

Prescribing Dental Radiographs for Infants, Children, Adolescents, and Individuals with Special Health Care Needs

Latest Revision

2024*

How to Cite: American Academy of Pediatric Dentistry. Prescribing dental radiographs for infants, children, adolescents, and individuals with special health care needs. The Reference Manual of Pediatric Dentistry. Chicago, Ill.: American Academy of Pediatric Dentistry; 2024:313-7.

Abstract

This best practice provides guidance on the proper timing, selection, and frequency of dental radiographs for pediatric dental patients and endorses the United States Food and Drug Administration and American Dental Association's Recommendations for Prescribing Dental Radiographs. Recommendations were made according to type of patient encounter and the patient's age and stage of dental development. Considerations included clinical findings, medical and dental histories, and risk factors for dental caries. This document highlights the purpose of radiographs for diagnosing oral diseases and trauma, monitoring growth and development, and assessing treatment outcomes. Emphasis is placed on the importance of minimizing radiation in the pediatric population, and intraoral radiographs are confirmed as the standard diagnostic radiographic tool. Special attention is paid to justification for use of cone beam computed tomography, related safety concerns, and need for comprehensive interpretation of resulting images. Dental providers may reference this document to guide decisions regarding the type and periodicity of dental radiographs, with aims to improve patient care, limit radiation exposure, and utilize resources appropriately.

This best practice was developed through a collaborative effort of the American Academy of Pediatric Dentistry Councils on Clinical Affairs and Scientific Affairs to offer updated information and recommendations regarding prescribing radiographs for pediatric dental patients.

KEYWORDS: ADOLESCENT; CHILD; CONE BEAM COMPUTED TOMOGRAPHY; GROWTH AND DEVELOPMENT; RADIATION; RADIOGRAPHY; RISK ASSESSMENT

Purpose

The American Academy of Pediatric Dentistry (AAPD) intends these recommendations to help practitioners make clinical decisions concerning appropriate selection of dental radiographs as part of an oral evaluation of infants, children, adolescents, and individuals with special health care needs. The recommendations can be used to optimize patient care, minimize radiation burden, and allocate health care resources responsibly.

Methods

In 1981, the Ad Hoc Committee on Pedodontic Radiology of the American Academy of Pedodontics developed guidance on radiographic examination of pediatric dental patients.¹ Six years later, the United States Food and Drug Administration (FDA) published recommendations² developed by an expert dental panel, which included a representative of the AAPD, convened “to reach a consensus on standardizing dental radiographic procedures”³. In 2002, the American Dental Association (ADA) initiated a review of that document. The AAPD, along

with other dental specialty organizations, participated in the review and revision of those guidelines. The FDA accepted the revision in November 2004,⁴ and the AAPD endorsed it the following spring. The ADA Council on Scientific Affairs has published updates to their recommendations for dental radiographs.^{5,6} While continuing to endorse the ADA/FDA recommendations, the AAPD expanded its guidance on dental radiographs, with the last revision in 2017⁷. This review includes a new search of the PubMed®/MEDLINE database using the terms: dental radiology, dental radiographs, dental radiography, cone-beam computed tomography AND guidelines, recommendations; fields: all; limits: within the last 10 years, humans, and English.

Background

Radiographs are valuable aids in the oral health care of infants, children, adolescents, and individuals with special health care

ABBREVIATIONS

AAOMR: American Academy of Oral and Maxillofacial Radiology. **AAPD:** American Academy of Pediatric Dentistry. **ADA:** American Dental Association. **ALARA:** As low as reasonably achievable. **CBCT:** Cone-beam computed tomography. **FDA:** United States Food and Drug Administration.

* The 2024 revision is limited to an addendum on patient shielding during dental radiography procedures. The body of this best practice will be revised in 2025.

needs. They are used to diagnose and monitor oral diseases, evaluate dentoalveolar trauma, as well as monitor dentofacial development and the progress of therapy. The recommendations in the ADA/FDA guidelines were developed to serve as an adjunct to the dentist's professional judgment. The timing of the initial radiographic examination should not be based upon the patient's age, but upon each child's individual circumstances. Radiographic screening for the purpose of detecting disease before clinical examination should not be

performed.⁶ Because each patient is unique, the need for dental radiographs can be determined only after consideration of the patient's medical and dental histories, completion of a thorough clinical examination, and assessment of the patient's vulnerability to environmental factors that affect oral health. AAPD recommendations for assessing risk for caries development in children ages birth through five years and age six and above can be found in *Caries-Risk Assessment and Management for Infants, Children, and Adolescents*.⁸ Review of

Table. RECOMMENDATIONS FOR PRESCRIBING DENTAL RADIOGRAPHS⁶

Patient Age and Dental Developmental Stage				
Type of Encounter	Child with Primary Dentition (prior to eruption of first permanent tooth)	Child with Transitional Dentition (after eruption of first permanent tooth)	Adolescent with Permanent Dentition (prior to eruption of third molars)	Adult, Dentate or Partially Edentulous
New Patient* being evaluated for oral diseases.	Individualized radiographic exam consisting of selected periapical/occlusal views and/or posterior bitewings if proximal surfaces cannot be visualized or probed. Patients without evidence of disease and with open proximal contacts may not require a radiographic exam at this time.	Individualized radiographic exam consisting of posterior bitewings with panoramic exam or posterior bitewings and selected periapical images.	Individualized radiographic exam consisting of posterior bitewings with panoramic exam or posterior bitewings and selected periapical images. A full mouth intraoral radiographic exam is preferred when the patient has clinical evidence of generalized oral disease or a history of extensive dental treatment.	
Recall Patient* with clinical caries or at increased risk for caries.**	Posterior bitewing exam at 6-12 month intervals if proximal surfaces cannot be examined visually or with a probe.			Posterior bitewing exam at 6-18 month intervals.
Recall Patient* with no clinical caries and not at increased risk for caries.**	Posterior bitewing exam at 12-24 month intervals if proximal surfaces cannot be examined visually or with a probe.		Posterior bitewing exam at 18-36 month intervals.	Posterior bitewing exam at 24-36 month intervals.
Patient (New and Recall) for monitoring of dentofacial growth and development, and/or assessment of dental/skeletal relationships.	Clinical judgment as to need for and type of radiographic images for evaluation and/or monitoring of dentofacial growth and development or assessment of dental and skeletal relationships.		Clinical judgment as to need for and type of radiographic images for evaluation and/or monitoring of dentofacial growth and development, or assessment of dental and skeletal relationships. Panoramic or periapical exam to assess developing third molars.	Usually not indicated for monitoring of growth and development. Clinical judgment as to the need for and type of radiographic image for evaluation of dental and skeletal relationships.
Patient with other circumstances including, but not limited to, proposed or existing implants, other dental and craniofacial pathoses, restorative/endodontic needs, treated periodontal disease and caries remineralization.	Clinical judgment as to need for and type of radiographic images for evaluation and/or monitoring in these conditions.			

* Clinical situations for which radiographs may be indicated include, but are not limited to:

A. Positive Historical Findings

1. Previous periodontal or endodontic treatment
2. History of pain or trauma
3. Familial history of dental anomalies
4. Postoperative evaluation of healing
5. Remineralization monitoring
6. Presence of implants, previous implant-related pathosis or evaluation for implant placement

B. Positive Clinical Signs/Symptoms

1. Clinical evidence of periodontal disease
2. Large or deep restorations
3. Deep carious lesions
4. Malposed or clinically impacted teeth
5. Swelling
6. Evidence of dental/facial trauma
7. Mobility of teeth
8. Sinus tract ("fistula")
9. Clinically suspected sinus pathosis
10. Growth abnormalities
11. Oral involvement in known or suspected systemic disease
12. Positive neurologic findings in the head and neck
13. Evidence of foreign objects
14. Pain and/or dysfunction of the temporomandibular joint
15. Facial asymmetry
16. Abutment teeth for fixed or removable partial prosthesis
17. Unexplained bleeding
18. Unexplained sensitivity of teeth
19. Unusual eruption, spacing or migration of teeth
20. Unusual tooth morphology, calcification or color
21. Unexplained absence of teeth
22. Clinical tooth erosion
23. Peri-implantitis

** Factors increasing risk for caries may be assessed using the ADA Caries Risk Assessment forms (0-6 years of age²⁴ and over 6 years of age²⁵).

prior radiographs, when available from within the same practice or through record transfer, also contributes to the decision of radiographic necessity.

Radiographs should be taken to substantiate a clinical diagnosis and guide the practitioner in making an informed decision that will affect patient care. The AAPD recognizes that there may be clinical circumstances for which a radiograph is indicated, but a diagnostic image cannot be obtained. When diagnostic radiographs cannot be obtained due to a lack of cooperation, technical issues, or a health care facility lacking in intraoral radiographic capabilities, the practitioner should inform the patient or guardian of these limitations and document these discussions in the patient's record. The decision to treat the patient without radiographs will depend upon the urgency of the treatment needs, availability and appropriateness of alternative treatment settings, and relative risks and benefits of the various treatment options for the patient.

Because the effects of radiation exposure accumulate over time,^{4,9} every effort must be made to minimize the patient's exposure. Good radiological practices are important in minimizing or eliminating unnecessary radiation in diagnostic dental imaging. Examples of good radiologic practice include: 1) use of the fastest image receptor compatible with the diagnostic task (F-speed film or digital [photostimulable phosphor {PSP} plate, charge-coupled device {CCD}]), 2) collimation of the beam to the size of the receptor whenever feasible,¹⁰⁻¹² 3) proper film exposure and processing techniques, 4) use of protective aprons and thyroid collars, and 5) limiting the number of images to the minimum necessary to obtain essential diagnostic information.⁶ The dentist must weigh the benefits of obtaining radiographs against the patient's risk of radiation exposure. Some of the newer panoramic machines are capable of producing extraoral bitewings. The radiation dose is similar to a traditional panoramic radiograph, although it is three to 11 times more than the traditional intraoral bitewing.¹³ Therefore, the extraoral bitewing should be prescribed based upon case specific needs and not as an alternative to intraoral radiographs.¹⁴

New imaging technology (i.e., cone beam computed tomography [CBCT]) has added three-dimensional capabilities that have many applications in dentistry. The use of CBCT has been valuable as an adjunct diagnostic tool in assessing periapical pathosis in endodontics, oral pathology, anomalies in the developing dentition (e.g., impacted, ectopic, or supernumerary teeth), oral maxillofacial surgery (e.g., cleft palate), dental and facial trauma, and orthodontic and surgical preparation for orthognathic surgery. For all procedures using CBCT, the clinical benefits must be balanced against the potential risks. Considering the cumulative effect of ionizing radiation^{4,9} and that children are more prone to radiation induced carcinogenesis than adults, the clinician needs to be aware of the inherent risks associated with cone beam tomography and the as low as reasonably achievable (ALARA) principle in patient selection.¹⁵ The American Academy of Oral and Maxillofacial Radiology (AAOMR) has published

position statements which summarize the potential benefits and risks of maxillofacial CBCT use in orthodontic and endodontic diagnosis, treatment, and outcomes and provides clinical guidance to dental practitioners.^{16,17} The AAOMR position statements support and affirm the position of the ADA Council on Scientific Affairs that the selection of CBCT imaging must be justified based on individual need.¹⁶⁻¹⁸ Because this technology has potential to produce vast amounts of data and imaging information beyond initial intentions, it is important to interpret all information obtained, including that which may be beyond the immediate diagnostic needs or abilities of the practitioner, and CBCT imaging should be referred for radiological and diagnostic interpretation.

Recommendations

The recommendations of the ADA/FDA guidelines are contained within the accompanying Table. "These recommendations are subject to clinical judgment and may not apply to every patient. They are to be used by dentists only after reviewing the patient's health history and completing a clinical examination. Even though radiation exposure from dental radiographs is low, once a decision to obtain radiographs is made, it is the dentist's responsibility to follow the ALARA principle to minimize the patient's exposure."⁶

Intraoral imaging should be maintained as the standard diagnostic tool. The use of CBCT should be considered when conventional radiographs are inadequate to complete diagnosis and treatment planning and the potential benefits outweigh the risk of additional radiation dose. It must not be routinely prescribed for diagnosis or screening purposes in the absence of clinical indication. Basic principles and guidelines for the use of CBCT include: 1) use appropriate image size or field of view, 2) assess the radiation dose risk, 3) minimize patient radiation exposure, and 4) maintain professional competency in performing and interpreting CBCT studies.¹⁶⁻¹⁹ When using CBCT, the resulting imaging is required to be supplemented with a written report placed in the patient's records that includes full interpretation of the findings.

Addendum

An ad hoc committee of the AAOMR recently reviewed current evidence and published guidelines regarding routine patient shielding during diagnostic dentomaxillofacial radiography procedures in adults and children.²⁰ The guidelines recommend discontinued use of patient thyroid, gonadal, and fetal shielding during dental diagnostic imaging (e.g., intraoral, panoramic, cephalometric, CBCT).²⁰ The recommendations are consistent with trends in the medical community and positions of the American College of Radiology^{21,22} and the American Academy of Pediatrics²³. Recognizing the evolving science in this field, a review of local, state, and federal regulations regarding routine shielding practices was recommended.²⁰

Recommendation: Practitioners should follow local, state, and federal rules regarding radiation safety requirements and

continue to adhere to the ALARA principle when considering shielding practices in the care of pediatric dental patients.

References

1. American Academy of Pedodontics. Dental radiographs in children. American Academy Pediatric Dentistry Reference Manual 1991-1992. Chicago, Ill.: American Academy of Pediatric Dentistry; 1991:27-8.
2. Joseph LP. The Selection of Patients for X-ray Examinations: Dental Radiographic Examinations. Rockville, Md.: The Dental Radiographic Patient Selection Criteria Panel, U.S. Department of Health and Human Services, Center for Devices and Radiological Health; 1987. HHS Publication No. FDA 88-8273.
3. American Academy Pediatric Dentistry. Guidelines for prescribing dental radiographs. *Pediatr Dent* 1995;17(6):66-7.
4. American Dental Association, U.S. Department of Health and Human Services. The selection of patients for dental radiographic examinations—2004. Available at: "<https://www.fda.gov/media/74704/download>". Accessed August 15, 2021.
5. American Dental Association Council on Scientific Affairs. The use of dental radiographs: Update and recommendations. *J Am Dent Assoc* 2006;137(9):1304-12.
6. American Dental Association Council on Scientific Affairs, U.S. Department of Health and Human Services Public Health Service Food and Drug Administration. Dental Radiographic Examinations: Recommendations for Patient Selection and Limiting Radiation Exposure. Chicago, Ill.: American Dental Association; 2012:5-7. Available at: "https://www.ada.org/-/media/ADA/Member%20Center/Files/Dental_Radiographic_Examinations_2012.ashx". Accessed August 15, 2021.
7. American Academy Pediatric Dentistry. Prescribing dental radiographs for infants, children, adolescents, and individuals with special health care needs. The Reference Manual of Pediatric Dentistry. Chicago, Ill.: American Academy of Pediatric Dentistry; 2021:258-61.
8. American Dental Association. Caries-risk assessment and management for infants, children, and adolescents. The Reference Manual of Pediatric Dentistry. Chicago, Ill.: American Academy of Pediatric Dentistry; 2021:252-7.
9. Hall JD, Godwin M, Clarke T. Lifetime exposure to radiation from imaging investigations. *Can Fam Physician* 2006;52(8):976-7. Available at: "<https://www.cfp.ca/content/cfp/52/8/976.full.pdf>". Accessed August 15, 2021.
10. National Council on Radiation Protection and Measurements (NCRP) Radiation Protection in Dentistry and Oral Maxillofacial Imaging, # 177 December 19, 2019:84.
11. Mallya SM. Safety and protection. In: White and Pharoah's Oral Radiology Principles and Interpretation. Mallya SM, Lam EWN, eds. 8th ed. St. Louis, Mo.: Elsevier, Inc.; 2019:29.
12. Mol A. Digital imaging. In: White and Pharoah's Oral Radiology Principles and Interpretation. Mallya SM, Lam EWN, eds. 8th ed. St. Louis, Mo: Elsevier, Inc.; 2019:40-6.
13. Branets I, Stabulas J, Dauer LT, et al. Pediatric bitewing exposure to organs of the head and neck through the use of juvenile anthropomorphic phantoms. *J Oral Biol* 2014;1(1):5. Available at: "https://pdfs.semanticscholar.org/6c43/23f1b8f01f6a37c672f37f51370a9dbc0239.pdf?_ga=2.154639409.88309241.1625333899-67121359.1625333899". Accessed August 15, 2021.
14. Wiley D, Yepes J, Sanders B, Jones J, Johnson B, Tang Q. Pediatric phantom dosimetry evaluation of the extraoral bitewing. *Pediatr Dent* 2019;42(1):3-7.
15. Kutanzi KR, Lumen A, Koturbash I, Miousse IR. Pediatric exposures to ionizing radiation: Carcinogenic considerations. *Int J Environ Res Public Health* 2016;13(11):1057.
16. American Academy of Oral and Maxillofacial Radiology. Clinical recommendations regarding use of cone beam computed tomography in orthodontics. Position statement by the American Academy of Oral and Maxillofacial Radiology. *Oral Surg Oral Med Oral Pathol Oral Radiol* 2013;116(2):238-57. Erratum in *Oral Surg Oral Med Oral Pathol Oral Radiol* 2013;116(5):661.
17. Special Committee to Revise the Joint AAE/AAOMR Position Statement on use of CBCT in Endodontics. AAE and AAOMR joint position statement: Use of cone beam computed tomography in endodontics 2015/2016 Update. Available at: "<https://f3f142zs0k2w1kg84k5p9i1o-wpengine.netdna-ssl.com/specialty/wp-content/uploads/sites/2/2017/06/conebeamstatement.pdf>". Accessed October 10, 2021.
18. American Dental Association Council on Scientific Affairs. The use of cone-beam computed tomography in dentistry. An advisory statement from the American Dental Association Council on Clinical Affairs. *J Am Dent Assoc* 2012;143(8):899-902.
19. SEDENTEXCT Project (2008-2011). Radiation protection No. 172: Cone beam CT for dental and maxillofacial radiology. Evidence-based guidelines. European Commission. Available at: "<https://ec.europa.eu/energy/sites/ener/files/documents/172.pdf>". Accessed August 15, 2021.
20. Benavides E, Krecioch JR, Connolly RT, et al. Optimizing radiation safety in dentistry: Clinical recommendations and regulatory considerations. *J Am Dent Assoc* 2024;S0002-8177(23):00734-1.
21. American College of Radiology. NCRP Recommends Against Routine Gonadal Shielding. January 13, 2021. Available at: "<https://www.acr.org/Media-Center/ACR-News-Releases/2021NCRP-Recommends-Against-Routine-Gonadal-Shielding>". Accessed March 19, 2024.

22. National Council on Radiation Protection and Measurements. Recommendations for Ending Routine Gonadal Shielding During Abdominal and Pelvic Radiography. Available at: "<https://ncrponline.org/wp-content/themes/ncrp/PDFs/Statement13.pdf>". Accessed March 19, 2024.
23. Frush D, Reid J. X-ray shields going by the wayside: What you and your patients need to know. American Academy of Pediatrics News. March 31, 2020. Available at: "https://publications.aap.org/aapnews/news/14974/X-ray-shields-going-by-the-wayside-What-you-and?auto_logincheck=redirected". Accessed March 19, 2024.
24. American Dental Association. Caries risk form (Ages 0-6 years). ADA Resources: ADA Caries Risk Assessment Forms. Caries Risk Assessment and Management. Chicago, Ill.: American Dental Association; 2011. Available at: "http://www.ada.org/-/media/ADA/Member%20Center/Files/topics_caries_under6.pdf?la=en". Accessed August 15, 2021.
25. American Dental Association. Caries risk form (Over 6 years). ADA Resources: ADA Caries Risk Assessment Forms. Caries Risk Assessment and Management. Chicago, Ill.: American Dental Association; 2011. Available at: "https://www.ada.org/-/media/ADA/Science%20and%20Research/Files/topic_caries_over6.pdf?la=en". Accessed October 10, 2021.