth obturation using NaviTip.

**Pulpectomy procedure**

Single operator carried out the pulpectomy procedure for all teeth under local anesthesia, 2% lignocaine with 1:80,000 adrenaline (Indoco Remedies Ltd., Gujarat, India) and rubber dam (Hygienic®) isolation. The procedure included (a) caries excavation, (b) straight line access preparation with round bur (BR-31 Dia Burs, Mani Inc., Japan), (c) pulp extirpation, (d) working length determination 1 mm short of apex, (e) chemomechanical debridement with selective filing[13] was done sequentially to size 30–35 K-file (Mani Co., Tokyo, Japan) aided with copious irrigation with 3% NaOCl (Prime Dental Products Pvt. Ltd., India) and saline, and (f) the root canals were dried out with appropriately sized sterile absorbent paper points (Pearl Dent Co, Ltd., Vietnam).

**Root canal obturation**

A homogenous mixture of Endoflas (Sanlor & Cia. S. en C.S., Colombia) was delivered into the root canals using one of the three randomly assigned techniques. Based on the requisite and physical limitations of different delivery systems, the powder-liquid ratio was adjusted to suit for the intended technique.

- **Group I**: For endodontic pluggers, the thick mix was obtained by mixing one scoop of powder with one drop of liquid and was placed into the canal orifices using a plastic instrument. An appropriate plugger (Mani Inc., Japan) corresponding to the last instrument size is used 2 mm short of the apex to incrementally plug the mix into the canals until the canal was visibly filled at the orifice [Figure 1a][9]

- **Group II**: Lentulospiral (21 mm Dentsply, Maillefer) smaller by two sizes from the last file was selected. The creamy mix obtained by mixing one scoop of powder with two drops of liquid. The Endoflas was applied by coating a lentulospiral and carrying into the root canals 1 mm short of the radiographic apex and rotating at 1000 rpm. The procedure was repeated till the backfill of material is observed at the orifice [Figure 1b][10]

- **Group III**: NaviTip with 29-gauge, 21 mm canula (Ultradent Products Inc., South Jordan, Utah, USA) was used with 2 ml luer lock disposable syringe (Unolok). One scoop of powder was mixed with three drops of liquid to obtain thin consistency. The mix was loaded into the syringe. The NaviTip was inserted into the canal 1 mm short of the apex, and material was pressed with slow retrieval of the cannula from the canal. Once the backfill of the material occurred, the canal was assumed to be filled [Figure 1c].[11]

After obturating the canals, the access cavity was restored using Intermediate Restorative Material (Caulk–Dentsply International Inc.). Postoperative radiograph was taken immediately after each obturation. Two blinded, calibrated...
observers assessed the presence of voids and level of obturation of all root canals using X-ray viewer and magnifying glass and graded based on Guellmann et al. criteria.\textsuperscript{14} The intraexaminer consistency was 99.85% whereas the interexaminer consistency is 85% ($\kappa = -0.852$).

Level of obturation was graded as, \textit{Grade A} - less than one half of the canal filled [Figure 2a]; \textit{Grade B} - under filling-greater than one-half but less than optimal fill [Figure 2b]; \textit{Grade C} - optimal filling-within 0–1.5 mm from the apex [Figure 2c]; \textit{Grade D} - over filling-any canal obturation material extruded outside the root beyond the apex [Figure 2d]. Regarding the voids, scoring based on the no of canals with voids at the coronal one-third, middle one-third, and apical one-third of root canal were recorded.\textsuperscript{14} The results were statistically analyzed with Chi-square test. The probability value was calculated. When $P < 0.05$, it was considered as statistically significant and when $P > 0.05$, it was considered as not statistically significant.

**Results**

**Level of canal obturation**

The results revealed no significant difference between the three experimental groups to fill Endoflas ($P = 0.178$). Pluggers (62.2% optimal fills) and lentulospirals (64.4% optimal fills) showed best and acceptable results with Endoflas compared to NaviTip system (48.9%) [Table 1]. The results of paired comparisons of experimental groups with no significant difference ($P > 0.05$) are shown in Table 2.

**Presence of voids**

Minor voids were reported with all the experimental techniques. The frequency of voids was more in NaviTip system (46.7%) compared to pluggers (31%) and lentulospirals (31.1%) but was not statistically significant ($P = 0.208$) [Table 3].

**Discussion**

Endoflas composing ZOE - 56.5%, barium sulfate - 1.63%, iodoform - 40.6%, calcium hydroxide - 1.07%, eugenol, and pentachlorophenol fulfills most of the basic requirements of a root canal filling material in primary teeth\textsuperscript{[9]} with clinically proven success rate of 93.3%–95.1\%\textsuperscript{[9,21,22]} Even though it has resorbable nature, studies have reported low success rate (58%–76%) when extruded beyond apex.\textsuperscript{[6,22]} Hence, the extent of fill can influence the clinical outcome of teeth filled with Endoflas. The present study compared the efficiency of pluggers, lentulospirals and NaviTips to fill the root canals at optimal level.

In the current investigation, motor-driven lentulospirals yielded best results with maximum optimal fills (64.4%). According to Peters \textit{et al.},\textsuperscript{[25]} the flexibility of the lentulospiral allows filling the root canals uniformly throughout the narrow, curved canals in the primary molars. The present study showed better results over NaviTips, but statistically, there is no difference between them ($P = 0.168$). This can be correlated with earlier studies by Torres \textit{et al.}\textsuperscript{[19]} and Memarpour \textit{et al.},\textsuperscript{[24]} who found that the lentulospiral fill the root canals better than injection technique such as NaviTip system.

The present study showed 62.2% optimal fills with pluggers almost similar to that of lentulospiral with no significant difference ($P = 0.855$). Pluggers have more optimal fills compared to NaviTips, but statistically, there is no significant difference ($P = 0.104$). Dandashi \textit{et al.}\textsuperscript{[9]} akin to the present study showed best apical seal with pluggers to fill ZOE compared to syringe system. NaviTip system yielded poor results (48.9% optimal fills) inferior to lentulospirals and pluggers in this study. Sigurdsso\textit{ et al.}\textsuperscript{[23]} stated that syringe system was less effective and produces low quality fill with calcium hydroxide compared to lentulospiral.

![Figure 2: Grading criteria to evaluate level of obturation (a) Grade A, (b) Grade B, (c) Grade C, (d) Grade D](image)

**Table 1: Intergroup comparison of scores obtained for the extent of obturation level**

|                  | Underfill | Optimal fill | Overfill | Total, n (%) | $\chi^2$ | $P$   |
|------------------|-----------|--------------|----------|--------------|---------|-------|
|                  | Score A + B, n (%) | Score C, n (%) | Score D, n (%) |                |         |       |
| Pluggers         | 14 (31.1) | 28 (62.2)    | 3 (6.7)  | 45 (100)     | 6.30    | 0.178*|
| Lentulospiral     | 12 (26.7) | 29 (64.4)    | 4 (8.9)  | 45 (100)     |         |       |
| NaviTip system   | 13 (28.9) | 22 (48.9)    | 10 (22.2)| 45 (100)     |         |       |

*Not significant ($P>0.05$)
In the present study, high frequency of overfills was observed with NaviTips (22.2%) compared to pluggers (6.67% overfilling) and lentulospirals (8.88%), a finding reported with the previous study by Dandashi et al.[9] where pluggers and lentulospirals reduced the chance of extrusion when delivering ZOE into root canals. Subba Reddy and Shakunthala[17] showed greater overfilling with tuberculin syringe compared to lentulospiral with ZOE. In contrast to these reports, Guellmann et al.[14] observed more desirable quality of filling with NaviTip system. Overall or pairwise comparison revealed no statistically significant differences between pluggers, lentulospiral, and NaviTip system, similar finding reported with the previous investigations.[9,24]

Voids were present in Endoflas filled canals with all the experimental techniques in the current study, consistent finding with earlier reports. On the basis of categorical assessment, the following order was observed regarding the presence of voids: Pluggers (31.1%) ≈ lentulospirals (31.1%) < NaviTip system (22.2%), and the results obtained were statistically not significant (P = 0.208). Peters et al.[23] found fewer voids with lentulospiral compared to injection system to place Ca(OH)₂. Torres et al.[18] stated that repeated removal and reinsertion of the lentulospiral during rotation aids in the elimination of small, entrapped air bubbles within the canal. The present outcome was in contrast with studies done by Dandashi et al.,[9] Subba Reddy and Shakunthala,[17] Memarpour et al.[24] which revealed better void-free obturation with syringe system NaviTips.

The vast contrariety of opinions among the present study and the previous in vitro studies could be due to the difference in the type of material used, technique used, and often influenced by operator skills and experience. Intraoral periapical radiograph depicts only two-dimensional view of the obturation, thus becomes a potential limitation of the current observations.

**Conclusion**

There was no statistically significant difference between pluggers, lentulospirals, and NaviTips to deliver Endoflas regarding the level of obturation (P = 0.178) and frequency of voids (P = 0.208). However, based on the results of the present in vivo study, lentulospirals and pluggers were almost equally effective for void-free obturation and provide a best apical seal with Endoflas compared to NaviTips.

**Financial support and sponsorship**

Nil.

**Conflicts of interest**

There are no conflicts of interest.

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