Radiology Information
Radiation Safety

The advantages of x-rays in dentistry are unquestioned. However, there are biological risks associated with exposure to ionizing radiation, even though no harmful effects are known to follow very low level exposures. Individuals are routinely exposed to low but definite levels of radiation by the radioactivity in natural and cosmic sources. Overexposure to diagnostic x-rays may not produce obvious physiologic change at the time of exposure, and may lead to an incorrect assumption that such exposure can be continued over an indefinite period of time without harm. Since radiation cannot be seen or felt and generally does not affect any of the senses, it is essential to practice the ALARA principle: keep radiation doses As Low As Reasonably Achievable to avoid unnecessary radiation exposure. The x-radiation policies outlined in this manual are designed to support this objective.

It is the policy at the OUCOD that only a licensed dentist may prescribe a radiographic examination after a careful review of the patient’s medical and dental records and a clinical examination. The use of radiographic images must be based on the needs of the patient and are not to be done for administrative purposes (i.e., third party or reasons other than diagnosis and treatment planning). Attention must be directed to the judicious use of ionizing radiation for diagnosis, treatment planning, and preventive services to reduce or minimize unnecessary primary radiation exposure of patients and to minimize secondary / scatter radiation exposure to faculty, students, and operating personnel.
Guidelines For Radiology Practice

1. All x-ray examinations and "retakes" must be ordered by authorized licensed dental faculty member or licensed postgraduate students. X-ray equipment must not be operated unless authorized by a licensed dental faculty member or licensed postgraduate student.

2. Restricted areas have been established where the x-ray equipment is located. No one is allowed in the treatment room with the patient during x-ray examination exposure.

3. The technique chart is located next to controls of each unit and provides parameters for each routine examination exposure (bitewing, anterior periapical and posterior periapical images)

4. During each exposure, operators should stand (select one of the following):
   a. at least 6 feet from the useful beam.
   - OR -
   b. behind the protective door or outside of the room and use the window to watch the patient during the x-ray examination exposure. The operator must be able to continuously see, hear and communicate with the patient.
   - OR -
   c. for hand-held dental x-ray machines, the operator shall maintain the shielding provided by manufacturer and operate according to the manufacturer instructions. Besides the operator and the patient, others shall stand at least 6 feet from the useful beam.

5. Approved film receptors and holders must be used for all examinations to eliminate the need for patients to hold films with their hands.

6. Neither patients nor image receptor (film or digital sensor or plate) should be held during exposures by the operator. The decision to hold a patient or the image receptor will always be made by a licensed dental faculty member or postgraduate student. If an operator is ever instructed to hold a patient or image receptor, a lead apron should be worn, forceps for holding film used, and the operator should stand well away from the useful beam. Also, if an operator is ever instructed to hold a patient or film, the operator should not be pregnant. For more information about working with dental x-ray
machines during pregnancy contact the Radiation Safety Office at 405-271-6121.

7. The tube housing or the support housing must not be held during any exposure. The tube housing must not drift or move during any exposure. If a problem with stability of the suspension arm develops, the Director of Radiology or radiology staff should be notified immediately so the unit can be serviced. The X-ray equipment should not be used until corrective measures are applied.

8. Personnel-monitoring devices to monitor radiation workers using dental machines are not required by the State of Oklahoma. However, the radiology technologists / staff and faculty who work full time or part time in radiology clinic / who take radiographic images are to wear monitoring devices. Workers are not allowed to receive exposures that exceed 5 rems (5,000 mrem or 0.05 sievert) so it is essential that radiation safety procedures be followed. Any questions can be addressed to the Director of Radiology or the radiation safety office of the University of Oklahoma.

9. The OUCOD maintains a current X-ray Registration with the State Health Department, OK. All x-ray machines are surveyed and evaluated annually by a licensed medical physicist.

10. The x-ray machines are equipped with devices to limit the radiation exposure to patients and employees. These devices include filters that reduce unnecessary low-energy radiation from the primary beam and collimators which restrict the size of the x-ray beam.

11. All intraoral dental exposures taken with film-holding beam-alignment devices shall routinely use round or rectangular dental beam collimator. Removal, tampering with or otherwise defeating these devices, or in any way causing needless radiation exposure is prohibited.

12. Conventional film, phosphor plates and sensors will be used.

13. Film Processing guidelines:
   
a. Correct processing technique, operating temperatures and settings should be followed to eliminate the number of re-takes ordered because of faulty film processors.

b. Basic Procedures:
   
   1. Unexposed film is stored in the main dispensing areas in various clinics and will be issued by the clinic staff upon request.
2. Films are to be processed according to the specifications supplied by the manufacturer.

3. Expiration dates on the film and the chemicals used in the processor should always be checked. Films or chemicals must not be used after the expiration date.

4. Chemicals will be replaced by the staff according to the manufacturer's recommended interval, which is every 2-3 weeks (dependent on use).

5. A log book of chemical replacement must be maintained with the date and initials of the person changing/servicing the chemical processor.

6. A temperature log should be maintained daily for automatic processors, with temperature, date, time and initials.

7. Lighting in the film processing/loading area should be in accordance with the manufacturer's recommendations, including filter type and bulb wattage.

8. Light leaks found around the doors, ceilings, or other openings in the darkroom should be reported to the Director of Radiology or radiology staff.

c. Manual Processing

The developing time shall be determined by the temperature. After checking the room temperature, follow the manufacturer's instructions for processing. The temperature should be rechecked frequently during the processing day.

d. Automatic Processing

1. Temperature should be checked at the beginning of the day, and films should not be processed unless developer temperature is at 80 to 86 degrees Fahrenheit. Temperature should be rechecked as necessary.

2. Clean-up or blank films are to be run daily or more often as specified by the manufacturer.

3. The processor should be maintained according to the instructions in the manufacturer's operating manual.
4. Record all chemical changes and adjustments in the quality assurance log book. Sign your initials and record the date.
Lead Apron and Thyroid Shield

All protective lead aprons used contain 0.25 millimeter or more lead equivalence. A non-lead apron may be used instead of a lead apron if the non-lead apron provides protection from x-rays that is equivalent to that of a lead apron. The protective apron must be used on all adults and all children. The apron is stored in the area of the X-ray unit, and should be checked for holes, cracks, or tears. If a defect is found, the Director of Radiology or the radiology staff should be notified.

A thyroid shield is to be used on all patients unless it interferes with the examination.

Radiation Equipment Inventory: An annual inventory list of all radiation machines is maintained by the Director of Radiology. Changes to the inventory (additions and/or deletions) should be reported to Director of Radiology to allow for permitting requirements, “calibration” and other appropriate radiation safety measures are in place.
Extraoral Imaging

1. The patient should be properly positioned and the beam centered for cephalometric, panoramic and tomographic (CBCT) machines following instructions per manufacturer specifications.

2. If the film/plate/sensor appears misaligned, it should be reported to the Director of Clinical Services or the Radiation Safety Officer. The machine should not be used.

3. With cephalometric and tomographic machines, the x-ray beam should be adjusted to the size and area specified by the doctor.
Portable and Hand-Held X-Ray Machines

Portable x-ray equipment is defined as an x-ray machine mounted on a permanent base with wheels and/or casters for moving while completely assembled or is equipment designed to be hand-held and carried.

Below are additional requirements for portable and hand-held machines (in addition to the requirements for wall mounted x-ray units):

1. Before using in a new location (e.g. building and room), approval from the Director of Radiology will be obtained for specific location(s), procedures and estimated frequencies to ensure compliance with x-ray permits. Device must be calibrated before use by a Licensed Medical Physicist.

2. During the exposure the operator:
   a. Must be positioned so that his/her exposure is as low as reasonable achievable (ALARA)
   b. Should never be in line with the direct/primary x-ray beam.

3. Bystanders (other than the patient and the operator) should be at least 6 feet away from the x-ray machine when energized or have suitable shielding utilized.

4. The tube housing should not be held during an exposure. Hand-carried device can only be held / used as instructed by the manufacturer (held by the handle only).
Radiation Safety Guidance for Hand-Held Dental X-Ray Machine Use (NOMAD)

In some instances a hand-held dental x-ray machine is warranted over the traditional wall mounted units. Below is a summary of guidelines to follow for these hand-held devices:

1. For best image, hold the unit at the proper angle and as close to the target as possible.

2. Always use both hands to hold the unit to ensure steady support during the procedure.

3. The unit shield must always be in place.

4. The medical physicists at OUCOD recommend use of lead apron for the patient and the operator during the procedure.

5. All the patient must wear the lead apron & the thyroid collar during this procedure.

6. Make sure that the patient will hold still during the procedure.

7. Keep all others at least 6 feet away from the primary source of radiation.

8. The NOMAD can only be used in areas in approved locations. For example, general waiting areas are not approved locations. To prevent the spread of infections, a plastic bag can be placed over the machine during use. Persons using the Nomad machine will be responsible for controlling the immediate area in which the device is used. When the Nomad machine is used all unnecessary persons will leave the area while the machine is used and any necessary persons, other than the machine operator, will remain greater than 6 feet from the device and immediately behind the operator to ensure they are in a shielded area.
Rules For The Radiology Clinic

1. Basic rules of radiation safety and protection must always be used as guidelines.

2. Gloves should not be worn from any other clinics (including OD) into Radiology. Hair should be secured back if needed. This applies to males and females.

3. Patients may not be brought in the Radiology department without permission from the radiology staff and faculty. This includes patients from all departments. All the patients should be seated in the waiting room while radiographic images are being processed and evaluated. This includes PEDO patients. Patients may not be dismissed until all images have been evaluated and approved, including the retakes.

   A. If twelve or more radiographic images are to be taken, a Full Mouth Radiograph evaluation sheet must be filled out. ALL RADIOGRAPHIC IMAGES WILL BE EVALUATED BY THE RADIOLOGY DEPARTMENT BEFORE YOU LEAVE. RADIOGRAPHIC IMAGES WILL BE EVALUATED UNTIL YOU GRADUATE.

   B. Review of the patient’s chart and previous radiographic images is necessary before any further images can be taken. Images CANNOT be taken without a signature from a faculty member. An appointment is necessary for twelve or more radiographic images to be taken. FMX appointment times are as follows: 9:00 a.m., 10:30 a.m., 1:00 p.m., and 2:30 p.m. Each appointment is for one and one-half hours (1-1/2). If you are more than 10 minutes late for your appointment, your chair can be given to another student. Appointments are made with the Radiology staff at 1-5687 or in person in the Radiology department.

   C. A log-in sheet is kept for all radiographic images taken in the department. Please be sure to sign-in. This log enables us to keep a record of patient flow and work loads.

   D. Students should clean the x-ray room after evaluation and completion of the required images including the retakes.

   E. Please read the set up procedures in the INFECTION CONTROL POLICY MANUAL for Radiology. It is important that these
procedures are followed for the safety of patients and students that follow you. Our clinic hours are from 9:00 a.m. until noon and 1:00 p.m. until 4:00 p.m. Any activity occurring outside of these hours must be approved by Dr. Masood.
Radiographic equipment and material

- Radiographic exposures can be made only in appropriate areas within the College of Dentistry and the direct beam must not irradiate any person other than the patient being image.

- The basis for receptor (image) selection should be the maximum sensitivity. At the University of Oklahoma College of Dentistry the following image receptors are provided: intraoral radiography: Kodak Insight or F-Speed film. digital sensors and for extraoral radiography the digital sensors or Rare Earth screen film combination.

- Always be sure that all controls on x-ray generators are properly set before proceeding to make an exposure on the patient.

- Never proceed with an x-ray exposure of a patient unless you are confident that it will produce technically and diagnostically acceptable radiographic images.

- Always monitor all indicators on the x-ray generator continuously throughout the exposures, being prepared to stop the procedure instantly should it not be proceeding as planned.

Patient management and Protection

- Check for the availability of recent radiographic images taken at another facility or by another dentist.

- Use professional judgment and selection criteria to determine the frequency and extent of each radiographic examination.

- Every exposure must be accounted for by a clear entry in the patient’s record and must be signed by a member of the teaching faculty.

- Use appropriate leaded protective apron and thyroid shield on patients during radiographic exposures.

Operator’s protection

- Never hold a receptor (image) in position for patients during any x-ray exposure.

- Always keep out of direction of the primary beam while making x-ray exposures, and always stay behind a protective barrier.
Viewing the Radiographic images

- Radiographic images should be viewed under the proper lighting conditions to obtain maximum available information. Illuminated view boxes are utilized for viewing conventional images. All regions around the image should be masked to prevent glare, with minimal extraneous room light to avoid excessive reflections.

Student responsibilities in radiology clinic

- Treat patients in a humane manner.
- Follow radiation protection procedures for patient and operator.
- Follow infection control rules.
- Record number of all exposed films in the patient’s chart.
- Properly mount, label and date all radiographic images.
- Complete all records in a legally acceptable manner.
- Treat all radiographic images in such a manner as to maintain them at an archival level of quality.
Operational Check List

Before seating the patient:

- Review the health history and determine the number and type of radiographic images to be made. Store the chart in the radiology viewing room. "NOT OUTSIDE THE OPERATORY".
- Check for appropriate faculty signature.
- Obtain a room assignment from a Radiology Tech.
- Check tubehead stability.
- Check out the operation of the chair adjustments.
- Obtain instruments and materials in advance.

Room set up / preparation:

- Place head rest cover.
- Tape over gloves to the outside bottom shelf.
- Tape the red biohazard bag to the wall, next to the door, inside the assigned room.
- Place blue napkin on the bottom shelf.
- Place the white napkin on top shelf.
- Place a paper cup on bottom shelf.
- Set the image holding devices (XCP or stabes) and place on bottom shelf.
- Lay out images (white side up) on top shelf.
- Get gloves. Mask and protective eye wear.
- Seat the patient, adjust the headrest, and place the apron and thyroid collar.
- Obtain permission to proceed (PTP) from a Radiation Tech.
- Determine and set the exposure factors with staff.
- Explain proceedings to the patient.

While making exposures:

- **Always wear gloves, mask and protective eye wear.**
- Keep clean materials on the top shelf and used materials on the shelf below.
- Dry exposed film packets with paper napkin and store them in a paper cup.
- Observe the patient through the viewing window during each exposure.

When you have completed the initial radiographic exposures:

- Return the tubehead to its storage position.
- Put on the overgloves and remove the apron and thyroid collar. Please do not contaminate the lead shields.
• Ask the patient to wait in the reception area while the films are processed and evaluated.
• Carry the films to the darkroom in a paper cup, place a paper towel on counter, remove over-gloves and open film packets, let the films fall onto the clean paper towel, already on the counter. Removed contaminated gloves and wash and dry hands before feeding the images into the automated processor.

Dark Room Procedures:

• Use over gloved hand to operate darkroom door.
• Cup with Exposed films should be in the other hand.
• Once inside the darkroom, discard the over-glove.
• Place paper towel on top of blue towel.
• Open each film packet and let film drop onto the blue towel.
• Lead foil should be placed in a container used for disposing the lead foils.
• Remove gloves, then wash and dry hands.
• Feed films slowly into the processor slowly.
• Discard trash into biohazard containers.
• Please keep darkroom surfaces dry.

When the radiographic images have been evaluated, graded and accepted:

• Clean instruments and discard disposables into red biohazard bags and place bags into large biohazard trash cans.
• Rinse and bag XCP for sterilization and place it in the designated container in the darkroom.
• Wipe down all contaminated surfaces with disinfectant.
• Return the tube head to its storage position.
• **Obtain permission to leave from a Radiology Staff.**

Preparation of surfaces in the operating room for each patient:

<table>
<thead>
<tr>
<th>Surface</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tube head and extension arms and BID (Beam indicating device/cone)</td>
<td>Disinfect and barrier wrap handling areas</td>
</tr>
<tr>
<td>Patient chair seat and arm rests</td>
<td>Disinfect</td>
</tr>
<tr>
<td>Chair controls (hand) and head rest</td>
<td>Disinfect and barrier wrap</td>
</tr>
<tr>
<td>Exposure control panels</td>
<td>Disinfect and barrier wrap</td>
</tr>
<tr>
<td>Surfaces where images are laid out</td>
<td>Disinfect and cover with paper towels</td>
</tr>
<tr>
<td>Lead apron, thyroid shield</td>
<td>Disinfect, over glove, minimize handling</td>
</tr>
<tr>
<td>Faucet, handles, soap dispenser</td>
<td>Wipe spills, disinfect, as needed</td>
</tr>
</tbody>
</table>
The Radiographic Log

Patient charts must contain a record of all radiographic exposures. At OUCOD, completion of the Radiographic Log meets this obligation.

The Radiographic Log is a white form that is part of the chart. When dentist-faculty authorize the making of radiographic images, have them fill out the form by listing the date of this request and the type of radiographic images or survey requested, and then signing the log with their full names and faculty numbers. The right side of the form is filled out by the operator who make the radiographic images. The operator shall list the date of exposure, the total number of exposures including retake radiographic images with name.

Using this form demonstrates OUCOD compliance with the A.D.A. accreditation requirement that all radiographic images are ordered by licensed dentists who have exercised their professional judgment in ordering the radiographic images.

### RADIOGRAPHIC LOG

<table>
<thead>
<tr>
<th>DATE OF REQUEST</th>
<th>IMAGE SURVEY AND TOOTH #</th>
<th>DENTIST SIGNATURE</th>
<th>DATE TAKEN</th>
<th>NO. OF IMAGES DISPENSED</th>
<th>NO. OF IMAGES EXPOSED</th>
<th>NAME OF OPERATOR</th>
</tr>
</thead>
</table>
Procedure For Duplicating Radiographs

For undergrad students

If a patient is requesting duplicate radiographs, they need to go in person to the office of clinic operations room# 238. The patient will then fill out the necessary forms authorizing duplication of radiographs. The patient will then go to the cashier window on the second floor to pay for the duplication. There is a twenty-four hour waiting period for duplicates to be processed. The patient can request to pick up the duplicate radiographs or have them mailed to them.

For graduate programs

Bring the films that you are requesting for duplication to the department of radiology room# 284. Fill out the necessary form for duplication request, paper clip the form to the radiographs and place them in the radiographs to be duplicated folder. There is a twenty four hour waiting period for duplicates to be processed. When the duplicates are ready you can pick them up in the completed duplicate folder.
Radiographic Interpretation Sessions And Examination DSII

Please note: Detailed information about the schedule and format will be provided during the orientation sessions.

During the sophomore year, all DS-II students will be asked to do radiographic interpretation during the fall and spring semesters. This should not be confused with a radiographic technique evaluation, which is used to determine the presence of required radiographic anatomic structures. All students taking radiographic images at the University of Oklahoma will continue to evaluate all radiographic images for diagnostic acceptability with radiology faculty/staff.

Radiographic interpretations

By radiology interpretation, we mean the ability to read the radiographic images of a patient. The interpretation is the process of identifying normal anatomical features and the variations, determining presence or absence of abnormalities, which may be diagnostically significant in the assembly of a tentative treatment plan. Assessment of a student’s ability to recognize normal anatomic landmarks and to distinguish remarkable findings and possible pathologic entities will be evaluated during multiple interpretation sessions in fall and spring semesters of sophomore year.

DS-II students will be asked to interpret a required of radiographic images (FMX & panoramic images) during the fall semester in various group settings. Schedule and format will be provided during the orientation sessions. Additional interpretation sessions may be required depending upon the student's progress. The need will be determined by the faculty for each student. A one-hour final written examination will be given at the end of the each semester.

Radiographic interpretations will be done with Oral Diagnosis and Radiology faculty.

- Faculty: Dr. Farha, Dr. Radfar and Dr. Masood.

Please keep in mind that these guided interpretations are opportunities to acquire some proficiency in viewing images and that the exchanges with the faculty are intended to be supportive of your own conclusions. Feedback from the faculty should reflect your progress towards a goal of passing the spring competency examination. Successful completion of the interpretation sessions will be a basis of your clinical grade and is a requirement for passing the sophomore year Oral Diagnosis course OD 7615.

Following topics should be reviewed for the interpretation sessions during the fall and spring semesters:
• Identification of radiographic anatomical landmarks on intraoral and Panoramic radiographic images.
• Application of image shift principles in localizing structures.
• Making image quality assessments.
• Recognition of common errors in technique and processing.
• Radiographic identification of evidence of caries, periodontal disease and periapical lesions on intraoral and panoramic images.
• Recognition of various dental anomalies such as variations in tooth number, structure and position.
• Recognition of restorative materials, inadequate restorations and implications of such treatment.
• Recognition, description and development of differential diagnosis of common oral pathology found on radiographic images.
• Knowledge of appropriate clinical examination procedures leading to definitive diagnosis.

No handouts will be provided. Students will use materials from courses OD 7191 & OD 7292 or the required oral radiology textbook for those courses.
Minimal Clinical Experiences

FMX and Panoramic Radiographic images:

Please note that all students must complete the following prior to the graduation:

- At least 10 Full intraoral radiographic surveys with a passing average grade.
- At least 5 Panoramic surveys with a passing average grade.