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

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Article History:
Received on: 20 Jun 2020
Revised on: 25 Jul 2020
Accepted on: 28 Jul 2020

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. Endoαlas 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 endoαlas 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 Endoαlas.

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ISSN: 0975-7538
DOI: https://doi.org/10.26452/ijrps.v11i4.3605

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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...
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.

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
Figure 1: Image showing the PubMed search strategy

Chart 1: Search Flowchart
Table 1: Characteristics of included studies

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

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

<table>
<thead>
<tr>
<th>Author and year</th>
<th>Obturation technique used</th>
<th>Level of canal obturation voids</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Underfill</td>
</tr>
<tr>
<td>(Gandhi et al., 2017)</td>
<td>Disposable syringe</td>
<td>15%</td>
</tr>
<tr>
<td></td>
<td>Lentulospiral</td>
<td>25%</td>
</tr>
<tr>
<td></td>
<td>Past inject</td>
<td>11.7%</td>
</tr>
<tr>
<td>(Pandranki et al., 2017)</td>
<td>Endodontic pluggers</td>
<td>31.1%</td>
</tr>
<tr>
<td></td>
<td>Lentulospirals</td>
<td>26.7%</td>
</tr>
<tr>
<td></td>
<td>Navi Tips</td>
<td>28.9%</td>
</tr>
<tr>
<td>(Vishwanathan et al., 2018)</td>
<td>Hand held lentulospiral</td>
<td>10%</td>
</tr>
<tr>
<td></td>
<td>Modified disposable syringe</td>
<td>10%</td>
</tr>
</tbody>
</table>

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

Jayalakshmi Pandranki compared plugger, lentulo spiral and NaviTips for delivery of Endolasts 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 Endolasts compared to NaviTips 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 NaviTips 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

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

Table 4: Characteristics of excluded articles

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

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-

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).
culature, it is essential to retain primary teeth in the dental arch. For a tooth which is pulparly 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; Subramaniam and Gilhotra, 2011). However, the success rate is lower (58%–76%) when extruded beyond apex (Fukus 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-PED01703/19/006)

**Funding Support**

The authors declare that they have no funding support for this study.

**Conflict of Interest**

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

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Guelmann, M., McEachern, M., Turner, C. 2004. Pulpectomies in primary incisors using three...


