

**THE SELECTION OF PATIENTS FOR  
DENTAL RADIOGRAPHIC EXAMINATIONS**

**REVISED: 2004**

**AMERICAN DENTAL ASSOCIATION  
Council on Dental Benefit Programs  
Council on Scientific Affairs**

**U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES  
Public Health Service  
Food and Drug Administration**

## CONTENTS

<b>Acknowledgements</b> .....	<b>ii</b>
<b>Background</b> .....	<b>1</b>
<b>Introduction</b> .....	<b>2</b>
<b>The Guidelines</b> .....	<b>2</b>
<b>Chart: Guidelines for Prescribing Dental Radiographs</b> .....	<b>5</b>
<b>Explanation of Chart Cells</b> .....	<b>9</b>
<b>Glossary of Terms</b> .....	<b>17</b>
<b>References</b> .....	<b>19</b>

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## **GUIDELINES FOR THE SELECTION OF PATIENTS FOR DENTAL RADIOGRAPHIC EXAMINATIONS – 2004**

### **Background**

The dental profession is committed to delivering the highest quality of care to each of its individual patients and applying advancements in technology and science to continually improve the oral health status of the U.S. population. These guidelines were developed to serve as an adjunct to the dentist's professional judgment of how to best use diagnostic imaging for each patient. Radiographs can help the dental practitioner evaluate and definitively diagnose many oral diseases and conditions. However, the dentist must weigh the benefits of taking dental radiographs against the risk of exposing a patient to x-rays, the effects of which accumulate from multiple sources over time. The dentist, knowing the patient's health history and vulnerability to oral disease, is in the best position to make this judgment in the interest of each patient. For this reason, the guidelines are intended to serve as a resource for the practitioner and are not intended to be a standard of care, requirements or regulations.

The guidelines incorporate the following updates:

- an additional clinical category entitled "Other Circumstances," which describes the use of radiographs in assessing patients for implants, monitoring remineralization of enamel, and evaluating restorative and endodontic needs and other pathology;
- specific monitoring of edentulous patients;
- expanded use of panoramic examination, recognizing that panoramic technology has improved over the last 15 years;
- clarification that "bitewings" refers to either or both horizontal and vertical bitewings; and
- an updated bibliography that can be a valuable reference for the practitioner.

The guidelines are not substitutes for a clinical examination and health history. The dentist is advised to conduct a clinical examination, consider the patient's signs, symptoms and oral and medical histories, as well as consider the patient's vulnerability to environmental factors that may affect oral health. This diagnostic and evaluative information may determine the type of imaging to be used or frequency of its use. Radiographs should be taken only when there is an expectation by dentists that the diagnostic yield will affect patient care.

Based on this premise, the guidelines can be used by the dentist to optimize patient care, minimize the total diagnostic radiation burden and responsibly allocate health care resources.

## **Introduction**

The guidelines titled “The Selection of Patients for X-Ray Examination” were first developed in 1987 by a panel of dental experts convened by the Center for Devices and Radiological Health of the U.S. Food and Drug Administration (FDA). The development of the guidelines at that time was spurred by concern about the U.S. population’s total exposure to radiation from all sources. Thus, the guidelines were developed to promote the appropriate use of x-rays. The guidelines have served dentists and other interested parties well during the subsequent 15 years. In 2002, the American Dental Association, recognizing that dental technology and science continually advance, recommended to the FDA that the guidelines be reviewed for possible updating. The FDA welcomed organized dentistry’s interest in maintaining the guidelines, and so the American Dental Association undertook this review.

The initial review of the guidelines was carried out by an informal work group, made up of representatives from the American Dental Association, the Academy of General Dentistry, the American Academy of Oral and Maxillofacial Radiology and the FDA. The draft of recommendations produced by the informal work group was then reviewed by representatives of dental specialties, including the American Academy of Pediatric Dentistry, the American Association of Endodontists, the American Academy of Periodontology, the American College of Prosthodontists and the American Association of Orthodontists, and was sent to the American Association of Oral and Maxillofacial Surgeons and Association for Public Health Dentistry for comment. The final draft was then submitted to the FDA for its consideration and was accepted in November 2004.

## **The Guidelines**

Radiographs and other imaging modalities are used to diagnose and monitor oral diseases, as well as to monitor dentofacial development and the progress or prognosis of therapy. Radiographic examinations can be performed using digital imaging or conventional film. The available evidence suggests that either is a suitable diagnostic method (1-3). Digital imaging may offer reduced radiation exposure and the advantage of image analysis that may enhance sensitivity and reduce error introduced by subjective analysis (4). In addition, new imaging technology offers the possibility of three-dimensional visualization of skeletal and other structures.

The development and progress of many oral conditions are associated with a patient’s age, stage of dental development, and vulnerability to known risk factors. Therefore, the guidelines on page 5 are presented within a matrix of common clinical and patient factors, which may determine the type(s) of radiographs that is commonly needed. The guidelines assume that diagnostically adequate radiographs can be obtained. If not, appropriate management techniques should be used after consideration of the relative risks and benefits for the patient.

Along the horizontal axis of the matrix, patient age categories are described, each with its usual dental developmental stage: child with primary dentition (prior to eruption of the first permanent tooth); child with transitional dentition (after eruption of the first permanent tooth); adolescent with permanent dentition (prior to eruption of third molars); adult who is dentate or partially edentulous; and adult who is edentulous.

Along the vertical axis, the type of encounter with the dental system is categorized (as “New Patient” or “Recall Patient”) along with the clinical circumstances and oral diseases that may be present during such an encounter. The “New Patient” category refers to patients who are new to the dentist, and thus are being evaluated by the dentist for dental disease and for the status of dental development. Typically, such a patient receives a comprehensive evaluation or, in some cases, a limited evaluation for a specific problem. The “Recall Patient” categories describe patients who have had a recent comprehensive evaluation by the dentist and, typically, have returned as a patient of record for a periodic evaluation or for treatment. However, a “Recall Patient” also may return for a limited evaluation of a specific problem, a detailed and extensive evaluation for a specific problem(s), or a comprehensive evaluation.

Both categories are marked with a single asterisk that corresponds to a footnote that appears below the matrix; the footnote lists “Positive Historical Findings” and “Positive Clinical Signs/Symptoms” for which radiographs may be indicated. The lists are not intended to be all-inclusive, rather they offer the clinician further guidance on clarifying his or her specific judgment on a case.

The clinical circumstances and oral diseases that are presented with the types of encounters include: clinical caries or increased risk for caries; no clinical caries or no increased risk for caries; periodontal disease or a history of periodontal treatment; growth and development assessment; and other circumstances. The category of “Other Circumstances” is a new category, added to update the guidelines. A few examples of “Other Circumstances” proposed are: existing implants, pathology, endodontic/restorative needs, and remineralization of dental caries. These examples are not intended to be an exhaustive list of circumstances for which radiographs or other imaging may be appropriate.

The categories, “Clinical Caries or Increased Risk for Caries” and “No Clinical Caries and No Increased Risk for Caries” are marked with a double asterisk that corresponds to a footnote that appears below the matrix; the footnote contains a list of factors that place a patient at increased risk for caries. It should be noted that a patient’s risk status can change over time and should be periodically reassessed (5). The list is not intended to be all-inclusive, rather it offers the clinician further guidance on clarifying his or her specific judgment on a case.

The panel also has made the following recommendations that are applicable to all categories:

1. Intraoral radiography is useful for the evaluation of dentoalveolar trauma. If the area of interest extends beyond the dentoalveolar complex, extraoral imaging may be indicated.
2. Care should be taken to examine all radiographs for any evidence of caries, bone loss from periodontal disease, developmental anomalies and occult disease.
3. Radiographic screening for the purpose of detecting disease before clinical examination should not be performed. A thorough clinical examination, consideration of the patient history, review of any prior radiographs, caries risk assessment and consideration of both the dental and the general health needs of the patient should precede radiographic examination (6-12).

In the practice of dentistry, patients often seek care on a routine basis in part because dental disease may develop in the absence of clinical symptoms. Since attempts to identify specific criteria that will accurately predict a high probability of finding interproximal carious lesions have not been successful for individuals, it was necessary to recommend time-based schedules for making radiographs intended primarily for the detection of dental caries. Each schedule provides a range of recommended intervals that are derived from the results of research into the rates at which interproximal caries progresses through tooth enamel. The recommendations also are modified by criteria that place an individual at an increased risk for dental caries. Professional judgment should be used to determine the optimum time for radiographic examination within the suggested interval.

Once a decision to obtain radiographs is made, it is the dentist's responsibility to follow the ALARA Principle (As Low as Reasonably Achievable) to minimize the patient's exposure to radiation (13). Examples of good radiologic practice include

- use of the fastest image receptor compatible with the diagnostic task;
- collimation of the beam to the size of the receptor whenever feasible;
- proper film exposure and processing techniques; and
- use of leaded aprons and thyroid collars.

The amount of scattered radiation striking the patient's abdomen during a properly conducted radiographic examination is negligible (14). However, there is some evidence that radiation exposure to the thyroid during pregnancy is associated with low birth weight (15). Protective thyroid collars substantially reduce radiation exposure to the thyroid during dental radiographic procedures (16). Because every precaution should be taken to minimize radiation exposure, protective thyroid collars and aprons should be used whenever possible. This practice is strongly recommended for children, women of childbearing age and pregnant women.

## GUIDELINES FOR PRESCRIBING DENTAL RADIOGRAPHS

The recommendations in this chart 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. Because every precaution should be taken to minimize radiation exposure, protective thyroid collars and aprons should be used whenever possible. This practice is strongly recommended for children, women of childbearing age and pregnant women.

TYPE OF ENCOUNTER	PATIENT AGE AND DENTAL DEVELOPMENTAL STAGE				
	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	Adult, Edentulous
<b>New patient*</b> being evaluated for dental diseases and dental development	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 dental disease or a history of extensive dental treatment.		Individualized radiographic exam, based on clinical signs and symptoms.
<b>Recall patient*</b> 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	Not applicable
<b>Recall patient*</b> 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	Not applicable

**GUIDELINES FOR PRESCRIBING DENTAL RADIOGRAPHS, cont'd.**

TYPE OF ENCOUNTER	PATIENT AGE AND DENTAL DEVELOPMENTAL STAGE				
	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 and Partially Edentulous	Adult Edentulous
<b>Recall patient*</b> with periodontal disease	Clinical judgment as to the need for and type of radiographic images for the evaluation of periodontal disease. Imaging may consist of, but is not limited to, selected bitewing and/or periapical images of areas where periodontal disease (other than nonspecific gingivitis) can be identified clinically.				Not applicable
<b>Patient</b> for monitoring of growth and development	Clinical judgment as to need for and type of radiographic images for evaluation and/or monitoring of dentofacial growth and development		Clinical judgment as to need for and type of radiographic images for evaluation and/or monitoring of dentofacial growth and development. Panoramic or periapical exam to assess developing third molars	Usually not indicated	
<b>Patient</b> with other circumstances including, but not limited to, proposed or existing implants, pathology, 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 circumstances.				

**\*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 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 pathology
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 erosion

**\*\* Factors increasing risk for caries may include but are not limited to:**

1. High level of caries experience or demineralization
2. History of recurrent caries
3. High titers of cariogenic bacteria
4. Existing restoration(s) of poor quality
5. Poor oral hygiene
6. Inadequate fluoride exposure
7. Prolonged nursing (bottle or breast)
8. Frequent high sucrose content in diet
9. Poor family dental health
10. Developmental or acquired enamel defects
11. Developmental or acquired disability
12. Xerostomia
13. Genetic abnormality of teeth
14. Many multisurface restorations
15. Chemo/radiation therapy
16. Eating disorders
17. Drug/alcohol abuse
18. Irregular dental care



## EXPLANATION OF CHART CELLS

### Patient Age and Dental Developmental Stages

**Child (Primary Dentition):** prior to eruption of first permanent tooth

**Child (Transitional Dentition):** after eruption of first permanent tooth

**Adolescent (Permanent Dentition):** prior to eruption of third molars

**Adult (Dentate or Partially Edentulous)**

**Adult (Edentulous)**

### Rationale by Type of Encounter and Patient Age and Dental Developmental Stages

**Row:** New Patient Being Evaluated for Dental Diseases and Dental Development

**Column:** Child (Primary Dentition)

Proximal carious lesions may develop after the interproximal spaces between posterior primary teeth close. Open contacts in the primary dentition will allow a dentist to visually inspect the proximal posterior surfaces. Closure of proximal contacts requires radiographic assessment (17-19). However, studies suggest that many of these lesions will remain in the enamel for at least 12 months, allowing sufficient time for implementation and evaluation of preventive interventions (20). A periapical/anterior occlusal examination may be indicated because of the need to evaluate dental development, dentoalveolar trauma or suspected pathology. Periapical and bitewing radiographs may be required to evaluate pulp pathology in primary molars.

*Therefore, the Panel recommends an individualized radiographic examination consisting of selected periapical/occlusal views and/or posterior bitewings if proximal surfaces cannot be examined visually or with a probe. Patients without evidence of disease and with open proximal contacts may not require radiographic examination at this time.*

**Row:** New Patient Being Evaluated for Dental Diseases and Dental Development

**Column:** Child (Transitional Dentition)

There has been a dramatic decrease in the incidence of dental caries over the last 30 years (21-23). However, the decrease has not been a uniform one. For example, 80% of the dental caries in permanent teeth of U.S. children aged 5-17 years occurs in 25% of those children (23). It is, therefore, important to consider a child's risk factors for caries before taking radiographs.

Although periodontal disease is uncommon in this age group, when clinical evidence exists (except for nonspecific gingivitis), selected periapical and bitewing radiographs are indicated to determine the extent of aggressive periodontitis, other forms of uncontrolled periodontal disease and the extent of osseous destruction related to metabolic diseases (24).

A periapical or panoramic examination is useful for evaluating dental development. A panoramic radiograph also is useful for the evaluation of craniofacial trauma (12). Intraoral

radiographs are more accurate than panoramic radiographs for the evaluation of dentoalveolar trauma, root shape, root resorption (25) and pulp pathology. However, panoramic examinations may have the advantage of reduced radiation dose, cost and larger area imaged.

Occlusal radiographs may be used separately or in combination with panoramic radiographs in the following situations: 1. unsatisfactory image in panoramic radiographs due to abnormal incisor relationship; 2. localizations of tooth position; and 3. when clinical grounds provide a reasonable expectation that pathology exists (26,27).

*Therefore, the Panel recommends an individualized radiographic examination consisting of posterior bitewings with panoramic examination or posterior bitewings and selected periapical images be performed.*

**Row: New Patient Being Evaluated for Dental Diseases and Dental Development**

**Column: Adolescent (Permanent Dentition)**

Within the pediatric population, the adolescent age group has the most decayed, missing or filled surfaces (DMFS) (23,28). The pattern of decay according to tooth surface type changes from primary to permanent dentition (23). Increasing independence and socialization, changing dietary patterns and decreasing attention to daily oral hygiene can characterize this age group. Each of these factors may result in an increased risk of dental caries. Another consideration is the increased incidence of periodontal disease found in this age group compared to children (29).

Panoramic radiography is effective in dental diagnosis and treatment planning (30-36). Specifically, the status of dental development can be assessed using panoramic radiography (26). Occlusal radiographs can be used to detect the position of an unerupted or supernumerary tooth (37). Third molars also should be evaluated in this age group for their presence, position and stage of development.

*Therefore, the Panel recommends an individualized radiographic examination consisting of posterior bitewings with panoramic examination or posterior bitewings and selected periapical images be performed. A full mouth intraoral radiographic examination is preferred when the patient has clinical evidence of generalized dental disease or a history of extensive dental treatment.*

**Row: New Patient Being Evaluated for Dental Diseases**

**Column: Adult (Dentate or Partially Edentulous)**

The overall dental caries experience of the adult population appears to be declining (28). However, risk for dental caries exists on a continuum and changes over time as risk factors change (38). Therefore, it is important to evaluate proximal surfaces in the new adult patient for carious lesions. In addition, it is important to examine patients for recurrent dental caries.

The incidence of root surface caries increases with age (39). Although bitewing radiographs can assist in detecting root surface caries in proximal areas, the usual method of detecting root surface caries is by clinical examination (39).

The incidence of periodontal disease increases with age (28). Although new adult patients may not have symptoms of active periodontal disease, it is important to evaluate previous experience with periodontal disease and/or treatment. Therefore, a high percentage of adults may require selected intraoral radiographs to determine the current status of the disease.

Occlusal radiographs can be used to detect the position of an unerupted or supernumerary tooth, to check for sialoliths and to assess the buccolingual extent of pathological lesions (21).

*Therefore, the Panel recommends that an individualized radiographic examination, consisting of posterior bitewings with panoramic examination or selected periapical images be performed. A full mouth intraoral radiographic examination is preferred when the patient has clinical evidence of generalized dental disease or a history of extensive dental treatment.*

**Row: New Patient Being Evaluated for Dental Diseases**

**Column: Adult (Edentulous)**

The clinical and radiographic examinations of edentulous patients generally occur during an assessment of the need for prosthetic appliances. The most common pathological conditions detected are impacted teeth and retained roots with and without associated disease. Other less common conditions also may be detected: bony spicules along the alveolar ridge, residual cysts or infections, developmental abnormalities of the jaws, intrabony tumors and systemic conditions affecting bone metabolism.

The original recommendations for this group called for a full-mouth intraoral radiographic examination or a panoramic examination for the new edentulous adult patient. Firstly, this recommendation was made because examinations of edentulous patients generally occur during an assessment of the need for prosthetic appliances. Secondly, the original recommendation considered edentulous patients to be at increased risk for oral disease. Studies have found that 33 to 41 percent of edentulous patients examined exhibited pathological conditions (40-42). A survey of 1,135 edentulous patients revealed that 14.2 percent had retained roots without pathology, 19.2 percent had retained roots with pathology or partly uncovered and 4.1 percent had retained teeth (43). In addition, the radiographic examination may reveal anatomic considerations that could influence prosthetic treatment, such as the location of the mandibular canal, the position of the mental foramen and maxillary sinus, and relative thickness of the soft tissue covering the edentulous ridge (44,45).

Screening radiography for new, edentulous patients has since been criticized because of the assertion that screening does not yield sufficient clinically relevant information (46-48). However, also there is support for screening (49-51).

This panel concluded that prescription of radiographs is appropriate as part of the initial assessment of edentulous areas for possible prosthetic treatment. A full mouth series of periapical radiographs or a combination of panoramic, occlusal or other extraoral radiographs may be used to achieve diagnostic and therapeutic goals. Particularly with the option of dental implant therapy for edentulous patients (52), radiographs can be an important aid in diagnosis, prognosis and the determination of treatment complexity (53).

*Therefore, the Panel recommends that an individualized radiographic examination, based on clinical signs and symptoms be performed.*

**Row: Recall Patient with Clinical Caries or Increased Risk for Caries**  
**Columns: Child (Primary and Transitional Dentition) and Adolescent (Permanent Dentition)**

Clinically detectable dental caries may suggest the presence of proximal carious lesions that can only be detected with a radiographic examination. In addition, patients who are at increased risk for developing dental caries because of such factors as poor oral hygiene, high frequency of exposure to sucrose-containing foods and deficient fluoride intake (see chart footnotes for other factors) are more likely to have proximal carious lesions.

The bitewing examination is the most efficient method for detecting proximal lesions (17,18). The frequency of radiographic recall should be determined on the basis of caries risk assessment (9,12,14,19,54-57). It should be noted that a patient's caries risk status may change over time and that an individual's radiographic recall interval may need to be changed accordingly (8).

*Therefore, the Panel recommends that a posterior bitewing examination be performed at 6 to 12 month intervals if proximal surfaces cannot be examined visually or with a probe.*

**Row: Recall Patient with Clinical Caries or Increased Risk for Caries**  
**Column: Adult (Dentate and Partially Edentulous)**

Adults who exhibit clinical dental caries or who have other increased risk factors should be monitored carefully for any new or recurrent lesions that are detectable only by radiographic examination. The frequency of radiographic recall should be determined on the basis of caries risk assessment (9,12,14,19,54-57). It should be noted that a patient's risk status can change over time and that an individual's radiographic recall interval may need to be changed accordingly (8).

*Therefore, the Panel recommends that a posterior bitewing examination be performed at 6 to 18 month intervals.*

**Rows: Recall Patient**  
**Column: Adult (Edentulous)**

A study that assessed radiographs of edentulous recall patients showed that previously detected incidental findings did not progress and that no intervention was indicated (48). The data suggest that patients who receive continuous dental care do not exhibit new findings that require treatment.

An examination for occult disease in this group cannot be justified on the basis of prevalence, morbidity, mortality, radiation dose and cost (49,58-61).

*Therefore, the Panel recommends that no radiographic examination be performed without evidence of disease.*

**Row: Recall Patient with No Clinical Caries and No Increased Risk For Caries**  
**Columns: Child (Primary and Transitional Dentition)**

Despite the general decline in dental caries activity, recent data show that subgroups of children have a higher caries experience than the overall population (23). The identification of patients in these subgroups may be difficult on an individual basis. For children who present for recall examination without evidence of clinical caries and who are not considered at increased risk for the development of caries, it remains important to evaluate proximal surfaces by radiographic examination. In primary teeth, the caries process can take approximately one year to progress through the outer half of the enamel and about another year through the inner half (62). Considering this rate of progression of carious lesions through primary teeth, a time-based interval of radiographic examinations from one to two years for this group appears appropriate. The incidence of carious lesions has been shown to increase during the stage of transitional dentition (28). Children under routine professional care would be expected to be at a lower risk for caries. Nevertheless, newly erupted teeth are at risk for the development of dental caries.

*Therefore, the Panel recommends that a radiographic examination consisting of posterior bitewings be performed at intervals of 12 to 24 months if proximal surfaces cannot be examined visually or with a probe.*

**Row: Recall Patient with No Clinical Caries and No Increased Risk for Caries**  
**Column: Adolescent (Permanent Dentition)**

Adolescents with permanent dentition, who are free of clinical dental caries and factors that would place them at increased risk for developing dental caries, should be monitored carefully for development of proximal carious lesions, which may be detected only by radiographic examination. The caries process, on average, takes more than three years to progress through the enamel (62). However, evidence suggests that the enamel of permanent teeth undergoes post-eruptive maturation and that young permanent teeth are susceptible to faster progression of carious lesions (63).

*Therefore, the Panel recommends that a radiographic examination consisting of posterior bitewings be performed at intervals of 18 to 36 months.*

**Row: Recall Patient with No Clinical Caries and No Increased Risk for Caries**  
**Column: Adult (Dentate or Partially Edentulous)**

Adult dentate patients, who receive regularly scheduled professional care and are free of signs and symptoms of oral disease, are at a low risk for dental caries. Nevertheless, consideration should be given to the fact that caries risk can vary over time as risk factors change. Advancing age and changes in diet, medical history and periodontal status may increase the risk for dental caries.

*Therefore, the Panel recommends that a radiographic examination consisting of posterior bitewings be performed at intervals of 24 to 36 months.*

**Row: Recall Patient with Periodontal Disease**  
**Columns: Child (Primary and Transitional Dentition), Adolescent (Permanent Dentition) and Adult (Dentate or Partially Edentulous)**

The decision to obtain radiographs for patients who have clinical evidence or a history of periodontal disease/treatment should be determined on the basis of the anticipation that important diagnostic and prognostic information will result. Structures or conditions to be assessed should include the level of supporting alveolar bone, condition of the interproximal bony crest, length and shape of roots, bone loss in furcations and calculus deposits. The frequency of radiographic examinations for these patients should be determined on the basis of a clinical examination of the periodontium and documented signs and symptoms of periodontal disease. The procedure for prescribing radiographs for the follow-up/recall periodontal patient would be to use selected intraoral radiographs to verify clinical findings on a patient-by-patient basis (64).

*Therefore, the Panel recommends that clinical judgment be used in determining the need for, and type of radiographic images necessary for, evaluation of periodontal disease. Imaging may consist of, but is not limited to, selected bitewing and/or periapical images of areas where periodontal disease (other than nonspecific gingivitis) can be identified clinically.*

**Row: Patient for Monitoring of Growth and Development**  
**Columns: Child (Primary and Transitional Dentition)**

For children with primary dentition, before the eruption of the first permanent tooth, radiographic examination to assess growth and development in the absence of clinical signs or symptoms is unlikely to yield productive information. Any abnormality of growth and development suggested by clinical findings should be evaluated radiographically on an individual basis. After eruption of the first permanent tooth, the child may have a radiographic examination to assess growth and development. This examination need not be repeated unless dictated by clinical signs or symptoms.

Cephalometric radiographs may be useful for assessing growth and planning orthodontic treatment (65,66).

*Therefore, the Panel recommends that clinical judgment be used in determining the need for, and type of radiographic images necessary for, evaluation and/or monitoring of dentofacial growth and development.*

**Row: Patient for Monitoring of Growth and Development**

**Column: Adolescent (Permanent Dentition)**

The major concern relating to growth and development for patients in this age group is to determine the presence, position and development of third molars. This determination can best be made by the use of selected periapical images or a panoramic examination, once the patient is in late adolescence (16 to 19 years of age).

*Therefore, the Panel recommends that clinical judgment be used in determining the need for, and type of radiographic images necessary for, evaluation and/or monitoring of dentofacial growth and development be used. Panoramic or periapical examination may be used to assess developing third molars.*

**Row: Patient for Monitoring of Growth and Development**

**Columns: Adult (Dentate, Partially Edentulous and Edentulous)**

In the absence of any clinical signs or symptoms suggesting abnormalities of growth and development in adults, no radiographic examinations are indicated for this purpose.

*Therefore the Panel recommends that, in the absence of clinical signs and symptoms, no radiographic examination be performed.*

**Row: Patients with other circumstances including, but not limited to, proposed or existing implants, pathology, restorative/endodontic needs, treated periodontal disease and caries remineralization**

**Columns: All patient categories**

The use of imaging, as a diagnostic and evaluative tool has progressed beyond the longstanding need to diagnose caries and evaluate the status of periodontal disease. The expanded technology in imaging is now used to diagnose other orofacial clinical conditions and evaluate treatment options. A few examples of other clinical circumstances are the use of imaging for dental implant treatment planning, placement or evaluation; the monitoring of dental caries and remineralization; the assessment of restorative and endodontic needs; and the diagnosis of soft and hard tissue pathology.

*Therefore the Panel recommends that clinical judgment be used in determining the need for, and type of radiographic images necessary for, evaluation and/or monitoring in these circumstances.*

## GLOSSARY OF TERMS

**Adolescent Dentition:** The state of dental development when all permanent teeth, except the third molars, should have erupted.

**Bitewings:** A form of dental radiograph that may be taken with the long axis of the film oriented either horizontally or vertically, that reveals approximately the coronal halves of the maxillary and mandibular teeth and portions of the interdental alveolar septa on the same film.

**Cephalometric Radiograph:** A standardized, extraoral projection, either in a lateral or frontal view, that shows the relationships between the jaws and other skeletal structures, usually used for orthodontic evaluation.

**Dentate :** Having one or more natural teeth present in the mouth. Individuals with only natural roots of teeth (e.g., patients with overdenture) are considered dentate as they are subject to caries, periodontal disease and other dental diseases.

**Diagnostic Imaging:** A visual display of structural or functional patterns for the purpose of diagnostic evaluation.

**Edentulous:** Toothless or without any natural teeth. Individuals without natural teeth but with implants are considered edentulous although they are subject to special problems associated with implants.

**Full Mouth Intraoral Radiographic Examination (FMX):** A set of intraoral radiographs usually consisting of 14 to 22 periapical and posterior bitewing images intended to display the crowns and roots of all teeth, periapical areas and alveolar bone crest.

**Guidelines:** A set of recommendations or decision rules to assist dentists in the selection of patients who are likely to exhibit useful findings resulting from a radiographic examination.

**Individualized Radiographic Examination:** A combination of periapical, bitewing (vertical or horizontal), panoramic or other views selected for an individual patient on the basis of patient signs, symptoms and historical findings.

**New Patient:** A patient who visits a specific dental practice or other patient care facility for the first time to initiate a course of care.

**Occult Disease:** Disease that is not accompanied by readily detectable clinical signs, symptoms or history.

**Occlusal Projection:** An intraoral projection whereby the film packet is held in position by having the patient bite lightly on the film to support it between the occlusal surfaces of the jaws.

**Panoramic Radiograph:** An extraoral projection whereby the entire mandible, maxilla, teeth and other nearby structures are portrayed on a single film, as if the jaws were flattened out.

**Recall Patient:** A patient who has made a previous visit(s) to a specific dental practice, or other patient care facility, and is receiving ongoing care.

**Selection Criteria:** Descriptions of clinical conditions and historical data that identify patients who are most likely to benefit from a particular radiographic examination.

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