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Original Article

Comparative Evaluation of Quality of Obturation between Two Obturation Techniques in Pulpectomy of Lower Primary Molars – An *In Vivo* Study

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Abstract

Aim: The aim of this study was to compare and evaluate the quality of obturation between hand held lentulo spirals and slow speed motor-driven lentulo spirals used obturation techniques in pulpectomy of lower primary molars.

Materials and Methods: The study was carried out among 136 children aged 4–7 years with pulpally involved mandibular primary molars requiring single visit pulpectomy who reported to the outpatient wing, Department of Pediatric and Preventive Dentistry, Government Dental College, Kottayam, satisfying the inclusion and exclusion criteria. Subjects were recruited consecutively into two groups with 68 children in each. Group I (obturation was done with handheld lentulo spirals technique) and Group II (obturation was done with slow speed motor – driven lentulo spirals technique). The parameters quality of obturation which, in turn, includes extent of apical seal, presence, or absence of voids was evaluated. The data were analyzed with Independent *t*-test and Chi-square test. Level of significance for the study was set as $P < 0.05$.

Results: Statistical analysis by Chi-square test showed that there is statistically significant difference regarding the quality of obturation between the groups with respect to apical seal and presence or absence of voids.

Conclusion: Powered lentulo spirals with a slow speed handpiece produced more ideal obturation compared to hand held lentulo spirals. Hence, the traditional lentulo spirals itself can be a better alternative option to newer costly, technique sensitive obturation techniques for an ideal obturation of the primary teeth.

Key words: Handheld-lentulo spirals, Obturation, Pulpectomy, Slow speed motor-driven lentulo spirals

INTRODUCTION

Maintaining the integrity of the primary teeth in the oral cavity is one of the major goals of pediatric dentistry. The primary dentition plays a key role in the child's growth and development, not only in terms of speech, chewing, appearance and the prevention of bad habits but also in the guidance and eruption of permanent teeth. The dental caries left untreated will progress to involve the pulp resulting in the early loss of the primary teeth. The best space maintainer in both primary and mixed dentition is the primary tooth itself, not only due to the clinical crown but also due to the presence of roots and periodontium that guides the eruption of the succedaneous permanent tooth.

Pulpectomy treatment is one option for maintaining primary teeth diagnosed with pulpal tissue inflammation involving radicular or non-vital pulp until normal exfoliation.[1] As per UK National Clinical Guidelines in Pediatric Dentistry, the rationale involved in pulpectomy procedure is to remove irreversibly inflamed or necrotic radicular pulp tissue and gently clean the root canal system. This is followed by obturating the root canals with a filling material that will resorb at the same rate as the primary tooth, which would

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be resorbed as time progress if accidentally extruded through the apex.[2]

Endodontic therapy of primary teeth is dependent on the factors such as unpredictable root canal anatomy of the primary teeth, deposition of secondary dentin, physiological resorption causing changes in anatomical forms of the root canals, and tortuosity of the root canals. An ideal filling technique should satisfy complete filling of the canal without overfill and with minimal or no voids. The most commonly used obturation techniques in the primary teeth includes amalgam pluggers, local anesthetic syringe, reamers, paper points, endodontic pressure syringe, handheld lentulo spiral, lentulo spiral mounted in a slow speed handpiece, mechanical syringe, cotton pellets, Jiffy tube, endodontic pluggers, endofiles, tuberculin syringe, and recently the NaviTip™.[3-8]

Lentulo spirals were advocated by Kopel.[9] It is the most traditional and commonly used instrument as the root canal paste carrier which is used in obturation of the primary teeth as hand held instrument or poer driven with a slow speed hand piece. According to the best of the researcher's knowledge, none of the obturation techniques available have been found to be ideal for obturation of root canals in the primary teeth. Several recent methods of obturation techniques in the primary teeth have found to show limitation in quality of obturation in various aspects, but considering the ease of use, handling and cost concerns, the traditional lentulo spirals can be a better option that can be used routinely in clinical practice than going in for advanced, technique sensitive and costly obturation techniques. Most of the studies about lentulospiral obturation techniques are *in vitro* comparisons and the quality of obturation is assessed by conventional radiography, digital radiography, and even cone-beam computed tomography. *In vitro* evaluation of root canal obturation methods in the primary teeth has reported the use of the lentulo spirals mounted in a slow-speed hand piece in filling of straight and curved canals of the primary teeth to be superior. However, there are a few research studies on *in vivo* clinical evaluation of obturation technique using two mode of usage of lentulo spirals. Hence, this present *in vivo* study was planned to assess the quality of obturation between hand held lentulo spirals and slow-speed motor-driven lentulo spirals as obturation technique in the primary teeth.

MATERIALS AND METHODS

The study was conducted in the Department of Pediatric and Preventive Dentistry, government dental college, Kottayam, Kerala. Evaluation of the study was done by the Ethical Committee of the Institute and Ethical Committee approval was taken before the study. Informed consent was taken from all the parents after explaining them the entire procedure in detail, before starting the treatment.

Sample size is calculated by the formula:[10,11]

$$n = \frac{Z^2_{1-\alpha/2}\left[P_1\left(1-P_1\right) + P_2\left(1-P_2\right)\right]}{\left(d2\right)2}$$

$$n = \frac{\left(1.96\right)2\left[\begin{matrix}0.15\left(1-0.15\right) + \\ 0.65\left(1-0.65\right)\end{matrix}\right]}{\left(0.1\right)2} = 136$$

Based on the inclusion and exclusion criteria, 136 patients indicated for pulpectomy were selected in the study. Pulpectomy was performed in all teeth indicated for pulp therapy. Based on technique of obturation, patients were divided into two groups by consecutive sampling:

- Group I: 68 teeth obturated with handheld lentulo spirals
- Group II: 68 teeth obturated with slow-speed motor-driven lentulo spirals.

Primary molars with signs of irreversible pulpitis, with adequate bone support with at least two-third of intact root length, no gingival swelling or presence of sinus tract, and no purulent exudates expressed from the gingival margin were included in the study. Whereas, grossly decayed teeth which cannot be restored. Any pathologic signs of external or internal resorption. Children with underlying systemic diseases and with special health-care needs. Children exhibiting lack of co-operative behavior. Teeth with anatomic variations were excluded from the study.

Clinical Procedure

A standard pre-operative radiograph was taken using digital radiography. Access to the pulp was obtained by round bur and barbed broach was used to remove it. The working length of the canal was established 1 mm short of radiographic apex. Biomechanical preparation of root canal was done and the canal was irrigated using saline and dried using paper points. Obturation of the tooth was then done using either handheld lentulo spirals or slow-speed motor-driven lentulo spirals and the teeth were divided in groups I and II, respectively.

Obturation with Handheld Lentulo spiral

A 21 mm hand held lentulo spiral was used to deliver the zinc oxide eugenol into root canals. Predetermined canal length was positioned with a stopper. Lentulo spirals was coated with the zinc oxide eugenol mix and inserted into

canal with clockwise rotation, accompanied by vibratory motion to allow material in to apex and then withdraw from the canal, while simultaneously continuing the clockwise rotation.

Obturation with slow Speed Motor-driven Lentulo spiral

A 21 mm lentulo spiral mounted in slow speed hand piece (1000 rpm) was used to deliver the zinc oxide eugenol into root canals. A rubber stopper was used to keep lentulo spirals 1 mm short of predetermined working length. The lentulo spirals were adjusted in clockwise rotation initially to pick up the freshly mixed creamy mix of zinc oxide eugenol. After insertion in to the canal, it was operated in counter clockwise rotation and withdrawn from the canal while still rotating.

The process was repeated in the both groups until the canal orifices appeared to be filled visibly. Final restoration was done with a glass-ionomer cement.

Assessment of Obturation Techniques

The comparison among the two techniques was determined radiographically by evaluating quality of obturation and voids in the obturated canals, based on the following criteria given by Sandrian and Coll (1996)[12]

a. Apical seal
   - Under filling (score1): All the canals were filled more than 2 mm short of radiographic apex
   - Optimal filling (score2): One or more of canals having obturation material ending at radiographic apex or up to 2 mm short of radiographic apex
   - Over filling (score 3): Any canal showing obturation beyond radiographic apex

b. Obturated canals were assessed for presence or absence of voids.

Apical seal was evaluated in millimeters from the apical end of the canal filling material and to the radiographic apex and categorized as score 1, score 2, and score 3. The highest score is considered as overall quality of obturation for individual tooth.

Statistical Analysis

Data collected were statistically analyzed using SPSS 18 software. Quantitative data (Age) were compared by mean and standard deviation with independent sample *t*-test. Qualitative data (Gender, Apical seal, and Voids) were compared by frequency and proportion with Chi-square test.

RESULTS

A total of 136 healthy children (65 males and 71 females) in the age group of 4–7 years with a mean age of 5.48 ± 0.950 in Group I and 5.66 ± 0.932 years in Group II participated in our study.

No statistical significant difference was noted between the groups with respect to the age ($P = 0.276$) and gender ($P = 0.479$) [Figures 1 and 2]. This indicates that there was an equal distribution of the participants between both the groups. Thus, both groups were balanced with respect to age and gender [Tables 1 and 2].

In Group I, the overall obturation of the canals was under filling in 16 cases (23.5%), optimum filling in 46 cases (67.6%), and over filling in 6 cases (8.8%) and in Group II, the obturation of canals was under filling in three cases (4.4%), optimum filling in 50 cases (73.5%), and over filling in 15 cases (22.1%) [Table 3].

The root canals were optimum filled in 46 and 50 cases in Group I and Group II, respectively, which is more than 70.6% of total obturations with Group II showing

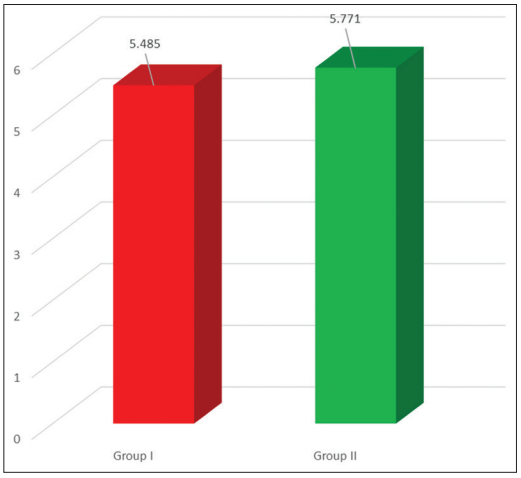

Figure 1: Bar diagram showing age-wise distribution in the study groups

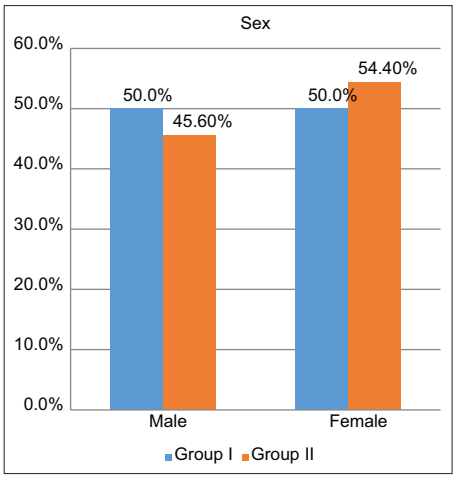

Figure 2: Bar diagram showing gender-wise distribution in the study groups

more number of optimally filled root canals which are about 73.5% [Figure 3]. Hence, a statistically significant difference was found between Group I and Group II with regard to apical seal in both canals of lower primary molars ($P = 0.002$) with Chi-square test [Table 3].

Table 1: Age-wise distribution in the study groups

Groups	*n*	Mean age	SD	t	*P*-value
Group I	68	5.485	0.9501	1.09	0.276
Group II	68	5.662	0.9322		

Table 2: Gender-wise distribution in the study groups

Groups	Sex		Total	χ^2	*P*-value
	Male	Female			
Group I				1.47	0.479
Count	34	34	68		
%	50.0	50.0	100.0		
Group II					
Count	31	37	68		
%	45.6	54.4	100.0		
Total					
Count	65	71	136		
%	47.8	52.2	100.0		

Table 3: Comparison of apical seal in obturation of two study groups

Groups	Apical seal			Total	χ^2	*P*-value
	Under filling	Optimum filling	Over filling			
Group I					12.91	0.002
Count	16	46	6	68		
%	23.5	67.6	8.8	100.0		
Group II						
Count	3	50	15	68		
%	4.4	73.5	22.1	100.0		
Total						
Count	19	96	21	136		
%	14.0	70.6	15.4	100.0		

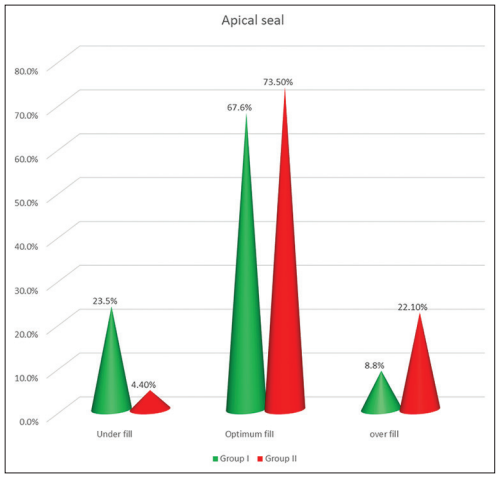

Figure 3: Bar diagram showing percentage distribution of under filled, optimum filled, and over filled cases of apical seal in obturation of two study groups

In Group I, absence of voids was in 34 cases (50.0%) and the presence of voids was in 34 cases (50.0%). Whereas in Group II, absence of voids was in 61 cases (89.7%) and presence of voids in seven cases (10.3%) in root canals, respectively, [Figure 4] so Group II showed less number of voids than Group I [Table 4].

Considering both groups, voids were present in only 41cases (30.1%) and absence of voids was noted in 95 cases (69.9%). Hence, a statistically significant difference was found between Group I and Group II with regard to the voids in canal obturation of lower primary molars ($P = 0.000$) which was calculated using Chi-square test [Table 4].

DISCUSSION

In the present study, the mean age (years) of the children was 5.57, which was similar to the study reported by Omar and Salama.[3] Out of 136 children, there were 47.8% of male patients and 52.2% of female (52.2%) patients. Hence, the gender imbalance has no effect on the procedure and results of root canal obturation. This was in agreement with study by Gandhi *et al*.[10] and Chandrasekhar *et al*.[11]

In our study, there were 73.5% of cases showing optimum filling with slow speed motor-driven obturation technique (Group II) after the procedure, whereas 67.6% cases showed optimum filling with the handheld lentulo spiral obturation technique (Group I) which was statistically significant. This findings are accordance with the study by Singh *et al*.[13] that motor-driven lentulo spirals produced best optimum filled obturation compared to handheld lentulo spirals technique and the study by Gandhi *et al*.[10] which showed that handheld lentulo spirals produced more number of underfilled canals compared to disposable syringes and past inject.

A previous study by Pandranki *et al*.[14] also revealed that motor-driven lentulo spiral was superior to tuberculin and endodontic pressure syringe in the obturation of the primary root canals. The flexibility of the lentulo spiral was contributed to these findings. A study by Staehle *et al*.[6] also reported that motor-driven lentulo spiral system revealed significantly better results when compared to hand instruments.

In our study, the underfilled obturation of 23.5% was seen with handheld lentulo spirals (Group I) and of 4.4% with motor-driven lentulo spirals technique, respectively. Similar findings were reported in a study by Gandhi *et al*.,[10] which

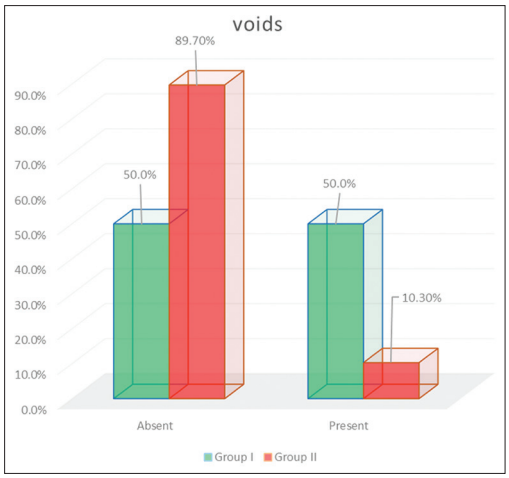

Figure 4: Bar diagram showing presence or absence of voids in obturation of two study groups

Table 4: Comparison of voids in obturation of two study groups

Groups	Voids		Total	χ^2	*P*-value
	Absent	Present			
Group I					
Count	34	34	68	25.45	0.000
%	50.0	50.0	100.0		
Group II					
Count	61	7	68		
%	89.7	10.3	100.0		
Total					
Count	95	41	136		
%	69.9	30.1	100.0		

showed 10% underfilled canals with handheld lentulo spirals when compared to past inject technique and a study by Sengupta *et al*.[15] reported a 30% of underfilled canals with motordriven lentulo spirals when compared to reamer technique.

The present study showed overfilled canals of 22.1% cases with motor-driven lentulo spirals and of 8.8% cases with handheld lentulo spirals, respectively. This was accordance with the study by Vashista *et al*.,[16] which reported 20% of overfilled obturation with handheld lentulo spirals compared to pressure syringe technique and a systematic review and meta-analysis by Aminabadi *et al*.[17] reported that 23.3% of overfilled obturation with motor-driven lentulo spirals. Hence, overfilled obturation is one of disadvantages with lentulo spiral obturation technique.

In the present study, the presence of voids in the root canal filling was also assessed radiographically following obturation. About 50.0% of cases showed voids with the handheld lentulo spirals in the obturation, whereas only 10.3% cases showed voids with the motor-driven lentulo spirals technique. The two techniques showed a significant difference regarding voids in the obturation. This result was in agreement with the previous study by Singh *et al*.[13] which stated that the handheld lentulo spirals produced more number of voids in obturation of the primary teeth than reamer technique and motor-driven lentulo spirals technique. A contradictory study by Walia *et al*.[18] showed that voids are inevitable and were present with both handheld lentulo spirals and motor-driven lentulo spirals techniques.

According to newer research, optimal fillings of the root canals of the primary teeth are easily achieved with past inject. Past inject paste carrier is a specifically designed device and works similarly to the lentulo spiral. However, study by Chandrasekhar *et al*.[11] concluded that lentulo spirals was superior in quality of obturation compared to past inject technique. Hence, lentulo spirals can act as substitute for cost effective obturation technique when compared to newer methods which produced better results as per several literatures.

The present investigation and findings of the study were limited to lower primary molars, the morphology of root canals of first and second primary mandibular molars are entirely different, and this may affect the quality of obturation which is not mentioned separately in this study. Quality of obturation was assessed as overall status of the primary molars; but it was not mentioned specifically whether it was in mesiobuccal, mesiolingual or distobuccal, or distolingual root canals.

CONCLUSION

We, thereby, conclude that within the limits imposed by the conditions used in the present study, both the hand held and slow speed motor-driven lentulo spirals technique could be effectively used for obturation in primary dentition. Considering apical seal and voids, the use of slow speed motor-driven lentulo spirals produced better quality of obturation as compared to handheld lentulo spirals. Being a clinical comparative study, based on the quality of evidence generated by comparing two traditional treatment techniques (handheld lentulo spirals and slow speed motor-driven lentulo spirals technique), this could be an alternative to newer costly techniques as quality of obturation which is an important clinical factor in pulpectomy procedure.

Limitations of the Study

The present study is based on the comparison between two different obturation techniques in the primary lower molars. The morphology of root canals of first and second primary mandibular molars is entirely different and this may affect the quality of obturation which is not mentioned separately in this study.

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