

Determining the Efficacy of Obturation Techniques in Primary Molars Using 2-D and 3-D Radiographs¹Dr. Sumaiya Nezam, ²Dr. Nudrat Neyaz, ³Dr. Bharatendu Kawatra, ⁴Dr. Shabab Ahmed Khan, ⁵Dr. Deepmala, ⁶Dr.

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E-Mail Id: sumaiyanezam786@gmail.com**Conflicts of Interest:** Nil**Abstract****Introduction:** The primary objective of pulp therapy is to maintain the integrity and health of the teeth and their supporting tissues.**Aims:** To evaluate obturating techniques namely; NaviTip and Lentulospirals in primary molars and compare them using RVG and CBCT.**Methods:** Pulpectomy of 10 primary molars was done and divided into two groups 5 each using Lentulospiral (Group I) and NaviTip (Group II). Biomechanical preparation was done and canals were obturated with ZnOE using the two different techniques mentioned. Postoperatively RVG and CBCT was done.**Results:** Statically significant difference was seen between two groups which suggested that NaviTips have shown better quality of obturation compared to Lentulospiral.**Discussion:** Evaluation of obturation for the presence of voids, intrusion and extrusion of the obturating material from the root canal has been observed and compared in the study to choose the most efficient technique for the success of the pulp therapy.**Keywords:** CBCT, RVG, NaviTip, Obturation**Introduction**

Pediatric dentistry has evolved from an extraction-oriented practice, where primary teeth with inflamed pulps were primarily extracted, to the application of various treatment

modalities for managing irreversibly inflamed or necrotic pulps.¹

Maintaining the integrity of primary dentition until normal physiologic exfoliation is a major goal of modern dentistry.

Pulpectomy is one such treatment option, which consists removal of the inflamed/necrotic pulp tissue from the canal followed by obturation using resorbable root canal filling materials.² Successful primary root canal therapy requires a thorough understanding of primary pulp morphology as well as the different obturating materials and techniques capable of compactly filling the entire root canal system.³ A number of different techniques have been used successfully to fill root canals of primary teeth and include introducing the filling materials into the canals with either an endodontic plugger or cotton pellets and the use of hand and rotary lentulo spirals, reamers, insulin syringes, and endodontic pressure syringes.^{2,4,5}

The ultimate aim of root canal filling is to create a fluid-tight seal along the entire cleaned and prepared root canal space with an obturating material in order to prevent post-treatment disease or complication.⁶ The presence of voids in root fillings of primary teeth may provide pathways for leakage, leading to bacterial regrowth and infection. Voids in the apical or coronal portion or extending through the entire root canal length increase the risk of endodontic therapy failure.⁷ Therefore, a careful and advanced assessment of the filling of the root canals is essential for evaluating the maximum success in pediatric endodontic procedures. Post treatment imaging is essential to evaluate the success of procedure done as it allows the clinician to visualize the efficacy of obturation and sealability of the material.

Various traditional methods used to assess the quality of filling of the root canals include radiographs, radio isotopes, dye penetration, fluid filtration, bacterial

leakage, microscopic analysis, cleaning techniques, and digital radiography.^{2,6,8} More-over, studies have reported different and varying success rates concerning the quality of fill of different obturation techniques as assessed by radiography.

The purpose of this study was to evaluate the obturating techniques namely; NaviTip and Lentulospirals in primary molars and compare them using RVG and CBCT.

Materials and method

The present study was conducted at the Department of Pedodontics and Preventive Dentistry, Buddha Institute of Dental Sciences and Hospital, Patna, Bihar, India. The present study was carried out in 10 selected primary mandibular molar teeth of both sexes in age group of 4-9 years. Sample was collected from outpatients of the department who were diagnosed for the root canal treatment.

The inclusion and exclusion criterias were:

Inclusion criteria

- History of spontaneous pain;
- Presence of sinus tract;
- Continuous bleeding after amputation of coronal pulp tissue;
- No pulp tissue remaining when the pulp chamber was accessed.

Exclusion criteria

- Non restorable crown;
- Evidence of extensive internal/external root resorption;
- Pathologic root resorption involving more than one third of the root;
- Roots showing any developmental anomalies.

Criteria for Group Division

The study consisted of two study groups that were divided according to the type of obturating technique used for filling the root canals of the primary molars(Group 1

consisted of samples which were obturated with Lentulospirals, and Group 2 consisted of samples which were obturated with Skini syringes with navi tip.

Methodology

Before initiating the treatment, standardized baseline IOPA radiographs were taken for all the patients. After gaining proper anaesthesia and isolation, access to the pulp was obtained using a #2 carbide bur which was followed by working length estimation with Electronic Apex Locator (EAL). Biomechanical preparation was done using Protaper rotary files followed by frequent irrigation. The canals then were dried with paper points and were obturated using the two different techniques mentioned. Postoperatively RVG and CBCT was done for the evaluation of the obturation techniques for the presence of voids, intrusion and extrusion of the obturating material from the root canal.

All pulpectomy procedures were performed by one investigator. A single-visit pulpectomy procedure was performed. Every pulpectomy visit was started by the same protocol for each tooth. The procedures were as follows. First, a preoperative intraoral periapical radiograph was taken using the XCP instrument. The tooth was anesthetized and isolated with a rubber dam. Before gaining access, all caries was excavated by a large round bur. The pulp chamber's roof was removed with a no. 330 tungsten-carbide bur in a high-speed handpiece which was followed by working length estimation with Electronic Apex Locator (EAL), the appropriate root canal stopper was placed in position on the broaches (Dentsply, Maillefer CH-1338 Ballaigues, France) and the complete extirpation of any remaining pulp tissue was carried out. The root canals were enlarged with a protaper files (Revo-S 0.04 taper).

All canals were enlarged simultaneously upto predetermined working length. The root canal were

irrigated with 2 ml normal Saline during instrumentation using with a 21-gauge needle attached to a 10-mL syringe. After completing instrumentation, the root canal were then dried by using paper points. A homogenous mixture of ZOE (Temrex, Freeport, NY), in the given ratio, was used for filling the root canals. The paste was transported into the root canals for each tooth using one of the randomly assigned techniques, either: Lentulospiral or Skini syringes with navi tip for each canal until the canal orifice appeared filled with the paste. The pulp chamber was covered with a rapid-setting ZOE cement (Dentsply Caulk, Dentsply International Inc, Milford, Del) and cotton pellet was used to spread the intermediate restorative material on the pulpal floor. All pulpectomies were completed in one visit. The tooth was restored with a stainless steel crown (Ion Ni-Cro, 3M Unitek, Sr. Paul, Minn) at the same visit. A postoperative radiograph was immediately taken using RVG and CBCT.

Method of Filling The Canals

The material of choice for filling pulpectomised primary teeth was zinc oxide eugenol(ZOE). A standardized mixture of pure ZOE(USP) Without additives or filters was prepared for each technique as per manufacturer's recommendation and/or the technique limitation.. A single pan electrical weighing machine was used to dispense the corresponding amount of eugenol liquid. The mixture of ZOE was spatulated on a dry glass slab at room temperature (68⁰ F) for 45 seconds. And then places into canals using using one of the given obturating techniques

GROUP 1: The Lentulospiral Technique

A 25 mm latch type Dentsply lentulo spiral instrument mounted on a slow-speed contra-angle handpiece, was selected and measured to the predetermined working length. Ratio of ZOE powder to eugenol liquid used by lentulospiral was 0.400 mi/1g. The lentulospiral was dipped into the mixture and was operated in reverse to

load the material. It was then slowly inserted into the canal, rotated in a clockwise direction so that the material was deposited in the forward direction and withdrawn with a pumping action from the canal while still rotating. The process was repeated 5 to 7 times for each canal until the canal orifice appeared filled with the paste. Wet cotton pellet was used to press the material at the orifice. The pulp chamber was covered with a rapid-setting ZOE cement (Dentsply Caulk, Dentsply International Inc, Milford, Del)

GROUP 2:- Skini Syringe With Navi Tip Technique

Navi Tip, is a thin and flexible metal tip used along with the Skini syringe was recently introduced in the market, to deliver the root canal obturating material or sealer into the canals. Navi Tips are available in color coded system according to different lengths- 17mm (X-short and white colored), 21mm (short and yellow colored), 25mm (medium and blue colored) and 27mm (long and green colored).

Navi Tip has a rigid and flexible end. The hub and shank of the needle are rigid to support the insertion. The flexible rounded end negotiates curves. Skini syringes is a small diameter syringe that facilitates the delivery of the viscous filling material through tiny Navi Tip with minimal plunger pressure. Navi Tip of yellow color code (21mm) was used for the present study and attached to skini syringe. The standardized mixture of ZOE using 0.270ml/1g ratio of Zinc oxide powder to Eugenol liquid was prepared following the manufacturer's recommendation. The plunger was removed and Skini syringe was filled with ZOE to back flange to avoid any entrapment of air between plunger and the obturating material. Plunger was inserted into the Skini syringe and pressed slowly till some obturating material flowed out of the Navi Tip to verify the flow of the material.

Rubber stopper was used to mark the length of the needle to be inserted into the canals by keeping it at the predetermined working length. Navi Tip on filled skini syringe was inserted into the canals and the plunger was pressed gently with slow retrieval of the needle from the canal as the material was seen to be expressed into the canal along with retrieval. While slowly withdrawing, it was verified that the obturating material was coming up the canal and the tip was submerged into the material to avoid air entrapment into the canal. Wet cotton pellet was used to press the material at orifice.

Statistical analysis: Data was entered in Microsoft excel and the categorical data was analyzed by chi square test using SPSS (version 16). 'p' value of less than 0.05 was accepted as indicating significance.

Chi-Square test:

Categorical data was analysed by chi square test.

$$\chi^2 = \sum \frac{(O - E)^2}{E}$$

O- Observed frequency

E- Expected frequency

E = Row total X Column total

Grand total

df= (r-1)x(c-1)

Σ = Denotes summation

r= Row

c= Column

Scoring Criteria:

- ✓ The measurements were standardized and given a scale of 1, 2, 3, while scale 1 measured as ≤ 1mm, scale 2 measured as 1-2mm, scale 3 measured as ≥ 2mm.
- ✓ Scale 1 indicated the best possible results, while 3 as the worst.

Result: Table 1: Comparison of Lentulospiral and Skini syringe with Navi tip technique by evaluating the Void of individual subjects using CBCT technique.

Score	Voids		P value
	Lentulospiral	Skini syringe with Navi tip	
1	3 (18.75%)	11 (64.71%)	0.0076
2	6 (37.50%)	5 (29.41%)	0.6223
3	7 (43.75%)	1 (5.88%)	0.0112
Total	16	17	

Pearson Chi-Square = 9.140, df =2 , P value= 0.0104 (Significant)

Observation:

We observed significant difference in score 1 (P=0.0076) and score 3 (P= 0.112) between Lentulospiral and Skini syringe with Navi tip technique. 64.71% of Skini syringe with Navi tip treated patients had score 1 and only one (5.88%) of them scored 3 which is statistically significant in comparison to the Lentulospiral using CBCT techniques.

Figure 1.

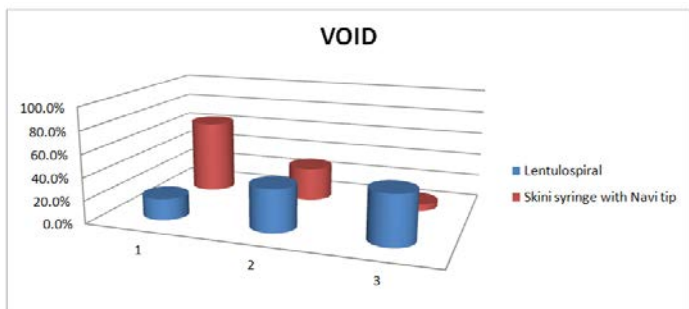


Table 2: Comparison of Lentulospiral and Skini syringe with Navi tip technique by evaluating the Apical Seal of individual subjects using CBCT technique.

Score	Apical Seal		P value
	Lentulospiral	Skini syringe with Navi tip	
1	5 (31.25%)	15 (88.24%)	0.0008
2	11 (68.75%)	2 (11.76%)	0.0008
3	0 (0%)	0 (0%)	NA
Total	16	17	

Pearson Chi-Square = 11.21, df =1, P value= 0.0008 (Significant).

Observation:

We observed significant difference in score 1 (P=0.0008) and score 2 (P= 0.0008) between Lentulospiral and Skini syringe with Navi tip technique. 88.24% of Skini syringe with Navi tip treated patients had score 1 and two of them (11.76%) of them scored 2 which is statistically significant in comparison to the Lentulospiral using CBCT techniques.

Figure 2.

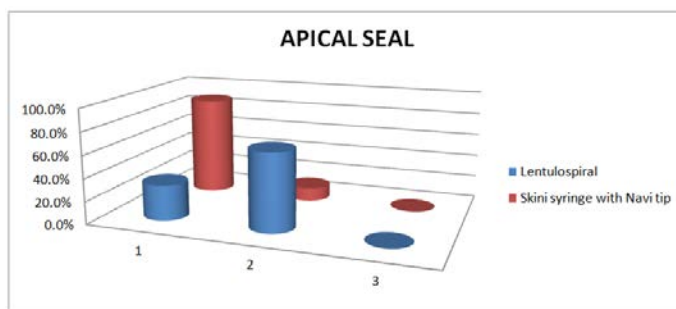


Table 3: Comparison of Lentulospiral and Skini syringe with Navi tip technique by evaluating the Extrusion of individual subjects using CBCT technique.

Score	Extrusion		P value
	Lentulospiral	Skini syringe with Navi tip	
1	8 (50.00%)	15 (88.24%)	0.0169
2	7 (43.75%)	2 (11.76%)	0.0392
3	1(6.25%)	0 (0%)	0.2952
Total	16	17	

Pearson Chi-Square = 5.883, df =2 , P value= 0.0528 (Non-Significant)

Observation:

We observed significant difference in score 1 (P=0.0169) and score 2 (P= 0.0392) between Lentulospiral and Skini syringe with Navi tip technique. 88.24% of Skini syringe with Navi tip treated patients had score 1 and two of them (11.76%) of them scored 2 which is statistically

significant in comparison to the Lentulospiral using CBCT techniques.

Figure 3.

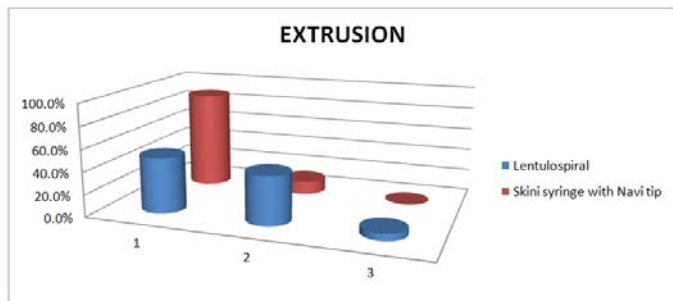


Table 4: Comparison of Lentulospiral and Skini syringe with Navi tip technique by evaluating the Void of individual subjects using RVG technique.

Score	Void		P value
	Lentulospiral	Skini syringe with Navi tip	
1	14 (87.50%)	13 (76.47%)	0.6715
2	2 (12.50%)	3 (17.65%)	0.6282
3	0 (0%)	1 (5.88%)	0.2952
Total	16	17	

Pearson Chi-Square = 1.208, df =2 , P value= 0.5467 (Non-Significant)

Observation:

We did not observed any significant difference in score 1, 2, and 3 between Lentulospiral and Skini syringe with Navi tip technique.

Figure 4.

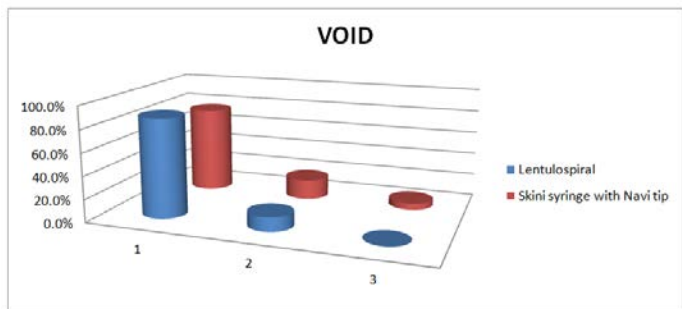


Table 5: Comparison of Lentulospiral and Skini syringe with Navi tip technique by evaluating the Apical Seal of individual subjects using RVG technique.

Score	Apical Seal		P value
	Lentulospiral	Skini syringe with Navi tip	
1	5 (33.33%)	13 (76.47%)	0.0141
2	9 (60.00%)	4 (23.53%)	0.0361
3	1 (6.67%)	0 (0%)	0.2794
Total	15	17	

Pearson Chi-Square = 6.379, df =2, P value= 0.0412 (Significant)

One patient report were excluded due to technical error.

Observation:

We observed significant difference in score 1 (P=0.0141) and score 2 (P= 0.0361) between Lentulospiral and Skini syringe with Navi tip technique. 76.47% of Skini syringe with Navi tip treated patients had score 1 and four of them (23.53%) of them scored 2 which is statistically significant in comparison to the Lentulospiral using RVG techniques.

Figure 5.

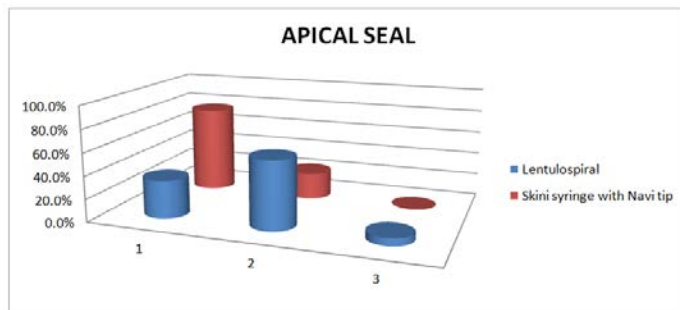


Table 6: Comparison of Lentulospiral and Skini syringe with Navi tip technique by evaluating the Extrusion of individual subjects using RVG technique.

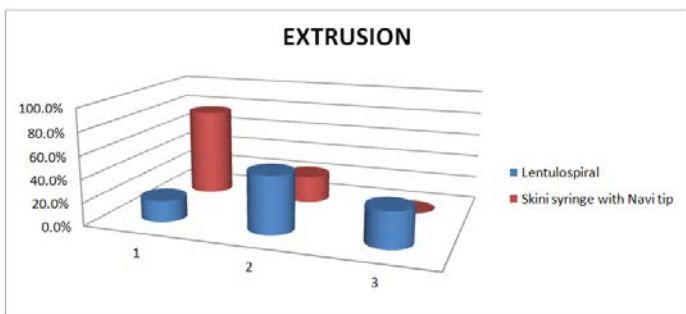
Score	Extrusion		P value
	Lentulospiral	Skini syringe with Navi tip	
1	3 (18.75%)	13 (76.47%)	0.006
2	8 (50.00%)	4 (23.53%)	0.1142
3	5 (31.25%)	0 (0%)	0.0123
Total	16	17	

Pearson Chi-Square = 12.56, df = 2 , P value= 0.0019 (Significant)

Observation:

We observed significant difference in score 1 (P=0.006) and score 3 (P= 0.0123) between Lentulospiral and Skini syringe with Navi tip technique. 76.47% of Skini syringe with Navi tip treated patients had score 1 and none of them (0%) scored 3 which is statistically significant in comparison to the Lentulospiral using RVG techniques.

Figure 6.



Discussion

The ultimate goals of root canal filling are to adequately adapt the obturating material to the canal walls, completely fill the root throughout its length (apical sealing without overfilling), and avoid the void creation or gaps in the paste.^{5,9,10}

In the present study two constant factors were kept—use of a single technique of biomechanical preparation and a single obturating material—and then assess the quality of fill via the two techniques using RVG and CBCT. ZOE is one of the most widely used preparations for primary

tooth pulpectomies, as several authors have reported a moderate to high success rate in preserving chronically infected teeth using this material.¹¹ Therefore, in the present study, ZOE was chosen as a root canal filling material. The difference in the consistencies of the ZOE mixtures was attributable to the physical limitations of the different techniques. Consequently, in all four techniques, ZOE mixtures were prepared according to the manufacturer’s recommendation or technique limitations. It has been reported in the literature that all of the techniques used in the present study— lentulo spiral, insulin syringe, endodontic pressure syringe, and NaviTip system—can deliver ZOE to optimally fill the root canals of primary teeth.^{2,5,8,12}

In the present study the frequency of overfilling with the Lentulo spiral was higher than in the other groups, a finding also reported in a previous study.⁸ This may be related to the reduction in operator "feel" and displacement of the rubber stop during the filling procedure, with resultant overfilling. Potential drawbacks of overfilling are foreign body reaction or deflection of the unerupted permanent tooth, especially when a moderately resorbable filling material such as ZOE is used.¹³ If the entire working length of the canal is cleaned, treatment following optimal filling or underfilling tends to be successful.^{5,8,14} Our findings showed that the mean sum of the voids in the Lentulo spiral group was higher than in the NaviTip group. This may be due to the entrapment of air bubbles in the paste during mixing of the powder with the liquid, and during repeated removal and reinsertion of the instrument during the filling procedure.^{15,16}

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.^{5,13} In the present study the Skini syringe with navitip led to the best filling. This is consistent with the

study done by Singh A et al,¹ who found that the Navi tip delivered paste into the canals better than Lentulospiral.

Singh A et al compared the volume of root canals of primary teeth filled by four different obturating techniques: lentulospiral; insulin syringe; endodontic pressure syringe and NaviTip system using CBCT & concluded that NaviTip system and endodontic pressure syringe showed the best root canal obturation, with the nearest to complete filling of the volumes of prepared root canals.

The Skini syringe is a small diameter syringe that facilitates the flow of viscous materials through the tiny NaviTip system, with minimal plunger pressure required. 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.^{5,14} The highly flexible needle penetrates into the curved, narrow canal close to the apex and injects paste rapidly and uniformly. The cannula of the NaviTip system is slightly rigid through the base and center but flexible at the tip to allow for easy navigation of curved canals. The hub and shank are rigid to support insertion, and the flexible rounded ends negotiate curves, especially in posterior teeth. Guelmann et al. assessed the quality of root canal fill by using three filling systems and concluded that the NaviTip system offered a more desirable filling quality than lentulo spiral and Vitapex syringe techniques.⁵ Moreover, Memarpour et al. concluded that the NaviTip system produced the smallest void size and lowest number of voids and was superior in controlling paste extrusion from the apical foramen.²

Hence, we could conclude that there is always a quest for the evolution of better & newer materials and techniques.

In this scenario these two techniques are proved to be effective for obturation ;but we look further for more

research in this area so that we can come up with more definitive results.

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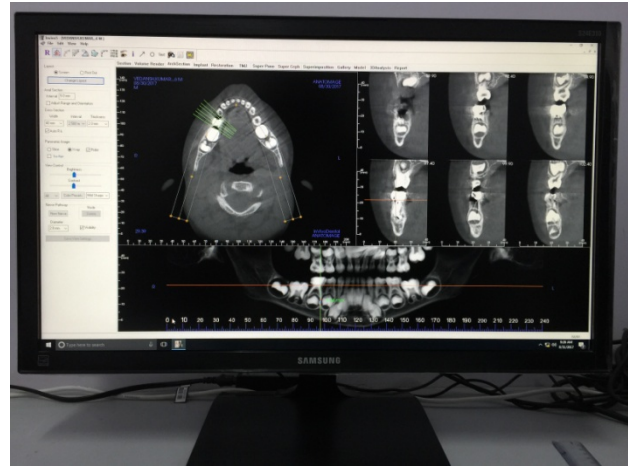
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Obturation with Lentulospiral



RVG

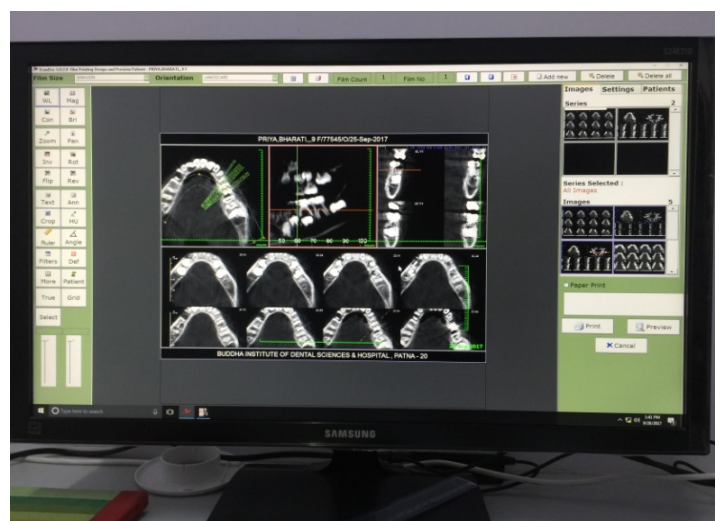


CBCT

Obturation with Skini syringe with Navitip



RVG



CBCT