

Evaluation and comparison of different obturation techniques in primary teeth through volumetric analysis using cone beam computed tomography: An In-Vitro Study

¹Dr. Deepak Bhayya, Professor and Head, Department of Paediatric and Preventive Dentistry, Hitkarini Dental College and Hospital, MPMSU, Jabalpur, India

²Dr. More Shubham Bapurao, Post Graduate Student, Department of Paediatric and Preventive Dentistry, Hitkarini Dental College and Hospital, MPMSU, Jabalpur, India

³Dr. Shilpi Dadarya, Professor, Department of Paediatric and Preventive Dentistry, Hitkarini Dental College and Hospital, MPMSU, Jabalpur, India

⁴Dr. Prabhath Kumar, Reader, Department of Paediatric and Preventive Dentistry, Hitkarini Dental College and Hospital, Jabalpur, MPMSU, Jabalpur, India

⁵Dr. Saurabh Tiwari, Senior Lecturer, Department of Paediatric and Preventive Dentistry, Hitkarini Dental College and Hospital, Jabalpur, MPMSU, Jabalpur, India

⁶Dr. Anushka Waghmare, Post Graduate Student, Department of Paediatric and Preventive Dentistry, Hitkarini Dental College and Hospital, MPMSU, Jabalpur, India

Corresponding Author: Dr. Deepak Bhayya, Professor and Head, Department of Paediatric and Preventive Dentistry, Hitkarini Dental College and Hospital, MPMSU, Jabalpur, India

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Abstract

Background: The main objective of pulp therapy in children is the successful treatment of the pulpally involved tooth to be retained in a healthy condition in order to fulfill its role as an important and useful component of the primary and young permanent dentition. The prerequisite of successful endodontic treatment is

removal of the pulp tissue associated with micro-organisms and eliminate as many bacteria as possible from the root canal system, followed by obturation with resorbable filling material. of densely filling the entire root canal system and providing a fluid tight seal from the apical segment of the This can be achieved by an ideal filling technique which will assure the complete filling of

the canal without overfill and also with minimal or no voids.

Objectives: The present study aimed to evaluate and compare 27-gauge local anesthetic syringe, tuberculin syringe, endodontic plugger and engine driven lentulospiral as obturation techniques in primary teeth through volumetric analysis using Cone Beam Computed Tomography.

Methods: A total of 40 extracted primary anterior teeth were collected. Access cavity preparation and biomechanical preparation was done till file number #30-35 using hand H-files. Preparation of rectangular moulds for scanning of specimen was done using modeling wax. A volumetric analysis of pre-obtured teeth specimen was done by using Cone Beam Computed Tomography. The Endoflas obturating material was mixed and filled into the specimens using 27-gauge local anesthetic syringe, tuberculin syringe, endodontic plugger and engine driven lentulospiral obturation techniques. All procedures were repeated 4-6 times till orifice of canal was filled. Postoperative canal volume determination was achieved using Cone Beam Computed Tomography.

Results: One-way ANOVA test showed the mean POV value in Group I (27 Gauge LA Syringe), Group II (Tuberculin syringe), Group III (Endodontic plugger) and Group IV (Engine driven Lentulo spiral) was 65.53 ± 2.16 %, 74.45 ± 2.03 %, 80.68 ± 2.23 % and 90.01 ± 2.25 % respectively.

Conclusion: The Engine driven lentulo spiral obturation technique had shown significant difference with highest Percentage Obturation Volume of filling material with minimum space compared to Endodontic plugger, Tuberculin syringe and whereas least was seen in 27 guage LA syringe technique.

Keywords: Endoflas, obturation techniques, primary teeth, pulpectomy

Introduction

Pulpectomy is a root canal procedure for pulp tissue that is infected or necrotic due to caries or trauma.¹ It helps to eliminate microorganisms from the root canal and prevent subsequent reinfection of the canal space.²

Zinc Oxide Eugenol is most widely used obturating material in pulpectomy, but due to some drawbacks, such as, delayed resorption.³ Alternative materials are also available in the market, such as, Calcium hydroxide⁴ Iodoform pastes such as Walkoff's paste and Maisto's paste.³ Another biocompatible material Endoflas, produces a perfect hermetic seal due to its hydrophilic property.² It has significantly greater antimicrobial activity⁵ with long-term substantivity over ZOE.⁶

Several methods of obturation have been used in the primary teeth root canals, such as disposable tuberculin syringe, local anesthetic syringe,⁷ endodontic plugger and motor driven lentulospirals. The commonly used techniques to evaluate filling quality of root canals is conventional radiograph or digital imaging while other methods include radioisotopes,⁸ dye penetration,^{9,10} fluid filtration,¹¹ bacterial leakage,¹² microscopic analysis, micro computerized tomography. All these techniques have their own disadvantages.¹³

The Cone Beam Computed Tomography, an advanced diagnostic aid has been used to make 3 dimensional image of subject.¹⁴ It is very convenient providing a 3D-assessment of volume. Thus, the present study is being conducted using four different obturation methods, that is, local anesthetic syringe technique, disposable tuberculin syringe technique, endodontic pluggers and motor driven lentulospiral technique by 3-D assessment of volumes of obturation using CBCT.¹

Materials and methods

The present *in-vitro* study was carried out in the Department of Paediatric and Preventive Dentistry,

Hitkarini Dental College and Hospital, Jabalpur (M.P) in collaboration with Proscan Digital Solutions, Khar, Mumbai (Maharashtra).

Previously, a pilot study was done to understand the intricacies so as to design a proper study and taking into considerations of any possible constraints during the main study.

A total of 40 extracted primary teeth collected from department of Paediatric and Preventive Dentistry, Hitkarini Dental College and Hospital, Jabalpur, Madhya Pradesh. The extracted teeth were stored, disinfected and handled as per the recommendation and the guideline laid down by Center for Disease Control (CDC).

Inclusion Criteria

- Primary anterior teeth with grossly carious.
- Any Primary anterior which is over retained in oral cavity.
- Primary anterior teeth with loss of bone support in oral cavity.
- Primary anterior teeth with at least 3/4th of root length are present.

Exclusion Criteria

- Primary anterior teeth should not less than 3/4th of its root length.
- Primary anterior teeth with calcified canal.
- Primary anterior teeth, which are difficult to obturate the canal.

Procedure

Preparation of Teeth Specimen: Access cavity preparation was done using diamond fissure bur with help of high speed air-rotor and check a gliding path while using #10 H-file, the working length of the canal was recorded as length of initial file at the apical foramen -1 mm. Biomechanical preparation was done till file number #30-35 using hand H-files. The canals were irrigated with normal saline and once the preparation was done, they

were dried using absorbent paper point. Root apex was blocked by a small amount of red wax to prevent extrusion of filling material and Canals was numbered from 1 to 40.

Preparation of model

- Rectangular shape block was made by using modelling wax and tip of the roots was embedded in the mould and rest was exposed.
- Volumetric analysis of pre-obtured teeth was assessed by using Cone Beam Computed Tomography.

Preparation of material : Endoflas FS material was used as obturating material, uniformly mix on the glass slab using cement spatula in creamy consistency 1:1.5 liquid-powder ratio for all groups.

Obturation techniques: Samples were divided into 4 groups after biomechanical preparation (n=10 in each group):

Group 1: The obturation was done with prepared material using 27 gauge LA syringe technique. Prepared paste was filled in Local anaesthetic syringe from back side and later using with 27-gauge needle, place over the canal orifice. After obturation of canal, cotton pellet was used to compress the material into the canal.

Group 2: The obturation was done with prepared material using 26 gauge needle of tuberculin syringe technique. This paste was filled in tuberculin syringe from back side with 26 gauge needle place over canal orifice. After obturation of canal, cotton pellet was used to compress the material into the canal.

Group 3: The obturation was done prepared material which was placed using incremental technique by endodontic pluggers. A prepared paste was rolled in to flame shape according to size and shape of orifice of canal, this material placed over orifice of canal and gently tapped into apex area using endodontic pluggers with a rubber stop 2 mm short of working length respective to the

size of the canal followed by the placement of additional 2 mm thick prepared material blocks until the canals were filled to the orifice then cotton pellet was used to compress the material into the canal.

Group 4: The obturation was done using lentulo spiral mounted on slow speed handpiece. The lentulospiral was dipped into prepared obturating material and rotated clockwise direction, inserted into canal after coating the walls of canals withdrawn gently while rotating. Then additional paste was placed into canal to fill till orifice. After obturation of canal, cotton pellet was used to compress the material into the canal in each of the groups. Postoperative Volume determination was achieved using the In Vivo 6.0.2 software (Anatomage, San Jose, CA,USA) Cone Beam Computed Tomography.

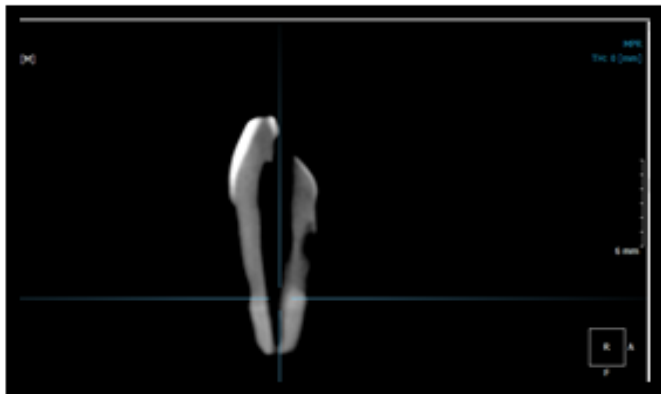


Figure a: Pre - obturation volumetric analysis in CBCT scan

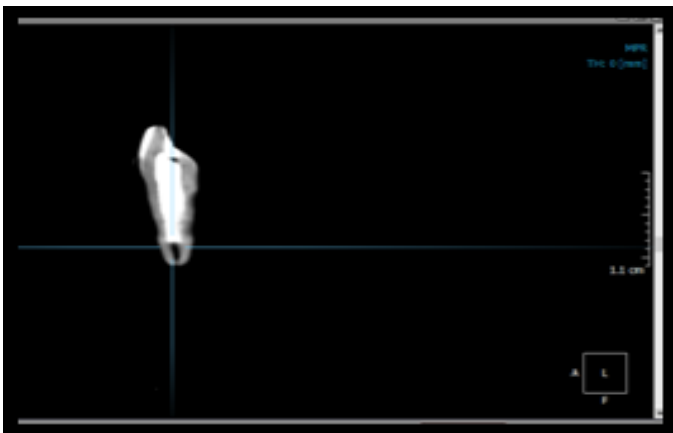


Figure b: Post - obturation volumetric analysis in CBCT scan

Results

The comparison of means among Group I, Group II, Group III and Group IV was done using One-way ANOVA test. The minimum and maximum values of POV of root canals in Group I (27 Gauge LA Syringe), Group II (Tuberculin syringe), (Group III) Endodontic plugger and Group IV (Engine driven Lentulo spiral) were 61.54% and 68.42%, 71.43% and 78.57%, 76.92% and 83.33%, 85.71% and 92.50% respectively. F value was found to be 225.388 and P value was found to be 0.000 (<0.001) (Statistically highly significant). (Table 1)

The mean difference of POV values when Group I is compared to Group II, compared with Group III and compared with Group IV gives a mean difference value of -8.92%, -15.15 and -24.48% respectively. The Tukey's post hoc test was used for pairwise comparison this shows the highest POV value was observed in Group IV and the least in Group I. (Table 2)

Table 1: Comparison of Percentage Obturate Volume (POV) of root canals between different groups.

Groups		Percentage Obturated Volume (POV) (%)	
		Min-Max	Mean ± SD
Group I	27 Gauge LA Syringe	61.54-68.42	65.53 ± 2.16
Group II	Tuberculin syringe	71.43-78.57	74.45 ± 2.03
Group III	Endodontic plugger	76.92-83.33	80.68 ± 2.23
Group IV	Engine driven Lentulo spiral	85.71-92.50	90.01 ± 2.25
One-way ANOVA		F = 225.388, P = 0.000 (<0.001) Very high significant	

Table 2: Pairwise comparison of Percentage Obturated Volume (POV) of root canals between different groups using Tukey Post Hoc test.

Comparison groups (Pairs)	Mean difference (%)	P value
Group I vs Group II	-8.92	P = 0.000 (<0.001)****
Group I vs Group III	-15.15	P = 0.000 (<0.001)****
Group I vs Group IV	-24.48	P = 0.000 (<0.001)****
Group II vs Group III	-6.23	P = 0.000 (<0.001)****
Group II vs Group IV	-15.56	P = 0.000 (<0.001)****
Group III vs Group IV	-9.32	P = 0.000 (<0.001)****

Discussion

A good obturation with optimum filling and minimum voids is considered to have highest success rate for pulpectomy in primary teeth.¹⁴ Very few studies have been carried out to evaluate the different techniques of root canal filling in primary teeth. Thus, the present study aimed to fill this gap, since it was still necessary to search and find out the best method of root canal obturation in primary teeth comparing.¹⁶

In the present study, engine driven lentulo spiral showed significant reduction in the root canal volume after obturation than the root canal volume before the obturation. The lentulo spiral filling method showed better results and was superior for filling curved canals, similar results were seen by **Aylard et al (1987)**¹⁷ when they demonstrated the various root canal filling techniques for curved canals of primary teeth. The flexibility of the lentulospirals effectively delivered the material throughout the canal shape during the filling procedure.

In the present study, the percentage of obturation volume (POV) was found to significantly maximum (90.01 ±

2.25%) for Engine driven Lentulo spiral. This result suggests that the Engine Driven Lentulo spiral was superior in terms of percentage of obturation volume than the LA-injecting technique, Tuberculin syringe technique and the Endodontic Plugger. Similar results were reported when comparison of lentulo spiral was done with pressure syringe by **Greenberg (1961)**,¹⁸ lentulo spiral gave significantly better results. The consistently spaced spirals present in the lentulo spiral provide flexibility in distributing the obturating material evenly throughout the root canal system as stated by **Nagaveni et al. (2017)**¹⁹ where they demonstrated volumetric evaluation of endodontic plugger, lentulo spiral (handheld), lentulo spiral mounted on slow speed handpiece, local anesthetic syringe and tuberculin syringe in primary teeth and showed 89.43% percentage of obturation in the technique using lentulo spiral mounted on slow speed hand piece.

In the present study, Engine Driven lentulo spiral showed significantly higher difference of 24.47%, 15.55% and 9.32% in the mean percentage of obturation volume on comparison with 27 Gauge LA Syringe, Tuberculin syringe and Endodontic plugger respectively. This indicates that more the percentage of volume in root canals, there will be minimum number of voids present in root canals. Also, the presence adequate amount of space in the root canal for Lentulo spiral allowed it to rotate and lead to less chance of it getting engaged. Similar results were demonstrated by **Pranitha et al. (2019)**,²⁰ where quality of obturation was assessed in Motor driven Lentulo spiral, Hand held Lentulo spiral and Endodontic pressure syringe group on primary teeth. **Chandrasekhar et al. (2017)**²¹ showed greater optimal filling with Lentulo spiral technique when compared to Bi-directional spiral and incremental techniques. However, no statistically significant differences were seen on overall or pairwise

comparison between pluggers, lentulo spiral and NaviTip system as reported by Pandranki et al. (2017).²²

From the analysis of results, Engine driven Lentulo spiral is easy and effortless obturation technique for primary anterior teeth. Thus, Engine driven lentulo spiral is effective technique for thorough obturation of primary anterior teeth with minimum gap. However, the sample size was not adequate enough to come to a final conclusion. Further *in-vivo* clinical trials with larger sample size and different techniques with different materials with advanced evaluation methods other than the 3-D (CBCT) are needed to authenticate the data of the present study.

Conclusion

Within the limitations of the present study, it can be concluded that engine driven lentulo spiral technique was the best technique in terms of obturation when compared to 27-gauge LA syringe, tuberculin syringe and endodontic pluggers techniques after volumetric analysis through three dimensional CBCT imaging system..

References

1. AAPD. American Academy on Pediatric Dentistry Clinical Affairs Committee-Pulp Therapy Subcommittee. Guideline on pulp therapy for primary and young permanent teeth. *Pediatr Dent*. 2014;30:170-74.
2. Praveen P, Anantharaj A, Venkataraghavan K, Rani P, Sudhir R, Jaya AR. A review of obturating materials for primary teeth. *J Res Dent Sci*. 2011;2(1):42-44
3. Rajsheker S, Mallineni SK, Nuvvula S. Obturating Materials Used for Pulpectomy in Primary Teeth-A Mini Review. *J Dent Craniofac Res*. 2018;3(1):1-9..
4. Estrela C, Sydney GB, Bammann LL, Felipe O Jr. Mechanism of action of calcium and hydroxyl ions of calcium hydroxide on tissue and bacteria. *Braz Dent J*. 1995;6:85-90.
5. Kaiwar A, Nadig G, Hedge J, Lekha S. Assessment of antimicrobial activity of endodontic sealers on *Enterococcus faecalis*: An in vitro study. *World J Dent*. 2012;3:26-31.
6. Kothari A, Langalia A. Comparative evaluation of the antimicrobial activity of different endodontic sealers on *Enterococcus faecalis*: An in vitro study. *Natl J Integr Res Med*. 2013;4:121-27.
7. Özer S, Tunç EŞ, Kalyoncuoğlu E, Gülcan B. Evaluation of Different Root Canal Filling Methods in Primary Teeth. *Meandros Meandros Med Dent J*. 2018;19(2):132-37.
8. Haïkel Y, Freymann M, Fanti V, Claisse A, Poumier F, Watson M. Apical microleakage of radiolabeled lysozyme over time in three techniques of root canal obturation. *J Endod*. 2000;26:148-52.
9. Mc Robert AS, Lumley PJ. An in vitro investigation of coronal leakage with three gutta-percha backfilling techniques. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod*. 1997;30:413-17.
10. Venturi M. Evaluation of canal filling after using two warm vertical gutta-percha compaction techniques in vivo: A preliminary study. *Int Endod J*. 2006;39:538-46.
11. Kontakiotis EG, Tzanetakis GN, Loizides AL. A 12-month longitudinal in vitro leakage study on a new silicon-based root canal filling material (Gutta-Flow). *Oral Surg Oral Med Oral Pathol Oral Radiol Endod*. 2007;103:854-59.
12. Jacobson HL, Xia T, Baumgartner JC, Marshall JG, Beeler WJ. Microbial leakage evaluation of the continuous wave of condensation. *J Endod*. 2002;28:269-71.
13. Nagaveni NB, Yadav S, Poornima P, Bharath KP, Mathew MG, Naveen Kumar PG. Volumetric evaluation of various obturation techniques in primary

- teeth using cone beam computed tomography - An in vitro study. *J Ind Soc Pedod Prev Dent.* 2017;35:244-48.
14. Scarfe WC, Farman AG. What is cone-beam CT and how does it work?. *Dent Clin North Am.* 2008;707-30.
15. Gandhi M, Tandon S, Vijay A, Kalia G, Rathore K. Clinical assessment of various obturating techniques for primary teeth: a comparative study. *J Clin Diagn Res.* 2017;11(7):48-51
16. Almeida LH, Krüger MM, Pilownic KJ, Costa VP, Romano AR, Pappen FG. Root canal filling techniques for primary molars: an in vitro evaluation. *Giornale Italiano di Endodonzia.* 2019;33(1):14-20
17. Aylard SR, Johnson R. Assessment of filling techniques for primary teeth. *Pediatr Dent.* 1987;9(3):195-98.
18. Greenberg M. Filling root canals in deciduous teeth by an injection technique. *Dent Dig.* 1961;67:574-75.
19. Nagaveni NB, Yadav S, Poornima P, Bharath KP, Mathew MG, Naveen Kumar PG. Volumetric evaluation of various obturation techniques in primary teeth using cone beam computed tomography - An in vitro study. *J Ind Soc Pedod Prev Dent.* 2017;35:244-48
20. Pranitha V, Sultana Z, Dwijendra KS, Shaik N, Jolige A, Moghani MA. Volumetric analysis of three different obturation techniques in primary teeth using CBCT: An in vitro study. *Int J Appl Dent Sci.* 2019;5(4):360-63.
21. Chandrasekhar et al. A comparative In vivo efficacy of three spiral techniques versus incremental technique in obturating primary teeth. *J Ind Soc of Pedod and Prev Dent.* 2018;36(1):71-75.
22. Pandranki J, Chitturi RR, Vanga NR, Chandrabhatla SK. A comparative assessment of different techniques for obturation with endoflas in primary molars: an in vivo study. *Ind J of Dent Res.* 2017;28(1):44-48.