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RESEARCH ARTICLE

A COMPARATIVE STUDY OF INTRA ORAL PERIAPICAL RADIOGRAPHIC E-SPEED FILM AND RADIOVISOGRAPHY (RVG) FOR DETECTION OF INCIPIENT PROXIMAL CARIES

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ABSTRACT

Objectives: Objectives of our study were to evaluate the efficacy of intraoral periapical radiographic E-speed film and radiovisiography (RVG) and to compare the efficacy of both in the detection of incipient proximal caries.
Methods: 40 extracted human premolar teeth were collected and conventional radiography and RVG were done using the intraoral radiographic machine, using paralleling technique. These images were evaluated for the detection of incipient proximal caries by three observers and graded according to 5 grade scale. The computed tomogram images were taken as the standard images.
Results:ROC curve analysis was done to compare the efficacy of Intraoral E speed film and RVG for the detection of incipient proximal caries. The area under the ROC curve for E speed film was 0.719. When the sensitivity and specificity value were compared a p-value of 0.007 was arrived which showed a statistical significance. When comparing the 3 modes of RVG, the area under ROC was 0.733, 0.707 and 0.599 respectively. When sensitivity and specificity values were compared, a strongly significant p value was found for endo mode (0.003) and a moderately significant p value for perio (0.012) and no significance for DEJ mode (0.282).
Conclusion: The E speed film can be used as one of effective means in the detection of incipient proximal caries. Among the three modes of RVG the efficacy of endo mode was the best in diagnosing incipient proximal caries followed by perio mode and DEJ mode respectively.

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INTRODUCTION

Intraoral films are currently accepted as the standard for radiographic caries detection. (Tyndall *et al*., 1998) Since the discovery of X-rays in 1895, film has been the primary medium for capturing, displaying, and storing radiographic images. (Laux *et al*., 2000) Films with different speeds like D-speed, Ekta (E-speed), Ekta plus (E plus), F speed (insight) are currently in use for intraoral radiography. Intraoral films have advantages but several shortcomings like more exposure, processing errors, radiographic retakes consistently for acceptable quality, may result in increased discomfort and radiation dose to the patient. (Tyndall *et al*., 1998; Parks and Williams, 2002) Thus digital intraoral imaging system gainedmomentum for diagnostic purposes. Radiovisiography (RVG) is widely used for intraoral diagnosis. Currently intraoral digital radiography systems appear to provide diagnostic accuracy similar to that of conventional dental films. Theadvantages of digital imaging are numerous. One main advantage is the elimination of processing errors thus avoiding radiographic retakes. (Tyndall *et al*., 1998; Wenzel, 1995) In addition, the radiation dose for digital systems is approximately 50% of E speed film. (Wenzel, 1995) Another potential advantage of digital imaging is the ability to perform quality image-enhancements such as contrast and density modulation, which may increase diagnostic accuracy. (Tyndall *et al*., 1998) The development of RVG system with high technical efficacy, perhaps marks a turning point in improving caries detection through better technologies. (Abreu *et al*., 2001) Early detection of incipient proximal caries is very important because if detected early and accurately, one can prevent further tooth decay thus avoiding future complex treatment modalities.

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So we intend to take up this study to determine the efficacy of intraoral periapical radiographic E-speed film and RVG in the detection of incipient proximal caries.

Objectives of our study were

1. To evaluate the efficacy of intraoral periapical radiographic E-speed film in the detection of incipient proximal caries.

2. To evaluate the efficacy of three modes of RVG in the detection of incipient proximal caries.
   a) Endo-mode (HRE-high resolution endo-mode)
   b) Perio-mode (HRP-high resolution perio-mode)
   c) Dentin-to-enamel junction mode (DEJ –mode / HRC-high resolution caries mode)

3. To compare the efficacy of both intraoral periapical radiographic E-speed film and RVG in the detection of incipient proximal caries

MATERIALS AND METHODS

This study was carried out during the period of October 2009 to October 2011, in the Department of Oral Medicine and Radiology, Vydehi Institute of Dental Sciences and Research Centre, Bangalore. After an informed consent, total of 40 extracted human premolar teeth were collected from patients undergoing orthodontic treatment. Teeth with large carious lesions, occlusal caries and caries on buccal and lingual surfaces were excluded from the study. These teeth were mounted on to the square cubes made out of plaster of Paris by carving a small hole on one side, in the center of the cube and the teeth were stabilized inside this carved hole using modelling wax (Figure 1a, b and c). To ensure that the tooth is perpendicular to the central ray, first a straight line was drawn which runs through the buccal and lingual surfaces of the tooth, thus orienting the tooth in one straight line. Next a circle is drawn on a card board which is divided into 4 quadrants by a horizontal & vertical line. This is used to centralize the tooth and ensure that the line on the card board is parallel to the line drawn on the cube involving the buccal and lingual surfaces. So every time, when each tooth is placed in front of the position indicating device for exposure, this line drawn is used to align the tooth perpendicular to the position indicating device (Figure 1d). Thus each tooth is placed in the center of the circle on the cardboard with the help of the orientation lines drawn. These lines dividing the circle were graduated to centimeter scale and used to maintain a constant distance of 1cm between the buccal surface of the tooth and end of the position indicating device to mimic the soft tissues.

Standardization for radiographic procedure

All the radiographs were taken according to standardized procedure and processed by freshly prepared solutions by time and temperature method. An X-ray machine (Trophy CCX digital) having 70 kVp, 8 mA and 1.5 mm aluminium filtration with 20 cms open collimator was used to obtain a radiograph. The focal spot to film / sensor distance of 40cms was used. Kodak Insight (E-speed) intraoral periapical radiographic films, size 2 (31 x 41 mm) Eastman Kodak Co, Rochester, NY and Trophy RVG, Access sensor, size 2, Digital Intraoral radiography system; Trophy a Kodak company; 14 lp/mm were used for the study. Hawe x-ray sensor holder- Super bite senso Posterior holderwere used to stabilize, the sensor and film. The images were obtained using paralleling technique and the distance between the teeth and position indicating device was maintained at 1cm distance to mimic the soft tissues. The film and RVG sensor were placed 1cm just posterior to the tooth (Figure 2). The exposed films were processed using freshly prepared processing solutions by time (2.5 minutes) and temperature (27^0 c) method.

Standardization procedure for exposure time

To standardize the exposure time for the procedure, an aluminium block of 5 steps, with total length of 2 cm and thickness of 1cm was considered. The thickness (increment) of each step was 2mm with width of 4mm. Two holes were drilled on each step, totally 10 holes in the aluminium block (Figure 3a). The aluminium step wedge was placed instead of the teeth in front of the positioning indicating device and radiographed at different exposure levels for both the systems.(Figure 3b) All the radiographs were randomly sequenced and presented to three oral radiologists. Each radiologist was asked to state the numbers of holes he or she could easily visualize in each radiograph, i.e. directly determine the number of holes visible in each radiograph. The average numbers of perceptible holes for each radiograph were obtained from all 3 observers for each exposure. The exposure level at which the maximum number of holes for each radiograph perceived was considered to be optimum exposure levels. In this way from both the systems i.e. conventional film and Digital based system an optimum exposure for the best visualization was standardized (Figure 3c and d). The maximum number of holes detected by each observer was at exposure of 1F (0.14 seconds) for conventional radiography and 4F (0.04 sec) for RVG.

Evaluation of IOPA and RVG images (Figure 4, 5)

The RVG images for the 40 teeth are stored as A1, A2, A3 images corresponding to 3 modes of the RVG (endo mode, perio mode, dentino-enamel junction (caries) mode. The RVG images, film images were evaluated for incipient proximal caries and compared by two oral radiologists and an endodontist who all have good knowledge of dental caries and sufficient experience in observing digital images. The observers were allowed to use the effects of the manipulations in the RVG and were asked to grade accordingly five grade scale as (Matsuda *et al*., 2002)

1-Definitely present
2-Probably present
3-Questionable
4-Probably absent
5-Definitely absent

All these 40 teeth were subjected to Computed Tomogram (CT) and teeth were assessed in coronal view, sagittal view, axial view, oblique view, 3D volume rendering view. The CT images were used to confirm the presence of caries and these

standard results were used to compare the results of the RVG and film images (Figure 6).

Statistical analysis

Descriptive statistical analysis has been carried out in the present study. To analyze the consistency among the observers, Cronbach classification (Bernard Rosner, 2000; Robert H Riffenburg, 2005) has been used in this study and given on the basis of α value as –

- $0 \leq \alpha \leq 0.40$: Not consistent
- $0.41 \leq \alpha \leq 0.60$: Low consistent
- $0.61 \leq \alpha \leq 0.80$: Very consistent
- $0.81\ \alpha \leq 1.00$: High consistent

Receiver Operating Characteristic (ROC) curve analysis was performed to find the correlation of radiological score against the standard. (Sunder Rao and Richard, John Eng, 2003)The statistical significance, between the observations were assigned based on the p- value as - Suggestive significance (P value: $0.05<P<0.10$), moderately significant (P value: $0.01<P \leq 0.05$), strongly significant (P value: $P \leq 0.01$). The Statistical software namely SAS 9.2, SPSS 15.0, Stata 10.1, MedCalc 9.0.1,Systat 12.0 and R environment ver.2.11.1 were used for the analysis of the data and Microsoft word and Excel have been used to generate graphs, tables etc.

RESULTS

In this present study a total of 40 extracted premolar teeth (80 surfaces) were evaluated for incipient proximal caries to determine the efficacy of intraoral periapical E-speed film and three modes of RVG (endo, perio, DEJ modes). Among 80 surfaces, 62 surfaces did not have incipient proximal caries and 18 surfaces had caries which was confirmed with the respective computed tomography images. Table 1 and graph 1 shows the comparison of the ratings given by the three evaluators in assessing the incipient proximal caries with intraoral periapical film on mesial and distal surfaces of the tooth. On computing the Cronbach Alpha value for the observations, 0.785 for mesial and 0.754 for distal surfaces were obtained, pointing towards a very consistent value. The interobserver variations for the detection of incipient proximal caries on the mesial and distal surfaces by E-speed film method were minimal and there was a good agreement between the observers. Table 2 and graph 2 shows comparison of the ratings given by the three evaluators in assessing the incipient proximal caries with RVG 1-endo mode and the interobserver agreement in the detection of incipient proximal caries for the mesial surface was fair and for the distal surfaces was good. Similarly in comparative evaluation for RVG 1- endo mode, on computing the Cronbach Alpha value for the observations, 0.588 for mesial and 0.738 for distal surfaces were obtained, pointing towards a low consistent value and very consistent value respectively.

Table 1 and Graph 1. Comparative evaluation of intraoral periapical radiographic E-speed film on mesial surface and distal surface for the detection of incipient proximal caries

Grading	MESIAL SURFACE			DISTAL SURFACE		
	Observer 1	Observer 2	Observer 3	Observer 1	Observer 2	Observer 3
1.Definitly present	3(7.5%)	6(15%)	10(25%)	4(10%)	3(7.5%)	5(12.5%)
2.Probably present	3(7.5%)	4(10%)	12(30%)	3(7.5%)	3(7.5%)	9(22.5%)
3.Questionable	6(15%)	5(12.5%)	1(2.5%)	5(12.5%)	4(10%)	1(2.5%)
4.Probably absent	5(12.5%)	3(7.5%)	1(2.5%)	2(5%)	6(15%)	4(10%)
5.definitly absent	23(57.5%)	22(55%)	16(40%)	26(65%)	24(60%)	21(52.5%)
Total	40(100%)	40(100%)	40(100%)	40(100%)	40(100%)	40(100%)
Cronbach Alpha for consistency among observers		0.785			0.754	

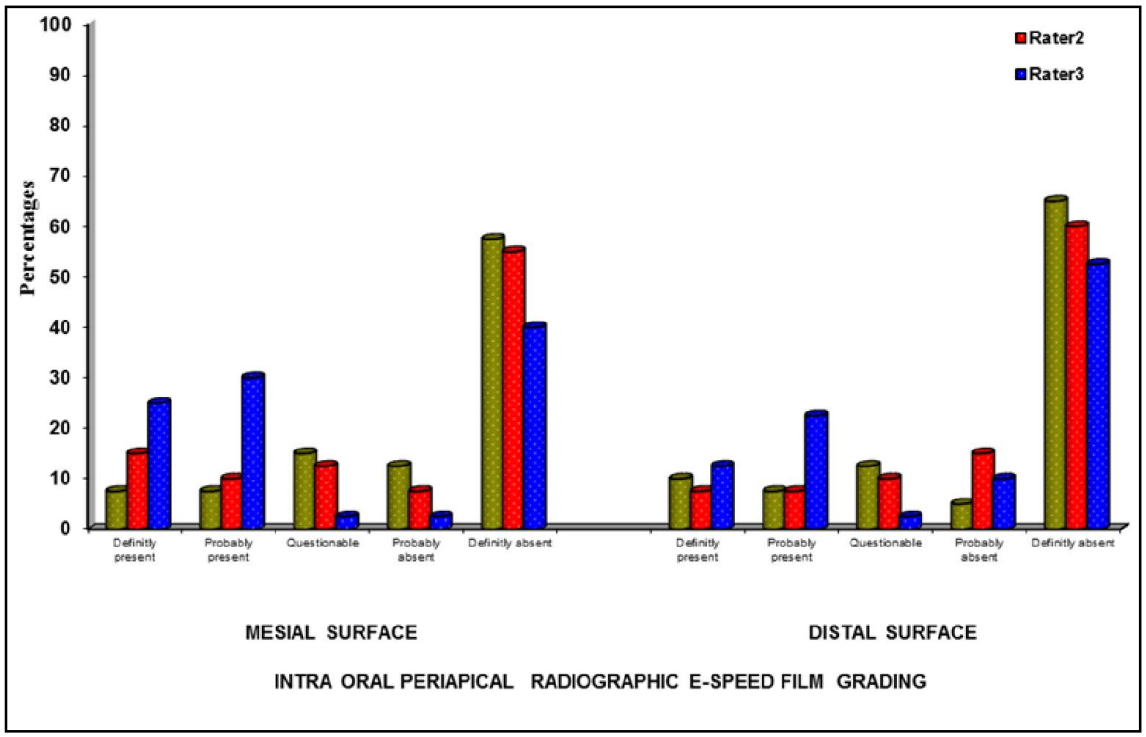


Table 2 and Graph 2. Comparative evaluation of RVG 1- endo mode on mesial surface and distal surface for the detection of incipient proximal caries

RVG 1 -Endo modeGRADING	MESIAL SURFACE			DISTAL SURFACE		
	Observer 1	Observer 2	Observer 3	Observer 1	Observer 2	Observer 3
1.Definitly present	4(10%)	4(10%)	2(5%)	2(5%)	3(7.5%)	5(12.5%)
2.Probably present	2(5%)	2(5%)	19(47.5%)	3(7.5%)	1(2.5%)	16(40%)
3.Questionable	6(15%)	6(15%)	8(20%)	2(5%)	1(2.5%)	6(15%)
4.Probably absent	3(7.5%)	8(20%)	6(15%)	4(10%)	13(32.5%)	7(17.5%)
5.definitly absent	25(62.5%)	20(50%)	5(12.5%)	29(72.5%)	22(55%)	6(15%)
Total	40(100%)	40(100%)	40(100%)	40(100%)	40(100%)	40(100%)
Cronbach Alpha for consistency among observers		0.588			0.738	

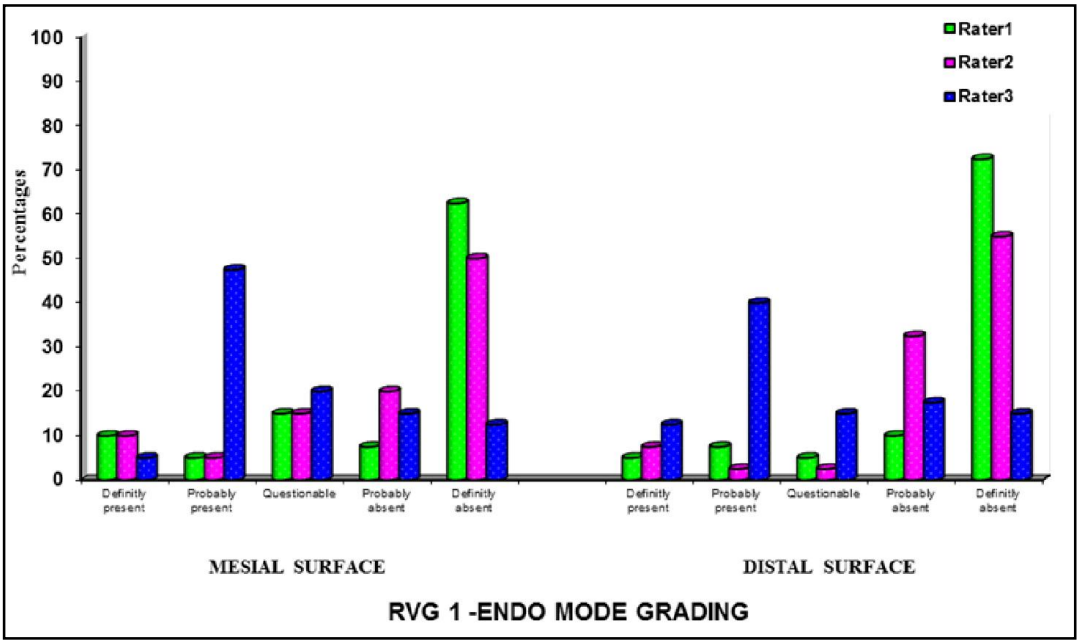


Table 3 and Graph 3. Comparative evaluation of RVG 1- Perio mode on Mesial surface and distal surface for the detection of incipient proximal caries

RVG 2-Perio modeGRADING	MESIAL SURFACE			DISTAL SURFACE		
	Observer 1	Observer 2	Observer 3	Observer 1	Observer 2	Observer 3
1.Definitly present	3(7.5%)	3(7.5%)	7(17.5%)	1(2.5%)	3(7.5%)	7(17.5%)
2.Probably present	2(5%)	4(10%)	14(35%)	2(5%)	2(5%)	8(20%)
3.Questionable	8(20%)	5(12.5%)	1(2.5%)	5(12.5%)	5(12.5%)	4(10%)
4.Probably absent	2(5%)	13(32.5%)	4(10%)	3(7.5%)	12(30%)	5(12.5%)
5.definitly absent	25(62.5%)	15(37.5%)	14(35%)	29(72.5%)	18(45%)	16(40%)
Total	40(100%)	40(100%)	40(100%)	40(100%)	40(100%)	40(100%)
Cronbach Alpha for consistency among observers		0.664			0.799	

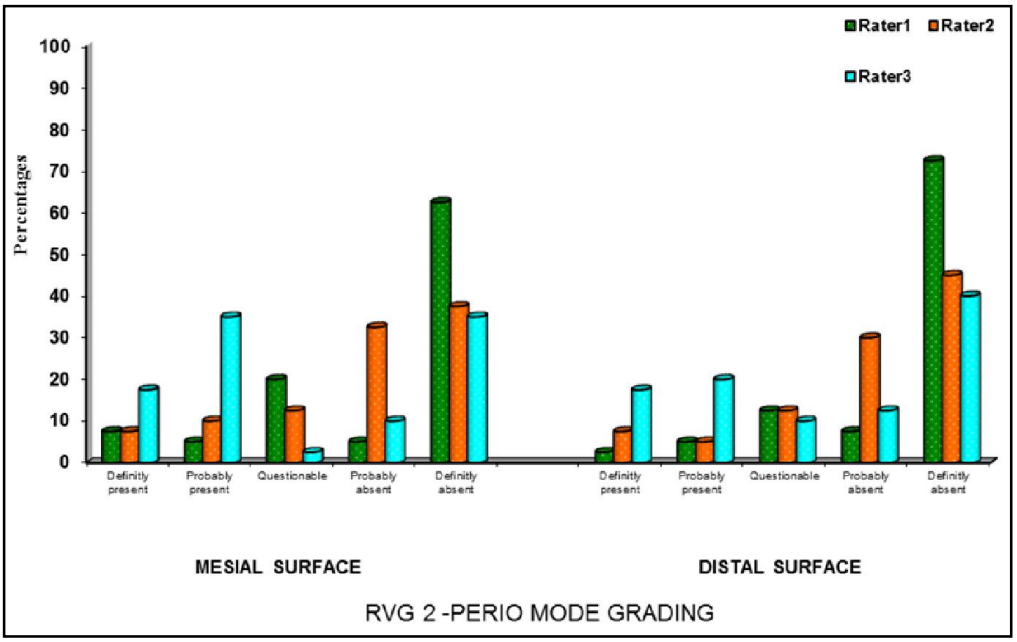


Table 4 and Graph 4. Comparative evaluation of RVG 1- DEJ mode on mesial surface and distal surface for the detection of incipient proximal caries

RVG 3 -DEJ modegrading	MESIAL SURFACE			DISTAL SURFACE		
	Observer 1	Observer 2	Observer 3	Observer 1	Observer 2	Observer 3
1.Definitly present	4(10%)	4(10%)	2(5%)	3(7.5%)	3(7.5%)	6(15%)
2.Probably present	3(7.5%)	0(0%)	13(32.5%)	1(2.5%)	2(5%)	11(27.5%)
3.Questionable	4(10%)	8(20%)	10(25%)	5(12.5%)	2(5%)	9(22.5%)
4.Probably absent	5(12.5%)	8(20%)	9(22.5%)	3(7.5%)	6(15%)	9(22.5%)
5.definitly absent	24(60%)	20(50%)	6(15%)	28(70%)	27(67.5%)	5(12.5%)
Total	40(100%)	40(100%)	40(100%)	40(100%)	40(100%)	40(100%)
Cronbach Alpha for consistency among observers		0.596			0.732	

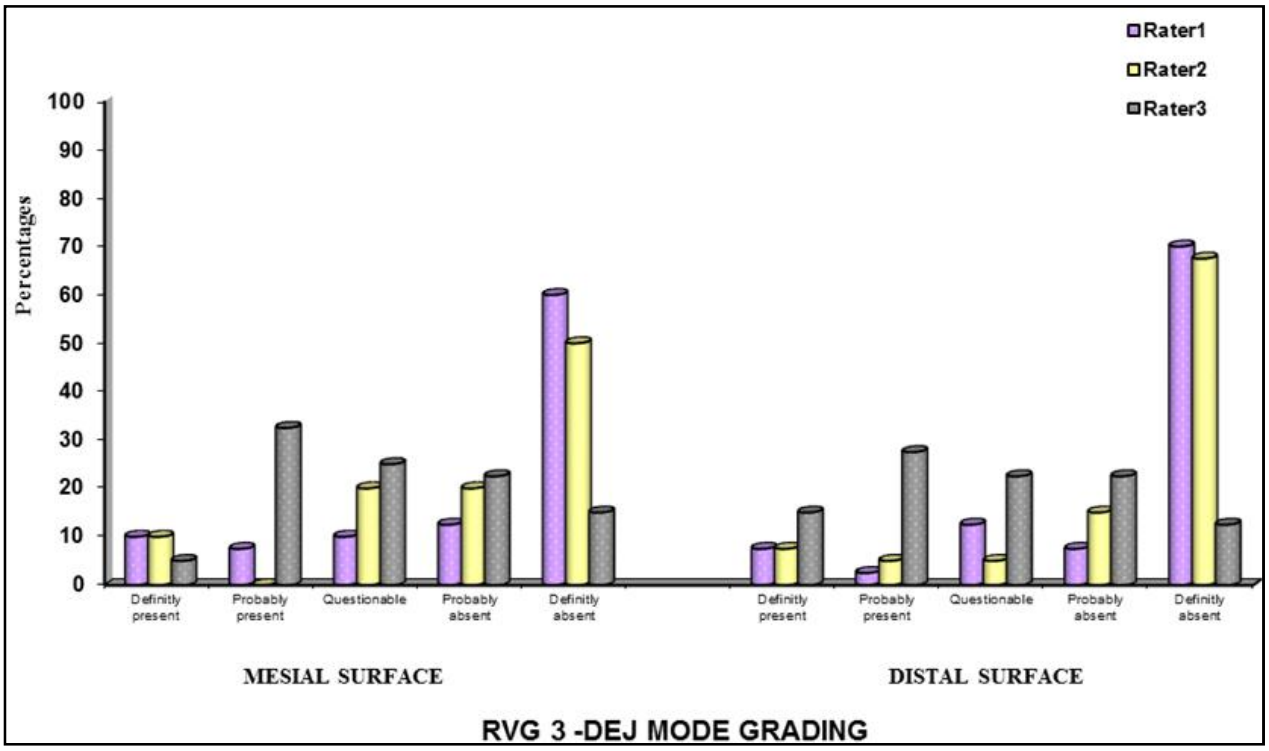


Table 5 and Graph 5. Table 5 & Graph 5: Presence of caries was confirmed by computed tomography taken as standardized

Incipient proximal caries	Mesial surface	Distal surface
Present	7(17.5%)	11(27.5%)
Absent	33(82.5%)	29(72.5%)
Total	40(100%)	40(100%)

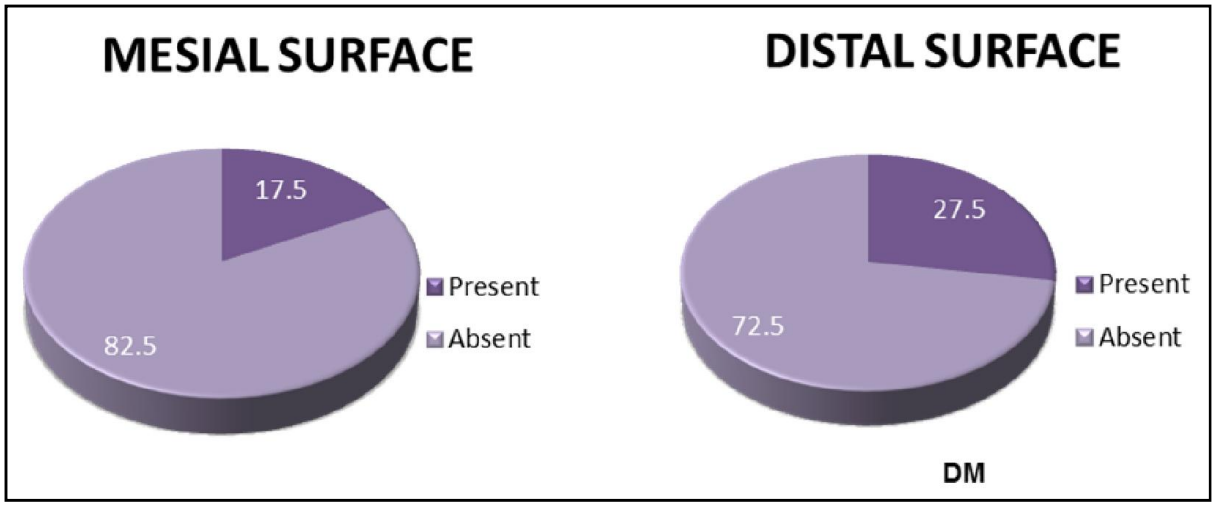
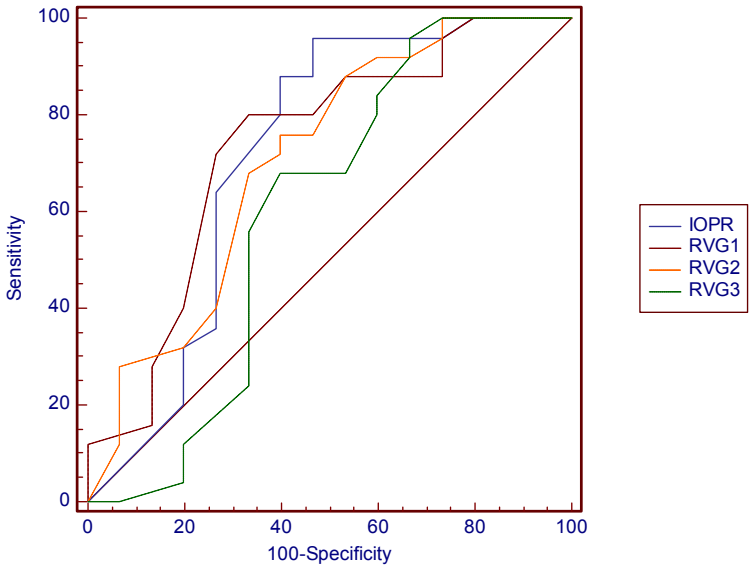


Table 6 and Graph 6. ROC curve analysis of intra oral periapical radiographic E-speed film and radiovisiography (RVG) for detection of incipient proximal caries

Criteria	Mean score	Cut-off score	Sensitivity	Specificity	AUROC	P value
intra oral periapical radiographic film	3.78	>3.0	96.00	46.67	0.719	0.007**
RVG 1 -endo mode	3.72	>3.67	80.00	66.67	0.733	0.003**
RVG 2-perio mode	3.80	>3.67	76.00	60.00	0.707	0.012*
RVG 3 -DEJ MODE	3.78	>2.50	96.00	33.33	0.599	0.282

Receiver Operator Characteristic (ROC) curve



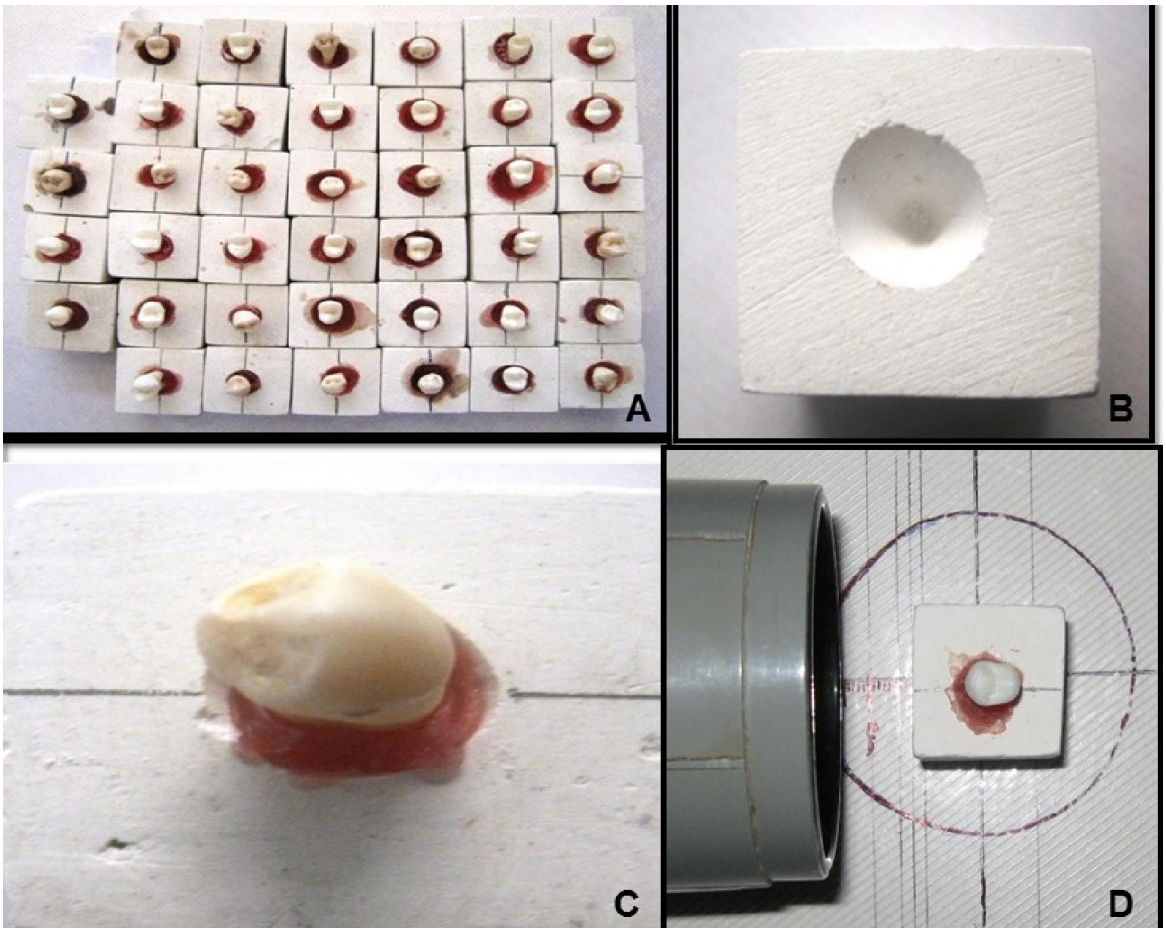


Figure 1A: Photograph showing total teeth sample (40 teeth), B – photograph showing cube made of plaster of Paris for mounting tooth, C – photograph showing tooth mounted onto the cube with wax, D- photograph showing positioning of the tooth for x-ray exposure

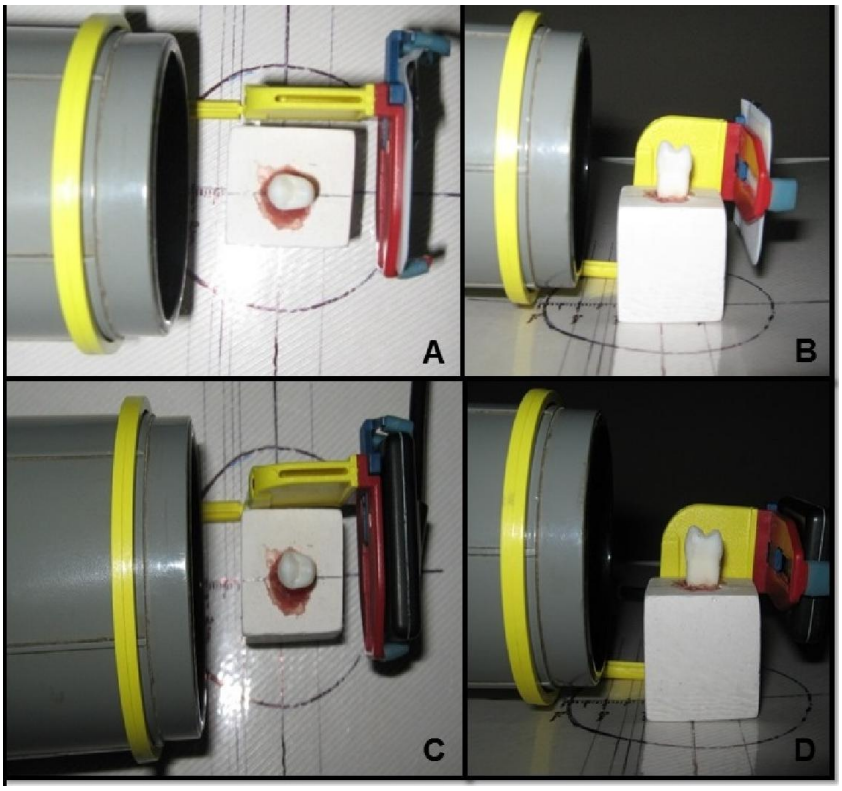


Figure 2A and B – Photograph showing exposure of tooth using intra oral periapical radiographic E-speed film, C and D- Photograph showing exposure of the tooth using RVG sensor

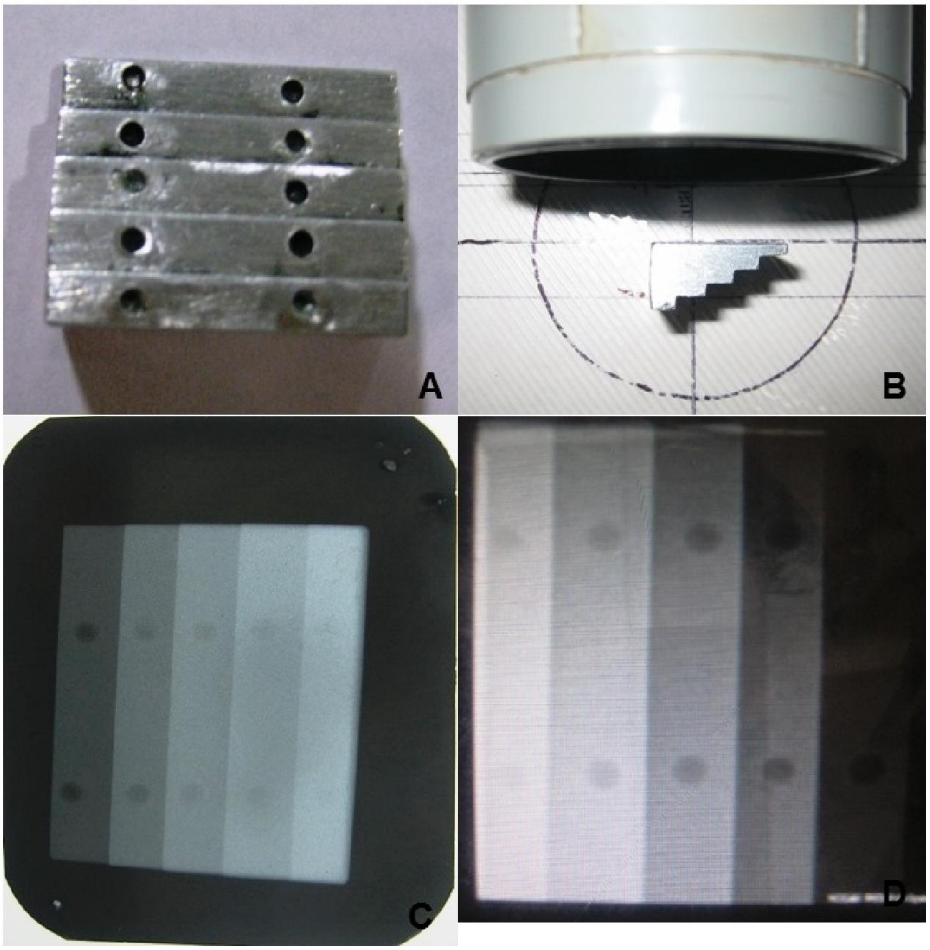


Figure 3 A: Photograph showing aluminium step wedge, B: Photograph showing standardization using aluminium step wedge C: Photograph showing step wedge in RVG, D: Photograph image of the step wedge in E- speed film

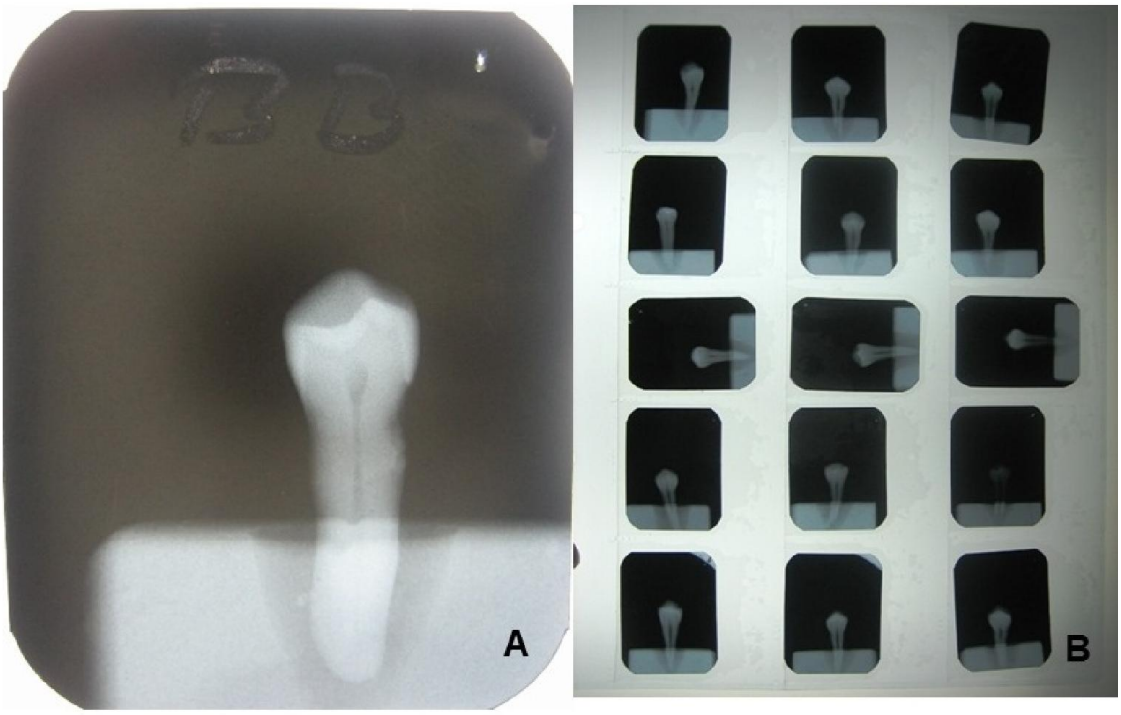


Figure 4. Photograph showing image of tooth on E-speed film

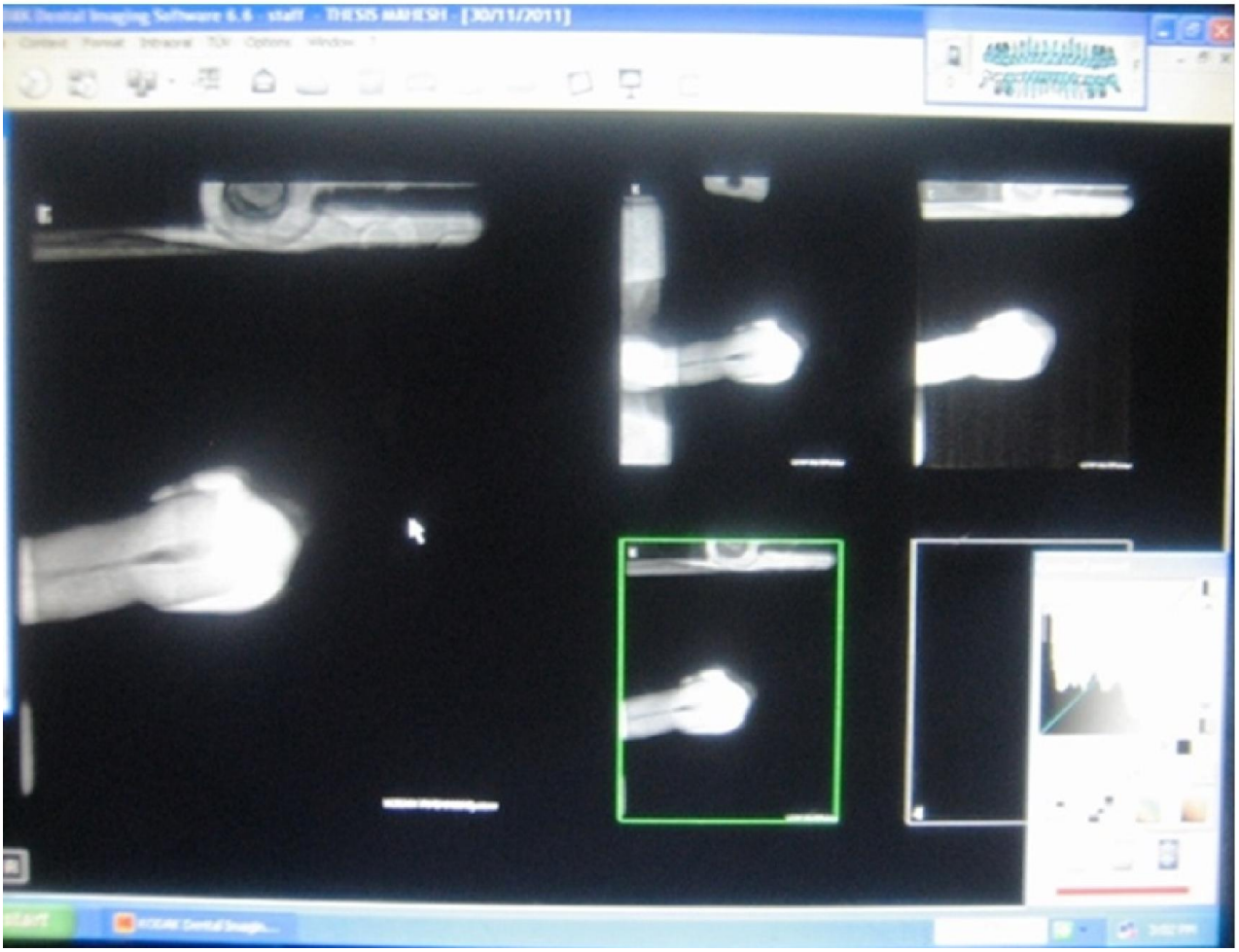


Figure 5. Photograph showing RVG image showing proximal caries (PERIO, ENDO, and DEJ MODES)

Figure 6. Photograph showing 3d CT image of tooth showing proximal caries

Comparative evaluation of RVG periomode, as shown in table 3 and graph 3 reveals very consistent Cronbach Alpha value of 0.664 for mesial and 0.799 for distal surfaces. Interobserver variations for the RVG perio mode were minimal and there was a good agreement between the observers. Similarily, Table 4 and graph 4 shows that in the RVG-caries mode the interobserver agreement in the detection of incipient proximal caries for the mesial surface was fair and for the distal surfaces was good, with Cronbach Alpha value for the observations, 0.596 for mesial and 0.732 for distal surfaces. The clinical presence or absence of incipient proximal caries on 40 tooth surfaces were confirmed by computed tomographic analysis. Among the total 80 surfaces, out of 40 mesial surfaces, 7 (17.5%) showed the presence of incipient proximal caries and 33 (82.5%) showed absence of caries. But on 40 distal surfaces, 11(27.5%) surfaces showed the presence of proximal caries while 29(72.5%) showed the absence of caries (Table 5 and Graph 5). ROC curve analysis was done to compare the efficacy of Intraoral E speed film and RVG for the detection of incipient proximal caries. When observations on E speed film were analyzed, the area under ROC curve was 0.719. When the sensitivity and specificity value were compared a p-value of 0.007 was arrived which showed a statistical significance. So this infers that the E speed film can be used as one of effective means in the detection of incipient proximal caries. When comparing the 3 modes of RVG, the area under ROC was 0.733, 0.707 and 0.599 respectively. When sensitivity and specificity values were compared, a strongly significant p value was found for endo mode (0.003) and a moderately significant p value for perio (0.012) and no significance for DEJ mode (0.282). This highlights that the efficacy of endo mode was the best in diagnosing incipient proximal caries followed by perio mode and DEJ mode respectively. (Table 6 and Graph 6)

DISCUSSION

The detection of incipient proximal caries is primarily by radiography, and its early detection is important so as to improve prognosis. (Verma and Dalal, 2014) With the recent advances both in conventional radiographic systems and digital image receptors, the clinician has access to precise information and added advantage of reduced radiation dose. Over the past years there have been attempts to improve the development of techniques for caries detection and quantification. In caries studies radiological and histological validation methods have been used as gold standard. The demand for a non-destructive method has encouraged the use of CT and micro-CT in studies of enamel de-remineralization. Hintz *et al*. (2002), evaluated the influence of the validation method on the diagnostic accuracy, the ROC (Az) obtained from radiographic validation was significantly higher than that obtained from histological validation. (Pahwa Nikhil, 2011) In histological validation there are chances of loss of tooth structure during the tooth preparation especially in the studies related to proximal caries. Hence in our study we considered the radiological validation by a computed tomography images with each slices of 0.6 mm

thickness as the gold standard. In newer technology like micro CT each slices is about 0.3 mm thickness for the 3D visualization of tooth structures. Since micro CT was not readily available in India, we preferred to have CT for the teeth with thin slices of 0.6 mm thickness.

In our study, interobserver variations for the detection of incipient proximal caries on the mesial and distal surfaces by conventional film method were minimal and there was a good agreement between the observers. In a developing country like India, intraoral periapical radiographs form the major part of diagnosis of caries in institutionalized patients and in private practice. This could be the reason that in our study the inter observer variation was minimal with conventional film method. Ludlow (2001) (Ludlow and Mol, 2001; Ludlow *et al*., 2001) in a study compared films from three speed groups (D,E and F) for the detection of proximal caries concluded that the performance of the new F-speed film was not statistically different from D or E speed for caries detection. Nair *et al*. also compared insight and Ekta speed Plus films for detecting proximal caries (Nairand Nair, 2001) and concluded that the performance of the insight film was not statistically different from that of the other films. Hintze *et al*. (1996) compared the diagnostic accuracy of two dental x-ray films, Kodak Ultra-speed (Ultra) and Ekta speed (Ekta) films for the detection of caries found that no statistically significant differences existed in the detection of occlusal and proximal caries lesions. Abreu *et al*. (2001) in a study to compare the sensitometric properties, diagnostic efficacy and image quality of the insight (F-speed) and Ekta speed Plus (E-speed) dental X-ray films (Kodak Eastman), concluded that the exposure time could be reduced by 20% in comparison with Ekta speed. (Abreu*et al*., 2001) Since F-speed films are not commercially available for routine clinical use, in our study we used E-speed film for the detection of incipient proximal caries.

The interobserver variations were observed more on the mesial surface than on the distal surface in the three modes of RVG in the detection of incipient proximal caries. Paul F and Van der Stel have outlined several shortcomings affecting the interpretation of images, including limitations of the human eye, optical illusions, cognitive processing of visual information, and biasing that may occur because of expectations or prior knowledge. (Paul and Van der Stelt, 2005) These factors can lead to images being misinterpreted. No matter how great an effort is made to randomize the images presented, there is a certain amount of learning that occurs during the observations, as a result, an image can be retained in the observer's memory and compared with images that are subsequently viewed. However, learning that occurs may not necessarily be a significant factor affecting the overall results, because it is likely to occur among all observers as a result of the nature of the process. Area covered under ROC curve for intraoral E speed film, and 3 modes of RVG (endo, perio and DEJ mode) were 0.719, 0.733, 0.707 and 0.599 respectively. Since RVG endo mode and E speed film had strongly significant p values, we can infer that both methods were equally efficient in detection of incipient proximal caries. Similar results were obtained by Yukiko Matsuda *et al*. (2002) who studied the differences between the four RVG modes and the Kodak Insight radiographic film, in terms of visualizing incipient proximal caries. Hintz *et al*. (Wenzel, 1998) compared several conventional digital systems and two film systems for the detection of occlusal and interproximal caries found no statistically significant differences between the digital systems and either of the films. E-speed has an edge over the digital system because of the initial investment cost. But the digital system has an edge over the film system with the advantage of dose reduction and options of image modulation like magnification, brightness enhancement and contrast. Various studies suggests that digital radiography imaging system performed equally well as compared to the conventional radiographic methods with respect to different types of diagnosis in the field of caries, (Nairand Nair, 2001; Wenzel, 1998; Munetaka Naitoh *et al*., 1998; Parissis *et al*., 2005) periodontal lesions, (Furkurt *et al*., 1992; Pass *et al*., 1994; Engstrom *et al*., 2007) endodontics (Ludlow *et al*., 2001; Sanderink *et al*., 1994), external root resorption (Kietzmann *et al*., 2011) and periapical lesions (Boel Kullendorff *et al*., 1996; Boel Kullendorff and Mats Nilsson, 1996; Rossi *et al*., 2007). Even though the sensitivity of E speed film and RVG DEJ mode were same, there was a decrease in specificity for the DEJ mode compared to E speed film. This could be the probable reason for not arriving at a significant association of DEJ mode in diagnosing interproximal caries. Because radiographic images were displayed and assessed on a view box and digital images were viewed on a computer monitor, the type of image being viewed is obvious. This could account for the potential bias that an observer might have towards one type of imaging technique in preference to another. One might assume that digital viewing has an advantage because of its larger scale. This is not necessarily true, however the resolution capability of the monitor will determine the number of pixels and gray values displayed in the digital image. Also Matsuda *et al.* (1995) in their study found that higher digital image magnification reduced observer performance in the detection of aproximal caries. Since this is a comparative study, based on the evaluation of 3 observers, the observer bias should always be taken into account when analyzing the results.

Conclusion

This study was carried out to evaluate the efficacy of intraoral periapical radiographic E-speed film and radiovisiography (RVG) and to compare the efficacy of both in the detection of incipient proximal caries. We inferred from the study that the E speed film can be used as one of effective means in the detection of incipient proximal caries. Among the three modes of RVG the efficacy of endo mode was the best in diagnosing incipient proximal caries followed by perio mode and DEJ mode respectively. RVG endo mode and E-speed film had strongly significant p values; we can infer that both methods were equally efficient in detection of incipient proximal caries. E-speed has an edge over the digital system because of the initial investment cost. But the digital system has an edge over the film system with the advantage of dose reduction and options of image modulation like magnification, brightness enhancement and contrast.

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