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

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Abstract

This best practice provides guidance on the proper timing, selection, and frequency of dental radiographs for pediatric dental patients and endorses the US Food and Drug Administration and American Dental Association's recommendations for prescribing dental radiographs. Recommendations were made according to the 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 the use of cone beam computed tomography, related safety concerns, and need for comprehensive interpretation of resulting images. Attention is given to updated recommendations on shielding for dental radiographs. Dental professionals 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 US Food and Drug Administration (**FDA**) published recommendations by an expert dental panel,[2] 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 revision which was accepted by the FDA in November 2004.[4] While continuing to endorse the ADA/FDA's updated recommendations,[5,6] the AAPD expanded its guidance on dental radiographs, with the last revision in 2024.[7] This review includes a new search of the PubMed/MEDLINE database using the parameters: (*evidence based dentistry* [**Majr**] *OR dental care for children* [Majr] OR *pediatric dentistry* [Majr] OR *dentistry* [Majr]) AND (*radiography, dental* [Majr] OR *radiography, dental, digital* [Majr] OR *dental radiograph** [**Tiab**]) AND (*radiation protection* [Majr] OR *conebeam computed tomography* [Majr] OR *spiral cone beam computed tomography* [Majr] OR *scattered radiation* [Tiab] OR *shielding* [Tiab]); fields: all; limits: within the last 5 years, humans, English, and child: birth-18 years. Forty-six articles matched these criteria and were evaluated by title and/or abstract. Additional resources included Google Scholar and textbooks. When data did not appear sufficient or were inconclusive, recommendations were based upon expert and/or consensus opinion by experienced researchers and clinicians.

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:** US Food and Drug Administration. **Majr:** Medical subject heading major topic. **Tiab:** Title and abstract.

* *Used in the PubMed search to identify all terms that begin with this truncated base.*

Background

Radiographs are valuable aids in the oral health care of infants, children, adolescents, and individuals with special health care needs. Rather than being screening tools, they are intended to diagnose or monitor oral diseases, evaluate dentoalveolar trauma, and monitor dentofacial development as well as the progress of therapy.[6] The recommendations in the ADA/FDA guidelines were developed to serve as an adjunct to the dentist's professional judgment.[6] Timing of initial radiographs and frequency of additional radiographic examinations are based on the patient's unique characteristics.[6] Considerations for obtaining radiographs include the patient's medical and dental histories, clinical findings, and vulnerability to environmental factors that affect oral health.[6] The AAPD's recommendations for assessing risk for caries development in children ages birth through 5 years and in children age 6 and above can be found in *Caries-Risk Assessment and Management for Infants, Children, and Adolescents.*[8] Review of prior radiographs, when available from within the same practice or through record transfer, also contributes to the decision of radiographic necessity. Factors such as age or insurance coverage are not, on their own, indications for taking radiographs, and using insurance reimbursement as a rationale may lead to overuse of radiographs.[9] Diagnostic codes may aid dentists in determining appropriateness of the radiographic examination.[10]

Radiographs can help substantiate a clinical diagnosis and guide the practitioner in making an informed decision that will affect patient care. The AAPD recognizes 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 intraoral radiographic capabilities, the oral health care professional typically informs the patient or parent of these limitations and documents 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 effects of radiation exposure accumulate over time,[4,6,11-14] good radiological practices are important to minimize or eliminate unnecessary radiation in diagnostic dental imaging. The benefits of obtaining radiographs are to be weighed against the patient's risk of radiation exposure, while also considering the probability of capturing diagnostic images. Adherence to the **ALARA** (as low as reasonably achievable) principle includes practices such as[6,12-16]: 1) use of the fastest image receptor compatible with the diagnostic task (E-speed film or digital [photostimulable phosphor {PSP} plate, charge-coupled device {CCD}]) and use of a receptor with a beam-guiding device; 2) use of rectangular collimation, collimation of the beam to the size of the receptor, and use of a long-positioning indicating device; 3) appropriate operating potentials and proper film exposure and processing techniques; and 4) limiting the number of images to the minimum necessary to obtain essential diagnostic information. Although some panoramic machines are capable of producing extraoral bitewings, the radiation dose is similar to a traditional panoramic radiograph (ie, 3 to 11 times more than the traditional intraoral bitewing).[17] Therefore, the extraoral bitewing is best based upon case specific needs and not as an alternative to intraoral radiographs.[17]

Three-dimensional imaging technology (ie, cone beam computed tomography [**CBCT**]) can have many applications in dentistry. While CBCT is not prescribed for initial diagnosis in the absence of clinical indication, it can be valuable as an adjunct diagnostic tool in assessing periapical pathosis, oral pathology, anomalies in the developing dentition (eg, impacted, ectopic, or supernumerary teeth), oral maxillofacial surgical needs (eg, bone graft placement), and dental and facial trauma.[18] CBCT imaging is also helpful for orthodontic and surgical planning prior to orthognathic surgery. Nonetheless, given the inherent radiation burden associated with CBCT and the vulnerability of children to radiation-induced carcinogenesis, attention to the ALARA principle and patient selection are critical.[6,11-14,19-21] The American Academy of Oral and Maxillofacial Radiology (**AAOMR**) summarized the potential benefits and risks of maxillofacial CBCT used in orthodontic and endodontic diagnosis, treatment, and outcomes and supports justified use of CBCT imaging on an individual basis.[22,23] Basic principles and guidelines for the use of CBCT include[22-25]: 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. Because this technology can produce vast amounts imaging information beyond initial intentions, interpreting all information obtained, including that which may be beyond the immediate diagnostic needs or abilities of the practitioner, is prudent. Thus, consultation with a radiologist for further radiological and diagnostic interpretation of CBCT images may be indicated.

The use of lead aprons and thyroid collars to protect individuals against unnecessary radiation exposure has been disputed by multiple professional radiology organizations in recent years.[15,26-28] Improvements in radiation technology, including beam collimation and digital sensors, have led to significant reductions in radiation exposure to patients and support discontinued use of shielding.[15] Shielding does not protect against internal scatter radiation,[29] and improper placement of shields can result in nondiagnostic images and need to rectify through additional exposures.

The AAOMR's guidelines reflect current evidence regarding patient shielding for diagnostic dentomaxillofacial radiography procedures in adults and children.[29] They recommend discontinued use of patient thyroid, gonadal, and fetal shielding during dental diagnostic imaging (eg, intraoral, panoramic, cephalometric, CBCT).[29] The recommendations are consistent with trends in the medical community and positions of the American College of Radiology[27] and the American Academy of Pediatrics[28]. The AAOMR recommended that, in light of

evolving science, governmental agencies at the local, state, and federal levels review regulations related to dental radiation safety.[29]

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 radiographic imaging is the standard diagnostic tool. CBCT can be utilized when conventional radiographs

Table. RECOMMENDATIONS FOR PRESCRIBING DENTAL RADIOGRAPHS[6]

	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 age[30] and over 6 years of age[31]).**

are inadequate to complete diagnosis and treatment planning and the potential benefits outweigh the risk of added radiation dose. When using CBCT, full interpretation of the resulting imaging must be documented in the patient's record.

Evidence suggests routine patient shielding is no longer necessary. Practitioners should follow local, state, and federal regulations regarding radiation safety and continue to adhere to the ALARA principle during radiographic procedures.

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