RESEARCH ARTICLE

Assessment of Four Obturation Methods in Deciduous Teeth Using Digital Radiography: An *In Vivo* Study

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Abstract

Aim and objective: This study was carried out to comparatively assess the efficiency of four methods of obturation viz Lentulo spiral, Navi tip syringe, Bi directional spiral, and Past inject carrier in deciduous teeth using vista scan.

Materials and methods: A total sample of 100 primary root canals [4 groups of 25 canals each] with 2/3rd of root length were selected and randomly allocated into four different obturating techniques, i.e., Group I: Lentulo spiral, Group II: Navi tip syringe, Group III: Bi directional spiral, and Group IV: Past inject carrier. The quality of obturation [Coll and sadrain, 1996] and presence or absence of voids were evaluated by using Vista scan. The recorded data was statistically analyzed.

Results: The highest mean rank value of optimally filled canals was obtained by Group IV [58.00] followed by Group I [50.00] with no significant difference. The highest mean rank value of under filled canals and over filled canals were obtained by Group III and Group II, respectively, and these results were statistically significant. All the four obturation techniques showed presence of voids with no significant difference.

Conclusion: Both Lentulo spiral and Past inject carrier were equally efficient in attaining an optimally filled homogenous obturation in deciduous teeth.

Keywords: Deciduous teeth, Obturation techniques, Quality of obturation, Vista scan, Voids.

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Introduction

The endodontic management of a grossly decayed primary teeth with pulpal involvement, pulpectomy, has been revolutionized from past to present in terms of both obturating materials and obturating techniques. The success of pulpectomy treatment depends on both the quality of obturation and homogenous obturation without voids. The quality of obturation and its success rate depends upon both mixing technique of obturating material and the type of obturating technique used.[1]

In the existing literature several obturation techniques have been developed for primary teeth i.e., Endodontic pressure syringe [Green berg 1963], Mechanical syringe [Green berg 1963], Reamer technique, Lentulo spiral [Kopel 1970], Incremental filling technique [Gould 1972], Jiffy tube [Rifficin 1980], Tuberculin syringe [Aylord and Johnson 1987], Endo plugger [Dandashi et al. 1993], Bi directional spiral [Barry muskanth 1998], pre mixed syringe [Nurko et al.], Navi tip [Guelman et al.], Disposable syringe technique [2012], and Micro Mega Past inject.[1-4]

A plethora of studies in the literature reported success rate of different obturating materials, but only few studies were assessed the success rate of obturating techniques. Hence, this current study has been undertaken to comparatively assess the efficiency of four obturating techniques i.e., Navi Tip, Bi directional spiral, Past inject, and Lentulo spiral in primary teeth using vista scan.

Materials and Methods

This study was carried out by the Department of Pedodontics, Kamineni Institute of Dental Sciences (KIDS), Narketpally after obtaining the parental informed consent and the approval from the institutional ethical committee.

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Conflict of interest: None

Sample Selection: The study population was selected from the walk in patients attending the Out Patient Department, Department of Pedodontics, KIDS, Narketpally.

Sample Size: A total of 35 healthy, cooperative children aged 5 to 9 years who have met the selection criteria, primary teeth with at least 2/3rd of root length showing all signs of irreversible pulpitis with adequate bone support were included.

A sample of 100 root canals from 44 endodontically treated primary teeth [12 maxillary and 32 mandibular] of the selected children were considered. To standardize the study, maxillary and mandibular teeth root canals were equally divided between groups.

The 100 root canals were randomly allocated into four groups with 25 canals in each group.

- Group I- Lentulo-spiral
- Group II- Navitip syringe [needle; 29-gauge, 29 mm length; Ultradent Products, South Jordan, USA]
- Group III- Bi directional spiral [EZ Fill essential]
- Group IV- Past inject carrier [Micro mega].

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Methodology

The operator [single investigator] was thoroughly trained to perform pulpectomy procedure, in vivo before commencement of the study. Initially, pre-operative intraoral periapical (IOPA) radiographs were taken with Vista scan. Local anesthesia was administered. After obtaining adequate anesthesia, teeth to be operated were isolated using rubber dam. Access opening was done with #2 round bur and to remove the roof of the pulp chamber Endo z bur [Dentsply/Maillefer, Ballaigues, Switzerland] was used. Root ZX mini apex locator was used to determine the working length. The root canals were negotiated using endodontic files and the working length, 1 to 2 mm short of the root was established in order to avoid over extension. Bio mechanical preparation was carried out with rotary ProTaper Universal files [Dentsply/Maillefer, Ballaigues, Switzerland] using the modified instrumentation protocol. Root canal orifices were enlarged with #Sx file, and then shaped with #S1 and #S2 files, with utmost care as perforations readily occur in primary teeth. Nearly 2.5% sodium hypochlorite solution was used for irrigating the root canals in between the procedure and saline solution was used as the last irrigating medium. Absorbent paper points [Dentsply/Maillefer, Ballaigues, Switzerland] were then used for drying the root canals and homogenous mixture of Zinc oxide eugenol (ZOE) was used for root canal obturation. The obturation procedure was carried out using one of the randomly assigned techniques.

The technique used for obturation in Group I - [Lentulo spiral–blue color coding, size 30], Group III [Bi–directional spiral], and Group IV [Micro mega Past inject] was similar (Fig 1). The respective instrument in each method of obturation was inserted 1 mm. short of root canal apex of deciduous teeth, thereby reducing the risk of fracture of instruments. They were mounted on slow hand piece, carried to the root canal, withdrawn gently while still rotating. This process was repeated 3–4 times until the root canal orifice appeared to be filled with ZOE paste. Wet cotton pellet was used to gently press the material inside the canal, which helps in creating a space for an interim restoration.[1]

In Group II, ZOE cement which was mixed to a creamy consistency was inserted into prepared root canals using a Navi Tip system. The Navi tip needle was inserted 2 mm short of the working length and slowly withdrawn such that the apical part of the root canal was obturated first and followed by subsequent filling of the remaining root canal space. When backfill of the ZOE paste from the root canal orifice was noticed (after two injections), it was presumed that the root canal was filled with the obturating material. Later, postoperative IOPAs were taken.

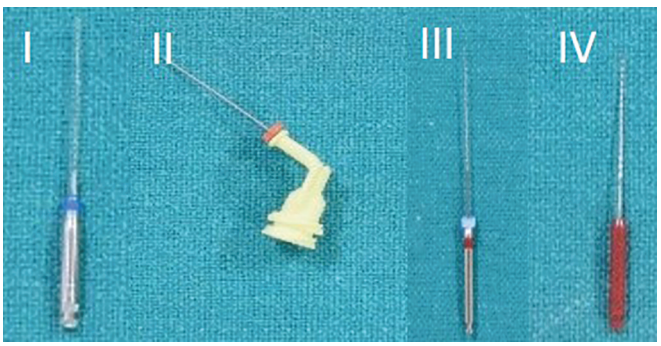


Fig. 1: Four obturating systems (I–Lentulo spiral, II- Navi tip syringe, III- Bi-directional spiral, IV- Micro mega past inject)

Postoperative radiographic images obtained were scanned immediately after exposure. These images were saved in a computer and analyzed with Soredex software on a 15-inch monitor [LG, Seoul, South Korea] in a darkened room. Two observers who were blinded to the study had evaluated the quality of the filled canals and presence or absence of voids in the obturation irrespective of their size, location, and number.

The quality of obturation was evaluated as [Coll and Sadrian 1999]

- Under filling - if the canal was filled more than 2 mm short of radiographic apex
- Optimal filling - if the canal was filled till the apex or up to 2 mm short of radiographic apex
- Over filling - Presence of material beyond the radiographic apex.

The acquired data was subjected to statistical analysis using SPSS software [SPSS Inc., Chicago, USA]. The comparison was done using Kruskal–Wallis test and inter group comparison was done with Mann–Whitney test. The statistical significance level was established at p value < 0.05. (Figs 2 to 5).

Results

Group I showed 72% of optimally filled canals, 16% of over filled canals and 12% of under filled canals Table 1.

Group II showed 64% of optimally filled canals, 36% of over filled canals and 0% of under filled canals.

Group III showed 68% of optimally filled canals, 04% of over filled canals and 28% of under filled canals.

Group IV showed 88% of optimally filled canals, 12% of over filled canals and 0% of under filled canals.

All the four obturation techniques showed good percentage of optimally filled canals with no significant difference [$p > 0.05$]. Group II and Group III showed highest percentage of over filled canals and under filled canals with significant difference, respectively Table 2.

The highest percentage of presence of voids was shown by Group III [32%] followed by Group I [16%], Group II [16%], and Group IV [16%]. All the four obturation techniques showed presence of voids with no significant difference Table 3.

On inter group comparison, Group II vs III and Group III vs IV showed significant difference [< 0.05] in under filled canals. Significant difference was seen only between Group II vs IV in Optimal filled canals whereas Group II vs III & Group II vs IV showed significant difference [< 0.05] in over filled canals.

Discussion

The success of pulpectomy depends on thorough biomechanical preparation, type of obturating material and technique of obturation used. Though the existing literature replete with the studies on the success of obturating materials used in primary teeth, only a few studies were there to quote an effective technique of obturation in primary teeth[1,3,5,6] A need has always persisted to evaluate the optimum technique of obturation of primary teeth to obtain a compact and dense filling of the root canal. Hence the present study was carried out to appraise the efficiency of four obturating techniques i.e., Lentulo spiral, Bi-directional spiral, Navi tips, and Past inject carrier.

In the present study, rotary instrumentation[7-9] method was opted for bio mechanical preparation in order to overcome few

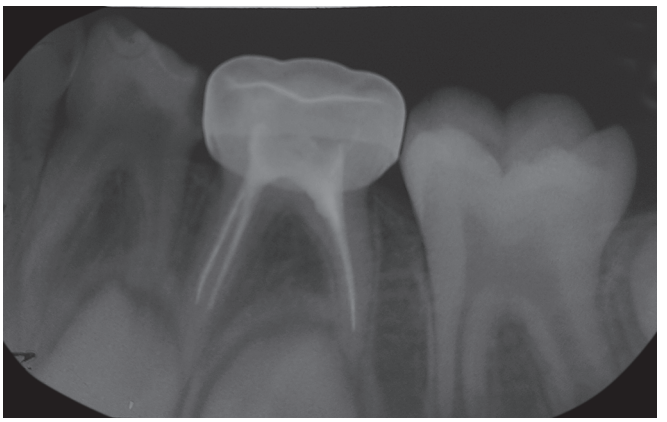


Fig. 2: Optimally filled canal obtained by Lentulospiral technique

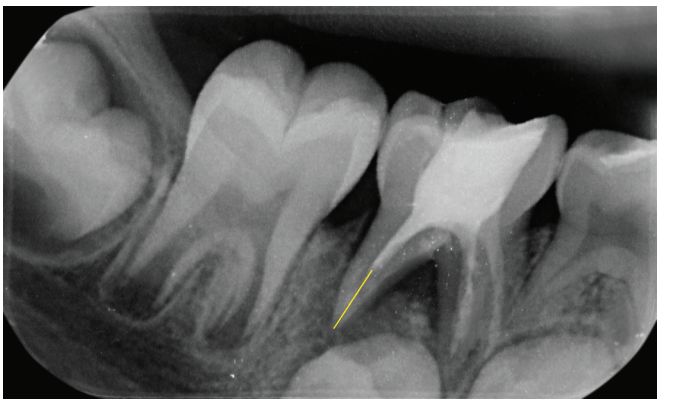


Fig. 4: Under filled canal obtained by bi-directional spiral



Fig. 3: Optimally filled canal obtained by Micro mega past inject

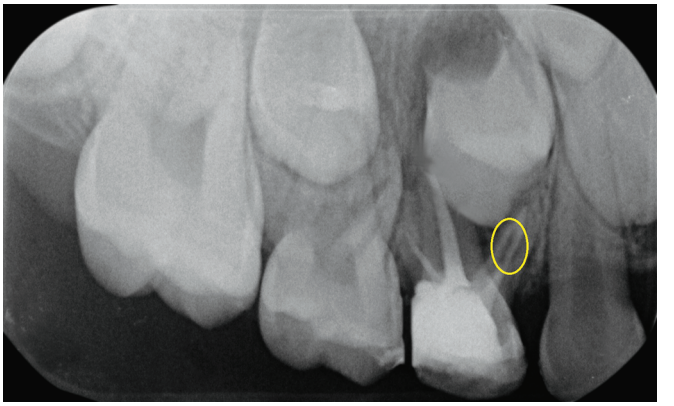


Fig. 5: Void shown in obturation done by Navitip syringe technique

Table 1: Descriptive statistics of percentage, mean rank value and *p* value of under filled, optimally filled canals, and over filled canals obtained with different obturation techniques

	Quality of obturation					
	Optimally filled canals		*Over filled canals*		*Under filled canal*	
Obturating technique	*Percentage*	*Mean rank value*	*Percentage*	*Mean rank value*	*Percentage*	*Mean rank value*
Group I	72	50.00	16	50.00	12	51.50
Group II	64	46.00	36	60.00	00	45.50
Group III	68	48.00	04	44.00	28	59.50
Group IV	88	58.00	12	48.00	00	45.50
P value	0.224		0.021		0.002	

disadvantages such as ledging, zipping, canal transportation, and apical blockage etc.[10]

Working length can be determined by using conventional radiography, digital radiography, and electronic apex locators.[11] In this study working length was established by Root ZX mini apex locator. Working length was established 1 mm short of apex which was intended to minimize the chance of over instrumentation apically and causing peri-apical damage.[12]

Photo stimulated phosphor-imaging plate radiography is an indirect type of digital imaging. The image is captured on a phosphor plate as analog information and then transformed into digital format.[5] This digitized image can be further visualized by altering the image contrast in order to better assess the quality of obturation and to detect the voids.[13-15] Digital radiography has offered many benefits in pediatric dentistry like less radiation exposure and enabling immediate image acquisition, with the possibility of enhancing the quality of image.[16] In this study efficiency [Quality of obturation /presence or absence of voids] of obturation techniques were assessed by using Vista scan.

In 1970, Kopel had advocated the Lentulo spiral obturation technique for primary teeth. The design and flexibility of the Lentulo spiral allow files to carry the paste uniformly throughout the narrow, curved canals in primary molars.[17] During obturation with motor driven lentulo spiral, smaller by 2 sizes from the last master apical file to be kept 1 mm short of the working length, to reduce the risk of instrument fracture and provide enough space for the lentulo spiral to rotate in the narrow root canal.[6] Singh et al.[18] concluded that motor driven lentulospiral showed highest number of optimally filled canals compared to hand held lentulospiral. On the contrary Bawazir et al. reported that there was no significant difference in the quality of obturation between motor driven and hand held lentulo spiral.[6] Motor driven Lentulospiral showed 72%

Table 2: Descriptive statistics of percentage of presence and absence of voids and *p* value obtained with four obturation techniques

Groups	*Presence of voids*	*Absence of voids*	*p value*
Group I	4 (16%)	21 (84%)	0.396
Group II	4 (16%)	21 (84%)	
Group III	8 (32%)	17 (68%)	
Group IV	4 (16%)	21 (84%)	

Table 3: Intergroup comparison with Mann Whitney test between all the groups in under filled, optimal filled canals, and over filled canals

Inter group comparison	*Under filled canals*		*Optimal filled canals*		*Over filled canals*	
	Z value	*P value*	*Z value*	*P value*	*Z value*	*P value*
Group I vs II	–1.76	0.077	–0.917	0.359	–1.59	0.111
Group I vs III	–1.40	0.162	–0.624	0.533	–1.40	0.162
Group I vs IV	–1.76	0.077	–1.09	0.274	–0.403	0.687
Group II vs III	–2.82	0.005 *	–0.296	0.768	–2.80	0.005*
Group II vs IV	0.000	1.00	–1.96	0.049*	–1.96	0.049*
Group III vs IV	–2.82	.005 *	–1.69	0.091	–1.03	.302

Z value–Mann Whitney test; *p* value–probability; *Significant at $p < 0.05$

percentage of optimally filled canals in the present study. Torres et al.[19] concluded that Lentulo spiral delivered paste into the canals better than injection system, Ultradent Tip system.

In 2004, the Navi tip was introduced, a specially designed obturating system with a thin and flexible metal tip to deliver obturating paste rapidly and uniformly into the narrow and curved canal. This thin flexible metal tip is not easily separated from the holder during injection[3,19] comes in different lengths with a rubber stop attached to it. Guelmann et al.[3] first assessed its clinical performance and reported that the Navitip system demonstrated the highest number of flush or complete fillings compared to motor driven lentulo spiral and vitapex syringe system. In the present study Navi tip obturation technique showed 36% percentage of over filled canals with statistically significant from other groups. This over filling could be due to excessive pressure applied while pressing the obturating material into root canal. In contrast, Mahtab memarpour et al.[5] reported that Navitip syringe produced the best results in controlling paste extrusion from the apical foramen.

In 1988, Dr Barry Muskanth developed Bi-directional obturartion technique which assures that a minimal amount of obturating material will past the radiographic apex. This is achieved because coronal grooved spirals travelling in an apical direction carry the cement apically while apical reverse spirals flows the cement in a coronal directional simultaneously. The two independent flows of cement collide where the grooved spirals change direction. At the point of collision, the cement is forced to travel laterally filling the lateral canals and any other invaginations that may exist.[20] Parikh et al.,[20] wu min kai et al.[21] concluded that bi directional spiral prevented apical extrusion of sealer when placed in permanent teeth. In the current study highest percentage [28%] of under filled canals were observed with bi directional spiral with statistically significant difference from other groups. The results were in accordance with the Grover et al.[1] who reported bidirectional spiral had shown highest number of under filled canals.

In the current study, Micro mega past inject showed highest percentage of optimally filled canals, however with no significant difference. Oztan et al. 2002 reported that canals obturated with lentulospiral were short of the apex, whereas the canals obturated with past inject were optimally filled.[22] Similarly, Grover et al.[1] reported that highest number of optimally filled canals were seen with Micro mega Past inject. The success of this technique could be attributed to flattened blades in past inject which improves material placement into root canal causing lower occurrence of under filled and over filled canals.[9]

In this present study, presence of voids in the obturation was observed with all the four selected obturation techniques. Factors that influence the location and size of the voids include the type, viscosity, and consistency of the paste, the method used to apply the paste, and operator skill and experiences.[3,23,24] In this study single operator was trained thoroughly before the commencing of study to gain a good experience in performing the procedure. However, one or more voids were observed in all the four obturation methods taken. In the present study Group I, Group II, and Group IV showed lowest percentage of presence of voids however with no statistically significant difference.

Conclusion

Within the limitations following conclusions were drawn from the present study:

- All the four obturation methods had shown promising results in the quality of obturation in primary teeth.
- Past inject carrier and Lentulo spiral obturation methods were proved to be the most prevailing with greater number of optimum filled canals followed by Bi directional spiral and Navi tip systems.
- Voids were seen in all the selected obturating techniques with no significant difference between the groups

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