

Comparative Evaluation of Three Obturating Techniques in Primary Molars: An *in Vivo* Study

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Objectives: The purpose of this study was to evaluate and compare the quality of obturation between the two tested methods for root canal filling with a newer system in primary teeth. Study design: A total of 104 canals were prepared and obturated using zinc oxide eugenol paste. The three delivery systems compared were: Rotary lentulospiral and Navitip® with Navitip® Double Sideport. Radiographs were used to evaluate the canals for length of obturation and presence of voids. **Results:** The data were analyzed using chi-square tests. Significant differences were seen between the three groups for the presence of voids (p value = 0.042) with less voids in Navitip® Double Sideport. There were no difference between the three groups for the extent of filling (p value = 0.170). **Conclusion-** Navitip® Double Sideport showed the better results in terms of extent of obturation and absence of voids when compared to the Rotary lentulospiral and Navitip®.

Keywords- Pulpectomy, Deciduous teeth, root canal

INTRODUCTION

Pulpectomy is one of the common treatment options in primary teeth where the pulp is inflamed or become nonvital with the intension of restoring the functions of the teeth until its exfoliation. The objective of root canal obturation is to eliminate any portals of entry between the root canal and the periodontium. The complex root canal systems of primary teeth thus dictates the outcome of treatment which will affect the success of root canal therapy¹.

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.²⁻⁵

NaviTip, routinely being used in endodontics for irrigation has been proved to create less voids when used for obturating as compared to lentulospiral and other techniques^{2,5,6}. Another variant of Navitip is Navitip Double Sideport and consists of double sideports which horizontally expresses the irrigant toward the canal walls and not into the apex as occurs in Navitip⁷. Thus it was decided to assess whether this benefits can be utilized for obturating primary root canals to minimize apical extrusion. This scope of Navitip Double Sideport has not yet been evaluated.

The present study was designed to evaluate and compare the quality of obturation using three delivery systems in primary teeth, that is, Navitip, Navitip Double Sideport and rotary lentulospiral.

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MATERIALS AND METHOD

The ethical clearance for the present *in vivo* study was obtained from the Institutional Ethics Committee and was carried out in our department.

Sample size was calculated at 95% confidence interval and 80% power with effect size of 0.5, with critical chi square value as 9.23 to compare three groups using G* Power 3.1.2. The total sample was thus 36.

Inclusion Criteria

1. Lower first and second deciduous molars
2. Teeth indicated for pulpectomy with no radiographic external or internal pathologic root resorption
3. Children who have signed the assent form and their parents who have signed the informed consent

Exclusion Criteria

Children with known allergy to zinc oxide eugenol

Medically compromised children

Teeth with greater than half root resorption

All pulpectomy procedures were performed by a single investigator. Rubber dam was used to isolate the teeth after administration of local anesthesia. Access to the pulp chamber was gained with a sterile round bur in a high-speed handpiece. The coronal pulp was amputated using a spoon excavator and irrigated with saline to view the canal orifice. Following radicular pulp extirpation, biomechanical preparation of the root canals was initiated with a no. 15 K-file (Mani Co, Tokyo, Japan) in a pullback action and then sequentially increased up to size 35. The instrumentation length was kept 1 mm short of the radiographic apex. The canals were irrigated with 1 ml of 1% sodium hypochlorite solution after each level of instrumentation followed by 2 ml of normal saline. The canals were dried using sterile absorbent paper points before obturation. The teeth were randomly divided into three groups using block randomization method and allocation concealment was followed. The three groups were as follows: (Figure 1)

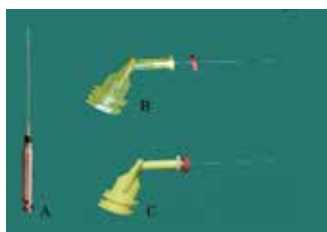
1. Group I Rotary lentulospiral (Mani Co, Tokyo, Japan)
2. Group II Navitip® (Ultradent Products, Inc., South Jordan, Utah, USA)
3. Group III Navitip® Double Sideport, Ultradent Products, Inc., South Jordan, Utah, USA)

Figure 1: Three obturation systems

A: Rotary Lentulo Spiral

B: Navitip®

C: Navitip® Double Sideport



The obturation material used was homogeneous mix of Zinc Oxide Eugenol by mixing one volume unit of powder and two volume units of liquid².

Group I: Mixture of ZOE was carried into the root canals using lentulospiral mounted on a slow-speed contra-angle handpiece. A rubber stopper was adjusted based on the radiographic measurement, staying 1 mm short of the radiographic apex. When backfill of the material into the pulp chamber occurred, the canal was assumed to be filled and the lentulospiral was withdrawn.

Group II and III: ZOE paste was inserted into the root canals using Navitip® and Navitip® (Double Sideport) and syringe. A rubber stopper was adjusted staying 1 mm short of the radiographic apex. When backfill of the paste from the canal orifice was observed it was assumed that the canal was filled.

Following obturation the teeth were restored with glass ionomer cement followed by stainless steel crown restoration.

Effectiveness of the three obturation techniques were assessed using postoperative Intraoral Periapical (IOPA) radiographs taken immediately after each obturation. The IOPA radiographs were viewed in an X-ray viewer with a magnifying lens. Three evaluators, blinded to the filling technique, assessed the presence of voids and extent of fill. Inter examiner reliability testing was done prior to the commencement of the study.

Scoring for extent of filling and presence of voids was based on Coll and Sadrian (1996) criteria⁸ which are as follows: (Figure 2)

1. Score 1 (Under filling): All the canals were filled more than 2 mm short of the apex.
2. Score 2 (Optimal filling): One or more of the canals having obturating material ending at the radiographic apex or upto 2 mm short of the apex.
3. Score 3 (Over filling): Any canal showing obturating material extending beyond the radiographic apex.
4. Presence or absence of voids.

The results were then tabulated and statistically analyzed. Statistical analysis was carried out using SPSS Version 17.0. Results were analyzed using Chi-Square test. Significance was kept at $p \leq 0.05$. Inter examiners was tested using Cronbach's alfa.

Figure 2: Radiographs showing A. Under filling: the mesial and the distal canals filled more than 2 mm short of the apex with no presence of voids; B. Optimal filling: the mesiobuccal, mesiolingual and distal canals having obturating material ending at the radiographic apex or upto 2 mm short of the apex no presence of voids; C. Over filling: The mesiobuccal and the mesiolingual canals showing obturating material extending beyond the radiographic apex with the presence of voids in the middle third of the mesiobuccal and the mesiolingual canals.

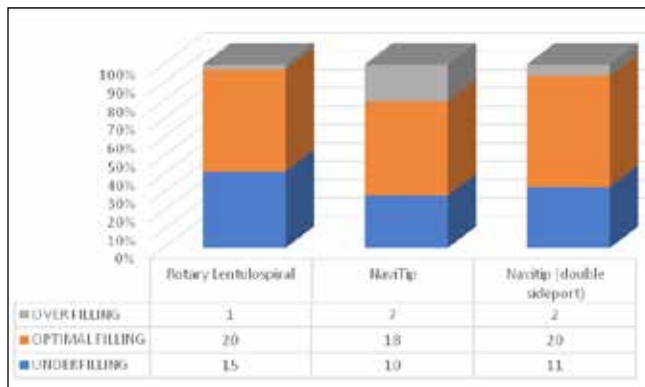


RESULTS

Figure 3 shows the quality of obturation in each group. Maximum number of optimally filled canals were seen in the NaviTip® Double Sideport group followed by the Rotary Lentulospiral and NaviTip® underfilled canals were seen maximum in the Rotary Lentulospiral group and overfilled canals were maximum in the NaviTip®.

Voids were present in all the three groups. Least number of voids were seen in the NaviTip® Double Sideport group followed by the NaviTip® group. Maximum voids were present in the Rotary Lentulospiral group. Statistical analysis for the scoring between the three groups was obtained using Fisher’s Exact Chi square test (Table 1).

Figure 3: Frequency distribution for quality of root canal filling in the three experimental groups. (Fishers Exact Test value of 6.357 and p value of 0.170)



DISCUSSION

The expected outcome of any root canal obturation is a adequately filled, compact obturation with minimum voids. Needles with apical opening tend to expel the material through the apical foramen during irrigation of the canals. This is the reason why needles with side opening were introduced for irrigation and the same while being used for obturation should also provide these benefits.

Radiographs are minimally invasive and the only non expensive clinical way to evaluate the quality of treatment *in vivo* studies⁹. Studies have shown that there is no difference between digital images, conventional radiographs and digital zoomed images for void detection in root canal fillings¹⁰. This technique was thus used to compare three different root canal filling methods. Presence of voids in the obturation is one predicament that might provide pathways for leakage and the possibility of microorganism and toxin retention, leading to post-treatment failures¹¹.

The NaviTip system is specially designed to deliver paste into the root canal, and consists of a flexible tip that is not easily separated from the holder during injection. The needle due to its high flexibility penetrates easily into the curved, narrow canal and reaches the apex injecting the paste rapidly and uniformly¹²⁻¹³.

The flexible design of Lentulospiral allows it to carry the paste uniformly throughout the curved and the narrow canals of the primary molar teeth. However, a few disadvantages include difficulty with fitting the rubber stop, instrument fracture, and a tendency for extrusion beyond the apex¹⁴⁻¹⁶.

The Navitip Double Sideport consist of a flexible 31-gauge needle with vents at the side of the needle and also a rubber stopper. This design might overcome the disadvantages of lentulospiral commonly found as overfilling^{2,14}

On comparing the three obturation techniques, i.e. Navitip, Navitip Double Sideport and rotary lentulospiral, no significant difference was found in the extent of obturation ($p > 0.05$). However significant difference was seen between the three groups comparing the presence of voids ($p < 0.05$). The results of our study were similar to other studies by Memarpour *et al*² and Khubchandani *et al*⁶ where the NaviTip syringe was efficient enough in reducing voids when compared with the lentulospiral group. In the present study Navitip showed maximum number of overfilled canals which could be due to the design of the needle where the opening vent is at the tip of the needle which lead to the extrusion of the obturating material beyond the apex. The Navitip Double Sideport consist of a flexible 31-gauge needle with vents at the side of the needle and also a rubber stopper. This design might overcome the disadvantages of lentulospiral commonly found as overfilling^{2,14}. But in the present study lentulospiral group showed the maximum number of underfilled canals though they were not statistically significant.

Navitip Double Sideport showed the least number of voids when compared to the lentulospiral and NaviTip. To the best of our knowledge there are no studies observing the efficiency of Navitip Double Sideport for obturation at present.

CONCLUSION

Based on this study’s results, the following conclusion can be made:

1. NaviTip® Double Sideport can be recommended as an alternative to Rotary Lentulospiral technique and NaviTip® system.

Table 1: Comparison between the three groups showing the presence and absence of voids

Rotary Lentulospiral		Crosstab			Total
NaviTip®		GROUP			
		Navitip® Double Sideport			
VOIDS	Absent	Count	24 (66.7%)	26(74.3%)	30(90.9%)
	Present	Count	12(33.3%)	9(25.7%)	3(9.1%)
Total		Count	36(100.0%)	35(100.0%)	33(100.0%)

Fisher’s Exact Test values of 6.142 and p value of 0.042 (significant)

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