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Clinical and Radiographic Outcome of Obturation Techniques in Primary Teeth – A Systematic Review

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ABSTRACT:
Purpose: To evaluate the radiographic and clinical outcomes of various obturation techniques namely, Hand-held lentulospiral technique, Motor-drive lentulospiral technique, disposable syringe technique and endodontic plugger technique used in primary teeth.
Methods
Search strategy: PubMed Advanced Search, Cochrane Database of Systematic Reviews using the MeSH terms-Obturation techniques/methods, Primary teeth, Root canal. Hand searching included relevant journals and bibliographies of all relevant papers and review articles until december 2019.
Selection criteria: Randomized controlled trials or clinical trials/studies or in-vivo studies evaluating the radiographic and clinical outcomes of various obturation techniques in primary teeth were included.
Results: Total of 7 articles (English literature) were included in the systematic review. The quality of obturation (optimal obturation and without voids) observed were as follows: Motor driven-Lentulospiral technique 40-75%; Endodontic plugger 30-62.2%; Disposable syringe 25-94.33%; Navi tip 26.7-48.9%; Insulin syringe 64%; Endodontic pressure syringe 91.5%; Hand held lentulospiral 48-60%; Bidirectional spiral 67.5%.
Clinical Significance: Amongst techniques reviewed the Motor-driven Lentulospiral technique followed by Hand- held lentulospiral, Disposable syringe and Endodontic plugger techniques showed better quality of obturation. However, it also depends on the material used for the obturation.

Keywords: Obturation techniques, clinical outcome, Primary teeth.

I. INTRODUCTION

Endodontic treatment of primary teeth is more challenging than that of their permanent teeth.[1-4] This is because of the anatomical complexities of their root canal systems and their proximity to the developing permanent tooth, coupled with the difficulty in behaviour management in children. [5-8] Premature loss of deciduous teeth in children due to trauma or dental caries creates special problems such as space loss, ectopic eruption, disturbance in eruption sequence, development of aberrant habits such as tongue thrusting, mouth breathing, altered phonation, and impairment of function.[9-11] Thus, it is important that primary dentition be maintained in the dental arch, in its functional form, for proper dental, skeletal, and psychologic development of the child.[10-13]

Pulpectomy can either be partial or complete depending on the extent of instrumentation of the root canals.[14] The pulpectomy procedure is a nonvital technique and involves the complete extirpation of the irreversibly inflamed and/or necrotic pulp followed by canal obturation with a resorbable medicament in primary teeth.[11] The primary goal is to eliminate infection and retain the tooth in a functional state until it is normally exfoliated.[8]

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.[14-16] So, in order to increase the chance of success of the endodontic treatment, substances with antimicrobial properties are frequently used as root canal filling materials in deciduous teeth.[14] The developmental and physiological differences between the primary and permanent teeth will allow for the difference in the criteria for root canal filling materials as well as techniques. [10, 17-18] However, the ultimate goal of endodontic obturation has remained the same for more than 50 years to create a fluid-tight seal along the length of the root canal system, from the coronal opening to the apical termination.[9]

To improve the success of the therapy the obturating material and technique used for

obturation play a vital role in pulp therapy. However not many obturation techniques used in primary teeth are discussed in the literature.

The purpose of this systematic review was to evaluate the radiographic and clinical outcomes of various obturation techniques namely, Hand-held lentulospiral technique, Motor-drive lentulospiral technique, disposable syringe technique and endodontic plugger technique used in primary teeth.

II. METHODS

Structured question

1. What are the clinical and radiographic success rates of commonly used obturation techniques namely hand held and motor driven lentulospiral techniques, disposable syringe technique and endodontic plugger technique used in primary teeth?

The PICO formed for this systematic review was;

- The **P**atients were children who had required pulpectomy treatment.
- The type of **I**ntervention performed was obturation of primary teeth in the pulpectomy procedure.
- The studies which had undertaken the **C**omparison of various root canal filling techniques used for obturation of primary teeth.
- The **O**utcome which was assessed was radiographic and clinical success of the root canal filling techniques used for the obturation of the primary teeth.

Sources

Sources used for identification of studies included or considered for this review, detailed search strategies were carried out on the following databases.

2.1. Searched Databases

- ✓ PubMed Advanced Search (until December 2019)
- ✓ Cochrane Database of Systematic Reviews

2.2. Language

- English literature articles were included.

2.3. Hand Searching

- Journal of Indian Society of Pedodontics and Preventive Dentistry
- Journal of Pediatric Dentistry
- International Journal of Pediatric Dentistry

2.4. Types of Studies

Randomized controlled trials or clinical trials/studies or in-vivo studies evaluating the radiographic and clinical outcomes of various obturation techniques in primary teeth.

2.5. Inclusion criteria

Patients who were undergoing pulpectomy.

2.6. Exclusion Criteria

The following studies were excluded,

- Case reports/case series
- Animal studies
- In vitro studies
- Studies not meeting the inclusion criteria.

III. SEARCH METHODOLOGY

3.1. Search methods for identification of studies

- ➢ The databases such as Pubmed were searched using the Mesh terms- obturation techniques/methods; primary teeth; root canal
- ➢ The filter applied was in vivo studies.
- ➢ Only full text peer reviewed articles were included.
- ➢ The other search base used was the Cochrane central register of controlled trials.
- ➢ Only English literature articles included and no restriction on the date of publication was applied during the search.

3.2. Selection of studies

The study was reviewed by two authors independently and any difference of opinion was resolved by reaching a consensus and if necessary resolved by a third reviewer. The review authors were not blinded to authors, institution or journal. All full text papers that were retrieved were similarly screened. All the studies which were excluded were recorded with reasons for exclusion.

3.3. Data extraction and management

Data and quality information was extracted and fed into **Revmann 5.3 software.** The Year of publication and country of origin was recorded. Inclusion/Exclusion criteria were specified and a detailed description of interventions was given.The sample size of the participants with the mean age of participants and the duration of follow-up and outcome data were recorded in the software. We tabulated all outcomes as reported in trials at different intervals.

A description of the risk of bias domains was tabulated for each included trial, along with **a judgement of low, high or unclear risk of bias.**

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Measures of treatment effect
The unit of analysis was the tooth, because teeth were randomly assigned to interventions.

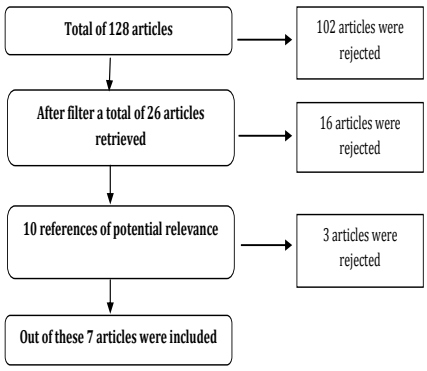
IV. RESULTS

4.1. Description of studies
A total of 128 articles were obtained when the databases such as PubMed were searched using the MeSH terms- obturation techniques/methods; primary teeth; root canal. Out of which 102 were excluded after reviewing the title or abstract. Out of these 26 articles, 10 articles of potential relevance were selected. A total of 7 full text articles were selected and 3 articles were rejected. So a total of 7 articles fulfilled the inclusion criteria (Flow chart 1).

Results of the search
The overall success rate (clinical and radiographic success rate) of:

- Motor driven-Lentulospiral 40-75%
- Hand held lentulospiral 48-60%
- Disposable syringe 25-94.33%
- Endodontic plugger 30-62.2%
- Navi tip 26.7-48.9%
- Insulin syringe 64%
- Endodontic pressuresyringe 91.5%
- Bidirectional spiral 67.5%.

Figure 1: SEARCH FLOW CHART



V. DISCUSSION

5.1. Studies included in the present systematic review (Table 1)
Out of 7 articles, 4 of the studies have included hand held lentulospiral technique and 3 studies motor driven lentulospiral technique, 3 studies disposable syringe, 2 Navi tip, 2 past inject and endodontic plugger, incremental and bidirectional techniques were used in 1 study.

Radiographic and clinical outcomes of the obturation techniques used in primary teeth were assessed in all the studies. The quality of obturation on radiograph was determined by the length of obturation and presence of voids.

Nagarathna C et al, compared modified disposable syringe technique with traditionally used handheld lentulospiral technique. Where in Hand-held lentulospiral showed good results in terms of quality of obturation. Both techniques showed optimum number of optimal fillings with no over fillings. Mean number of voids in the apical third was significantly less in the modified disposable syringe group.Reason for voids in obturation using the modified disposable syringe would be due to air entrapment which could have occurred in the middle and coronal regions while withdrawing the syringe.[19]

Author also suggested that if the cleaning and shaping is ideal with a good coronal seal, the presence of voids in obturation will not be the primary criteria to determine the success or failure of pulpectomy. And concluded, modified disposable syringe can be recommended as a technique of obturation as it is simple, easy to use, less threatening to the child and relatively less time- consuming when compared to the handheld lentulospiral technique.

Another study by **Chandrashekar S et al**, where three spiral filling techniques; bi- directional spiral, past inject, lentulo spiral and incremental techniques have been compared and results of this investigation showed no statistically significant differences among the techniques tested when optimal fill, overfilling and the presence of voids were evaluated, except for underfill.[20]

Bawazir et al. carried out an in vivo investigation to compare the efficiency of the lentulo spiral mounted in a slow-speed handpiece and hand-held at providing optimal filling for the root canal of primary molars. At the same time, the authors compared the quality of the root canal filling (which is a result of the technique used) to the success rate. And considering the quality of the root canal filling or success rate, there was no statistically significant difference found between the use of a lentulo spiral mounted in a slow-speed handpiece or hand-held.[21]

Gandhi et al conducted an in vivo study to evaluate and compare the efficacy of three different obturating methods used in primary teeth i.e, Disposable syringe, lentulo spiral and past inject techniques. Postoperative evaluation was done for; quality of canal obturation, presence of voids using postoperative radiographs. Among the three groups of the study, past inject exhibited the maximum number of optimally filled canals. Maximum number of underfilled canals was found with

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Table 1: SUMMARY OF STUDIES INCLUDED:

AUTHOR AND YEAR OF STUDY	AGE	TECHNIQUES COMPARED AND SAMPLE SIZE	FOLLOW UP DURATION	SUCCESS RATES(%)	
				Radiog-raphic	Clinical
Nagarathna C et al. 2018	4 – 9 years	Group 1-hand held lentulospiral (n=30) Group 2-modified disposable syringe (n=30)	1 week	60 66.7	Not mentioned
Chandrashekar S et al. 2018	5 - 9 years	Group 1 bidirectional spiral (canals=40) Group 2- incremental technique (canals=40) Group 3- past inject (canals=40) Group 4- lentulospiral (canals=40)	Not mentioned	67.5 30 50 65	Not mentioned
Mahima Gandhi et al. 2017	4 – 9 years	Group 1-disposable syringe (n=20) Group 2-hand held lentulospiral (n=20) Group 3- past inject (n=20)	Not mentioned	50 60 90	Not mentioned
Pandranki J et al. 2017	4-9 years	Group 1- endodontic plugger (n=15) Group 2-motor driven lentulospiral (n=15) Group 3-navi tips n=(15)	Not mentioned	62.2 64.4 48.9	Not mentioned
Khubchandani M et al. 2017	4 – 8 years		Not mentioned		

		Group 1-motor driven lentulospiral (n=15) Group 2-navi tip (n=15)		35 26.7	Not Mentioned
Bhandari SK et al. 2012	3.5 – 9 years	Disposable injection technique	3 years and6 months	97	97
Omar A et al. 2005	4.5 – 9 years	Group 1-motor driven lentulospiral (n=25) Group 2- hand held lentulospiral (n=25)	6 months	91 72	96 92

Where 'n' is Number of teeth obturated.

lentulospiral, and the maximum number of overfilled canals was seen with disposable syringe. Least number of voids was observed in canals filled with the past inject technique and disposable syringe. Suggesting that the most successful technique for obturation of primary teeth was past inject.[22]

Bhandari S K et al studied root canal obturation of primary teeth using disposable injection technique, where in a total of 75 primary teeth were treated in 52 subjects by the disposable injection technique, i.e. injecting plastic flowable material into the root canals after desired preparation, using disposable needle and syringe. Follow up was done for 3 years and 6 months, with no clinical or radiologic evidence of pathology or need for untimely extraction. And concluded that, the technique is simple, economical, can be used with almost all filling materials used for the purpose and is easy to master with minimal chances of failure.[23]

Pandranki J et al did a comparative assessment of different obturation techniques in primary molars. 38 children (4–9 years old) with a total of 45 pulpally infected primary mandibular molars indicated for pulpectomy were categorized into three groups endodontic pluggers, lentulospirals, and NaviTips respectively, for obturation with Endoflas. The level of obturation and the presence of voids were evaluated radiographically. And concluded that 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.[24]

Khubchandani M et al compared the filling quality of a 30 gauge cannula used on a pressure syringe with a lentulospiral in primary molars. Thirty mandibular first and second primary molars in 28 healthy children of both sexes in the age group of 4–8 years were by the two obturation techniques. Effectiveness of the techniques was assessed by analyzing presence or absence of voids, extent of fill and apical seal using postoperative radiographs taken immediately after each obturation. And concluded that Lentulospiral was best in terms of length of obturation, while NaviTip syringe was efficient enough in controlling voids and produced the best results for apical seal.[25]

Overall, from this systematic review the Motor driven-Lentulospiral technique followed by Hand held lentulospiral, Disposable syringe and Endodontic plugger techniques showed better quality of obturation amongst the techniques reviewed. However it can be concluded that there is no single technique that can fulfill the requirements of all cases whereas it also depends on the proper case selection and the material used for the obturation.

However, the number of good quality clinical trials included in this review is very limited. This shows the lack of evidence supporting the findings. Hence, more high quality clinical trials are required to prove the success rates of various root canal filling techniques.

5.2. Limitations :

1. This systematic review included both randomized and non-randomized clinical

studies. Non-randomized studies may lead to bias.

2. Follow up duration is not mentioned in few studies.
3. The children included in the studies were not of the same age groups (age of the tooth). Age is a factor because primary teeth in the later half have higher calcification and narrow canals. These factors have implication on thorough debridement and canal preparation.

5.3. Report on Outliers Data
No outlier data obtained.

5.5. Inference
According to this systematic review, amongst techniques reviewed the Motor-driven Lentulospiral technique followed by Hand- held lentulospiral, Disposable syringe and Endodontic plugger techniques showed better quality of obturation. Whereas it also depends on the material used for the obturation.

VI. CONCLUSION

- Outcome of the treatment depends on clinician's experience and how meticulous, the technique is practiced and cannot be solely attributed to the technique used.
- Physical and chemical properties of the material also have influence on the quality of obturation irrespective of the technique used.
- There is no single technique that can fulfill the requirements of all cases and hence in addition to proper case selection, one should be familiar with as many if not all techniques, to use either singly or in combinations for the successful endodontic root canal filling.
- The aim of the clinicians should be to find the balance between technique and material used to bring about predictable obturation and hence the predictable outcome of the treatment.

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