

# Comparison of obturation techniques using three delivery systems: An in vitro study

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## Abstract

**Abstract:** The aim of the study was to assess and compare the obturating ability of traditional plugger, lentulo spiral, and NaviTip delivery system on extracted maxillary incisors. Pre-operative radiographs of thirty extracted incisors were taken and divided into three groups. Canals were prepared and obturated accordingly. Two independent evaluators blinded to the technique used evaluated post-operative radiographs. Quality of obturation was determined by analyzing the presence of voids and the amount of material in the canal. The obturation with NaviTip had least number of voids. As compared to the other two techniques, 90% of teeth obturated with this technique were adequately filled.

**Key words:** Pulpectomy, plugger, lentulo spiral, NaviTip

## Introduction

One of the keys to successful pulpectomy therapy is to obturate adequately the prepared root canal space. The aim of root canal obturation is to completely fill the canal and create a fluid tight seal to prevent ingress of bacteria and toxins into the periapical tissues. The outcome of the treatment is based on the development and maintenance of the seal.<sup>1</sup>

Root canal pluggers have been traditionally used to condense the filling material into the canals. A lentulo spiral (Dentsply) mounted in a low speed turbine have also been used, to facilitate the introduction of the Zinc oxide eugenol (ZOE) until the canal is completely filled.<sup>2</sup> These ISO colour coded instruments has consistently spaced spirals, which provide flexibility in distributing root canal

cement evenly throughout the root canal system. Safe instrumentation is, when it is operated in a clockwise direction and never started or stopped in canal.

NaviTip (NaviTip™, Ultradent Inc, South Jordan UT, and United States), a thin flexible metal tip was introduced to deliver root canal sealers. The greatest advantage of NaviTip is that its ends are rounded, it is rigid at the shank region, which prevents further bending and the end of the tip is flexible to facilitate navigation even through curved canals. NaviTips are available in 29 and 30 gauges. They are colour coded depending on the length-17mm-white, 21mm-yellow, 25mm-blue, and 27mm-green. This technique is fast and user-friendly.<sup>3</sup> However, until date, no obturation technique satisfies all of

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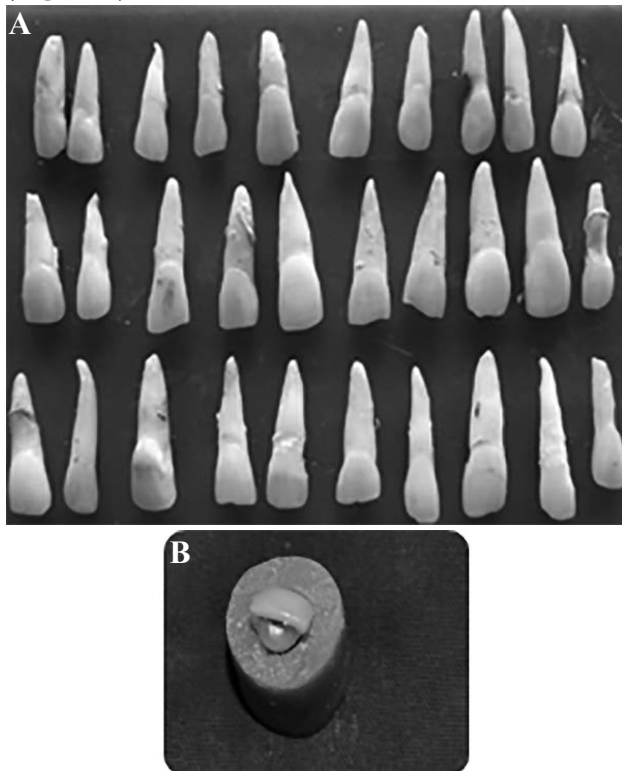
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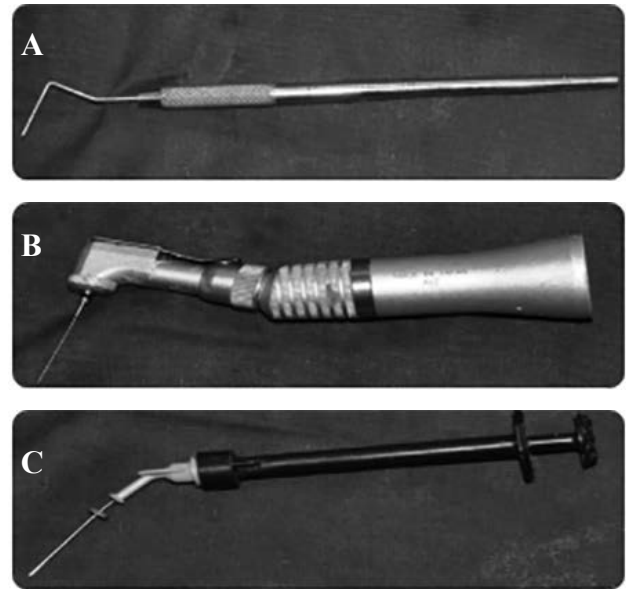
the requirements of an ideal technique. Hence, the purpose of this study was to evaluate and compare the obturating ability of traditional plugger, lentulo spiral, and NaviTip delivery system on extracted maxillary incisors.

### Materials and Methods

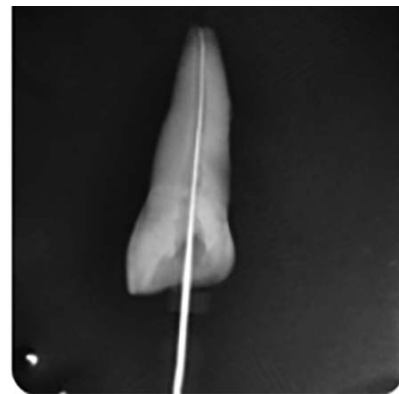
Thirty intact extracted anterior maxillary teeth with no sign of root resorption were selected for the study. After the extraction, the teeth were placed in formalin. While preparing the samples, the teeth were placed on paper towels for air dry. When completely dried, a modelling wax was used to cover the apex of each root. Each tooth was suspended vertically in a disposable plastic tube half inch in diameter, leaving two to three millimetres between the wax and the bottom of the tube. Pink orthodontic acrylic was poured into the tube submerging the roots, leaving the coronal third of the root and the crown uncovered. After 24 hours, specimens were placed on a flat table and pre-operative radiographs were taken perpendicular to the long axis of the tooth with a distance of ten millimetres from the cone. After mounting the teeth on the acrylic block, access cavity preparation was done using endo access bur (Figure 1).



**Figure 1:** A) Extracted anterior maxillary teeth, B) Acrylic block



**Figure 2:** Delivery system methods A) Plugger; B) Lentulo spiral; C) NaviTip



**Figure 3:** Working length estimation

Working length estimation was done using ISO No 15 K-file with rubber stop (Figure 3). Pulp was extirpated and biomechanical preparation was done up to size 45 file to the determined working length. The root canal was irrigated using sodium hypochlorite during and after completion of instrumentation. The canals were dried with paper points. The thirty extracted maxillary anterior teeth were randomly divided into three groups of ten each, respectively.

**Group 1** teeth were obturated using the endodontic plugger; length of the endodontic plugger equalled the predetermined root canal length minus 2mm (Figure 2A). The ZOE mixing ratio was four scoops of powder and two drops of liquid as supplied by the manufacturer. The thick mix was prepared and rolled into a flame shape, corresponding to the size

and shape of the canal. A ZOE block measuring approximately 2mm, starting from the tapered part of the rolled mix was carried into the canal, and tapped gently into the apical area. Additional increments of 2mm blocks were added until the canal was filled up to the cervical area.<sup>4</sup>

**Group 2** teeth were obturated using a fine lentulo spiral instrument (Figure 2B), on a slow-speed contra angle, measured to the predetermined canal length minus 1mm. The mixing ratio of ZOE was two scoops of powder and two drops of liquid. The lentulo spiral was dipped into the mixture and then introduced into the canal to its predetermined length and was rotated into the canal. Additional amount of paste was gradually introduced until the canal was filled.<sup>4</sup>

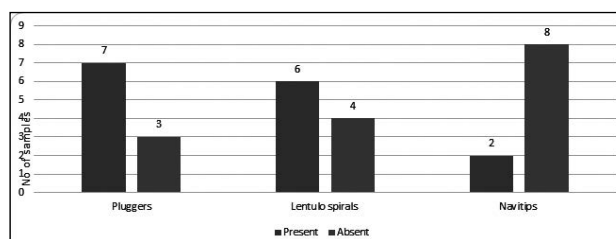
**Group 3** teeth were filled using the NaviTip and ZOE paste (Figure 3C).The metal tip was placed into the canal, a rubber stop was adjusted to the predetermined measurement and the material was expressed. Once backfill of filling material occurred, the canal was assumed filled. Three Post-operative radiographs were obtained using the same radiographic settings described for the pre-operative radiographs. Each radiograph was mounted in a slide frame and two evaluators blinded to the obturation technique, assessed for the presence of voids, quality of canal obturation, and radio-opacity. Quality of canal obturation was assessed based on the amount of paste in the canal: less than one-half of the canals filled, greater than one-half but less than flush, flush, and overfilled.<sup>3</sup> (Figure 4) Data obtained was subjected to statistical analysis using the Chi-square test.

**Results**

Only two teeth obturated with NaviTip showed presence of voids as compared to the incremental pluggers and lentulo spirial methods, which were seven and six, respectively. However, the difference was not statistically significant (Table 1, Graph 1).

**Table 1:** Table showing the presence of voids following the use of the 3 techniques

Technique	Present	Absent	Total	$\chi^2$	p-Value
Pluggger	7	3	10	5.600	0.061
Lentulo spirals	6	4	10		
NaviTip	2	8	10		
<b>Total</b>	15	15	30		

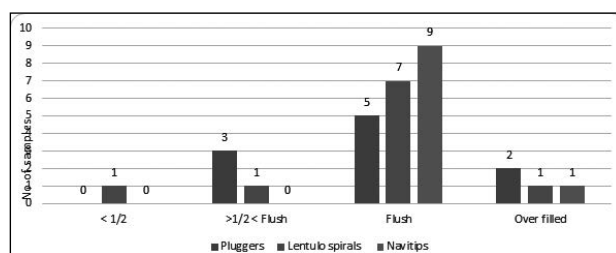


**Graph 1:** Showing presence of voids according to technique

The quality of obturation also depends on the amount of material in the canals. Only one tooth was obturated less than half of the canal, which was done using the lentulo spiral technique. Three out of four teeth were obturated more than half but less than flush with the incremental and one was with the lentulo spiral. Twenty one teeth were obturated to flush nine with NaviTip, seven and five with lentulo spiral and incremental technique respectively. Four canals were over filled, two with incremental and one each with both lentulo spiral and NaviTip technique. The results were not statistically significant (Table 2, Graph 2).

**Table 2 :** Table showing the obturation quality following the 3 techniques

Technique	<1/2	>1/2<Flush	Flush	Over filled	Total	$\chi^2$	p-Value
Pluggger	0	3	5	2	10	4.443	0.349
Lentulo spirals	1	1	7	1	10		
NaviTip	0	0	9	1	10		
<b>Total</b>	1	4	21	4	30		

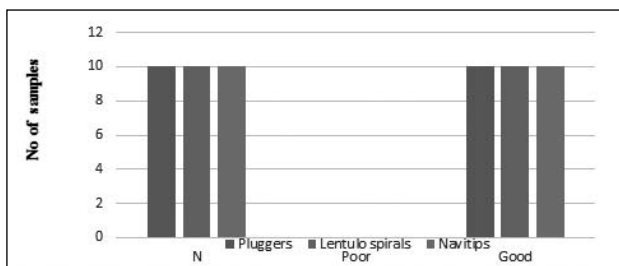


**Graph 2:** Showing the presence of quality of obturation according to technique

Regarding the radiopacity, 30 radiographs were examined for hand plugger, lentulo spiral, and NaviTip each, and were graded under “Poor” or “Good” (Table 3, Graph 3). It was observed that all the three groups showed equally good radiopacity in all 30 radiographs.

**Table 3 :** Table showing difference in radiopacity following the 3 techniques

Technique	N	Poor	Good
Plugger	10	0	10
Lentulo spirals	10	0	10
NaviTip	10	0	10

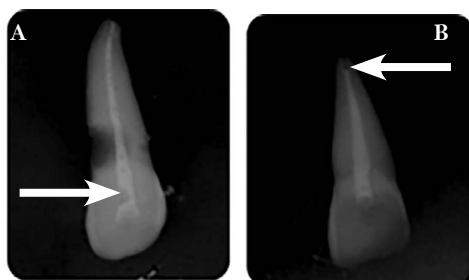


**Graph 3:** Showing radiopacity according to technique

### Discussion

An ideal filling technique should assure complete filling of the canal, without overfill and with minimal or no voids. Overfilled canals lead to mild foreign body reaction and a risk of deflection of succedaneous tooth.<sup>3</sup> Coll and Sadrian<sup>5</sup> found that ZOE-retained material altered the paths of eruption of succedaneous teeth in 20% of the cases.

An under filled canal leads to furcal radiolucency and periapical granuloma and cyst.<sup>6</sup> Voids in canal can lead to reinfection and retreatment.<sup>3</sup> Coll and Sadrian reported a significant success rate for teeth filled to the apex (89%) and teeth filled short (87%) compared to overfilled teeth, which had a 58% success rate.<sup>5</sup>



**Figure 4:** A) Voids B) Under filled C) Flush D) Over filled

Presence of voids was seen in all the three groups in the present study with NaviTip system showing the least amount of voids, this was similar to a study by Dandashi *et al.* where the voids were frequently observed, but the pressure syringe had the least number of voids.<sup>4</sup> Guelmann *et al.* in a similar study stated that the NaviTip system offered a more desirable filling quality than lentulo spiral and vitapex syringe.<sup>3</sup>

The lentulo spirals used in this study were smaller by two sizes from the last Hedstrom file used and was kept 1mm short of the working length. Hence, there were no broken lentulo spirals in this study. This is considered a key, for safe use of the lentulo spiral. The lentulo spirals were kept 1 to 2 sizes smaller than the master apical file, to reduce the risk of fracture, there was enough space for the lentulo spiral to rotate and hence, less chance of it getting engaged in the narrow root canal.<sup>7</sup>

Aylard and Johnson<sup>8</sup> compared the lentulo spiral and the pressure syringe techniques with regard to the depth of canal filling in simulated plastic canal moulds. The investigators demonstrated no significant difference between the two techniques while filling the straight canals. However, in curved canals, the lentulo spiral was superior.

Ravindranath Reddy<sup>9</sup> stated that there is no significant difference among incremental filling, lentulo spiral, and pressure syringe technique used for obturation of primary teeth canals. It was concluded that operator’s manual dexterity was very important than the technique of obturation.

The present study demonstrated that the NaviTip showed the highest number of flush or complete fillings and resulted in the fewest voids. The technique was fast and user-friendly.

## Conclusion

The study showed that the NaviTip system was more reliable than the plugger and the lentulo spiral techniques, when compared for voids and obturation quality.

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