

D A 67: RADIATION SAFETY COURSE

Foothill College Course Outline of Record

Heading	Value
Effective Term:	Summer 2024
Units:	3
Hours:	2 lecture, 3 laboratory per week (60 total per quarter)
Degree & Credit Status:	Degree-Applicable Credit Course
Foothill GE:	Non-GE
Transferable:	CSU
Grade Type:	Letter Grade Only
Repeatability:	Not Repeatable

Student Learning Outcomes

- Complete a x-ray series on a patient with no errors regarding radiation safety.
- Complete a bitewing and full mouth series of x-rays on a patient with four or less re-takes.

Description

This course covers the principles of dental radiology. Topics include theory and techniques, operation of the x-ray machine, biological effects, safety practices, and the practical application of utilizing appropriate infection control while exposing, processing, mounting, and evaluating intraoral dental images.

Course Objectives

The student will be able to:

1. Understand radiation physics and biology.
2. Describe the production of dental x-rays, the components of dental radiology equipment, film, and processing.
3. Identify the potential risks or harm of radiation exposure.
4. Demonstrate acceptable practices of health and safety, including infection control, in relation to exposing and processing radiographs.
5. Identify anatomical landmarks and visible dental materials radiographically.
6. Summarize radiographic exposure and processing techniques using manual and automatic methods.
7. Demonstrate mounting/sequencing techniques.
8. Explain intraoral techniques, armamentaria, and receptor holders.
9. Differentiate and demonstrate bitewing radiographs, including principles of exposure methods of retention and evaluation.
10. Interpret dental images.
11. Identify and correct faulty radiographs.
12. Summarize supplemental techniques, including the use of computerized digital radiography.
13. Employ appropriate infection control in dental radiographic procedures.
14. Demonstrate radiographic record management.

Course Content

1. Understand radiation physics and biology
 - a. Structures of an atom and the process of ionization
 - b. Differentiation between radiation and radioactivity
 - c. Types of ionizing radiation
 - d. Characteristics of electromagnetic radiation
 - e. Properties of x-radiation
2. Describe the production of dental x-rays, the components of dental radiology equipment, film, and processing
 - a. Component parts of the x-ray machine
 - b. Parts of the dental x-ray tube head and the dental x-ray tube
 - c. The production of dental x-rays
 - d. Possible interactions of x-rays with matter
 - e. Effects of kilovoltage on the quality of the x-ray beam
 - f. Kilovoltage effect on density and contrast of the image
 - g. Influence of milliamperage on the quality of the x-ray beam
 - h. Effects of milliamperage on the density of the image and how exposure time and milliamperage are related
 - i. Influence of kilovoltage, milliamperage, exposure time, and source-to-receptor distance on intensity of the x-ray beam
 - j. Calculation of the inverse square law
3. Identify the potential risks or harm of radiation exposure
 - a. Mechanisms and theories of radiation injury
 - b. Dose-response curve and radiation injury
 - c. Sequence and determining factors for radiation injury
 - d. Short and long-term effects as well as somatic and genetic effects of radiation exposure
 - e. Effects of radiation exposure on cells, tissues, and organs, and identification of the relative sensitivity of a given tissue to x-radiation
 - f. Units of measurement used in radiation exposure
 - g. Common sources of radiation exposure
 - h. Risk and risk estimates for radiation exposure
 - i. Dental radiation and exposure risks
 - j. Risk versus benefit of dental images
4. Demonstrate acceptable practices of health and safety, including infection control, in relation to exposing and processing radiographs
 - a. Basics of patient protection before x-ray exposure
 - b. Types and recommendations of filtration for dental x-ray machines
 - c. Collimation of dental x-ray machines and recommendation for proximity to patient's skin during exposure
 - d. Six ways to protect the patient from excessive radiation during x-ray exposure
 - e. The importance of receptor handling and processing after patient exposure to x-radiation
 - f. Operator protection
 - i. Adequate distance
 - ii. Shielding
 - iii. Avoidance of the useful beam
 - g. Personnel and equipment monitoring devices used to detect radiation
 - h. Radiation exposure guidelines including radiation safety legislation, maximum permissible dose (MPD), and the ALARA concept

- i. Discussion with dental x-ray patient regarding the protection steps used before, during, and after exposure to x-radiation
5. Identify anatomical landmarks and visible dental materials radiographically
 - a. Differentiation between cortical and cancellous bone
 - b. Terms such as prominences, spaces, and depressions in bone
 - c. Identification and description of the normal anatomic landmarks of the maxilla and mandible on a human skull and as viewed on dental images
 - d. Identification of normal landmarks of the maxilla and mandible as either radiolucent or radiopaque as viewed on dental images
 - e. Identification and description of the appearance of normal tooth anatomy and supporting structures as viewed on dental images
 - f. Identification of normal tooth structures as radiolucent or radiopaque as viewed on dental images
 - g. Identification of the primary teeth and eruption patterns of the permanent teeth as viewed on dental images
 - h. Identification and description of the bony landmarks of the maxilla and mandible and surrounding structures as viewed on a panoramic image
 - i. Identification of air spaces as viewed on a panoramic image
 - j. Identification of soft tissues as viewed on a panoramic image
6. Summarize radiographic exposure and processing techniques using manual and automatic methods
 - a. Film composition and latent image formation
 - b. Different types of x-ray film used in dentistry
 - c. Types and sizes of intraoral film
 - d. Film speed
 - e. Extraoral film and extraoral film packaging
 - f. Differentiation between screen and non-screen films
 - g. Use of intensifying screens and cassettes
 - h. Duplicating film and processing techniques and equipment
 - i. Film storage and protection
 - j. Process of turning a latent image into a visible image
 - k. Component parts, procedural steps and advantages of automatic film processing
 - l. Care and maintenance of automatic film processors and solutions
 - m. Five steps of manual film processing
 - n. Basic ingredients of the fixer and developer
 - o. Equipment and steps for manual film processing
 - p. Room lighting and safe lighting during processing
 - q. Waste management of processing chemicals
 - r. Film processing problems as a result of time/temperature, chemical contamination, film handling, and lighting errors
7. Demonstrate mounting/sequencing techniques
 - a. Principles of mounting film and digital images
 - b. Key landmarks to identify in mounting dental images
 - c. Identification dot on film used to determine film orientation
 - d. Step-by-step procedures for film mounting
 - e. Equipment necessary for viewing x-ray images
 - f. Importance of viewing images in optimal viewing conditions
8. Explain intraoral techniques, armamentaria, and receptor holders
 - a. Types of radiation equipment for intra and extraoral dental images
 - b. Portable x-ray units and limiting operator exposure during use
 - c. Federal, state, and local regulations of dental x-ray machines
 - d. Use and types of receptor holders, beam alignment devices, and collimating devices
 - e. Principles of the bisecting technique and location of the receptor, tooth, imaginary bisector, dental ray, and PID
 - f. Basic rules of bisecting technique
 - g. Beam alignment devices and receptor holders used with the bisecting technique
 - h. Correct and incorrect horizontal and vertical angulation
 - i. Receptor placement for all 14 periapical images using bisecting technique
 - j. Advantages and disadvantages of bisecting technique
 - k. Principles of the paralleling technique and location of the receptor, tooth, imaginary bisector, central ray, and PID
 - l. Basic rules of paralleling technique
 - m. Object-receptor distance affects the image
 - n. Target-receptor distance used to compensate for object-receptor distance
 - o. Utilizing beam alignment devices
 - p. Receptor placement for all 14 periapical images using paralleling technique
 - q. Modifications required for patients with a shallow palate, bony growths, or sensitive gag reflex
 - r. Advantages and disadvantages of the paralleling technique
9. Differentiate and demonstrate bitewing radiographs, including principles of exposure methods of retention and evaluation
 - a. Purpose and use of the bite-wing image
 - b. Appearance of opened and overlapped contact areas
 - c. Basic principles of the bite-wing technique
 - d. Receptor sizes commonly used for bite-wing exposure
 - e. Correct and incorrect horizontal angulation
 - f. Differentiation between positive and negative vertical angulation
 - g. Recommend vertical angulation for bite-wing exposures using bite-wing tabs
 - h. Basic rules for bite-wing technique
 - i. Patient and equipment preparation before using bite-wing techniques
 - j. Receptor placement for premolar and molar bite-wing exposures
 - k. Purpose and use of vertical bite-wing images
 - l. Modifications in the bite-wing technique for patients who have edentulous spaces or bony growths
 - m. Evaluation of diagnostic bite-wing exposures
10. Interpret dental images
 - a. Importance of the evaluation of images
 - b. Identification of dentist and auxiliary roles in image interpretation, evaluation, and diagnosis
 - c. Differentiation between interpretation and diagnosis
 - d. Documentation of interpreted dental images
 - e. Patient education utilizing dental images
 - f. Retention of dental images
11. Identify and correct faulty radiographs
 - a. Identification, description, and correction of the following errors:
 - i. Unexposed receptor
 - ii. Exposure to light

- iii. Overexposed receptor
 - iv. Underexposed receptor
 - v. Receptor placement errors
 - vi. Absence of apical structures
 - vii. Dropped receptor corner
 - viii. Incorrect horizontal angulation
 - 1. Overlapping
 - ix. Incorrect vertical angulation
 - 1. Elongation
 - 2. Foreshortening
 - x. Incorrect beam alignment
 - 1. Cone cutting
 - xi. Bending and creasing film
 - xii. Double image
 - xiii. Blurred image
 - xiv. Receptor reversal
12. Summarize supplemental techniques, including the use of computerized digital radiography
- a. Principles and uses for occlusal examination
 - b. Purpose and principles of localization techniques
 - c. Buccal object rule
 - d. Receptor placements for the buccal object rule
 - e. Purpose and use of digital imaging
 - f. Fundamentals of digital imaging
 - g. Radiation exposure in digital imaging
 - h. Equipment used in digital imaging
 - i. Types of digital images
 - j. Patient and equipment preparation required for digital images
 - k. Advantages and disadvantages of digital images
 - l. Purpose and fundamentals of panoramic imaging
 - m. Equipment and patient preparation/positioning for panoramic projections
 - n. Common errors with panoramic imaging
 - o. Advantages and disadvantages of panoramic imaging
 - p. Purpose, head position, receptor placement, and beam alignment for each of the following extraoral projections:
 - i. Lateral jaw projection
 - ii. Lateral cephalometric projection
 - iii. Posterior-anterior projection
 - iv. Waters projection
 - v. Submentovertex projection
 - vi. Reverse townes projection
 - vii. Transcranial projection
13. Employ appropriate infection control in dental radiographic procedures
- a. Rationale for infection control
 - b. Routes of disease transmission
 - c. PPE, hand hygiene, sterilization, and disinfection of instruments (especially those used in dental radiography)
 - d. Cleaning and disinfection of the dental unit and environmental surfaces
 - e. Infection control procedures necessary before, during, and after x-ray exposure
 - f. Infection control procedures necessary for digital imaging and for film processing
 - g. Film handling in the darkroom or daylight loader
14. Demonstrate radiographic record management
- a. Handling of dental images
 - b. Storage of dental images
 - c. Confidentiality associated with dental images
 - d. Risk management and informed consent
 - e. Malpractice issues including negligence and standard of care

Lab Content

1. Preparation of the x-ray treatment room prior to taking x-rays
2. Decontamination of the x-ray treatment room after taking x-rays
3. Exposing, processing, and mounting of dental radiographs
 - a. Periapical images
 - b. Bitewing images
 - c. Panoramic images
 - d. Occlusal films
 - e. Distal films
4. Instrument processing and sterilization

Special Facilities and/or Equipment

Radiology x-ray facility with the following equipment:

1. Individual treatment rooms
2. X-ray tube head and control panel
3. Lead shield
4. Foot operated patient chair
5. X-ray mannequins
6. Sink and soap/hand sanitizer
7. Viewboxes
8. Phosphor plate processing equipment
9. Cord sensors and laptops
10. Phosphor plate processor
11. Computers for film mounting
12. Film placement devices
13. Ultrasonic cleaner
14. Steam autoclave

When taught via Foothill Global Access, on-going access to computer with email software and hardware; email address.

Method(s) of Evaluation

Methods of Evaluation may include but are not limited to the following:

- Quizzes
- Midterm/final exam
- Mannequins evaluations
- Live-patient evaluations

Method(s) of Instruction

Methods of Instruction may include but are not limited to the following:

- Lab sessions: on-campus, synchronous
- Lecture: online, asynchronous

Representative Text(s) and Other Materials

Iannucci, Howerton. Dental Radiography, 5th ed.. 2016.

This is the most recent edition of the Iannucci text. An updated edition will be released in the near future.

Types and/or Examples of Required Reading, Writing, and Outside of Class Assignments

1. Chapter readings from required textbook
2. Essay answers to ethical scenarios

Discipline(s)

Dental Technology