# 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.
- 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. Sort 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
- 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
  - 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 xray 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
- 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
  - I. 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
- I. 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
- 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 imageb. 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
  - I. 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 alignment1. 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
  - I. 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 towne projection
    - vii. Transcranial projection
- 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 xray 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
- Exposing, processing, and mounting of dental radiographs

   Peripical 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. Phorphor 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**

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

This is the most recent edition of the lannucci 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