

A Comparative Assessment of Three Different Techniques for Obturation with Zinc Oxide Eugenol in Primary Teeth: An In Vivo Study

Anushka Deoghare¹ Nabila Naaz Sheikh^{2*} Nagarathna PJ³ Keyura Jain⁴ Pragya Daga⁵ Rashi Dubey⁶

¹Reader, Department of Pedodontics and Preventive Dentistry, Chhattisgarh Dental College and Research Institute, Chhattisgarh, India.

²PG Student, Department of Pedodontics and Preventive Dentistry, Chhattisgarh Dental College and Research Institute, Chhattisgarh, India.

³Professor and Head, Department of Pedodontics and Preventive Dentistry, Chhattisgarh Dental College and Research Institute, Chhattisgarh, India.

⁴Reader, Department of Pedodontics and Preventive Dentistry, Chhattisgarh Dental College and Research Institute, Chhattisgarh, India.

⁵Senior Lecturer, Department of Pedodontics and Preventive Dentistry, Chhattisgarh Dental College and Research Institute, Chhattisgarh, India.

⁶Senior Lecturer, Department of Pedodontics and Preventive Dentistry, Chhattisgarh Dental College and Research Institute, Chhattisgarh, India.

ABSTRACT

Background: The ultimate goal of pulpectomy is to achieve good hermetic seal. The obturating technique besides the obturating material significantly influences the success rate of the endodontic therapy.

Materials and Methods: Thirty primary mandibular second molars indicated for pulp therapy in thirty healthy, cooperative children within the age group of 4–9 years were included. Pulpectomy was performed by single operator and one of the three obturation techniques was randomly selected for the subject.

Result: The quality of obturation and voids was assessed by an observer other than operator and Chi-square analysis was used to find the significance of study parameters on categorical scale. For level of obturation, group I showed 70% optimal filling, when compared to group II and group III which showed statistically significant difference ($P > 0.05$). For presence of voids, when all the three groups were compared 70% of cases in group II showed presence of voids, which was statistically non-significant (p value 0.053).

Conclusion: Ultrasonic tip method showed better results for obturation with zinc oxide eugenol in terms of optimal filling when compared to lentulospiral and hand plugger method. However, further studies are needed to obtain better results for voids since ultrasonic is a new technique and requires more skills and techniques.

Keywords: Pulpectomy, ultrasonic tip, motor-driven lentulospiral, plugger, zinc-oxide eugenol.

INTRODUCTION

Premature loss of deciduous teeth continues to be common, despite efforts to emphasize prevention of caries.^[1] Primary teeth are the best space maintainers and hence should be preserved and retained as long as possible.^[2] Pulpectomy is a root canal procedure for pulp tissue that is irreversibly infected or necrotic. The root canals are debrided

and shaped and canals are dried and obturated with a resorbable material.^[3] The ultimate goal of pulpectomy is to achieve good hermetic seal which depends on various factors such as good biomechanical preparation, types of obturating material used and achievement of minimum voids. Obturation of the canal creates a fluid tight seal

Received: Jan. 4, 2021: Accepted: Feb. 15, 2021

*Correspondence Dr. Nabila Naaz Sheikh.

Department of Pedodontics and Preventive Dentistry, Chhattisgarh Dental College and Research Institute, Chhattisgarh, India.

Email: drnabilapedo@gmail.com

along the length of the root from the coronal opening to the apical system and eliminating all portals of entry between the periodontium and the root canal system [4,5]

Several different products have been reported as successful filling materials for pulpectomies of primary teeth. Among the most common materials used are zinc oxide eugenol (ZOE), iodoform, calcium hydroxide, endoflas, and vitapex. Currently, ZOE paste is one of the most widely used materials for primary tooth pulpectomies. [6] ZOE still remains as a suitable obturating material for primary teeth pulpectomies due to its advantages such as the ease of manipulation and handling. Various techniques are available today for placement into the canal, antimicrobial properties, availability, and cost effectiveness. This was in agreement with the two systematic reviews published earlier on this topic[7,8].

The obturating technique besides the obturating material significantly influences the success rate of the endodontic therapy. Studies have been conducted using different obturating techniques in primary teeth such as using motor driven lentulospiral, hand held lentulospiral, reamer, local anesthetic syringe with 27-gauge needle, NaviTip® system, endodontic pressure syringe, tuberculin syringe, absorbent paper point etc. Endodontic finger pluggers are the most commonly used technique, simple and effective for incremental packing of thick consistency filling material into the canals. The packing method has a high success rate in long, straight canals, such as those of primary anterior teeth. However, lentulospiral mounted on a slow-speed handpiece is superior in filling both straight and curved narrow canals.[6]. Lentulospirals are another widely accepted and successful technique due to their flexibility. It has been reported that motor-driven lentulospirals showed significantly better results than handheld lentulospirals.[7]

Currently for permanent dentition to achieve complete obliteration of the root canal space and to achieve optimum results ultrasonically energized spreaders are used as aids for lateral condensation of gutta percha cones. Ultrasonic spreaders vibrate linearly and produce heat, thus thermoplasticizing the gutta percha, achieve a more homogeneous mass with decrease in number and size of voids and

hence produce a complete three-dimensional obturation of the root canal system. It has been suggested that the energy developed by the Ultrasonically energized spreaders can be transformed into heat and consequently the thermomechanical effects by the spreader may transform the cones into a more homogeneous gutta percha mass.[8] Since no studies on obturation with ultrasonic system has been reported in primary dentition, so the present in vivo study aimed to evaluate and compare 3 different obturation techniques using hand plugger, motor-driven lentulospirals and ultrasonic tip for the intracanal conveyance of zinc oxide eugenol in the primary teeth using conventional radiography.

MATERIALS AND METHODS

Thirty healthy, cooperative children within the age group of 4–9 years who reported to the Department of Pedodontics and Preventive Dentistry with indication of pulpectomy of primary second molar 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 conducting the study. Thirty primary mandibular second molars indicated for pulp therapy were selected based on the following inclusion and exclusion criteria.

Inclusion criteria

- Primary 2nd mandibular molar teeth with deep occlusal caries and 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.

Thirty primary mandibular second second molars indicated for pulp therapy were selected based on the inclusion and exclusion criteria and randomly assigned into three groups to obturate with

Zinc oxide eugenol.

- Group I: 10 teeth obturation using ultrasonic tip.
- Group II: 10 teeth obturation using lentulospiral mounted in slow speed handpiece
- Group III: 10 teeth obturation using hand plugger

Procedure: Single operator carried out the pulpectomy procedure for all teeth under local anesthesia, 2% lignocaine with 1:80,000 adrenaline and rubber dam isolation. The procedure included

(1) caries excavation, (2) straight line access preparation with round bur and safe- end bur, (3) pulp extirpation using H- file, (4) working length determination 1 mm short of apex,

(5) chemicomechanical debridement with selective filing^[13] was done sequentially to size 30–35 K-file with copious irrigation with 3% NaOCl and saline, and (6) the root canals were dried out with appropriately sized sterile absorbent paper points.

Description of obturation with different obturation techniques:

A homogenous mix of zinc oxide eugenol was prepared and delivered in one of the three randomly assigned groups. For the ease of delivery into the canals, powder liquid ratio was adjusted depending upon the technique

Group I: For ultrasonic system corresponding to the last instrument size is used at the coronal 2/3 rd of the canal so that due to vibrations the mix gets settled homogenously along the walls of the root canals. For this technique thick mix is prepared, so that the homogenous mix can be inserted in the canal and vibrated which should not stick to the tip (fig: 3)

Group II: for Lentulospiral smaller by two sizes from the last file was selected. creamy mix was prepared. The ZOE was applied by coating a lentulospiral and carrying into the root canals 1 mm short of the radiographic apex and rotating at 1000 rpm. (fig : 4)

Group III: For endodontic pluggers: Thick mix was prepared, an appropriate plugger 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. (fig : 5)

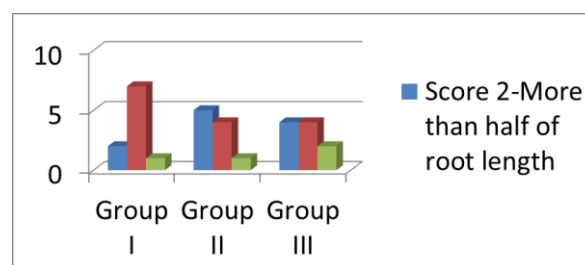


Fig 1: comparisons for different levels of obturation with various obturating techniques.

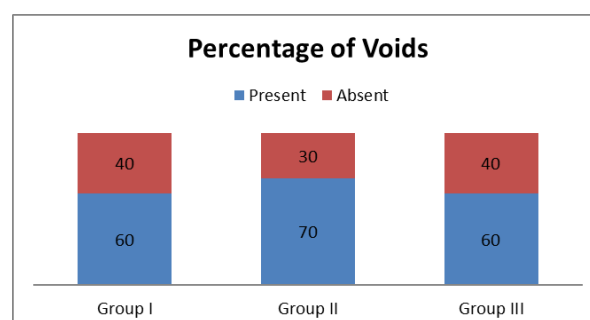


Fig 2: Percentage of voids among Group I, II and III.



Fig 3: Obturation with ultrasonic system.



Fig 4: Obturation with motor-driven lentulospiral.

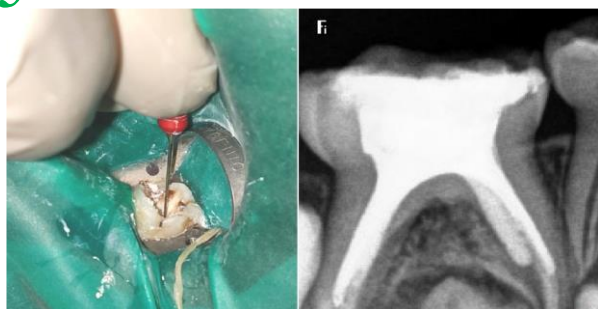


Fig 5: Obturation with plugger.

After obturating the canals, the access cavity was restored using Intermediate Restorative Material. Postoperative radiograph was taken immediately after each obturation. The operator assessed the presence of voids and level of obturation of all root canals using X-ray viewer without knowing which radiograph is of what technique and and graded based on Guelmann *et al.* criteria.^[9]

Level of obturation was graded as, *Grade A* - less than one half of the canal filled ; *Grade B* – under Filling-greater than one-half but less than optimal

RESULTS

Table 1: Intra-group comparisons for different levels of obturation with various obturating techniques.

Parameters		Scores				Total	p-value
		Less or equal to half the root length (Score-1)	More than half the root length (Score-2)	Optimal filing (Score-3)	Filling extruding from the apex (Score-4)		
Group I	N	0	2	7	1	10	0.034
	%	0%	20%	70%	10%	100%	
Group II	N	0	5	4	1	10	0.047
	%	0%	50%	40%	10%	100%	
Group III	N	0	4	4	2	10	0.057
	%	0%	40%	40%	20%	100%	

Table 2: Inter-group comparisons for different levels of obturation with various obturating techniques.

Parameters		Groups			p-value
		Group I	Group II	Group III	
More than half the root length (Score-2)	N	2	5	4	0.057
	%	20%	50%	40%	
Optimal filing (Score-3)	N	7	4	4	0.052
	%	70%	40%	40%	
Filling extruding from the apex (Score-4)	N	1	1	2	0.064
	%	10%	10%	20%	
Total	N	10	10	10	
	%	100%	100%	100%	

fill ; *Grade C* -optimal filling- within 0–1.5 mm from the apex ; *Grade D* - over filling-any canal obturation material extruded outside the root beyond the apex. 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. The results were statistically analysed.

Statistical Analysis:

Descriptive and inferential statistical analyses were carried out in the present study. Results on continuous measurements were presented on Mean $\pm$ SD and results on categorical measurement were presented in number (%). Level of significance was fixed at $p=0.05$ and any value less than or equal to 0.05 was considered to be statistically significant. Chi square analysis was used to find the significance of study parameters on categorical scale. The Statistical software IBM SPSS statistics 20.0 (IBM Corporation, Armonk, NY, USA) was used for the analyses of the data and Microsoft word and Excel were used to generate graphs, tables etc.

Table 3: Intragroup comparison of voids in canals obturated with different techniques.

Parameters		Voids		Total	p-value
		Present	Absent		
Group I	N	6	4	10	0.06
	%	60%	40%	100%	
Group II	N	7	3	10	0.04*
	%	70%	30%	100%	
Group III	N	4	6	10	0.06
	%	40%	60%	100%	

Table 4: Intergroup comparison of voids in canals obturated with different techniques.

Parameters		Groups			p-value
		I	II	III	
Voids	Present	6	7	4	0.053
	%	60%	70%	40%	
	Absent	4	3	6	0.052
	%	40%	30%	60%	
Total (%)		10(100%)	10(100%)	10(100%)	

Intra-group comparisons for different levels of obturation with various obturating techniques, (Table 1 fig 1)

Group I showed 20% more than half the root length (Score-2), 70% showed Optimal filing (Score-3) , 10% showed Filling extruding from the apex (Score-4) which showed statistically significant p-value of 0.034 (<0.05).

In Group II 50% showed score 2, 40% showed score 3, 10% showed score 4 which showed statistically significant p-value of 0.047 (<0.05).

In Group III 40% showed score 2, 40% showed score 3, 20% showed score 4 which showed statistically significant p-value of 0.057 (<0.05).

Inter-group comparisons for different levels of obturation with various obturating techniques. , (Table 2)

Group I showed 20% more than half the root length (Score-2), 50% showed Optimal filing (Score-3) , 40% showed Filling extruding from the apex (Score-4) which showed statistically significant p-value of 0.034 (<0.05).

In Group II 70% showed score 2, 40% showed score 3, 40% showed score 4 which showed statistically significant p-value of 0.047 (<0.05).

In Group III 10% showed score 2, 10% showed score 3, 10% showed score 4 which showed statistically non- significant p-value of 0.057 (>0.05).

Intragroup comparison of voids in canals obturated with different techniques , (Table 3 , fig 2)

In group I, 60% showed presence of voids 40% showed absence, which showed statistically non significant values (p value 0.06). In group II, 70% showed presence of voids 30% showed absence, which showed statistically significant values (p value 0.04). In group III, 40% showed presence of voids 60% showed absence, which showed statistically non significant values (p value 0.06).

Intergroup comparison of voids in canals obturated with different techniques , (Table 4)

When all the three groups were compared 70% of cases in group II showed presence of voids, which was statistically non significant (p value 0.053).

DISCUSSION

The aim of pulp therapy for primary teeth is mainly to restore the form and function of the tooth which ultimately leads to good oral health. If timely treatment is not done for deciduous tooth with irreversible pulpitis or pulpal necrosis, damage to

the succedaneums tooth can occur which produce a negative impact on the child's oral health related quality of life.^[10] The prognosis of an endodontically treated primary tooth is affected not only by the irrigating solutions and biomechanical preparation but also by the obturating material.^[11] Conventionally, ZOE has been the material of choice for filling the root canals of deciduous teeth.^[12] In literature there are plenty of studies to evaluate the success rate of different root canal filling materials used for primary teeth in comparison to obturating technique studies. So the present study was carried out to compare the clinical efficacy of three root canal obturating techniques in primary teeth. The ultimate goals of root filling are to adequately adapt the paste to the canal walls, completely fill the root throughout its length (apical sealing without overfilling), and avoid the creation of voids or gaps in the paste.^[13]

Many investigations have evaluated and compared the success rate of different root canal filling techniques used for primary teeth. In vivo evaluation of the use of the ultrasonic Tip system to fill root canals in primary teeth, has not been investigated. This can be correlated by study done in permanent molars by Bhanu pratap singh et al who found that there was fewer voids and effective obturation when compared with cold lateral condensation. . In the present study, higher percentage of voids was seen in motor-driven lentulospiral group 70% and least in hand plugger 40% method but the difference was found to be not significant ($p > 0.05$) which is similar to the results of study done by khubchandani et al and padranki et al where lentulospiral group showed more number of voids.^[6,7] Joseph et al also mentioned that maximum voids were present in the Rotary Lentulospiral group when compared with navi tip and Double Sideport.^[15]

In the present study, Out of total 10 from each group, in group I, 20 % showed score 2, 70 % showed score 3, 10% showed score 4 with the p-value of 0.034 (< 0.05) which was statistically significant. In group II, 50% showed score 2, 40% showed score 3, 10% showed score 4 with the p-value of 0.047 (< 0.05) which was statistically significant. In group III, 40% showed score 2, 40% showed score 3, 20% showed score 4 with the p-value of 0.057 (> 0.05) which was statistically non-significant. These results were not in accordance

with padranki et al. where motor-driven lentulospirals yielded best results with maximum optimal fills (64.4%) and 62.2% optimal fills with plugger which was almost similar to that of lentulospiral with no significant difference ($P = 0.855$).⁷ In the present study greater overfills was observed with plugger which could be due consistency of the mix, the amount of pressure required to push paste into the canals cannot be finely controlled by the operator, and if the pressure is greater particularly when root apices are undergoing resorption resulting in wider apical foramina for these roots, there is a higher chances of paste over extrusion. Aylard et al. who reported lentulospiral to be the most effective technique for filling both the straight and curved canals.^[16] Camps et al.^[17] Some studies have shown higher frequency of overfill with the lentulospiral technique.^[4,9] The discrepancies between the results of present study and those of other studies probably reflect differences in the type of teeth, sample size, tip thickness, and operator experience.

In present study, sample size was not adequate to come to a final conclusion. The evaluation criteria in present study was IOPA radiographs which is a 2-D view so voids and filling are evaluated in 2-D view only. Further clinical trials with larger sample size and evaluation in 3-D (CBCT) are needed to validate the results of present study.

CONCLUSION

Ultrasonic tip method showed better results for obturation with zinc oxide eugenol in terms of optimal filling when compared to lentulospiral and hand plugger method. However, further studies are needed to obtain better results for voids since ultrasonic is a new technique and requires more skills and techniques.

CONFLICTS OF INTEREST

The authors declare they have no potential conflict of interests regarding this article.

REFERENCES

1. Trairatvorakul C, Chunlasikaiwan S. Success of pulpectomy with zinc oxide-eugenol vs calcium hydroxide/iodoform paste in primary molars: A clinical study. *Pediatr Dent* 2008;30:303-8.

2. Cohen S, Burns RC. Pathways of pulp: Joe H Camp. Paediatric Endodontic Treatment: 6th ed. St. Louis: Mosby, 1994:633-712.
3. Thomas AM, Chandra S, Chandra S, Pandey RK. Elimination of infection in pulpectomized deciduous teeth: A short-term study using iodoform paste. J Endod 1994;20:233-5.
4. Bawazir OA, Salama FS. Clinical evaluation of root canal obturation methods in primary teeth. Paediatr Dent. 2006;28(1):39-47.
5. Yacobi R, Kenny DJ, Judd PL, Johnston DH. Evolving primary pulp therapy [4] techniques. J Am Dent Assoc. 1991;122:83-85.
6. Khubchandani M, Baliga MS, Rawlani SS, Rawlani SM, Khubchandani KM, Thosar N. Comparative evaluation of different obturation techniques in primary molars: An *in vivo* study. Eur J Gen Dent 2017;6:42-7.
7. 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.
8. Gianluca Plonito, Cornelis H. Pameijer, Nicola Maria Grande, Francesco Somma. Ultrasonics in Endodontics (Review). Journal of Endodontics 2007; 33,88 .
9. Guelmann M, McEachern M, Turner C. Pulpectomies in primary incisors using three delivery systems: An *in vitro* study. J Clin Pediatr Dent 2004;28:323-6.
10. Low W, Tan S, Schwartz S. The effect of severe caries on the quality of life in young children. Pediatr Dent 1999;21:325-6.
11. Mass E, Zilberman UL. Endodontic treatment of infected primary teeth, using Maisto's paste. ASDC J Dent Child 1989;56:117-20.
12. Rodd HD, Waterhouse PJ, Fuks AB, Fayle SA, Moffat MA; British Society of Paediatric Dentistry. Pulp therapy for primary molars. Int J Paediatr Dent 2006;16 Suppl 1:15-23.
13. Sari S, Okte Z. Success rate of Sealapex in root canal treatment for primary teeth: 3-year follow-up. Oral Surg Oral Med Oral Pathol Oral Radiol Endod 2008;105:e93-6.
14. Singh BP, kamat S, hugar S, Saraf P. Root canal obturation by ultrasonic condensation of gutta percha and an *in vitro* investigation on the quality of obturation. Edodontology.
15. Joseph EJ, Rao A, Srikant N, Rao A Suprabha BS. The Journal of Clinical Pediatric Dentistry, 2019;43: 6.
16. Aylard SR, Johnson R. Assessment of filling techniques for primary teeth. Pediatr Dent 1987;9:195-8.
17. Camps J, Pommel L, Bukiet F, About I. Influence of the powder/liquid ratio on the properties of zinc oxide-eugenol-based root canal sealers. Dent Mater 2004;20:915-23.