

LOUISIANA STATE UNIVERSITY

SCHOOL OF DENTISTRY

INSTITUTIONAL POLICY FOR THE DIAGNOSTIC
USE OF IONIZING RADIATION

2023

SECTION I
INTRODUCTION

The purpose of the following guidelines is to standardize the institutional use of ionizing radiation for diagnostic procedures. Strict adherence will result in the least possible patient risk and provide maximum diagnostic yield. It is understood that clinical experience and necessity may take precedence on occasion.

The major benefit achieved from the use of high-yield criteria is a reduction in the number of unproductive x-ray examinations, and thereby a reduction in patient radiation exposure and dental costs. The use of high-yield criteria implies a decrease in the number of dental x-ray examinations which may result in an increased possibility of missing positive x-ray image findings. If dental images are not made at the appropriate stage, there may be resultant irreversible damage to the oral tissues (teeth, alveolar bone, etc.), a compromised treatment, increased risk of failed dental treatment, and more costly dental care. Therefore, the dentist must consider or weigh the "radiation risk" against the "diagnostic value" in ordering images after completing a thorough clinical and historical (medical and dental history) examination. The x-ray image offers the only means of adequately inspecting the hidden structures of the oral cavity, namely the roots and internal structures of the teeth, proximal surfaces of the teeth, surrounding alveolar bone, bone of the jaws and associated structures, maxillary sinuses, orbits, and the temporomandibular joint (TMJ).

Although high-yield criteria are appropriate for selecting x-ray projections in symptomatic patients and are potentially useful in reducing overutilization of dental x-rays, the importance of early detection of asymptomatic or "silent" disease conditions raises the potential question of underutilization or "diagnostic risk." In these circumstances, an x-ray study may be the only means of detecting a potentially destructive or lethal condition in time for effective treatment. An appropriate general "baseline" x-ray examination is desirable as a part of the proper care of all new patients who are accepted for comprehensive dental treatment at Louisiana State University School of Dentistry.

This document is prepared in compliance with National Council on Radiation Protection, NCRP Report No.177 "Radiation Protection in Dentistry and Oral and Maxillofacial Imaging" (2019), NCRP Report No. 187 "Operational Radiation Safety Program" (2022), American Dental Association and the U.S Food and Drug Administration: Dental radiographic Examinations: Recommendations for Patient Selection and Limiting Radiation Exposure, 2012. NCRP report No.160, Recommendations of the National Council on Radiation Protection and Measurements 2008. "Accreditation Standards for Dental Education Programs, Commission on Dental Accreditation, 2022 the "Federal Radiation Control for Health and Safety Act of 1969," the "Consumer-Patient Radiation Health and Safety Act of 1981," and the "Radiation-Use Guidelines for Dental Education Facilities of 1989 (adopted by the AADS House of Delegates)." These guidelines have been written in consultation with all Clinical Departments of the Louisiana State University School of Dentistry.

SECTION II

ADMINISTRATION OF CLINICAL RADIATION SAFETY

Radiation safety at the Louisiana State University School of Dentistry is administered by the following:

1. Emergency and Radiological Services Division (State of Louisiana, Dept. of Environmental Quality (DEQ) P.O. Box 4312, Baton Rouge, LA 70821-4312
2. LSU Health Sciences Center - Radiation Safety Office, Office of Environmental Health and Safety (Stanislaus Hall, Room 216, 450A South Claiborne Ave., New Orleans, LA 70112). Tel: 504-588-6585; 568-4952 or 314-5989. This office is the location of University Radiation Safety Officer.
3. LSUSD Radiation Safety Committee. This committee comprises of the full-time radiology faculty of the dental school and members of clinical departments where x-radiation is used on a regular basis. The main objective of this committee is to ensure that the dental school is in compliance with the NCRP Report 177 Radiation Protection in Dentistry and Oral and Maxillofacial Imaging (2019); Federal Radiation Control for Health and Safety Act of 1969, the Consumer-Patient Radiation Health and Safety Act of 1981, state rules and regulations, and dental practice acts.
4. Clinical staff of the Radiology Clinic. This includes the x-ray technologists and auxiliaries of the Radiology Clinic who are assigned the responsibility of daily maintenance and operation of x-ray machines and processing equipment.

The above-mentioned Offices and Committees will be responsible for the following:

1. Surveys of radiation levels in controlled and non-controlled areas.
2. Performance levels of x-ray units regarding Federal, State and University regulatory codes.
3. Monitoring of Radiation Safety, Quality Assurance, and Infection Control in the Radiology Clinic and the various satellite clinics.
4. Modifications or location changes of existing equipment and planned installation and location of new equipment.
5. Investigating reported incidents of misuse of equipment.
6. Investigation of suspected incidents concerning health hazards related to x-ray equipment usage.

7. Maintenance of records for each x-ray unit regarding inspections, work loads and equipment supervision.
8. Recommendations to the dental school administration and faculty regarding radiation safety and quality assurance.

SECTION III

FACILITIES AND EQUIPMENT

1. Shielded cubicles should be equipped with a transparent leaded panel or equivalent to permit a safe view of the patient during exposure.
2. All patients will be x-radiated with the use of leaded aprons.
3. The LSUHSC Radiation Safety Officer is to be informed of any proposed purchase and/or installation of x-ray equipment to be assured of the following:
 - a) The inherent or added shielding of the cubicle is adequate for the safety of the operator and adjacent non-controlled areas.
 - b) The mA and kVp meters and radiation termination light are in a position to be easily viewed during exposure.
 - c) The cubicle is of sufficient dimensions so that the tube head can be easily positioned for all exposures.
 - d) Proposed x-ray areas are considered in terms of occupancy factors of adjacent areas, structural attenuation and anticipated workload.
4. All dental x-ray equipment employed during patient care shall comply with the following provisions:
 - a) The tube head gantry shall keep the tube head stationary in the exposure position. This may not be possible with the Nomad if a tripod stand is not available.
 - b) The diameter of the useful beam at the exit of the circular position indicating device, as used for intraoral x-ray imaging, shall be no greater than 2.75 inches. If rectangular collimation is used, the longer side of the rectangular beam should be limited to 2.0 inches at the face or to the size of the digital sensor. Only open-end position indicating devices will be used.
 - c) The position indicating device must be of sufficient length to provide a target-to-skin distance of no less than 8.0 inches. Whenever practical, a long position indicating device will be used (12.0 inches and above) to minimize the volume of tissue exposed and maximize image quality.
 - d) The total filtration of the beam must be not less than 2.5 mm aluminum equivalence at or above 70 kVp nor less than 1.5 mm aluminum equivalence below 70 kVp.
 - e) The exposure control switch shall be a dead-man type. All radiation emission should terminate after the present time of exposure.
 - f) When possible, the x-ray unit shall have both an audible and visual indicator to signal exposure termination.

- g) Newly installed x-ray units shall be registered with the Department of Environmental Quality, Office of Environmental Compliance, Licensing & Registrations Section (Post Office Box 4312, Baton Rouge, Louisiana 70821-4312). Calibration of exposure levels must be regulated at the time of installation or shortly thereafter. The unit must not be used to make x-ray images on patients until it has been satisfactorily calibrated.
5. The LSUHSC Radiation Safety Officer will inspect all x-ray units at the time of installation, change of location, modification, or tube replacement. The scope of these inspections shall include, but not be limited to:
 - a) An area survey of radiation levels in controlled areas and adjacent non-controlled areas.
 - b) The half value layer of the useful beam for the average kVp employed.
 - c) Timer accuracy.
 - d) Output reproducibility.
 - e) Exposure at the end of the position indicating device.
 6. Notification of any dental x-ray unit malfunction shall be made to the chairman of the LSUSD Radiation Safety Committee or to any full-time radiology faculty member as soon as possible.
 7. Periodic inspections not further apart than once per year (in accordance with American Dental Trade Association recommendations) shall be made by the University Radiation Safety Officer. Any non-compliance with state statutes will be noted and necessary changes made as directed.
 8. The settings for exposures shall be posted at the controls for each x-ray unit under the control of the School of Dentistry, including those housed at satellite facilities within the dental school. Information posted should include kVp, mA, and exposure time.

SECTION IV

POLICIES AND PROCEDURES

These provisions are included to insure the safe and legal use of ionizing radiation for diagnostic purposes.

1. Operator qualifications and authorization. Only those categories defined in this section shall be considered authorized to operate dental x-ray equipment.
 - a) Students:

The operation of x-ray equipment by dental and dental hygiene students (under supervision) is authorized provided:

 - (i) The operator shall be in the process of completion or have completed didactic courses including radiation safety and protection (DENT 1105),

and pre-clinical laboratory training to demonstrate competence on mannequins before exposing patients (DENT 3113). An individual can be stopped from taking dental x-rays if competency has not been obtained.

- (ii) All exposures must be authorized by a member of the clinical faculty of the Dental School. Students will not perform any retakes unless approved by a clinical instructor.
- (iii) A faculty member or radiology-certified staff must be present to provide the necessary supervision.

b) Staff:

The operation of x-ray equipment by members of the dental school staff is authorized provided:

- (i) The x-ray operator shall be a certified dental assistant, registered dental hygienist, or registered radiology technologist.
- (ii) The x-ray exposure shall be authorized by a member of the clinical faculty of the Dental School.
- (iii) A member of the Dental School clinical faculty shall be available for consultation.

c) Faculty:

All members of the Dental School faculty and post-doctoral students possessing a dental or dental hygiene degree are authorized to operate x-ray equipment.

d) Continuing Education Students:

- (i) Courses which require the use of x-ray equipment by students lacking certification or degree must be supervised by a member of the clinical faculty of the Dental School.

2. Patient X-ray Records

- a) X-ray examinations made outside the Radiology Clinic are to be supervised by a clinical faculty member of the department concerned. The supervising faculty member is responsible for dental image quality in each department.
- b) For those patients who wish to discontinue treatment, x-ray images will be released to attending dentists, physicians, or insurance companies upon written request from the appropriate individuals.

3. Selection Criteria

- a) No x-ray image will be taken unless authorized by a dentist faculty member following detailed dental and medical history taking and clinical examination.
- b) Where relevant and available, prior x-ray images will be obtained and evaluated before new x-ray images are made.

- c) No x-ray image will be taken on a routine basis nor by a time lapsed basis. This includes bitewings and postoperative views which may be authorized only when judged necessary for diagnosis.
- d) Individuals (including students) will not be exposed to ionizing radiation for teaching or training purposes. There must be a diagnostic or treatment indication as designated by a clinical faculty member.
- e) No x-ray images will be made solely for administrative purposes. Patients will not be exposed to radiation following treatment procedures solely to document procedure completion.
- f) Patients will not be subjected to image retakes solely for students to demonstrate technical proficiency.
- g) Only x-ray images necessary for essential immediate treatment will be taken on pregnant patients, especially in the first trimester.
- h) Judicious clinical protocol dictates the absolute minimization of x-ray images for the child patient. X-ray images are not to be taken arbitrarily nor should an x-ray image be taken on a child if the clinician has strong suspicions that, because of movement of the child, the likelihood of success is poor.
- i) X-ray image procedures chosen will be predicated upon the basis of maximizing diagnostic yield while minimizing patient exposure to ionizing radiation. If in doubt, consult with a Radiology clinic faculty member.

4. Frequency of imaging studies.

a) New Patient:

- (i) Child with primary dentition: Selected periapical/occlusal radiographs and/or posterior bitewings if interproximal contacts cannot be visualized/probed.
- (ii) Child with transitional dentition: Panoramic radiographs with posterior bitewings or posterior bitewings and selected periapical radiographs.
- (iii) Adolescent and Adult, dentate or partially edentulous: In the presences of generalized oral disease or extensive dental treatment, a full mouth series is the preferred over selected periapical and posterior bitewings or a panoramic radiograph and posterior bitewings.

b) Recall patient with increased caries risk:

- (i) Child through adolescent: Exam intervals of 6-12 months with posterior bitewings if proximal surfaces cannot be probed/visualized.
- ii) Adult: Posterior bitewings at 6-18 month intervals.

c) Recall patient without increased caries risk.

- (i) Child with primary or transitional dentition: Posterior bitewings at 12-24 months if proximal surfaces cannot be probed/visualized.
- (ii) Adolescent: Posterior bitewings at 18-36 months.
- (iii). Adult: Posterior bitewings at 24-36 months.

5. Retake of Radiographs.

Students will be restricted in the number of retakes for any projection, and then only if diagnostically necessary and authorized by a faculty member. All retakes made by

students must be directly supervised by an appropriate faculty or staff member. Additional retakes may only be made by faculty or staff.

6. Radiation Protection

- a) No person other than the patient shall be in the x-ray cubicle during the radiation exposure period. If assistance is required for children or handicapped patients, non-occupationally exposed persons (preferably a member of the patient's family) will be asked to assist. No individual who is potentially occupationally exposed to radiation will be permitted to hold patients or x-ray sensors in place during exposure. For the use of the Nomad, special guidelines have been developed and should be followed.
- b) Patients will be draped in protective aprons. Each operatory will be provided with an appropriate hanger for the protective apron. Thyroid shielding shall be provided when it will not interfere with image acquisition.
- c) When a mobile x-ray unit is used for research purposes, and shielded barriers are not available, the operator must wear a leaded apron, stand at least six feet from the experimental animal and stand at right angles to the central beam.

7. Occupational Exposure Monitoring

- a) Monitoring of all personnel, including clinical faculty who are involved in x-ray procedures and are likely to receive an effective dose >1 mSv/year, should be carried out using radiation badge services. Reports will be open to scrutiny by the personnel concerned. Such records will be kept on file on a permanent basis. If any radiation badge records a dose in excess of that recommended by the NCRP, the individual involved will be informed about the dose and an investigation will be undertaken to determine the cause.
- b) Maximum radiation doses allowed for personnel will not exceed those recommended by the NCRP, and preferably will be much lower.
- c) Radiation badges are not to be worn during such times that the wearer is subjected to diagnostic exposures as a patient.
- d) Tampering with or use of radiation badges for any purposes other than those intended will not be condoned.

8. Declaration of Pregnancy for Dental and Hygiene Students

- a) A pregnant student needs to formally declare pregnancy to the Associate Dean of Academic Affairs.
- b) Once the pregnancy is formally declared, the student can participate in a program that offers a lower gestational dose limit of 5 mSv to the embryo-fetus.
- c) Participation in the program is always voluntary (NCR 1999; DOE 2011a).
- d) If participation is elected, the student will be issued a dosimeter to be worn under the abdominal protect garment.

SECTION V

QUALITY ASSURANCE

Dental x-ray image quality assurance (Q.A.) is based upon the principle that patient exposure can be kept to a minimum when all components of an x-ray system are operating at or above defined standards. There are simple and relatively inexpensive testing procedures which can be routinely instituted to identify problems with x-ray equipment. These tests and subsequent corrections can be made without subjecting a patient to unnecessary retakes of non-diagnostic x-ray images.

QUALITY ASSURANCE = QUALITY CONTROL + QUALITY ADMINISTRATION

The testing procedures, correction of deficiencies, and preventive maintenance procedures are the components of the quality control aspect of Q.A. Quality administration is the recording, copying, and documentation of all the quality control procedures. The administration of this school-wide program is the responsibility of the LSUHSC Radiation Safety Officer.

SECTION VI

INFECTION CONTROL POLICIES

1. All patients should be treated as potentially infectious. Since potentially infectious patients may have no evidence of a problem, the patient's medical history should be evaluated for indications of infectious disease.
2. PPE (gloves, mask, gown, goggles, or face shield) must be donned correctly before entering the cubicle area and remain in place for the duration of work.
3. Supplies should be dispensed rather than stored in a drawer where they could become contaminated.
4. Digital sensors must be covered with disposable plastic non-permeable wraps.
5. Sensor holders should be sterilized by an appropriate, verifiable method. Otherwise, disposable items should be used.
6. The control panel, chair adjustments, tubehead, and positioning indicating device (cone) should be covered with disposable plastic or wiped down with Clorox hydrogen peroxide wipes or an equivalent disinfectant.
7. A disposable piece of plastic should cover the exposure control switch.
8. PPE must be removed after x-raying the patient and all refuse should be disposed of in accordance with current applicable regulatory guidelines.

LSUSD protocol for use of NOMAD: a Hand-Held X-ray Unit

Introduction

FDA 510(k) approval for the NOMAD hand-held x-ray unit demonstrated substantial equivalence to a portable intraoral x-ray system designed for field use. However, it is not equivalent to a fixed dental x-ray unit. Because of yet unknown risks associated with repeated low doses of radiation to the operator, patients scheduled for routine intraoral radiographs at the dental school will continue to be imaged using fixed wall-mounted/mobile x-ray machines because of lower exposure dosage to the operator resulting from remote activation, higher operating potential and better diagnostic images from the stabilization of the x-ray tube-head. Consequently, the Nomad should not be used as a substitute for a fixed, mounted/ mobile dental x-ray unit in permanent facilities. Within the purview of the dental school, there will be limited scenarios in which the use of a handheld x-ray unit such as the “Nomad” will be permitted. This will be limited to preclinical teaching laboratory procedures, postgraduate surgical procedures, operating rooms, any medically compromised patient where fixed/mobile x-ray units are impractical, and in instances approved by faculty. In addition, the NOMAD may be utilized in off-campus (mobile) dental clinics, humanitarian missions, forensic studies, etc. where fixed/mobile x-ray units are impractical or unavailable.

NOMAD Utilization

Hand-held x-ray units (Nomad) will not be used in the Radiology clinic as a substitute for a fixed dental x-ray tube-head. In other departments, students using the NOMAD will be under the direct supervision of the faculty from those disciplines. Standard radiation protection procedures must be followed; the only exception being that the operator of the NOMAD physically being in the operatory with the patient during the x-ray procedure. Standard sensor holding devices should be used with the hand-held x-ray unit. All handheld units must be obtained and returned to dispensary personnel upon completion of the x-ray procedures. Only in situations such as research studies, where one operator may be taking extreme numbers of images, will a radiation monitoring device and protective apron be required.

LSUSD Protocol on the Use of Cone Beam Computed Tomography

Use of CBCT

LSU School of Dentistry embraces the introduction of cone beam computed tomography (CBCT) as a major advancement in the imaging armamentarium available to the dental profession. The practitioner should apply imaging procedures based on considerations of patient radiography selection criteria, dose optimization, technical proficiency, and assessed diagnostic or treatment needs. The following guidelines have been formulated to assist LSUSD faculty and staff in providing appropriate CBCT radiologic care. Exposure protocols take into account patient body size, field limitation to the region of interest, and use of personal protective devices such as a lead torso apron.

Who should make CBCT scans?

CBCT imaging involves exposure of the patient to ionizing radiation. Imaging should be performed only by CBCT trained radiology faculty or similarly trained certified radiologic technicians.

When should CBCT scan be ordered?

CBCT examinations should be performed only for valid diagnostic or treatment reasons and with minimum exposure necessary for adequate image quality. The decision to order a CBCT scan must be based on the patient's history and clinical examination and justified on an individual basis by demonstrating that the benefits to the patient outweigh the potential risks of exposure to x-rays. CBCT should only be used when the question for which imaging is required cannot be answered adequately by lower dose conventional dental radiography.

Responsibilities of clinicians who order CBCT scans

Clinicians who operate a CBCT unit or request CBCT imaging 1) should have a thorough understanding of the indications for CBCT as well as a familiarity with the basic physical principles and limitations of the technology; 2) should be familiar with alternative and complementary imaging and diagnostic procedures and be capable of correlating the results of these with CBCT findings; and 3) must have a thorough understanding of the operational parameters and the effects of these parameters on image quality and radiation safety.

Large field cone beam CBCT scans for school patients will be reviewed and recorded into axiUm by a radiologist.

Postgraduate residents using a "limited field" CBCT should review and report on the scan just as they would for any other conventional radiographic image. No consult required. In general, if a resident finds an anomaly in the quadrant scanned, the resident should request an evaluation/consultation by a radiologist. The radiologist will review the scan and report the findings into axiUm.