I. Operator Safety

1. Maximum Permissible Dose (MPD) and Maximum Accumulated Dose (MAD)
   
   a. To assure the optimum safety for all personnel and students, the maximum permissible dose (MPD) shall not exceed 100 mR per week. Maximum 13-week dose is 3R and maximum accumulated dose for a year is 5R as governed by this formula: maximum accumulated dose equals 5(N-18), where N equals the age of the worker.
   
   b. Pregnant personnel and students will notify the Programs' Directors of their pregnancy. The pregnant person will be informed by the Directors and the Radiation Safety Officer of the hazard areas to avoid and will be closely monitored by film badges. All pregnant women students will wear a badge at the waist to indicate a baby's exposure and a badge at the collar to indicate the student’s exposure. If any film badge shows any exposure, the pregnant person and the program directors will be notified immediately.

2. Monitoring Personnel and Maintaining Records
   
   a. All students will wear personal monitors while in the course DHG 117. The monthly reports provided by the company that supplies the monitors will be reviewed by the Programs' Directors and will be posted for review by the dental program’s students. The Radiation safety officer will keep reports from personal monitors for 1 year then permanently archived in the College archives.
   
   b. Film badges will be stored in room L-155 when the student is not operating x-ray equipment.
3. Operation of Equipment
   a. Dental x-ray equipment will be operated only with the supervision of the faculty during class/lab time or during remedial sessions.
   b. The students will never remain in the room or hold a film during x-ray exposure.
   c. Students must demonstrate knowledge of radiation safety measures prior to making any radiographic exposures.

4. Technique and Exposure Factors
   a. The paralleling technique is recommended for all intra-oral periapical radiographs. The XCP holding device with rectangular collimator and lead diaphragm in the P.I.D. or cone is recommended. In cases where use of the paralleling technique is not possible, the bisecting angle technique will be used.
   b. The student will never hold the film in the patient’s mouth and will always leave the room during the exposure.
   c. A chart of impulse settings is listed in each treatment room. These exposure factors will change if requested by the patient’s dentist.

5. Positioning of Operator
   All personnel and students operating the x-ray equipment will stand at least 6 feet away from the source of radiation behind a lead barrier during exposure.

6. Supervision of students
   a. Students in radiology courses will be directly supervised while they are using radiation.
   b. Students in clinical courses must have qualified for exposing radiographs through the successful completion of an accredited course in oral radiology. In clinical courses, the clinical instructor will intermittently supervise the students’ use of radiation.
Instructors will verify the exposure setting, P.I.D. length and shape, and film placements and then return frequently for continued supervision.

c. Students are encouraged to ask for assistance with films as needed. Retake films will be exposed only under the direct supervision of the clinical instructor. During the last 8 weeks of the clinical course DHG 219 Clinic IV, students are expected to expose retake films without instructor assistance.

d. The number and reason for retakes will be monitored. Any dental hygiene students who have 4 or more retakes due to the same error within a semester will be required to have remedial instruction with one of the program clinical faculty. (Appendix B & C).

e. The clinical dentist will be present in the clinic during all patient exposures.

7. Regulations

a. The program is in compliance with the State of Illinois and the Federal Laws related to radiation. The following references are used:

1) Federal Health and Safety Act of 1969
2) NCRP #35 on X-Ray Protection
3) A.D.A. Regulation on Acceptable Practices
4) Rules and Regulations for Protection against Radiation, by Illinois Department of Public Health.

8. A.L.A.R.A. Concept

All personnel and students will receive x-ray exposures as low as reasonably achievable. The design of the facilities incorporated lead walls for barriers to radiation, by providing a totally safe environment for the operator. Human error is the only contributing factor to operator exposure.
II. Patient Safety

Patient Selection Criteria

a. After a complete oral and dental examination, the patients' medical dental and oral histories are evaluated to determine previous radiation exposures and oral conditions.

b. The need, extent, and frequency of radiography is determined by the supervising dentist. The guidelines that will be used to screen suitable patients are in chart A. Pregnant patients will not be radiographed.

c. A cumulative record of the patient exposures will be kept on the front of the patient file including the date, number of films, types of films, areas exposed and total number of retake.

d. A CMX may be taken if ordered by the patient's dentist even if the five year criteria are not met.

e. A CMX may be taken if the patient has not had films in the past five years and plans to have dental treatment within the next six months.

f. No radiographs will be exposed for post-treatment analysis. All radiographs will be mailed to the patient's dentist with a copy of bitewing radiographs remaining in the patients file. Radiographs will be exposed only to provide a direct health care benefit to the patient, not only to meet course objectives or requirements.

g. Students, personnel or patients will not be exposed solely for the purpose of teaching radiographic technique.

h. Patient radiographic images will be utilized during patient treatment.

III. Radiograph Acceptability

The following are the criteria for radiographic acceptability. Retakes will be ordered if the following criteria are not met. No more than 3 retakes will be taken per patient per complete periapical series and 2 per bitewing series. (5 total) Direct supervision by an instructor is required for all retakes except in the last 8
weeks of DHG 219, Clinic IV. During these last 8 weeks, the students are expected to expose retakes without instructor assistance.

1. Periapical Surveys
   a. The radiograph should be an accurate representation of the area being radiographed.
   b. The radiograph should be within an acceptable density range not too light or too dark as per our quality control system.
   c. The image of the teeth should be of the proper length - neither excessively foreshortened or elongated.
   d. There should be no overlapping of the interproximal spaces surrounding the roots of the teeth.
   e. There should be at least 3 mm of alveolar bone visible around the apex of each root.
   f. The apex plus 3 mm of bone of each root should be visible at least once in any CMX series for every tooth.
   g. There should be a 1/8 to 1/4 inch margin between the crown of each tooth and the edge of the film.
   h. There should be no excessive cone cuts. At least 2/3 of the film must have an image.
   i. The embossed dot should be at the incisal/occlusal edge on periapical films and at the distal edge on bitewing films.
   j. The films should be free of processing and handling artifacts.

2. For interproximal surveys: (Bitewings)
   a. The proximal tooth surfaces should not be overlapped from the distal of the canine to the mesial of the third molar. The premolar view should include open contacts between the maxillary 1st and 2nd premolar and the molar view should include open contacts between the maxillary 1st and 2nd molars.
b. There should be an equal distribution of teeth in both maxillary and mandibular arches on the film.

c. The crest of the alveolar bone in each interproximal space should be clearly visible.

d. The occlusal plane should be straight or curved slightly upward in the distal portions of the film.

e. The crowns of the teeth should be an accurate reproduction of the teeth being radiographed, and not magnified or distorted.

f. **Premolar Interproximal Survey (bitewings)** Radiograph should include the distal half of both canines, crowns of premolars, first molars and a portion of the second molar crowns. Retakes are necessary if the distal half of the canines is not visible, if excessive horizontal overlapping is present, if unequal distribution of maxillary and mandibular teeth exists, or if any other distortion exists that would render the film unacceptable for diagnosis.

g. **Molar Interproximal Survey (bitewings)** The radiograph should show all of the first and second molar crowns and at least the distal of the first premolar crown. Retakes necessary if errors exist similar to premolar errors.

   1. Retakes are not necessary if each proximal surface from the distal of the canine to the third molar is clearly visible at least once in the premolar or molar bitewings.

   2. Retakes will be taken but will not be charged to the student's grade if overlapped contacts are judged by an instructor to be due to malpositions of the patient's teeth and not due to faulty horizontal angulations by the operator.

h. Exception: It is necessary to be able to view each proximal surface of the molars and premolars in at least one of the views of the CMX. Retakes are not necessary if each interproximal space between canines premolar and molars is open at least one of the views of the premolar region, molar region or the bitewings.

i. In special cases of third molar periapical malpositions, the entire third molar may not be clearly visible in the molar region radiograph. The clinical dentists recommend taking a panoramic image to best diagnose third molar areas.
Definitions:
1. Excessive horizontal overlapping is defined as any superimposition of the crowns of the teeth such that the dentin-enamel junction is not visible in the appropriate proximal surfaces.
2. Excessive cone cut is defined as a cone cut in excess of 1/3 of the film.
3. Density range is defined as acceptable if the dentino-enamel junction is visible.
4. Excessive elongation is defined as evidence of the periodontal membrane space not visible at the apex of the tooth.

IV. Preventative Equipment Checks
   a. The lead apron and thyrocervical shield will be inspected annually for cracks or defects and repair made as needed. The inspection and necessary repairs will be documented. Annual inspection and subsequent documentation will be done by the instructor for DHG 117.
   b. A daily preventive inspection will be done by the DHG 117 instructor in the spring semester.
      1) a check of the processing solutions to determine their age and need for replenishing or replacement of processing solutions will be done according to a schedule based on previous experience of work load and manufacturer's recommendation. Solutions are changed weekly.
      2) a check of the safelight in the darkroom for adequacy and proper working condition
      3) a check of light leaks in the darkroom and the daylight processor
      4) a check of the viewers for proper functioning
c. Central IL X-Ray is contracted to change solutions in both processors and perform preventative and routine maintenance every week during fall, spring, and summer semesters.

V. Film Quality Assurance Program

a. A film quality assurance check will be performed daily. The test will include exposing and processing a test film using the same equipment and processor to be used for patients’ films. The test film will be compared to a control film. If the quality varies from the ideal control film, both the equipment and the processor will be checked for possible malfunctions. The equipment will not be used unless the test film matches step 3, 4, or 5 on the step wedge control film.

b. A record will be made daily of the quality control test results.

VI. Exposure Technique

a. The paralleling technique is recommended for all intra-oral periapical radiographs. The XCP holding device and the rectangular collimator with position indicating device (P.I.D. or cone) is recommended. In cases where the paralleling technique is not possible due to the patient's oral condition, the bisecting angle technique with a round cone can be used.

b. The bitewing interproximal films can be exposed using the round cone with rectangular collimator and the XCP film holder or the tab film holder and the round P.I.D.

c. All P.I.D. (cones) must provide at least a 16" source film distance.

d. Impulse varying depends on the area to be radiographed. A chart of impulse settings is listed in each treatment room. These exposure factors will vary only on the order of the patients' dentists. The exposure factors match the film manufacturer's recommendations.

VII. Film Speed and Film Storage

a. Film type group F will be used.

b. All film will be stored away from possible radiation exposure.
c. All film will be distributed to students for preclinical and clinical use by an instructor. This procedure accounts for each film used.

VIII. Lead Barriers

a. Each patient will wear a lead apron with a thyrocervical shield.

b. Additional protection for the operator is provided by lead barriers and lead walls which separate all rooms.

IX. Equipment Certified

a. All x-ray equipment will be inspected by the State of Illinois at least every 24 months. The equipment will be calibrated for beam quality, geometry and exposure rate and output. Records of each inspector will be kept with the radiation safety office.

b. The x-ray generating equipment meets Federal Performance Standards and ADA specifications.

X. Asepsis

a. The disinfection of equipment and aseptic technique policies recommended for clinical patients will be used followed for x-ray patients:

b. The procedures for unit set up and clean up will remain posted in each treatment room.

c. The film will be disinfected before processing following posted guidelines.

XI. Patient's Consent

a. The patient will sign at the bottom of the treatment plan in the Oral Exam booklet, giving consent to have radiographs taken by a dental auxiliary student under the supervision of the faculty. This form is filed in the patient's permanent record. The Radiograph Authorization form with the clinical dentist’s signature is also filed in the patient’s folder.

b. A record will be made of the number of films exposed. This information will be recorded on the patients’ treatment sheet sequentially and cumulatively. The patients’ folder will contain a sequential list of exposures.
c. All films will be mailed to the patient’s dentist.

XII. Student Competency in DHG 117

a. Each student will meet 100% competency on manikins during preclinical instruction before exposing films on patients. The students will demonstrate competency by exposing $\frac{3}{2}$ complete series of periapicals and $\frac{3}{2}$ bitewings sets and passing. Each set must be perfect.

b. Preclinical experience will include primary, mixed, permanent dentition, and edentulous patients, on manikins and permanent dentition on adult patients. Panoramic and extra oral radiographic exposures will be completed in a simulation or on manikins.

c. After completion competency demonstration on manikins, the student will expose two complete sets of radiographs on patients with direct supervision at 80% competency.

d. Any students not meeting the above competency levels will be permitted additional practice during laboratory hours.

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