ROENTGENOGRAPHIC INTERPRETATION OF EXPERIMENTALLY PRODUCED BONY LESIONS USING RADIO VISIOGRAPHY AND CONVENTIONAL RADIOGRAPHY

*AZIZAH AL MOBEERIEK, BDS, MSc **HANAN BALTO, BDS, MSc ***LIEF KULMAN, DDS, PhD ****SAHAR AL-JAFFAN, BDS *****NABEELA AL-MALKI. BDS

ABSTRACT

The aim of this investigation was to evaluate Radio VisioGraphy (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 a round bur #2, #4, #6 and #8. Four defects were created posteriorly in between the teeth of each jaw on the buccal aspects in 30 jaws and lingual side in another 30 mandibles. A 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 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 the Radio VisioGraphy (RVG) 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 displayprocessing unit and converted into grey level image³. The advantages of DDI include instantaneous image production, manipulation, patient education, accurate telephonic transmission, reduction of hazatdous 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 un-

Interns, College of Dentistry, King Saud University, Riyadh, Saudi Arabia.

^{*} Assistant Professor, College of Dentistry, King Saud University, Riyadh, Saudi Arabia.

^{**} Lecturer, College of Dentistry, King Saud University, Riyadh, Saudi Arabia.

^{***} Associate Professor, College of Dentistry, King Saud University, Riyadh, Saudi Arabia.

Address for Correspondence: Dr. Azizah F Al-Mobeeriek, Department of Maxillofacial Surgery and Diagnostic Sciences, College of Dentistry, PO Box 231189, Riyadh 11321, King Saud University, Saudi Arabia. Tel & Fax No: 00 966 1 4683717 Hyperlink "<u>mailto:azizah@ksu.edu.sa</u>" <u>Elazizah@ksu.edu.sa</u>

known 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}.

Along with the several advantages offered by the DDI system it is superior in detection of bony lesions. Numerous investigator were able to demonstrate that bony lesions are detected at smaller size in an earlier stage with better structure definition and outline. when the RVG is used for both radiolucent and radiopaque lesions¹²⁻¹⁶. Researches; 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 were 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.

MATERIAL AND METHOD

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 a 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 a round bur #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 standardize radiogrphic 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 manufactures, 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 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.

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 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 disease processes as early as possible for better prognosis. Accurate radiographic diagnosis is imperative for proper clinical judgement 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 even in those defects with a small diameter.

In contrast to others¹⁵, 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 1996¹⁸ 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 increased density of the cancellous bone layer. The density of the spongiosa has been reported to increase visibility significantly²². 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. 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 site is essential to evaluate particularly during surgical approach.

CONCLUSION

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

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