American TeleDentistry Association

The Danger of Dental Radiography

Radiographs Linked to Increased Rates of Cancer

Twenty-one studies have found a correlation between dental diagnostic X-rays and overall health, with many finding a **correlation between X-rays and brain/thyroid cancer**.[1]

The American Cancer Society **affirms that x-rays cause cancer**. They also cite a study which found that the people who had brain tumors were more likely to have had a dental x-ray.[2]

"There is **no safe limit or "safety zone" for ionizing radiation exposure** in diagnostic imaging. Every exposure cumulatively increases the risk of cancer induction."[3]

A Yale study found that **dental X-rays also increased the risk of developing a meningioma**, the most common and potentially debilitating type of non-cancerous brain tumor.[4]

"The study does support various associations reported previously such as the association of brain tumors with … with frequent full mouth dental X-rays… **Both major tumor types appear to be related to the frequency of full-mouth dental X-rays** after age 25."[5]

"Exposure to **dental x-rays was associated with a significantly increased risk of thyroid cancer**. In individuals who were exposed to dental x-rays, the risk of thyroid cancer increased with increasing number of exposures."[6]

"The **association with [dental x-rays and] meningioma was significant** in 5 of 7 studies."[7]

"In four of the five studies, there were significant correlations between **dental diagnostic X-rays and thyroid cancer**."[8]

"The full-mouth examination type **increased the risk of brain tumors significantly** in three of the four studies."[9]

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[1] "Clinical recommendations regarding use of cone beam computed tomography in orthodontics. Position statement by the American Academy of Oral and maxillofacial radiology." *American Academy of Oral and Maxillofacial Radiology, Vol. 116 No. 2 (2013).*

[2] Do x-rays and gamma rays cause cancer? American Cancer Society. cancer.org/cancer/cancer-causes/radiation-exposure/x-rays-gamma-rays/do-xrays-and-gammarays-cause-cancer.html

[3] "Clinical recommendations regarding use of cone beam computed tomography in orthodontics. Position statement by the American Academy of Oral and maxillofacial radiology." *American Academy of Oral and Maxillofacial Radiology, Vol. 116 No. 2 (2013).*

[4] Claus EB, Calvocoressi L, Bondy ML, Schildkraut JM, Wiemels JL, Wrensch M. Dental x-rays and risk of meningioma. Cancer 2012, 118:4530-7.

[5] Preston-Martin S, Mack W, Henderson BE. Risk factors for gliomas and meningiomas in males in Los Angeles County. Cancer Res. 1989;49(21):6137–6143.

[6] Memon A, Godward S, Williams D, Siddique I, Al-Saleh K. Dental x-rays and the risk of thyroid cancer: a case-control study. *Acta Oncol*. 2010;49(4):447-453.

[7] Su-Yeon Hwang, Health effects from exposure to dental diagnostic X-ray, Environ Health Toxicol. 2018 Dec; 33(4).

[8] Su-Yeon Hwang, Health effects from exposure to dental diagnostic X-ray, Environ Health Toxicol. 2018 Dec; 33(4).

[9] Su-Yeon Hwang, Health effects from exposure to dental diagnostic X-ray, Environ Health Toxicol. 2018 Dec; 33(4).

"Exposure to dental diagnostic X-rays **increased the risk of laryngeal cancer**. There was also a statistically significant correlation between full-mouth X-rays and salivary gland cancer."[10]

"Leukemia and low birth weight have been reported as systemic health outcomes related to dental X-ray exposure. The **risk of leukemia significantly increased in accordance with dental diagnostic X-ray exposure**."[11]

"The random effects meta-analyses, based on seven studies of thyroid cancer and eight studies of meningioma showed that **multiple exposures to dental X-rays were significantly associated with an increased risk of thyroid cancer and meningioma**."[12]

"Based on data from 8 case-control studies that assessed the association between exposure frequency to dental x-rays and brain tumours, thyroid cancer, breast cancer, or pediatric cancer of connective tissues, the Canadian Agency for Drugs and Technologies in Health review presents some evidence that **dental x-rays may increase the risk for cancer**."[13]

"Exposure to dental diagnostic X-rays in oral and maxillofacial care **increases the risk of benign brain tumors** (BBTs). This study indicates that the BBT risk increases with dental X-ray exposure. This implies that repeated dental X-ray exposure carries a high risk of BBTs."[14]

Treating Dentists Must Determine if Radiographs are Clinically Justified on a Patient by Patient Basis

The FDA and ADA released guidelines stating that "Radiographs should be taken **only when there is an expectation that the diagnostic yield will affect patient care.**"[15]

"The American Dental Association supports and affirms the position that the selection of CBCT imaging **be justified on individual need, that the perceived or actual benefits to the patient must outweigh the radiation risks,** and that exposure of patients to ionizing radiation must never be considered "routine.""[16]

"The **dentist is the one who decides if the radiographs are needed** … They are an important diagnostic tool and it is the responsibility of the treating dentist to determine how often they are needed."[17]

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[10] Su-Yeon Hwang, Health effects from exposure to dental diagnostic X-ray, Environ Health Toxicol. 2018 Dec; 33(4).
[11] Su-Yeon Hwang, Health effects from exposure to dental diagnostic X-ray, Environ Health Toxicol. 2018 Dec; 33(4).
[12] Anjum Memon, Imogen Rogers, Priyamvada Paudyal, and Josefin Sundin. Thyroid. Nov 2019.1572-1593.
[13] Canadian Dental Association, CADTH Examines Cancer Risk from Dental X-raysJ Can Dent Assoc 2012;78:c79
[14] M.C. Lin, C.F. Lee, Dental diagnostic X-ray exposure and risk of benign and malignant brain tumors, Original Articles Epidemiology, Col 26, Issues 6, June 2013.
[15] FDA/ADA,DENTAL RADIOGRAPHIC EXAMINATIONS:RECOMMENDATIONS FOR PATIENT SELECTION AND LIMITING RADIATION EXPOSURE(2012)
[16] "Clinical recommendations regarding use of cone beam computed tomography in orthodontics. Position statement by the American Academy of Oral and maxillofacial radiology." *American Academy of Oral and Maxillofacial Radiology, Vol. 116 No. 2 (2013).*
[17] Oregon Board of Dentistry, *Clarification on Radiographs*, https://www.oregon.gov/dentistry/Documents/Clarification_on_Radiographs.pdf

"The clinical decision about the need to radiography is influenced by many factors. It is **unethical to take radiographs for medico-legal, administrative reasons** or 'just in case' if there is no clinical need. Furthermore, there is no known safe level of radiation exposure."[18]

"The International Commission on Radiological Protection (ICRP) recommends that activities which cause exposure to radiation should be **scrutinized and must be justified by a benefit to risk analysis**."[19]

"Clinicians must perform radiographic imaging on patients **only** when they expect that the information provided by the radiographic examination **will provide additional diagnostic information and meaningfully contribute to the treatment plan**."[20]

Delta Dental's Utilization Review Guidelines for 2020 state that radiographs "**should only be taken for clinical reasons as determined by the patient's dentist**."[21]

"The ADA encourages dentists and patients to discuss dental treatment recommendations, **including the need for X-rays**, to make informed decisions together."[22]

"To help reduce risk to the patient, all exams using ionizing radiation should be performed **only when necessary to answer a medical question, treat a disease, or guide a procedure**."[23]

The FDI World Dental Federation's Policy Statement on Radiation Safety in Dentistry states that "a **dentist needs to decide that a radiograph should be made when a patient is likely to benefit from exposure to diagnostic imaging**… Radiographs should only be made when there is an expectation that the diagnostic yield will affect patient care. All reasonable means should be used to reduce radiation exposures…"[24]

The University further states that "professional judgment and the needs of the patient for optimal diagnosis and treatment will determine the frequency of radiographic examination and not solely the period of time elapsed since the last examination. In each case, consistent with the guidelines stated and cited in this document and subject to the legal doctrine of informed consent, **the ultimate decision to prescribe a radiographic examination rests with the supervising clinician**."[25]

The College of Dental Surgeons of British Columbia released Standards and Guidelines for Dental Radiography, which states that "the **frequency of a radiological examination is a matter of clinical judgment,** and the selection of equipment and techniques used is **the decision of the dentist**."[26]

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[18] Isaacson KG, (2015), "Guidelines for the Use of Radiographs in Clinical Orthodontics," *British Orthodontic Society.*
[19] ICRP – International Commission on Radiological Protection, Radiological protection in medicine, Ann. ICRP (2008) ICRP Publication 105
[20] Tadinada A. (2019) Dental Radiography. In: Ferneini E., Goupil M. (eds) Evidence-Based Oral Surgery. Springer, Cham
[21] Thomas Correia, DDS – Dental Director, Delta Dental, "Utilization Review Guidelines," Jan 1, 2020.
[22] American Dental Association, Oral Health Topics X-Rays/Radiographs, ADA website, accessed June 2, 2020.
[23] US Food and Drug Administration, Medical X-Ray Imaging, FDA website, 6/14/19.
[24] "Radiation Safety in Dentistry," FDI World Dental Federation, September 2014.
[25] Richard Monahan, Director of the Division of Radiology, UIC College of Dentistry, "Policy for the Diagnostic Use of Ionizing Radiation, Patient Selection and Limiting Radiation Exposure," January 2016.
[26] Canadian Dental Society British Columbia, "Standards & Guidelines – Dental Radiography, September 2015.

"The justification for taking dental radiographs must be determined by a need to obtain specific information not available from other sources. CBCT examinations **must be justified for each patient** to demonstrate that the benefits outweigh the risks."[27]

"CBCT **should not be repeated 'routinely'** on a patient without a new risk/ benefit assessment having been performed."[28]

"if the dentist takes a radiograph, **there must be a clinical reason** for doing so. The **dentist remains responsible for the clinical decision reasoning**, so taking radiographs on the request of third parties for administrative purposes alone would be difficult to support in a court of law based on unnecessary exposure."[29]

"The decision when to take or not to take radiographs **is the responsibility of an Oregon licensed Dentist** … and is based on factors including the patient's oral health, patient's age, the risk for disease and any sign or symptoms of oral disease that a patient may be experiencing. The Board does not have a time requirement for how often radiographs or X-rays are to be taken."[30]

"The **dentist selects the patient who needs radiographs**, determines which radiographs are needed, takes or supervises the exposure of the films and interprets the images. From the selection of patients for radiographic examination, through the exam itself, to the interpretation of the results, the **dentist has a professional obligation to control radiation exposure** in the dental office."[31]

Radiographs are Not Clinically Necessary for all Orthodontic Cases

"No benefit for radiography has been demonstrated for patients referred for dental crowding."[32]

Upon the review of several studies that examined the efficacy of radiography, "researchers reported the **limited effect radiography has on changing orthodontic diagnosis or treatment plans**… questions whether the present use of radiography may be excessive."[33]

"Diagnostic value of orthodontic radiographs and indications for their use are still debatable … the **minimum set of records required for orthodontic diagnosis and treatment planning has never been solidly established** or defined in the literature. Consequently, the use of radiation by orthodontists is accompanied by **a responsibility to ensure appropriate indication**. It must always be justified and delivered in doses 'as low as reasonably achievable.'"[34]

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[27] Canadian Dental Society British Columbia, "Standards & Guidelines – Dental Radiography, September 2015.
[28] Canadian Dental Society British Columbia, "Standards & Guidelines – Dental Radiography, September 2015.
[29] Dr. Stephen Bray, *A Legal Insight Into Dental X-Rays,* Expert Pages.
[30] Oregon Board of Dentistry, *Clarification on Radiographs*, https://www.oregon.gov/dentistry/Documents/Clarification_on_Radiographs.pdf
[31] CareStream Dental, *radiation Safety in Dental Radiography,* 2014.
[32] "Clinical recommendations regarding use of cone beam computed tomography in orthodontics. Position statement by the American Academy of Oral and maxillofacial radiology." *American Academy of Oral and Maxillofacial Radiology, Vol. 116 No. 2 (2013).*
[33] "Use of Ionising Radiation," Selection Criteria for Dental Radiography, Faculty of General Dental Practice, 2020.
[34] Aldin Kapetanović, *Orthodontic radiology: development of a clinical practice guideline,*Head, Neck and Dental Radiology, April 2020.

"Due to the lack of evidence, there is an **on-going discussion on the diagnostic value of orthodontic radiographs** and indications for their use."[35]

The European Academy of Paediatric Dentistry (EAPD), upon the conclusion of four expert working groups each independent conducting a systemic literature review on radiographs, concluded that, "There is **no or low-grade evidence about the efficacy of dental radiographic examinations** in young populations. It is essential to respect the radiological principles of an **individualized and patient-specific justification**."[36]

The Tennessee Department of Health states that an accurate and complete dental history should only include "**appropriate radiographs as determined by the dentist** as necessary for diagnosis or treatment..."[37]

The Faculty of General Dental Practice states that "a number of epidemiological studies have provided evidence of a possible increased risk of brain, salivary gland, and thyroid tumours related to dental radiography" and that "no patient should be expected to receive additional radiation dose and risk as part of a course of dental treatment **unless they are likely to benefit from dental radiography**."[38]

"It can be concluded that for most treatment planning decisions, the **availability of a lateral cephalometric radiograph did not make a significant difference**."[39]

"This study supports previous literature that sufficient evidence **does not exist to warrant pretreatment lateral cephalometric radiographs be taken as a part of standard diagnostic records** on every individual seeking orthodontic treatment."[40]

"The **lateral cephalometric radiograph is not a necessary diagnostic tool for most cases in orthodontic diagnosis and treatment planning**. Weighing the usefulness of a lateral cephalometric on a case-by-case basis should be recommended to align with the principle of ALARA."[41]

"Lateral cephalometric **radiographs did not significantly influence orthodontists' diagnosis**."[42]

"There was also **little evidence to demonstrate the radiograph's efficacy in treatment planning cases** with no skeletal discrepancy or no significant labiolingual incisor movement planned."[43]

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[35] Aldin Kapetanović, *Orthodontic radiology: development of a clinical practice guideline,* Head, Neck and Dental Radiology, April 2020.
[36] J. Kuhnisch, "Best clinical practice guidance for prescribing dental radiographs in children and adolescents: an EAPD policy document," *European Archives of Paediatric Dentistry*, 2019.
[37] STANDARDS OF PRACTICE FOR DENTAL PUBLIC HEALTH Tennessee Department of Health, Eighteenth Edition Revised May 2019.
[38] "Use of Ionising Radiation," Selection Criteria for Dental Radiography, Faculty of General Dental Practice, 2020.
[39] Helal NM, Basri OA, et al. Significance of Cephalometric Radiograph in Orthodontic Treatment Plan Decision. J Contemp Dent Pract 2019;20(7):789–793
[40] Helal NM, Basri OA, et al. Significance of Cephalometric Radiograph in Orthodontic Treatment Plan Decision. J Contemp Dent Pract 2019;20(7):789–793
[41] Anjali Dinesh, *Value-addition of lateral cephalometric radiographs in orthodontic diagnosis and treatment planning,* Angle Orthodontist (2020).
[42] Currell, Scott Derek; Roberts, Sophie May; Abdalla, Yousef and Esterman, Adrian. The effect of the lateral cephalometric radiograph on orthodontists' diagnosis and treatment decisions: A double-blind, randomised controlled trial [online]. Australasian Orthodontic Journal, Vol. 34, No. 2, Nov 2018: 188-195.
[43] Currell, Scott Derek; Roberts, Sophie May; Abdalla, Yousef and Esterman, Adrian. The effect of the lateral cephalometric radiograph on orthodontists' diagnosis and treatment decisions: A double-blind, randomised controlled trial [online]. Australasian Orthodontic Journal, Vol. 34, No. 2, Nov 2018: 188-195.

The University of Illinois Chicago's College of Dentistry has an Institutional Policy for the Diagnostic Use of Radiographs. In it, they state that "to maximize the benefits of the radiation exposure, the need for all radiographs should be determined by using high-yield criteria as the basis of professional judgement, as established through history, patient dialogue and clinical examination" and that "**No radiograph or image will be made solely for the purpose of initial screening of patients** for acceptability for treatment."

"The appropriate imaging modality for **radiographic evaluation should be chosen based on the specific diagnostic task at hand.** Radiographic imaging exams must only be ordered after a comprehensive clinical examination."[44]

"A clinical examination is necessary to ensure that the radiographs requested will be appropriate for the patient's specific orthodontic problem. Similarly, the need for radiography to monitor treatment progress is dependent upon a careful clinical assessment. Alternative methods to using ionising radiation in caries diagnosis should be considered once their diagnostic validity has been clearly established. Various studies have **confirmed that a clinical examination supplemented by study models is often sufficient for treatment planning**."[45]

Many Traditional Dentists Ignore Well-Established Guidelines

"Potential harm from ionizing radiation has led to the development of guidelines to protect patients and practitioners from unnecessary radiation exposure; however, these guidelines may or may not be followed in practice. This study surveyed US dental hygienists with regard to radiology policies in the workplace. The majority of respondents (82%) reported that a clinical examination was not performed before imaging, and 70% reported that images were ordered on the basis of a set time interval. Approximately 36% reported that images were requested on the basis of the patient's insurance reimbursement. The findings suggest that some **dental practices are not strictly following the ADA/FDA guidelines** with regard to frequency of radiographic exposures."[46]

"We establish that there are significant increases in X-rays when dentists receive fee-for-service. Our findings suggest that **financial incentives have a substantial impact on dental X-raying**."[47]

"Routine **dental X-rays are among the most common sources of ionizing radiation exposure** for healthy individuals globally - in the United States, an increased use of dental radiography is evident."[48]

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[44] Tadinada A. (2019) Dental Radiography. In: Ferneini E., Goupil M. (eds) Evidence-Based Oral Surgery. Springer, Cham

[45] European Commission on Raditation Protection, *European guidelines on radiation protection in dental radiology The safe use of radiographs in dental practice,* Issue No. 136 (2004).

[46] Muzzin KB, Flint DJ, Schneiderman E. Dental radiography-prescribing practices: a nationwide survey of dental hygienists. General Dentistry. 2019 Mar-Apr;67(2):38-53.

[47] Martin Chalkley, First do no harm – The impact of financial incentives on dental x-rays, Journal of Health Economics, Volume 58, March 2018.

[48] Vinita Chauhan & Ruth C. Wilkins (2019) A comprehensive review of the literature on the biological effects from dental X-ray exposures, International Journal of Radiation Biology, 95:2, 107-119