

Radiation in Dentistry: Friend or Foe

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Introduction

Diagnostic radiation is a common and useful diagnostic tool in dentistry. However, few professionals realize the potential hazards and impact on the human tissues, when exposing their patients to ionizing radiation. The impression that, compared to general medical radiology, the radiation doses are substantially lower and therefore harmless, is a misconception among many dental professionals. Main reason for that is the number of dental radiographs an individual is exposed to during a lifetime which can be significantly higher than the number of radiographs one will receive for general medical purposes. The accumulative effect from low dose X-rays, as is the case in dentistry, should therefore not be ignored. The so-called linear non threshold dose model explains the risk for stochastic effects from ionizing radiation, even in the low energy range.

Intraoral radiographs are usually taken at 60 to 70 kilovolts (kV), 4 to 10 milli-Ampères (mA) at exposure times of 0.10 to 0.20 seconds. Depending on the collimation that is used (circular or rectangular) the effective dose varies between 1 to 8 microSieverts (μSv). Panoramic dental and cephalometric radiographs result in an effective dose of about 24 μSv and 16 μSv respectively. The past decade cone beam computed tomography has invaded dentistry and with the variety of devices, the effective radiation dose lies somewhere between 5 and 500 μSv . The latter is because every manufacturer uses different kV, mA and exposure settings and moreover, the field-of-view can differ too. Compared to medical diagnostic exposures, the latter doses may seem ridiculously low. Also when compared to the annual natural background radiation in Europe (2500 μSv) or the USA (3500 μSv), a single dental radiograph seems to fade into the negligible of doses. However, it should be emphasized that the number of dental radiographs is probably much higher over a lifetime than the number of exposures one will receive from general medical imaging. The most important reasons why such a high number of radiographs are taken in dentistry is the fact that patients visit the dentist more often than the radiologist and the fact that there is an abundance of devices in every dental office, whereas for medical care providers most of the imaging is performed by a specialized radiology team. This is part of the explanation though.

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Another misconception is that digital dental radiology results in a substantial reduction in radiation dose. The latter was true in dentistry when compared to D-speed film (long exposure times and high contrast film). However, compared to E/F-speed film, this comparison is not true any longer. Both solid state sensors and photo stimulable phosphor plates are used in dentistry and since their introduction, the number of radiographs has increased dramatically. The ease to expose patients and the fact that, especially the solid state sensors are not always large enough to 'fetch the image of the entire tooth', provides another part of the explanation why patients are more exposed to dental radiographs than to medical ones.

Another issue many dental practitioners do not realize is that exposing children holds a much higher risk than exposing adult patients. The relative risks for a child under the age of 10 to develop a fatal cancer from exposure to diagnostic ionizing radiation are 3 times higher than that of an adult. The justification of exposing a patient to ionizing radiation is suddenly projected in a whole different perspective and the so called low doses issue seems to vanish!

Conclusion

Diagnostic radiation in dentistry is necessary for patient's dental treatment or follow-up. On the other hand the potential risk of exposing our youngest patients to ionizing radiation should be well justified. In that respect, ionizing radiation is our friend and foe at the same time. All health care providers should respect the three basic principles of radiation protection (justification, limitation and optimization) at all times and should ensure that economical reasons do not prevail. As long as it is not proven that dental radiation is harmless, we should act as if it is potentially harmful and be very selective when to and not to expose our patients.