Dental diagnostic X-ray exposure and risk of benign and malignant brain tumors.

**BACKGROUND:** This study evaluates the risk of benign brain tumors (BBTs) and malignant brain tumors (MBTs) associated with dental diagnostic X-ray, using a large population-based case-control study.

**MATERIALS AND METHODS:** We identified 4123 BBT cases and 16 492 controls without BBT (study 1) and 197 MBT cases and 788 controls without MBT (study 2) from Taiwan National Health Insurance claim data. The risks of both types of tumor were estimated in association with the frequency of received dental diagnostic X-ray.

**RESULTS:** The mean ages were ~44.2 years in study 1 and 40.6 years in study 2. Multivariable unconditional logistic regression analysis showed that the risk of BBT increases as the frequency of received dental diagnostic X-ray increases. The BBT odds ratio increased from 1.33 [95% confidence interval (CI) 1.22-1.44] for those with annual mean X-ray examination of less than one to 1.65 (95% CI 1.37-1.98) for those with three or more X-ray examinations, after controlling for comorbidities. No significant association was found between MBTs and dental diagnostic X-ray exposure.

**CONCLUSIONS:** Exposure to dental diagnostic X-rays in oral and maxillofacial care increases the risk of BBTs, but not MBTs.
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Title
Temporomandibular joint imaging: a summary.
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A comparative study of three imaging modalities currently used in the assessment of patients for maxillofacial surgery.
Source
SADJ.  68(3):106-12, 2013 Apr.
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Abstract
Diagnostic imaging is pivotal in clinical maxillofacial evaluation. This study evaluated and compared the use of conventional radiographs (CR) with two-dimensional (2D) and three-dimensional (3D) computed tomography (CT) in patients requiring maxillofacial surgery. Pre-surgical records of sixty five patients who had undergone routine CR, 2D CT and 3D CT were selected and classified into the categories of traumatic injury, pathology and deformities. The accuracy of image analysis, diagnosis and treatment planning were scored and the data statistically analysed. 2D CT scanning was more effective diagnostically and is preferred for cases of traumatic injury (44%, SD=0.54, p>0.05) and pathology (34%, SD=0.47, p>0.05) whilst 3D CT imaging was indicated for the deformity category (22%, SD=0.58, p>0.05). Linear comparisons between radiographic modalities within each clinical group revealed significant differences (p<0.05). Multiplanar reformatted (MPR) 2D cross sectional CT views offered additional imaging information. Conclusion: 2D CT scanning is an excellent imaging modality for the majority of craniomaxillofacial surgical cases. 3D CT scanning is also recommended for cases of trauma and pathology. Both 2D CT and 3D CT scanning are vital in craniomaxillofacial deformities and reconstructive surgery.
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Safe use of X-rays by dentists.
Source

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Title
Radiation in dental practice: awareness, protection and recommendations. [Review]
Source
Abstract
Radiation is the transmission of energy through space and matter. There are several forms of radiation, including ionizing and nonionizing. X-rays are the ionizing radiation used extensively in medical and dental practice. Even though they provide useful information and aid in diagnosis, they also have the potential to cause harmful effects. In dentistry, it is mainly used for diagnostic purposes and in a dental set-up usually the practicing dentist exposes, processes and interprets the radiograph. Even though such exposure is less, it is critical to reduce the exposure to the dental personnel and patients in order to prevent the harmful effects of radiation. Several radiation protection measures have been advocated to ameliorate these effects. A survey conducted in the Bengaluru among practicing dentists revealed that radiation protection awareness was very low and the necessary measures taken to reduce the exposure were not adequate. The aim of the article is to review important parameters that must be taken into consideration in the clinical set-up to reduce radiation exposure to patients and dental personnel.

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New dental radiology procedure codes in perspective.
Source

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Title
Responsible use of cone beam computed tomography: minimising medico-legal risks.
Source
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Abstract
This communication highlights some of the ethical and possible legal responsibilities which pertain to the taking, reading, reporting, and communication of findings from cone-beam computed tomography (CBCT) scans. The importance of knowledge of head and neck anatomy and pathology to reduce the likelihood of incorrect interpretation is emphasised. Failure to detect critical findings in any diagnostic image can potentially result in medico-legal consequences. CBCT is no exception to this rule. Dental schools are advised to include CBCT imaging as a diagnostic tool in their under- and postgraduate curricula thereby equipping graduates to use 3D imaging in general and CBCT in particular. Existing dental practitioners are advised to seek continuing education on 3D imaging as part of their required lifelong learning.

Keywords: Dental schools, Continuing Education, CBCT imaging, Ethical and Legal Responsibilities.

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Abstract
OBJECTIVE: To compare the diagnostic accuracy between cone-beam computed tomography (CBCT) and periapical radiography for detecting simulated external apical root resorption (EARR) in vitro.

MATERIALS AND METHODS: The study sample consisted of 160 single-rooted premolar teeth for simulating EARR of varying degrees according to four setups: no (intact teeth), mild (cavity of 1.0 mm in diameter and depth on root surface), moderate (0.4 mm, 0.8 mm, 1.2 mm, and 1.6 mm root shortening), and severe (2.4 mm, 2.8 mm, 3.2 mm, and 3.6 mm root shortening). Two groups of radiographic images were obtained via CBCT and periapical radiography. The absence or presence and the severity for all resorption lesions were evaluated blindly by two calibrated observers.

Keywords: Cone-beam computed tomography, Periapical radiography, Internal apical root resorption, Diagnostic accuracy.
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RESULTS: With the CBCT method, the rates of correct classification of no, mild, moderate, and severe EARR were 96.3%, 98.8%, 41.3%, and 87.5%, respectively; with the periapical radiography method, the rates were 82.5%, 41.3%, 68.8%, and 92.5%, respectively. Highly significant differences were found between the two imaging methods for detection of mild (P < .001), moderate (P < .001), and all EARR (P < .001). For detection of all EARR, the sensitivity and specificity values were 75.8% and 96.3% for CBCT, compared with 67.5% and 82.5% for periapical radiography.

CONCLUSION: CBCT is a reliable diagnostic tool to detect simulated EARR, whereas periapical radiography underestimates it. However, if a periapical radiograph is already available to the diagnosis of EARR, CBCT should be used with extreme caution to avoid additional radiation exposure.

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Title
Integration of basic sciences and clinical sciences in oral radiology education for dental students.
Source

Abstract
Educational research suggests that cognitive processing in diagnostic radiology requires a solid foundation in the basic sciences and knowledge of the radiological changes associated with disease. Although it is generally assumed that dental students must acquire both sets of knowledge, little is known about the most effective way to teach them. Currently, the basic and clinical sciences are taught separately. This study was conducted to compare the diagnostic accuracy of students when taught basic sciences segregated or integrated with clinical features. Predoctoral dental students (n=51) were taught four confusable intrabony abnormalities using basic science descriptions integrated with the radiographic features or taught segregated from the radiographic features. The students were tested with diagnostic images, and memory tests were performed immediately after learning and one week later. On immediate and delayed testing, participants in the integrated basic science group outperformed those from the segregated group. A main effect of learning condition was found to be significant (p<0.05). The results of this study support the critical role of integrating biomedical knowledge in diagnostic radiology and shows that teaching basic sciences integrated with clinical features produces higher diagnostic accuracy in novices than teaching basic sciences segregated from clinical features.
RESULTS: Both algorithms reduced artifacts instead of slightly decreasing gray levels. The OS-EM and small ROI reduced the processing duration without apparent detriments. Sequential and reverse processing did not show apparent effects.

CONCLUSIONS: Two alternatives in iterative reconstruction methods were effective for artifact reduction. The OS-EM algorithm and small ROI setting improved the performance. Copyright 2012 Elsevier Inc. All rights reserved.
Dental cone beam computed tomography (CBCT), also known as digital volumetric tomography was developed in the late 1990s and is now increasingly available in clinical practice. It can provide high resolution cross-sectional images of teeth and the maxillofacial region with applications in all branches of dentistry. As a new imaging modality, there were no established suspension levels at a European level. A literature review, encompassing scientific, professional publications and existing national guidelines was performed in an attempt to develop a set of suspension levels for dental CBCT, using additional expert opinion from the members of the European Academy of dento-maxillo-facial radiology. A limited set of suspension levels has been devised for aspects of the X-ray tube and generator, dosimetry, field-of-view, alignment and image quality. These should be kept under review in the light of growing experience of testing equipment in practice.

**Abstract**

PURPOSE: In this anatomical study, we compared the diagnostic accuracy of rotational panoramic radiography (OPG), computed tomography (CT) and cone beam computed tomography (CBCT) for preoperative assessment in implant surgery.

MATERIALS AND METHODS: Dental images were taken of 10 human cadaver heads. Thereafter, they were prepared and measured. The height of the alveolar ridge to the mandibular canal was compared with the prior images taken. The deviation from the anatomical situation was calculated for each imaging technique.

RESULTS: In the group of OPG images, there was a median of 2.3 mm distortion ranging from -0.2 to 5.7 mm in the vertical plane compared to the actual situation found during dissection. If steel balls were used during OPG, the median distortion was lowered to 0.2 mm, but the width of -1.6 to 3 mm was still quite extensive. CT images showed a mean distortion of -0.2 mm and a width of -1.5 to 1.3 mm. The mean distortion of the CBCT images was similar to the one found in CT, namely -0.3 mm with a range from -1.5 to 0.8 mm.

CONCLUSIONS: The results show that OPG using steel balls as a calibration reference seems reliable in a standard situation. In more difficult cases, modern three-dimensional techniques should be used to additionally determine available bone volume.

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**Abstract**

OBJECTIVES: This study compares the effective dose for different fields of view (FOVs), resolutions and X-ray parameters from two cone beam CT units: the KaVo 3D (three-dimensional) eXam and the KaVo Pan eXam Plus 3D (KaVo Dental, Biberach, Germany).

METHODS: Measurements were made using thermoluminescent dosemeter chips in a radiation analog dosimetry head and neck phantom. The calculations of effective doses are based on the ICRP 60 and ICRP 103 recommendations of the International Commission on Radiological Protection.
RESULTS: Effective doses from the 3D eXam ranged between 32.8Sv and 169.8Sv, and for the Pan eXam Plus effective doses ranged between 40.2Sv and 183.7Sv; these were measured using ICRP 103 weighting factors in each case. The increase in effective dose between ICRP 60 and ICRP 103 recommendations averaged 157% for all measurements.

CONCLUSIONS: Effective doses can be reduced significantly with the choice of lower resolutions and mAs settings as well as smaller FOVs to avoid tissues sensitive to radiation being inside the direct beam. Larger FOVs do not necessarily lead to higher effective doses.

METHODS: Dose measurements were performed on three-dimensional cone beam CT (3D-CBCT) machines (3D Accuitomo (J. Morita Mfg. Corp., Kyoto, Japan), Veraviewepocs (J. Morita Mfg. Corp.) and CS9300 (Carestream, New York, NY)) by exposing a cylindrical poly-methyl methacrylate (PMMA) phantom using a CT ionization chamber. These dose measurements were used for the calculation of Dose Indices 1 and 2, according to the methodology suggested by SEDENTEXCT. The DAP was measured using a DAP meter that was attached to the detector to cover the entire irradiated area.

RESULTS: The DI1 ranged from 53.6mR to 216.6mR, the DI2 ranged from 77.1mR to 325.0mR and the DAP ranged from 101.1mGycm(2) to 457.9mGycm(2), depending on the machines and exposure settings. Index 2 had a better correlation with the DAP than Index 1.

CONCLUSIONS: The DIs and DAP proposed by SEDENTEXCT may be useful for establishing DRLs for dental CBCT machines; however, further studies are necessary to determine which of these indices provide accurate dose estimates proportionally relating to the effective dose.