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DIAGNOSTIC ACCURACY OF CONVENTIONAL AND DIGITAL RADIOGRAPHY IN PERIAPICAL BONE LESIONS

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Abstract:

The only symptom of chronic inflammation of the periapical tissues are periapical changes visible on radiographs. The damage is visible as the inflammation reaches the cortical plates. The lesions located in the cancellous bone are not easily visible on the radiograph. The advancement of computer technology in radiography, which has many advantages and appears on the market, is encouraging clinicians to use this technology. It has additional image processing software such as the color spectrum. Most of the systems available today can convert the colors of images to grayscale. People can distinguish between many more colors than shades of gray. The aim of this study was to compare the diagnostic efficacy of conventional radiography, and digital radiography with color conversion in diagnosing the periapical lesions located in cancellous bone.

Place and Duration: *In the Department of Endodontics, Nishtar Institute of Dentistry, Multan for six months duration from January 2020 to June 2020.*

Methods: *10 premolars were placed in the bony sections of the mandible. Conventional X-rays were taken to ensure that the slices had not previously seen any periapical changes. In the next stage, simulated periapical changes in the cheek or lingual spongy bone were artificially prepared. Then, direct and indirect conventional and digital photos were taken. The digital black and white images have been converted to color images using an image processing system. Five observers were asked to determine the presence, location and size of the lesions.*

Results: *Statistical analyzes showed that color conversion in digital radiography is more accurate than in black and white digital and conventional radiography in determining the presence, location and size of lesions.*

Conclusion: *In conclusion, converting gray values of digital images to a color spectrum can improve bone loss detection. It is a useful tool for diagnosing cancers of the cancellous bone.*

Keywords: *digital radiography, bone damage, color spectrum.*

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INTRODUCTION:

The damage to the periapical bone visible on the radiograph is the only symptom of asymptomatic periodontitis of the apex[1-2]. When the lesion is located in the cancellous bone, the possibility of its detection would be a significant clinical advantage. Several studies have been conducted to determine the limitations of conventional radiographs in detecting cancellous bone defects[3-4]. The conclusions of these studies are that the lesions in the cancellous bone cannot be detected radiographically. Detection of changes occurs only after the thickness of the cortical layer has changed, or at least until the connection between the cortical and spinal bone has been penetrated. This is due to bone density and the randomness of the structure of the cancellous bone. The development of digital radiographic methods made it possible to reduce the dose of radiation and improve the image quality after its acquisition[5-6]. Since the early 1980s, subtraction radiography has been used orally to visualize bone loss or gain. This technique increased diagnostic accuracy in detecting small changes in periapical density compared to conventional radiography. However, a subtraction technique is required between the subtracted images[7-8]. An alternative to extracting more information is to use all sorts of special feature enhancements such as additional image processing software such as the color spectrum. Most of the systems available today can convert the colors of images to grayscale[9]. Humus can distinguish much more colors than shades of gray. The aim of the study was to compare the diagnostic efficiency of conventional and digital radiography with color conversion in the diagnosis of periapical lesions located in the spongy bone.

MATERIALS AND METHODS:

This study was held in the Department of Endodontics, Nishtar Institute of Dentistry, Multan for six months duration from January 2020 to June 2020. Six cadaver mandibles were used for the study. They were cut vertically to cover the area between the canine region and the first molar. A diamond disk mounted on a slow-running handpiece was used to cut the jaw. Efforts were made to avoid involvement of the periapical areas of the examined teeth. Ten sections were performed with this method. Conventional x-rays of these sections were taken to determine the presence of any pre-existing periapical pathosis. Bone samples were embedded in a block of silicone paste. An E-speed film (Ekta speed, Eastman-kodak Co., Rochester, N.Y.) was placed in the holder on the lingual side of the samples. The X-ray tube was placed in the buccal area with the collimator opening parallel to the foil, using the long cone technique. Twelve pictures were made in the same way. Only those sections that had no previous periapical changes were selected for the study, a total of 10 premolars from twelve sections were selected for the study. Bone sections were examined by direct digital radiographs, the digital sensor used in this study was a DIX12 (Planmeca, Finland) with a size of 23.1 x 40.8 mm. Its resolution was 26 P1 / mm, and the image resolution was 13-26 P1 / mm. The pixel size of the images ranged from 19 to 30 micrometers. The monitor displayed images in 12-bit grayscale corresponding to 4096 levels of gray. The sensor is placed in the lingual area of the bone samples in a block of silicone paste. The x-ray table was placed in the buccal area with the collimator opening parallel to the sensor, using no technique for a long time. Ten digital images were created. The images were stored in the computer in their original form, contrast and brightness. One artificial lesion was created at the periapical region of each sample, which included a laminae. The lesions were created with a slow-running straight handle with a round drill No. 4 or 8. In five samples, the lesions were created using a round drill No. 4, and in others with a round drill No. 8. In half of the ten samples the lesions were located in the lingual region, and in others on buccal area. Care was taken to avoid involvement of the buccal and lingual cortical plates. Direct, conventional radiographs were made using the previously mentioned technique. Intermediate conventional radiographs of 20 degrees horizontally were taken. So, each specimen had two images, direct and indirect. In total, twenty conventional paintings were produced. Direct and indirect digital images were produced using the same procedure. These images were then converted into color images using the color conversion software of an image processing system. Twenty color images were then taken which included blue, yellow-orange, and red. Five observers, two oral radiologists and three endodontists participated in the study. They were asked to identify the presence, location and size of the lesion. They were allowed to process the image as they chose to get what they thought was the best possible presentation, that is, a subjective assessment of the quality of the image. Together with the questioner, they received a total of 80 images (conventional and digital). They determined the presence, location and size of the lesions.

RESULTS:

Statistically significant differences were found between digital color radiography and black and white digital and conventional radiographs in determining the presence of changes. However, there were no significant differences between black and white digital and conventional radiographs (Table 1).

TABLE 1: COMPARISON BETWEEN 2 DIFFERENT RADIOGRAPHIES IN PRESENCE OF BONE LESIONS

Black and white digital radiography	**Conventional radiography**
Colored spectrum X^2=49.8	X^2=58.1
Of digital radiography P=0.00	P=0.0
Black and white –	X^2=0.502
digital radiography	P=0.478

But there were significant differences between digital color and black radiography, and digital and conventional radiography in determining the size of lesions. Although there were no significant differences between black and white digital and conventional radiographs (Table 2).

TABLE 2: COMPARISON BETWEEN 2 DIFFERENT RADIOGRAPHIES IN DIAGNOSIS OF LOCATION OF BONE LESIONS

	Black and white digital radiography	Conventional radiography
Colored spectrum of digital radiography	X2 =39.3	P=0.0 X2 =57.54
Black and white –digital radiography	P=0.00	P=0.0080

In contrast, the differences between digital color photos and black and white digital and conventional radiographs were significant in determining the location of lesions, while there were no significant differences between the 2 black and white photos (Table 3).

Black and white digital radiography	**Conventional radiography**
Colored spectrum X^2=34.77	X^2=41.54
Of digital radiography P=0	P=00
Black and white –	X^2=0.457
digital radiography	P=0.499

DISCUSSION:

The only symptom of periapical tissue inflammation is the periapical lesion visible on radiographs. The changes are visible when the inflammation reaches the cortical plates. Lesions located in the cancellous bone are not readily visible on radiographs[10]. In this study, we chose cadaver mandibles the same as in the Folk, Kullendorff and Douglas study to evaluate the diagnostic performance or color conversion radiographs in diagnosing periapical lesions located in the cancellous bone[11-12]. By using the cadaver mandible, we were able to make sure that there was no previous damage and we made the changes ourselves in various places and sizes and had accurate information about them. Due to the possibility of repeating X-rays in the same condition, all made in a parallel technique with a long cone. In addition, the bone samples were embedded in the silicone paste block and the foil or sensor was placed in the holder. Five observers took part in the study, namely two radiologists and three endodontists. They were to answer three questions of the questionnaire: presence, location and size of lesions. The data collected from this study illustrates the best diagnostic performance of digital color radiography for all three questions, while the difference between black and white digital radiography and conventional radiography was not significant[13-14]. The reason for this is to diagnose the effectiveness of color images because of the high dynamic range. In black and white images, observers should distinguish the change in shades of gray, but in color images there are different colors, such as the colors in the rain arch, which can increase diagnostic efficiency. In this study, there were no statistically significant differences between black and white digital radiography and conventional radiography, as in the Kullendorff study. In this study, we used the "SLOB" technique to give observers more information about the lesions by separating the cheek and lingual plaques in the images. It was useful for diagnosing lesions in

black and white digital radiography and conventional radiography, but had no significant differences in diagnosis in a color image as this radiography has great potential for diagnosing lesions themselves[15]. However, in black and white images, the presence of the lesion causes changes in total contrast, which are more visible when the direction of exposure to X-rays is changed, and increases diagnostic efficiency.

CONCLUSION:

In summary, converting gray values of digital images into a color spectrum can improve bone loss detection. It is a useful tool for diagnosing cancers of the cancellous bone.

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