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The guideline of the Taiwan academy of pediatric dentistry for the dental X-ray examinations in children and adolescents

KEYWORDS

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Since an academic article introduced the value of X-ray for the diagnosis of dental diseases with a photobook published in the Journal of the Formosan Medical Association by the Taiwan Government Taipei Hospital in 1913, the clinical application of the dental X-ray examinations has been developed in Taiwan for more than 110 years. After the 1920s, the dental X-ray machines might have been the common equipment in the hospitals or the dental clinics in Taiwan.^{1,2} Especially after Taiwan implemented the national health insurance (NHI) that covers the dentistry in 1995, the high accessibility of dental care has led to an extensive use of the dental X-ray examinations. Therefore, it is crucial to establish a guideline for the dental X-ray examinations based on the concepts of the medical safety and radiation protection. The Taiwan Academy of Pediatric Dentistry (TAPD) has developed a guideline to help the dentists to judge the appropriate dental X-ray examinations when evaluating the infants, children, adolescents, and patients with special medical needs. This guideline is intended to provide the best oral care for the patients, minimize their radiation exposure, and allocate the medical resources appropriately. In this article, we introduced the key concepts of this guidance for the dental X-ray examinations in children and adolescents.

This guideline was developed specifically for the dental patients of children and adolescents under the age of 18 years based on Taiwan's NHI system, as shown in Table 1.

It distinguished three types of the patients based on the stage of dentition development (such as the primary dentition, mixed dentition, or permanent dentition). There were six types of dental consultation distinguished based on the patients' dental and medical statuses and their needs, making a total of the 11 situations. In these different situations, this guideline recommended whether to use the dental X-ray examinations, the types of dental radiography, and the frequency. In addition to the recommendation of the routine dental X-ray examinations for the first-visit patients, individuals with healthy oral and physiological conditions and visually detectable dental status usually do not require additional dental X-ray examinations for the return visits. For individuals at a specific risk or with the evaluation needs for the return visit, the appropriate dental radiographies and frequency patterns are recommended. In addition, this guideline has a detailed list of the high risk factors for dental caries and other situations requiring the dental X-ray examinations for the convenience of the dentists' reference (Table 1).

In terms of the oral care for the infants, children, adolescents and those with the special medical needs, the dental X-ray examinations are important auxiliary tools in the diagnosis of oral diseases, monitoring the oral and facial growth, and evaluating the treatment progress. This guideline is intended to serve as an aid to the dentists' professional judgment in making decisions about the dental

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Table 1 The clinical guideline for the dental X-ray examinations (recommended dental radiographies and frequency) in children and adolescents based on age and stage of dental development.

Type of dental consultation	Primary dentition	Mixed dentition	Permanent dentition (teens under 18 years old)
Patients for the first visit	<ol style="list-style-type: none"> 1. To use the upper and lower occlusal radiographs or the periapical radiographs for the anterior teeth. 2. To use the bitewing radiographs for the posterior teeth or selective periapical radiographs when the interproximal surfaces cannot be examined visually or probed. 3. Patients without clear pathological features or those with open interproximal surfaces may not require the X-ray examinations. 	<ol style="list-style-type: none"> 1. To use the upper and lower occlusal radiographs or the periapical radiographs for the anterior teeth. 2. To use the bitewing radiographs for the posterior teeth or selective periapical radiographs when the interproximal surfaces cannot be examined visually or probed. 3. To use the panoramic radiographs. 	<ol style="list-style-type: none"> 1. To use the bitewing radiographs for the posterior teeth and the panoramic radiographs, or selective periapical radiographs. 2. Full mouth intraoral radiographs are a better choice when the patients have clinical evidence of extensive dental disease or a history of intensive dental treatment.
Patients with dental caries or at a high risk for dental caries for the return visit ^a	<ol style="list-style-type: none"> 1. To use the bitewing radiographs for the posterior teeth taken at 6- to 12-month intervals when the interproximal surfaces cannot be viewed or probed. 		<ol style="list-style-type: none"> 1. To use the bitewing radiographs for the posterior teeth taken at 6- to 18-month intervals.
Patients without dental caries and not at a high risk for dental caries for the return visit	<ol style="list-style-type: none"> 1. To use the bitewing radiographs for the posterior teeth taken at 12- to 24-month intervals when the interproximal surfaces cannot be viewed or probed. 		<ol style="list-style-type: none"> 1. To use the bitewing radiographs for the posterior teeth taken at 18- to 36-month intervals.
Patients for the return visit of periodontal problem	<ol style="list-style-type: none"> 1. When the clinical judgment is made regarding whether the X-ray examinations are necessary to evaluate the periodontal disease, the X-ray examinations may be included but are not limited to the bitewing radiographs and the periapical radiographs that can detect the periodontal condition of a specific area. 		
Patients with the needs for monitoring the growth and development	<ol style="list-style-type: none"> 1. Clinical judgment is made regarding whether the X-ray examinations are necessary to assess or monitor the growth and development. 		<ol style="list-style-type: none"> 1. Clinical judgment is made regarding whether the X-ray examinations are necessary to assess or monitor the growth and development. 2. To use the panoramic radiographs or the periapical radiographs for evaluating the development of the third molars.

(continued on next page)

Table 1 (continued)

Type of dental consultation	Primary dentition	Mixed dentition	Permanent dentition (teens under 18 years old)
Patients in other situations where the dental X-ray examinations may be required ^a	1. Clinical judgment is made regarding whether the X-ray examinations are necessary for evaluation or monitoring.		
^a High risk factors for dental caries include but are not limited to the following: 1. Severe caries experience or decalcification; 2. History of the secondary caries; 3. High concentrations of cariogenic bacteria; 4. Existing prostheses of poor quality; 5. Poor oral hygiene; 6. Insufficient fluoride exposure; 7. Too long feeding time (including bottle feeding or breast feeding); 8. Regularly eating a diet with a high sucrose content; 9. Poor oral health in the family; 10. Developmental or acquired enamel defects; 11. Developmental or acquired disabilities; 12. Dry mouth; 13. Genetic abnormalities in the teeth; 14. Many multifaceted tooth fillings; 15. Chemotherapy/radiotherapy; 16. Eating disorders; 17. Drug/alcohol abuse; and 18. Irregular dental care.			
^b Other situations requiring dental X-ray examinations: A. Confirmed medical history findings: 1. Experience of periodontal or root canal treatment; 2. History of pain or trauma; 3. Family history of tooth variation; 4. Postoperative assessment of the recovery status; 5. Monitoring remineralization; and 6. Experience of implants or evaluating implant placement. B. Confirmed clinical manifestations/phenomena: 1. Clinical evidence of periodontal disease; 2. Large fillings or fillings close to the pulp; 3. Extensive caries or caries close to the pulp; 4. Misaligned or impacted teeth; 5. Swelling inside or outside the mouth; 6. Evidence of dental or facial trauma; 7. Loose teeth; 8. Fistula; 9. Clinical suspicion of the sinus disease; 10. Developmental abnormalities; 11. Oral manifestations related to known or suspected systemic disease; 12. Indeed neurological findings in the head and neck; 13. Evidence of the foreign body; 14. Temporomandibular joint pain/dysfunction; 15. Facial asymmetry; 16. Abutment teeth for the fixed or partial removable dentures; 17. Unexplained bleeding; 18. Unexplained tooth sensitivity; 19. Abnormal eruption, spacing, or displacement of teeth; 20. Abnormal tooth shape, calcification or color; 21. Unexplained tooth missing; and 22. Tooth erosion.			

X-ray examinations. The dental X-ray examination items for the initial diagnosis should not be judged solely based on the patient's age, but should be considered based on the actual situation of each patient. Because each patient is unique, the decision to perform the dental X-ray examination items should be made after reviewing the patient's dental and medical history, completing a comprehensive clinical examination, and assessing the risks that may affect the patient's oral health (Table 1).

The X-ray examinations are only necessary when they can increase the accuracy of the diagnosis and affect the patients' treatment. Since the radiation accumulates over time, the dentists should try their best to reduce the chances of radiation exposure to their patients, especially the infants, children and adolescents. Additionally, the dentists should weigh the pros and cons of the radiation exposure for their patients. It is very important to follow the good radiation practice, such as the use of lead aprons, thyroid collars, high-speed films, and beam collimators, and the correct parameter settings.^{3,4} The recommendations in this guideline should be based on the clinical judgment of the dentists and may not be applicable to every patient.

This guideline was developed by the TAPD in 2012 for the reference of the practicing dentists in Taiwan. To the best of our knowledge, this may be the earliest clinical guideline for the dental X-ray examinations formulated by a dental professional group in Taiwan. However, after more than a decade of development, the clinical application of dental radiology in Taiwan is very prosperous, and even the cone-beam computed tomography (CBCT) has already become popular in the dental clinics.⁵ Therefore, in the near future, it is necessary to formulate a more comprehensive clinical guideline related to the dental X-ray examinations for the patients of all ages and various aspects.

Declaration of competing interest

The authors have no conflicts of interest relevant to this article.

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Feng-Chou Cheng[†]

*Chia-Te Dental Clinic, New Taipei City, Taiwan
School of Life Science, College of Science, National Taiwan
Normal University, Taipei, Taiwan
Science Education Center, National Taiwan Normal
University, Taipei, Taiwan*

Yin-Lin Wang[†]

*Department of Dentistry, National Taiwan University
Hospital, College of Medicine, National Taiwan University,
Taipei, Taiwan
Graduate Institute of Clinical Dentistry, School of
Dentistry, National Taiwan University, Taipei, Taiwan
School of Dentistry, National Taiwan University, Taipei,
Taiwan*

Guay-Fen Huang^{**}

*Department of Dentistry, National Taiwan University
Hospital, College of Medicine, National Taiwan University,
Taipei, Taiwan
School of Dentistry, National Taiwan University, Taipei,
Taiwan*

Chun-Pin Chiang^{*}

*Department of Dentistry, National Taiwan University
Hospital, College of Medicine, National Taiwan University,
Taipei, Taiwan
Graduate Institute of Oral Biology, School of Dentistry,
National Taiwan University, Taipei, Taiwan
Department of Dentistry, Hualien Tzu Chi Hospital,
Buddhist Tzu Chi Medical Foundation, Hualien, Taiwan
Institute of Oral Medicine and Materials, College of
Medicine, Tzu Chi University, Hualien, Taiwan*

^{**}Corresponding author. Department of Dentistry, National Taiwan University Hospital, College of Medicine, National Taiwan University, No. 1, Chang-Te Street, Taipei, 10048, Taiwan.

E-mail address: 000841@ntuh.gov.tw (G.-F. Huang)

^{*}Corresponding author. Department of Dentistry, Hualien Tzu Chi Hospital, Buddhist Tzu Chi Medical Foundation, and Institute of Oral Medicine and Materials, College of Medicine, Tzu Chi University, No. 707, Section 3, Chung-Yang Road, Hualien, 970, Taiwan.

E-mail address: cpchiang@ntu.edu.tw (C.-P. Chiang)

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[†] These two authors contributed equally to this work.