

BOSTON UNIVERSITY SCHOOL OF DENTAL MEDICINE

RADIATION MANUAL

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1) RADIATION SAFETY OFFICER

The Chairperson of the Department of Diagnostic Sciences and Patient Services is appointed as the Radiation Safety Officer for all diagnostic radiation sources at the clinics under Boston University Goldman School of Dental Medicine's jurisdiction, including those in the main facility and at the 930 Commonwealth Avenue practice.

The responsibilities of the Radiation Safety Officer include

- A) Establishing, implementing, and monitoring guidelines and policies on radiographic practices
- B) Approving any purchases and remodeling of radiographic facilities.
- C) Monitoring performance levels of x-ray units.
- D) Monitoring radiation safety procedures.
- E) Investigating reported or suspected incidents of misuse or hazards of radiation equipment.
- F) Implementing quality assurance programs.
- G) Maintaining records for each x-ray unit inspection.
- H) Educating all new staff to the radiation policies including technique, safety practices, prescribing procedures, and state and federal radiation rules and regulations.
- I) Providing periodic continuing education programs for all staff operating x-ray generating and processing equipment.
- J) Working in association with the x-ray safety committee at Boston University Medical Center.

2) CLINICIANS

Only dentists, dental hygienists, certified dental assistants, other personnel who are certified in radiology, and students who have completed sufficient training on manikins are permitted to make patient exposures.

- A) Those dentists employed by Boston University Goldman School of Dental Medicine as faculty, clinicians, or in the post-doctoral programs are authorized to operate x-ray equipment.
- B) Registered dental hygienists employed in the various clinics are authorized to operate x-ray equipment.
- C) Dental assistants must be certified in radiology to operate the radiographic equipment.
- D) Surgical assistants are required to be certified in radiology to operate x-ray equipment.
- E) Any other staff must also complete a radiology certification program that includes a radiation safety didactic course and a preclinical exercise on DXTTR to operate any x-ray equipment.
- F) Dental students and hygiene students must complete the Radiology preclinical laboratory training to a satisfactory level before being allowed to make x-ray exposures on patients. Faculty supervision is required.
- G) A member of the Boston University Goldman School of Dental Medicine faculty must supervise courses that use x-ray equipment by students lacking certification.

3) PREGNANCY

Any x-ray operator who is pregnant may voluntarily declare her pregnancy and the estimated date of conception in writing to the Radiation Safety Officer. Thereafter, her occupational radiation exposure shall be limited to 0.5mSv per month after pregnancy is known as required by the NRC (National Regulatory Commission.)

It is the responsibility of the operator to decide whether the risks to her or to a known or potential unborn child are acceptable.

4) STAFF AND FACULTY TRAINING

- A) Periodic training sessions are provided for all personnel using x-ray equipment.
- B) Radiation safety sessions are required of all new personnel and post-doctoral residents who may be using x-ray equipment.
- C) Auxiliary staffs are also required to meet the requirements of DANB or other professional organizations as they may apply.

5) EXPOSURE CRITERIA

- A) All radiographs are prescribed in writing by a Boston University Goldman School of Dental Medicine faculty member who is a dentist or by a postdoctoral resident.
- B) All prescriptions are made after determining the patient's need by reviewing the medical and dental history and by performing a clinical exam. The selection criteria follows those recommended in the enclosed chart developed by representatives of various dental and federal agencies.
- C) If prior radiographs are available, they are obtained and evaluated prior to taking new radiographs.
- D) Retakes are taken after evaluating the initial film, which does not meet diagnostic criteria, and after determining the technical error. Supervision of faculty to aid in the correction of the error is required. A full mouth series is acceptable if the radiographs are of diagnostic quality and exhibit the following features:
 - 1. Apex of each tooth will be visible at least once with 1 to 2 mm of bone surrounding it.
 - 2. The interproximal region of each tooth will be open in at least one radiograph.
 - 3. A panoramic film will be taken to visualize unerupted/ partially erupted third molars if these teeth are not visualized on the molar periapical films.
- E) Radiographs are made only on patients who are capable of complying with the procedure.
- F) No radiographs are taken on a routine basis.
- G) Radiographs may be taken for research purposes with institutional review board approval.
- H) Radiographs solely for teaching, training, insurance, or other administrative purposes are not permitted.
- I) Radiographs are not taken solely for dental board examination purposes.
- J) All radiographic interpretations are noted in the patient's chart.
- K) For pregnant patients, the school will follow the recommendations of the Dental Radiographic Selection Criteria Panel set by the ADA and US Department of Health and Human Services (2004). The amount of scattered radiation striking the patient's abdomen during a properly conducted radiographic examination is negligible. However, there is some evidence that radiation exposure to the thyroid during pregnancy is associated with low birth weight. Protective thyroid collars substantially reduce radiation exposure to the thyroid during dental radiographic procedures. 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.

6) SELECTION CRITERIA FOR EXPOSURE

In 2004, recommendations were developed by an expert panel, under the sponsorship of the American Dental Association and United States Food and Drug Administration, as a guideline for dentists in selecting the proper x-rays to examine a patient. The guidelines are subject to clinical judgment and do not necessarily apply to every patient. Dentists should use the guidelines after taking the patient's health history, completing a clinical examination and evaluating various risk factors. The American Dental Association recommends that pregnant women postpone elective dental x-rays until after delivery; however, there are times when an x-ray may be required during pregnancy to help dentists diagnose and treat oral disease.

After it has been decided that radiographs are needed, three determinations must be made:

1. Determine whether the patient presenting for dental care is a new patient or a recall patient.

2. Categorize the patient by chronological age and by developmental stage or dental status, i.e., child (primary or transitional dentition), adolescent, or adult (dentulous or edentulous).
3. Assign the patient to a risk category based on history and clinical signs and symptoms. The risk categories are: clinical caries or high risk factors for caries, no clinical caries and no high risk factors for caries, and periodontal disease or a history of periodontal treatment.

Because the patient's condition may change over time, it is necessary to periodically reconsider the type of visit, age category, and risk group.

After making these determinations, the corresponding guidelines from the charts on the following pages should be considered.

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
New patient* 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.
Recall patient* with clinical caries or at increased risk for	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
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	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
Recall patient* 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
Patient 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	
Patient 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

From: American Dental Association, U.S. Food & Drug Administration. The Selection of Patients For Dental Radiograph Examinations. Available on www.ada.org

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

References

1. American dental association, US Food and Drug Administration: The Selection of Patients for Dental Radiographic Examinations (2004)
2. Joseph LP. *The Selection of Patients for X-ray Examinations: Dental Radiographic Examinations*. Rockville, MD: The Dental Radiographic Patient Selection Criteria Panel, US Dept of Health and Human Services, Center for Devices and Radiological Health; 1987.HHS Publication No. FDA 88-8273.
3. ADA Council on Dental Materials and Devices. Recommendations in radiographic practices: an update, 1988. *JADA* 1989;118
4. Council on Scientific Affairs. An update on radiographic practices: information and recommendations. *Journal of the American Dental Association*, 2001; 132: 234-8.

7) SAFETY PROCEDURES

- A) All patients are draped with lead aprons and, where the technique allows, thyroid collars.
- B) Only film of an American National Standards Institute group "F" rating or faster is used.
- C) No person other than the patient is allowed to be in the x-ray operatory during the exposure. If assistance is required, non-occupationally exposed persons (preferably a member of the patient's family) will be asked to assist and will be draped with a separate apron.
- D) Extra-oral exposures employ screen-film combinations of the highest speed consistent with their diagnostic purpose. As a rule, this implies use of rare earth screens and T-grain film.
- E) The x-ray operator must never hold a film for the patient during exposure
- F) The operator must stand behind a barrier equipped with a transparent window to observe of the patient during exposure.
- G) When a mobile x-ray unit is used or when no barriers are present, the operator is required to stand 6 feet and 90 to 135 degrees from the patient.
- H) Film holding devices, particularly the Rinn equipment, is used to avoid the patient holding it with a finger
- I) Proper processing procedures to obtain quality radiographs

8) RADIATION MONITORING

- A) Monitoring of all personnel who are involved in radiographic procedures is available. Badges are to be worn during working hours. Those who do not wish to have a badge are to sign a waiver form.
- B) Badges are to be worn during working hours on your body between the collar and the waist while exposure is expected to be at its highest. The Badges are not to be taken home.
- C) Dosimetry reports are gathered monthly and filed in the radiology department and are open for inspection.
- D) Maximum radiation doses allowed are not to exceed those recommended by the NCRP, and preferably much lower.

9) PATIENT RECORDS

- A) Radiographic Permission (blue form)
 - a. All radiographic examinations are authorized by Boston University faculty who are dentists. These prescriptions are dated and made after a complete review of the medical and dental history and a clinical exam.
 - b. The amount of radiation to which the patient is exposed is recorded. This includes the type of film, the PID (round or rectangular), the number of films, the exposure time, the kVp, and the mA.
 - c. An initial interpretation of the radiographs is noted.
- B) Treatment Record
 - a. The clinician records the date of exposure, the type and number of films taken, any retakes which are exposed and the reason, and any difficulties which occurred during this procedure
 - b. Signatures by both the student and the faculty are documented.
- C) Oral Diagnosis / Oral Medicine / and Radiology Screening Form
 - a. A more complete interpretation of the radiographic exam is documented.
- D) Radiographs
 - a. All radiographs are mounted and labeled with the patient's name and date.
 - b. The right and left side is noted on panoramic, other extra-oral films, and on duplicates.
 - c. The films are stored in the chart in the pocket marked "radiographs."
 - d. Patients who request their films are provided with a duplicate. Original radiographs remain with the patient's chart.

10) PHYSICAL FACILITIES AND EQUIPMENT

- A) Boston University School of Dental Medicine is in full compliance with state and federal laws pertaining to radiation safety including NCRP.
- B) All operatories with x-ray equipment have adequate barriers for the operator. This may include lead lining of the walls and doors or a portable lead barrier in areas where the doors do not close or are not present. All have a transparent panel to permit a safe view of the patient during exposure.
- C) The x-ray beam is collimated to not more than 2.75 inches when striking the face. When circular collimators are used for intra-oral films, the beam diameter at the patient's face is restricted to 2.75 inches. Rectangular collimators limit the beam to 2.0 inches at the face on the long side.
- D) Shielded open-end cylinders are used with paralleling technique.
- E) The target-to-skin distance for intra-oral radiography is not less than 8 inches. When practical, a long position-indicating device of 12 inches or over is used.
- F) X-ray machines contain a minimum total filtration consistent with Federal and State regulations; 1.5 mm of aluminum to 70 kVp and 2.5 mm aluminum for equipment operating above 70 kVp.
- G) Exposure control switches are the deadman type and is positioned behind the barrier. All radiation emission terminates after the preset time of exposure. When possible, the x-ray unit has both an audible and a visual indicator to signal exposure termination.
- H) All machines shall have appropriate exposure parameters posted near the control panel.
- I) Radiographic viewing is accomplished with equipment such as dim background lighting where possible, masked viewboxes, opaque mounts, and magnifying glass.
- J) Information regarding each x-ray unit and processor, its installation date, and all repairs re maintained by the Repair Department. Calibration reports are kept in the Radiology Department.

11) LEAD APRONS

- A) Lead aprons are hung upon hooks and are discarded after a maximum of five years of use. The date when the apron is first put into circulation is marked on the lower corner--- '2 7.
- B) Lead aprons are hung up between use in each operatory with an x-ray machine. They are not folded.

12) QUALITY ASSURANCE

Records are maintained and filed in the Radiology Department with the following information:

- A) periodic calibrations of x-ray tube output.
- B) dates and actions to correct any fluctuations of the x-ray equipment output.
- C) exposure at the end of the PID tests.
- D) a description of the room housing the x-ray unit.
- E) results of safety surveys
- F) Massachusetts Department of Public Health inspection certifications.

Strict quality assurance is followed for the processors and dark room
The following processor maintenance should be followed:

- A) Daily:
 - a. Clean developer and fixer rollers
 - b. Change Chemistry
 - c. Turn processor on and check water temperature
 - d. Run roller transport cleanup films
 - e. When processors are ready, perform step-wedge test.

- B) Weekly:
 - a. Clean the wash rollers.

- C) Monthly:
 - a. Perform Penny test to check for darkroom light leakage

13) INFECTION CONTROL AND SAFETY

- A) Proper infection control protocol should be followed during radiographic procedures. All patients are treated as potentially infectious.
- B) Proper personal protection equipment is worn including gloves, masks, and lab coats.
- C) Proper hand washing procedures are adhered to before and after patient contact.
- D) All equipment is sterilized between patients.
- E) The operatory is appropriately covered with headrest covers, tubehead covers, and tape.