وَمَنْ اَحْيَاهَا فَكَاَنَّمَا اَحْيَا النَّاسَ جَمِيْعًا ۝ (۵:۳۲)

And whoso saveth the life of one,
it shall be as if he had saved
the life of all mankind.
- Al-Quran V:32

ISSN 1012 8700

Pakistan Oral & Dental Journal

Volume 23, No. 1
June 2003 Rabi-us-Sani 1424 H

Pakistan Oral & Dent. Jr. 23 (1) June 2003

ROENTGENOGRAPHIC INTERPRETATION OF EXPERIMENTALLY PRODUCED BONY LESIONS USING RADIOVISIOGRAPHY AND CONVENTIONAL RADIOGRAPHY — UPDATE

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ABSTRACT

The aim of this investigation was to evaluate RadioVisioGraphy (RVG) and conventional radiography using Ektaspeed films in the detection of mechanically created bony lesion and determine the difference in identification of both buccal and lingual lesions. Thirty goat mandibles were used. Artificial lesion were created in the area of the body of mandible using round burs #2, #4, #6 and #8 round. Four defects were created posteriorly in between the teeth of each jaw on the buccal aspects in 30 jaws and the lingual side in another 30 mandibles. Periapical radiographs were made using RVG and conventional radiography. Results displayed a statistically significant difference between the size of bur and the detection of bony lesion regardless of the imaging type. (P> 0.005). Defects on the lingual were significantly well depicted than those on the buccal at P> 0.005. RVG demonstrated superiority in it is diagnostic accuracy (p>0.005). It is concluded that RVG has significantly a better diagnostic value in the detection of early pathological conditions.

INTRODUCTION

Radiography plays an essential part in the identification and diagnosis of osseous lesions. Accurate interpretation may largely depend on the extent of bony involvement, type of diagnostic imaging system used and technique precision [1,2]. Direct Digital Imaging (DDI) is a new imaging system that has been developed lately. Of which, is the Radiovisiography (RVG) that uses intensifying screen, fibre optic bundle, and a charge coupled sensor as an x-ray detector or receptor [3-5]. The signals are transferred to the display-processing unit and converted into grey level image[3]. The advantages of DDI include instantaneous image production, manipulation, patient education, accurate telephonic transmission, reduction of hazardous radiation up to 50% and elimination of chemical processing [3,6,7,8]. Drawbacks of this system may involve thickness and flexibility of the sensor, cost, and unknown expectancy of the sensor [1,3,7,9-11]. Furthermore, RVG system has a lower image resolution, which has been overwhelmed in the new generation [1,3,7,9-11].

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Along with the several advantages offered by the DDI system it is superior in detection of bony lesions. Numerous investigator have been able to demonstrate that bony lesions are detected at smaller size an in an earlier stage with better structure definition and outline, when the RVG is used for both radiolucent and radiopaque lesions [12-16]. Researchers, however; did not agree on what volume, type and surface of bone loss must be present for bony lesions to be detected. In general, most of the studies agreed that the detectability of the lesion is governed by whether the cortical bone and lamina dura where involved or not and if there is perforation of the bone cortex [17,18]. Up to date and in the reviewed literature none of the studies have investigated the lingual fenestration of bone. The aim of this study is to (1) evaluate the detectability of artificially created bony lesion and (2) determine differences in the identification of lesion on both buccal and lingual side using RVG versus conventional radiography.

MATERIALS & METHODS

Thirty goat mandibles were obtained from the animal house of Dental College, King Saud University, in Riyadh, Saudi Arabia (King Saud University, Dental College). Soft tissues were dissected to facilitate proper mounting. Specimens were stored in 10% formalin. Screening periapical radiographs and digital images were made to identify ant pre-existing bony lesion. Any specimen with lesion or bony defect was excluded.

Bony lesions

Artificial lesions were created in the area of the body of mandible using a slow-speed hand piece and round burs #2, #4, #6 and #8 round. Defects were drilled vertically in to the depth of each bur head in a consecutive way. Four defects were created posteriorly in between the teeth of each jaw. Entry was made from the cortical plate of the buccal aspects in 30 jaws and from lingual side in another 30 mandibles.

Radiographic imaging

To standardized radiographic geometry mandibles were mounted with a polyvinylsiloxane putty material on 0.5 inch thick glass base. The distant between film/sensor, object and source was standardized with the sensor/film holder and a Rinn plastic paralleling ring (Rinn Corp., Elgin. IL). Mounting was designed so that it provides a constant source- to object distance, object to film distance with accurate removal and repositioning of the specimens. All factors were predetermined in a pilot study to give the best images for both radiographic techniques.

Thereafter, a periapical radiographs were made using Kodak Ektaspeed films (Eastman Kodak Co., Rocheste, NY) and a Siemens X-ray source set at 10 mA, 70 kvp, and exposure time 0.32. All radiographs were developed according to the manufacturers' recommendations using automatic processor AT Automatic Processor (Air Technique Inc., Hicksville, NY). RVG images were taken using with the trophy 1X70 version 4.x, preset at 70 kvp, 7 mA and exposure time 0.12s, the digital image were stored in the computer. The total number of 60 RVG images and 60 radiographs were evaluated.

Evaluation procedure

All images were coded serially and were evaluated blindly at two different times one week apart. Conventional radiographs were mounted and then viewed in darkened room using a masked viewer. RVG image were viewed and evaluated in normal reflected lights. A resolution of 1024 x768 pixels was used and 256 grey scale level.

Evaluation sheets were provided to score the radiographs and images using a 4-point scale of 1 to 4: (1) Lesion definitely present, (2) Lesion probably present, (3) Lesion probably not present and (4) Lesion not present.

RESULTS

In this study 240 defects were evaluated using two different radiographic techniques. There was a statistically significant difference between the size of bur and the detection of bony lesion regardless of the imaging type. In general, the larger the defect the better is the detection of the bony lesions. Defects made with bur size 6 & 8 were significantly ($p > 0.005$) better visualized than size 2 & 4. Lesions on the lingual were significantly well depicted than those on the buccal at $p > 0.005$. RVG demonstrated superiority in it is diagnostic accuracy ($p > 0.005$). Results are summarized in table 1 & 2. In this study, intra examiner agreement was

TABLE 1: BUCCAL BONY LESION RANGE OF VISIBILITY AMONG INVESTIGATORS USING BOTH RADIOGRAPHIC TECHNIQUES.

		Definitely present	Probably present	Probably not present	Not present
Size 2	E-Films	0-6.7 %	26.7-40%	6.7-16.7%	43.3-60 %
	RVG	20-76.7%	10-43.3%	6.7-16.7%	6.7-20%
Size 4	E-Films	43.3-60%	20.2-23.3 %	3.3-23.3%	10-13.3 %
	RVG	56.7-100%	23.3-33.3%	0-6.7%	0-3.3 %
Size 6	E-Films	76.7-96.7%	3.32-3.3%		
	RVG	90-100%	0-10%		
Size 8	E-Films	90-100%	0-10%		
	RVG	96.7-100%			

TABLE 2: RANGE OF LINGUAL BONY LESION VISIBILITY USING RVG AND CONVENTIONAL PERIAPICAL RADIOGRAPH AMONG INVESTIGATORS.

		Definitely present	Probably present	Probably not present	Not present
Size 2	E-Films	0-3.3%	10 - 40%	10-13.3	43.3-73.3%
	RVG	20 - 90%	10-30%	0-3.3%	10-46.7%
Size 4	E-Films	73.3-93.3%	16.7%	0-10%	0-6.7%
	RVG	76.7-96.7%	10-16.7%	0-6.7%	0-3.3%
Size 6	E-Films	86.7-96.7%	0-10%	3.3-6.7%	3.3-6.7%
	RVG	86.7-100%	0-6.7%	0-6.7%	–
Size 8	E-Films	96.7-100%	0-3.3%	–	–
	RVG	96.7-100%	–	–	0-3.3%

moderate (mean 0.286), while, inter examiner mean was 0.2156. Most of the uncertainty was associated with those made with small bur (size 2) and trabcular pattern. The data were entered to SPSS version 10 and statistically analyzed.

DISCUSSION

The aim of any new technology is to detect diseases processes as early as possible for better prognosis. Accurate radiographic diagnosis is imperative for proper clinical judgment and therapy. It has been reported that 30-60% of mineral loss is required for a lesion to be evident radiographically[19,20].

In agreement with previous literature[18,21], our investigation provides an evidence that large-sized lesions have better visibility regardless of the imaging system used. However, RVG has significantly better diagnostic quality than conventional radiography, even in those defects with a small diameter.

In contrast to others [15], our findings displayed a significant difference between RVG and conventional radiography in demonstrating lesions less than 1mm but no difference in lesions more than 1mm. Similarly, Tirrell and co-workers 1996 [18] using a chemically produced lesion, found that smaller lesions were significantly better visualized using RVG and no differences in large sized lesions. Anatomical landmarks, experience, technique's sensitivity and generation may preclude or enhance accurate diagnosis.

In this research site was found to be a significant factor in the interpretation of any bony lesion. This might be explained by the increases density of the

cancellous bone layer. The density of the spongiosa has been reported to increases visibility significantly [22]. The effect of cortical plate perforation and lamina dura in the process of lesion's detection is well investigated in the literature. Earlier studies were able to demonstrate the superiority of RVG in the detection of lesions involving lamina dura and cancellous bone [7,21,17,24]. Defects affecting cortical plate have less radiographic detectability; but are better in visualization when compared to solitary trabcular lesions [7,21,17,24]. None of the reviewed literature has compared the variation in site. Defect's site is essential to evaluate particularly during surgical approach.

CONCLUSION

Within the limitations of this study design we concluded that RVG has an excellent discrimination and can significantly improves the diagnostic skills; reduces misdiagnosis of pathological states and, thereby, increases clinical competence.

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