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Background: The importance of quality assurance (QA) measures in intraoral digital imaging has been recognized by the American Dental Association. These standards are specific for the image receptor (including acquisition software), the x-ray unit, and the computer monitor.[1] Given the multiple aspects involved with digital imaging, it is crucial to establish a quality assurance (QA) protocol that ensures the use of appropriate exposure factors for optimal diagnostic yield.

Materials and Methods: Six brand new DIGORA Optime PSP plates (Soredex/Orion Corp., Helsinki, Finland) were used to assess the effects of software settings on dynamic range. The exposure parameters required to achieve optimal diagnostic yield and a wide dynamic range were 63 kV, 8 mA, and 0.2 seconds. Varying gamma values (0.8, 1.0, and 1.3) and sharpness filters (0, 15, 30, 40, 50, and 60) were adjusted to assess their effects on dynamic range. A radiographic phantom capable of measuring spatial resolution, dynamic range, and contrast resolution was used to assess image quality.

Results: The sharpness and gamma settings did not affect dynamic range.

Discussion: *Dynamic range* is defined as the range of x-ray intensities captured simultaneously by the image receptor.[1] When using the dental digital quality assurance (DDQA) radiographic phantom, when all 7 steps in the stepwedge are visible, it confirms that the image receptor is capable of acquiring a wide dynamic range. A wide dynamic range is necessary to accurately assess caries and periodontal disease.[1] The fact that the dynamic range was unaffected by software adjustment is an important and crucial finding. This demonstrates that as long as proper exposure factors are used, the sharpness and gamma settings, within the adjustments made in this study, do not affect dynamic range. Likewise, it validates the importance of using a suitable radiographic phantom to determine the appropriate exposure factors for the intraoral imaging device.

References

1. American Dental Association (ADA). ADA Technical Report No. 1094: Quality Assurance for Digital Intra-Oral Radiographic Systems. The ADA Standards Committee on Dental Informatics (SCDI); 2017:1-12.

ASSESSMENT OF CBCT IMAGE ARTIFACTS GENERATED BY IMPLANTS LOCATED IN THE EXOMASS

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Background: Currently, use of a small cone beam computed tomography (CBCT) field of view (FOV) has increased for several diagnostic purposes. However, smaller FOVs cause an indirect increase of the exomass, defined as the area outside of the FOV but between the source of x-rays and the image receptor. Metallic objects in the exomass generate artifacts that result in inconsistent image reconstructions.

Objective: The aim of this study was to evaluate the effect of artifacts arising from implants in the exomass on CBCT images.

Study design: Using titanium, titanium−zirconium and zirconium implants, 4 × 5 cm and 8 × 5 cm FOV images were acquired with the Planmeca ProMax, with or without metal artifact reduction (MAR), at 80 and 90 kVp. On each axial image, 3 rectangular regions of interest (ROIs) of 3.6 × 12 mm were delineated and standardized for all images as: region 1: closest to the implant; region 2: in the middle; and region 3: furthest from the implant. The standard deviation was determined from the ROI histograms and considered to be the measure of artifact. Effects of FOV size, implant type, MAR, kVp, region, and their interactions were assessed.

Results: The zirconium implant produced the most artifacts, followed by the titanium−zirconium and titanium implants, especially in region 1. The 8 × 5 cm FOV created more artifact than the 4 × 5 cm FOV when an implant was present. However, FOV size did not influence the amount of artifact when a zirconium implant or no MAR was used; 90 kVp produced fewer artifacts than 80 kVp, and MAR decreased the artifact only in the 8 × 5 cm FOV, 90 kVp, and zirconium and titanium−zirconium implant settings.

Conclusion: Implants in the exomass generated noticeable artifacts. Consideration should be given to imaging parameters that reduce artifacts, especially in the presence of a zirconium implant.

A COMPARISON OF CONTEMPORARY PORTABLE X-RAY SYSTEMS

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Background: There is substantial evidence for a cumulative dose-related response to ionizing radiation in the form of cancer development years after initial exposure. Therefore, this study focused on effective dose (E), a quantity with direct correlations to biologic risk from dental x-ray exposures.

Objectives: The purpose of this study was to measure doses and calculate (E) from adult full-mouth examinations (FMXs) by using handheld and conventional wall-mounted x-ray sources with both circular and rectangular collimation (RC).

Materials and Methods: A human tissue-equivalent phantom and optically stimulated luminescent dosimeters were used to measure dose from simulated FMXs (n = 18) at 24 head/-neck tissue sites. The parameters were 70 kV/7 mA (0.84 mAs and 1.34 mAs) for Conventional Circular and RC handheld device; 60 kV/2.5 mA (2.16 mAs) for NOMAD Circular and RC handheld device; and 60 kV/2.0 mA (1.98 mAs) for Xray2 Go Circular (XTG) handheld device. Analysis of variance (ANOVA) and Tukey's HSD ("honest significant difference") statistics demonstrated significant relationships.

Results: The FMX E (μSv) values were: NOMAD RC (6.9); XTG (16.7); NOMAD Circular (17.4); and Conventional Circular (26.3). For circular techniques, the handheld device E was significantly lower than the conventional unit for both devices ($P < .0001$). With RC, E was significantly lower than all circular techniques ($P < .0001$). Significant differences in E were found for all modality combinations except NOMAD Circular and XTG ($P = .8329$). Operator groin exposure was significantly higher (60%−90%) than thyroid, chest, and trigger hand exposures, which were indistinguishable from ambient background levels, for all handheld modalities ($P < .0001$).

Discussion: Handheld device E was at least 34% less than conventional circular and as much as 74% less with the use of RC. Operator exposure to the groin can increase significantly from overangulating the handheld sources; however, the addition of RC can reduce this exposure by as much as 76%.