

## Comparison of Radiovisiography with Conventional Bitewing Radiography in Assessing Proximal Caries

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### How to cite the article:

Das A, Jagdish L, Rani AS, Garhnayak M, Kumar V, Pandey A. Comparison of radiovisiography with conventional bitewing radiography in assessing proximal caries. J Int Oral Health 2015;7(11):107-109.

### Abstract:

**Background:** Radiography is a commonly used imaging modality in dental setup to aid in diagnosis. Digital radiography using radiovisiography (RVG) is a direct digital intraoral radiographic imaging system, requiring a substantial reduction of radiation dosage to the patient over other radiographic techniques using the film. This study was undertaken with the aim of comparing the sensitivity of RVG system with conventional Bitewing radiography (BWR) in assessing proximal caries and also to evaluate the diagnostic accuracy of RVG to conventional BWR in assessing proximal caries.

**Materials and Methods:** The study included 60 patients in the age group of 18-25 years were randomly selected for this study. Mandibular first molar tooth of right or left side was selected in every individual. No clinical examination was carried out initially, as the teeth were required to be subjected to RVG and BWR examinations first. Grossly destructed tooth or tooth with evident caries was not included in the study. RVG was used to obtain the image of mandibular molars of all the individuals. Interpretations of the images from the monitor were recorded in the proforma. BWR were subsequently taken for the same tooth from a dental X-ray unit operating 70 kVp and 10 mA.

**Results:** All the 60 students were subjected to RVG, BWR and clinical examination for the presence of caries on mandibular first molar. It was noted that out of 60 students 28 (47%) students showed evidence of caries by RVG. Conventional BWR revealed 27 (45%) students positive for caries and only 4 (6.7%) students showed evidence of caries by clinical examination.

**Conclusion:** In the present study, it was found that RVG was equally effective as BWR in detecting proximal caries.

**Key Words:** Bitewing radiograph, dental caries, proximal caries, radiovisiography

### Introduction

Radiography is a commonly used imaging modality in dental setup to aid in diagnosis. Conventional radiographs have been commonly used to record the dental findings. Over the years, many new systems have been introduced to assist in radio diagnosis. Digital radiography using radiovisiography (RVG) is one such system. It is a direct digital intraoral radiographic imaging system, requiring a substantial reduction of radiation dosage to the patient over other radiographic techniques using the film.<sup>1</sup> In 1987, an intraoral radio graphic imaging system "RVG" (Trophy Radiologie, Toulouse France) was introduced on the international market.<sup>2</sup>

As the name "RVG" suggests, it is composed of three components: The "Radio" (radiation source) part consists of the conventional X-ray generator connected to a highly precise microprocessor timer for very short exposure times and an anatomically adapted sensor with rounded edges and angles.<sup>3</sup> The sensor is composed of rare earth intensifying screen (26 mm × 18 mm), housed in a rigid plastic casing, connected to a "charge-coupled device" (CCD) through an array of optical fibers.<sup>4</sup> The signal from the CCD is transmitted through along flexible cable to the display processing unit (DPU) that forms the vision part of the equipment. As the sensor cannot be sterilized, it is covered during use, by a disposable latex finger sheath. The sensor can be held in the mouth by the patient, by a bite block or by a specially designed sensor building device.<sup>5</sup> The "Visio" part of the equipment consists of the DPU, which digitizes, processes and stores the analog signal from the CCD and displays image on the monitor.<sup>4</sup> The "Graphy" part of the image consists of a digital mass storage unit connected to a printer.<sup>4</sup>

Improvements in the computer boards and further developments of the software allowed an extensive range of image configurations. The image can be electronically adjusted in a number of ways including image enhancement, resolution radiation dose, X-ray sensitivity, wide dynamic range, photometric accuracy, and high signal noise ratio.<sup>5</sup>

This study was undertaken with the aim of comparing the sensitivity of RVG system with conventional Bitewing radiography (BWR) in assessing proximal caries and also to evaluate the diagnostic accuracy of RVG to conventional BWR in assessing proximal caries.

### Materials and Methods

The study was carried out at the Department of Oral Medicine and Radiology, JSS Dental College and Hospital, Mysore, after obtaining the ethical clearance from Institution Review Board. The 60 patients in the age group of 18-25 years were randomly selected for this study. Mandibular first molar tooth of the right or left side was selected in every individual. Mandibular first molar was selected in order to maintain maximum parallelism between the image receptor and the object, thereby reducing image distortion.

In a standard proforma, details such as name, age, sex, and address for each individual was recorded. No clinical examination was carried out initially, as the teeth were required to be subjected to RVG and BWR examinations first. Grossly destructed tooth or tooth with evident caries was not included in the study.

The RVG unit used in the study was Trophy (Trophy Radiologie Toulouse France). The intraoral sensor measured 40 mm × 21 mm in size. The sensor is connected by a flexible cable of 250 cm length to DPU. The RVG was connected to a CCX digital X-ray system, which works on 70 kvp and 8 mA. The CCX digital has a microprocessor-controlled timer which sets the exposure time. The exposure time is predetermined and fixed for individual teeth. The exposure for the mandibular molar was selected accordingly. A printer which prints the image in black and white on the thermal paper was used for this study. RVG was used to obtain the image of mandibular molars of all the individuals. Interpretations of the images from the monitor were recorded in the proforma. Later print outs for the same were obtained for the purpose of maintaining a permanent record.

BWR were subsequently taken for the same tooth from a dental X-ray unit operating 70 kVp and 10 mA. The films used were periapical film No.2 Kodak Ektaspeed. The films were processed using an automatic processor (periomat) and the findings were recorded in the proforma.

The tooth which was subjected to RVG and BWR examinations were late reexamined clinically, to avoid bias, using a mirror and a probe under artificial light, for the presence of caries. The findings were recorded in the exclusive proforma.

Criteria used for interpretation of caries lesion in the study are: Evidence of caries was given a score of 01 and no evidence of caries was recorded as 0. Rating for depth of caries was not taken into account.

Results were drawn and statistically analyzed.

### Results

The present study evaluated the efficacy of RVG with BWR and clinical examination to detect proximal caries.

All the 60 students were subjected to RVG, BWR and clinical examination for the presence of caries on mandibular first molar. It was, noted that out of 60 students 28 (47%) students showed evidence of caries by RVG. Conventional BWR revealed 27 (45%) students positive for caries and only 4 (6.7%) students showed evidence of caries by clinical examination as shown in Table 1.

After calculating the mean scores and standard deviation for each parameter, as shown in Table 2, significance of this study was judged by applying the Student's *t*-test.

The comparison of mean scores of RVG (0.4667) and BWR (0.45) was not statistically significant as shown in Table 3. Whereas the comparison of mean scores of RVG (0.4667) and clinical examination (0.066) showed the difference to be significant ( $P < 0.01$ ) as shown in Table 4.

**Table 1: Total number of students examined and score percentage of the three different methods used in detecting proximal caries.**

RVG		BWR		Clinical examination	
Mean scores	Standard deviation	Mean scores	Standard deviation	Mean scores	Standard deviation
0.4667	0.4989	0.45	0.4979	0.0667	0.2494

RVG: RadioVisioGraphy, BWR: Bitewing radiography

**Table 2: Distribution of mean scores and standard deviation of RVG, BWR and clinical examination.**

Scores	N (%)		
	RVG	BWR	Clinical examination
0	32 (53.3)	33 (55)	56 (93.3)
1	28 (46.7)	27 (45)	4 (6.6)

RVG: RadioVisioGraphy, BWR: Bitewing radiography

**Table 3: Comparison between mean scores of RVG and BWR.**

Group	Number of teeth	Mean score	SD	Critical ratio	Significance
RVG	60	0.4667	0.4989	0.01	Not significant
BWR	60	0.45	0.4979		

$P > 0.01$  not significant, RVG: RadioVisioGraphy, BWR: Bitewing radiography, SD: Standard deviation

**Table 4: Comparison between mean scores of RVG and clinical examination.**

Group	Number of teeth	Mean score	SD	Critical ratio	Significance
RVG	60	0.4667	0.4989	5.51	Significant
Clinical	60	0.0667	0.2494		

$P < 0.01$  significant, SD: Standard deviation

The results of this study suggest that the sensitivity of RVG was found to be same as that of BWR in detecting proximal caries.

### Discussion

This study aimed to compare the efficacy of RVG with conventional radiograph for detection of proximal dental caries. The study found no difference in sensitivity of both the imaging systems in the detection of proximal caries.

Similar finding was observed by Rusell and Ditts. They studied *in-vitro* the sensitivities and specificities of BWR (D and E speed films) with those of RVG Bitewing video prints. It was found that the specificity of both the methods to be similar but the sensitivity of RVG was slightly lower. There was no significant difference between the groups studied.<sup>6</sup>

Another research comparing conventional with digital in combination with clinical examination of caries opined that radiographic examination revealed more carious lesions than that from just clinical examination.<sup>7</sup>

A study conducted by Wenzel *et al.* compared digitized, conventional and RVG for detection of occlusal caries found that RVG is a valid medium for detecting of caries.<sup>8</sup>

Another study aimed to compare the diagnostic quality of conventional and digital images of primary teeth for approximal caries which were exposed and viewed by a new wireless handheld unit. It found that that diagnostic quality of both the imaging system was comparable.<sup>9</sup>

Another research compared the diagnostic precision of Kodak Ektaspeed film and Dexis digital imaging systems in uncovering proximal caries and later evaluated them histologically. The study concluded that both the systems underestimated the caries compared to histological evaluation. However, there was no significant difference in both the systems to evaluate carious lesion.<sup>10</sup>

In the present study, it was found that RVG was equally effective as BWR in detecting proximal caries. The advantages of using RVG are manifold. It provides an option to enhance or decrease the contrast of image though this advantage may lead to increased rate of false positive in detecting proximal caries.<sup>11</sup>

RVG yields results broadly comparable with conventional BWR for the detection of carious lesion whilst supplying an instant image at a substantially reduced radiation dose. Electronic manipulation of the digitally acquired RVG images may be expected to produce an increased diagnostic yield to accompany the reduction in radiation dose.<sup>11</sup>

Overall, the two methods, i.e., RVG and BWR were not statistically significantly different for the diagnosis of proximal caries.

### Conclusion

RVG and conventional BWR are equally efficient in detecting proximal caries and there was statistically no significant difference between the two methods in the diagnosis of proximal caries.

RVG yields result comparable with conventional BWR at a substantially reduced radiation dose.

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