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COMPARISON OF PHOTOTHERMAL RADIOMETRY AND MODULATED LUMINESCENCE, INTRAORAL RADIOGRAPHY, AND CONE BEAM COMPUTED TOMOGRAPHY FOR DETECTION OF NATURAL CARIES UNDER RESTORATIONS.

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Background: Intraoral radiographs (IR) are commonly used to evaluate for caries but require approximately 30% to 40% mineral loss before detection, thereby necessitating techniques with a high sensitivity index for early detection. Photothermal radiometry and modulated luminescence (PTR/LUM) offers a potentially more sensitive and safe method for detecting recurrent caries; however, there are no published studies comparing its use in detection of recurrent caries under composite restorations relative to IR and cone beam computed tomography (CBCT).

Objective(s): The aim of this in vitro study was to compare the sensitivity, specificity, and receiver operating characteristic area under the curve (ROC AUC) of a caries diagnostic system based on PTR/LUM to digital IR and CBCT in detecting simulated recurrent decay under restorations.

Study Design: The study used 54 teeth with Class II composite restorations on 70 proximal surfaces; 35 had caries lesions remaining, and 35 were sound. The gingival floor of the restored surfaces was assessed for presence or absence of caries under composite restorations using each of the 3 modalities. Statistical calculations and analysis were performed using the R statistical computing environment. Sensitivity and specificity were calculated for each device, for each rater and image combination, and ROC analysis was performed.

Results: Average sensitivity across the 6 experienced dentists was 0.40 for both IR and CBCT. However, the sensitivity for the PTR/LUM was 0.89. Specificity of PTR/LUM and IR was 0.80, whereas the CBCT method was 0.70. The intrarater agreement varied for different observers with the use of IR and CBCT, ranging between moderate and substantial with only 1 observer having poor intrarater agreement for both methods. PTR/LUM showed only moderate agreement.

Discussion/Conclusions: PTR/LUM, which involves nonionizing radiation, can serve as a sensitive adjunct in early caries detection and monitoring.

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DOSIMETRY AND DIAGNOSTIC ACCURACY OF INTRAORAL AND EXTRAORAL BITEWINGS IN DETECTING APPROXIMAL CARIES.

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Background: Traditionally, interproximal caries has been diagnosed radiographically by intraoral bitewing radiographs. Although this has been the conventional practice, the challenge of accommodating the film/ image receptor in the mouth, especially in patients with a gag reflex, has affected image acquisition and quality. A new method of acquiring bitewings with an extraoral approach has been recently introduced but the quality and diagnostic efficacy along with the radiation dosage of these techniques have not been well studied.

Objective(s): The aim of this study was to evaluate the diagnostic accuracy of intraoral and extraoral bitewings (IOBs and EOBs) in their ability to detect proximal caries and to compare the effective doses from both techniques.

Study Design: Human teeth with or without proximal caries were used in this study. Carious lesions were created with different degrees of decalcification on 60 teeth (120 surfaces). These teeth were then placed into sockets of dry human skulls. Intraoral bitewings were acquired using a Kavo LM/CM109 wall-mounted X-ray tube with exposure parameters of 70 KVp, 7 mA, and 0.125 second. Extraoral bitewings were acquired with a Planmeca Promax at 74 kVp,7 mA, and 7.5 seconds. Two radiologists and a general dentist scored the radiographs using standardized software (MiPACS) and display monitors. Dose measurements were done on an anthropometric RANDO phantom. OSLdot dosimeters were used at 24 sites for radiation dose measurements. Fifteen exposures were performed for each dosimeter, and absorbed dose was calculated as an average of the15 exposures using the International Commission on Radiological Protection (ICRP, 2007) tissue weighting factors.

Results: For the diagnosis of interproximal caries, extraoral bitewings showed a sensitivity of 92.3% and specificity of 93.4%, whereas intraoral bitewings showed sensitivity of

94.5% and specificity of 96.8%, Interim dosimetry analysis showed that the doses for IOBs and EOBs were comparable but were slightly different for intraoral membranes.

Discussion/Conclusions: EOBs showed comparable results to IOBs in the detection of approximal caries and had similar effective doses.

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IMPACT OF FIELD OF VIEW AND SCATTER INDUCED NOISE IN DETECTION OF MB2 CANALS.

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Background: Cone beam computed tomography (CBCT) units provide different fields of view (FOVs) for different clinical applications. Small FOV scans are often used in endodontic treatment planning. However, endodontic pathology is also detected as an incidental finding in large FOV scans. Some machines have introduced a new feature known as *zoom reconstruction.* This essentially allows for a specific area of interest to be carved out of the original data set and made into an independent scan that will allow for evaluation of the area in better detail.

Objective(s): The objective of this study was to evaluate the number of missed canals on small FOV scans and zoom reconstruction gleaned from large field of scans.

Study Design: A total of 30 extracted maxillary first molars were used in this study. The teeth were scanned with small FOV to locate MB2 canals. The results were used as the gold standard. The teeth were endodontically treated and restored. The MB2 canal was not instrumented when it was present or detected clinically. The prepared teeth were mounted on a dry human skull and secured with sticky wax. The skull was scanned with large and small FOV scans. The areas of interest were zoom reconstructed from large FOV scans. Interobserver variations were calculated using kappa statistics. Nonparametric tests were used to compare the reading of the observers with gold standard.

Results: Kappa statistics from 0.605 to 0.650 for small FOV, from 0.350 to 0.650 for large FOV, and from −0.305 to 0.590 for zoom reconstruction. In general, the smaller FOV scans had better agreement with gold standard.

Discussion/Conclusions: Small FOV scans were found to have better detection accuracy compared with small scans gleaned out of a larger FOV scan through zoom reconstruction in its ability to detect missing root canals and pathology.

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RELATIONSHIP BETWEEN GRAY LEVELS IN CONE BEAM COMPUTED TOMOGRAPHY AND HOUNSFIELD UNITS IN COMPUTED TOMOGRAPHY.

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Background: A deficiency of studies on clinical or close clinical materials of biologic nature exists in the conversion of gray values in cone beam computed tomography (CBCT) to more logically useful Hounsfield units (HU) in multidetector CT.

Objective(s): The aim of this study was to assess the HU of various tissue materials in CT with their corresponding gray levels in 3 different CBCT units and compare their correlation individually, to compare the actual HU (aHU) values for each material with derived HU (dHU) values from gray levels using the interpolation method, and to evaluate its reliability.

Study Design: An in vitro study was conducted using a human skull model, which was coated with a soft tissue equivalent and embedded with 6 premeasured titanium implants. It was imaged with 3 different CBCT scanners and 1 CT scanner. The exported DICOM (Digital Imaging and Communications in Medicine) data were viewed in Carestream 3-D imaging software.

The data were analyzed using Pearson's correlation test to evaluate the correlation between observed aHU values from CT and the corresponding gray levels from each CBCT unit. The method of Mah et al. was used to calculate dHU from gray levels and compare them with aHU.

Results: Among the CBCT machines used, the highest correlation for implants and bone was with Kodak 9500; for teeth, Sirona Galileos; and for soft tissue and air space, Planmeca Promax. The dHU values had significant percentage differences from aHU values.