DENT-1331: DENTAL IMAGING

Cuyahoga Community College

Viewing: DENT-1331 : Dental Imaging
Board of Trustees:
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Academic Term:
Fall 2024

Subject Code
DENT - Dental Hygiene

Course Number:
1331

Title:
Dental Imaging

Catalog Description:
History and development of the x-ray, its nature and properties. Biological effects of x-radiation with application of Safe Operating Procedures to protect the operator and patient. Theory and practice in fundamentals of oral imaging techniques including receptor placement, tube angulation, scanning, mounting and interpretation of images. Digital sensors and photostimulable phosphor plate receptors for periapical, bitewing, and occlusional intraoral exposures and localization techniques, and panoramic extraoral imaging techniques will be discussed. Students will expose image receptors on a manikin. Consists of lecture modules of instruction correlated with weekly laboratory modules.

Credit Hour(s):
3

Lecture Hour(s):
2
Lab Hour(s):
3

Requisites

Prerequisite and Corequisite
Departmental acceptance and concurrent enrollment in DENT-1300 Preventive Oral Health Services I.

Outcomes
Course Outcome(s):
Practice Safe Operating Procedures for the patient and operator of imaging equipment during x-ray exposure techniques.

Essential Learning Outcome Mapping:

Not Applicable: No Essential Learning Outcomes mapped. This course does not require application-level assignments that demonstrate mastery in any of the Essential Learning Outcomes.

Objective(s):
1. Discuss the hazards and radiation effects associated with exposure to x-radiation.
2. Discuss governmental regulations concerning dental x-ray equipment and operation.
3. Apply radiation protection principles for the operator and patient during x-ray exposures and mock exposures.
4. Differentiate the type of exposure (bitewing, periapical, occlusal or panoramic) and the number of exposures recommended for a patient based on a patient's health and dental histories, condition, risk assessments, age and previous radiation exposure.
5. Practice an acceptable infection prevention protocol during imaging procedures.

Course Outcome(s):
Apply the principles of physics involved in the production of x-radiation to control the characteristics of the resultant image.

Essential Learning Outcome Mapping:

Not Applicable: No Essential Learning Outcomes mapped. This course does not require application-level assignments that demonstrate mastery in any of the Essential Learning Outcomes.

Objective(s):

1. Discuss the discovery and uses of x-radiation.

2. Describe the production of x-radiation including the function of each of the x-ray machine parts.

3. Explain how changes to the kilovoltage, milliamperage, exposure time or distance from the x-ray tube to the image receptor affects the resultant image.

4. Identify factors affecting the geometric characteristics (sharpness, magnification and distortion) of an image and modify those factors, when possible, to produce a diagnostically acceptable image.

5. Complete a geometric principle exercise.

6. Adjust exposure factor(s) on the x-ray unit based on the size of the patient or appearance of a previously-exposed image.

Course Outcome(s):

Produce diagnostically acceptable bitewing images.

Essential Learning Outcome Mapping:

Not Applicable: No Essential Learning Outcomes mapped. This course does not require application-level assignments that demonstrate mastery in any of the Essential Learning Outcomes.

Objective(s):

1. Discuss the reasons for exposing bitewing images.

2. Expose bitewing images utilizing bitewing tabs or other beam alignment devices on manikins and evaluate the images for technique, and when applicable, scanning and mounting errors. Demonstrate use of digital sensors or photostimulable phosphor plates as image receptors.

3. Recognize and be able to correct exposure, scanning and mounting errors specific to bitewing images.

4. Identify possible modifications to the bitewing technique for client management issues including gagging, various disabilities, anatomic constraints, edentulous areas and pediatric patients.

Course Outcome(s):

Produce diagnostically acceptable periapical images utilizing the paralleling technique of exposure.

Essential Learning Outcome Mapping:

Not Applicable: No Essential Learning Outcomes mapped. This course does not require application-level assignments that demonstrate mastery in any of the Essential Learning Outcomes.

Objective(s):

1. Recognize and be able to correct exposure, scanning, and mounting errors specific to periapical images.

2. Expose complete mouth series of x-ray images on manikins and evaluate each series for technique, and when applicable, for scanning and mounting errors. Demonstrate use of digital sensors and photostimulable phosphor plates as image receptors.

3. Complete a mounting competency within 10 minutes. All images must be mounted correctly.

4. Attempt successful completion of a Complete Mouth X-ray Paralleling Technique Competency. Expose, mount and interpret for errors a complete mouth series. Complete infection prevention protocol will be required. Each section of this competency will be timed and under the direct observation of faculty.

5. Compare and contrast the quality of the images produced with both the paralleling versus the bisecting-the-angle techniques of exposure.

6. Identify possible modifications to the periapical technique for client management issues including gagging, various disabilities, anatomic constraints, edentulous areas and endodontic treatment.

Course Outcome(s):

Produce diagnostically acceptable panoramic images.

Essential Learning Outcome Mapping:

Not Applicable: No Essential Learning Outcomes mapped. This course does not require application-level assignments that demonstrate mastery in any of the Essential Learning Outcomes.

Objective(s):

1. Complete student partner, mock panoramic exposures including machine preparation, patient preparation and positioning, and computer acquisition. Students will not be exposed to x-radiation.

2. Identify and be able to correct all possible patient preparation, patient positioning and machine preparation errors associated with panoramic imaging.

3. Evaluate a panoramic exposure for patient preparation, patient positioning and machine preparation errors.

4. Identify possible modifications to the panoramic imaging technique for client management issues including various disabilities, pedodontic exposures and edentulous anterior areas.

Course Outcome(s):

Perform daily and periodic quality control procedures for imaging equipment.

Essential Learning Outcome Mapping:

Not Applicable: No Essential Learning Outcomes mapped. This course does not require application-level assignments that demonstrate mastery in any of the Essential Learning Outcomes.

Objective(s):

1. Discuss quality control procedures and tests that may be performed to evaluate imaging equipment.

2. Complete quality control procedures during Imaging Assistant experiences.

3. Observe quality control procedures performed by the Imaging Assistant in DENT 2300, Preventive Oral Health Services III during a required observation experience.

Course Outcome(s):

Differentiate normal anatomic landmarks, specific teeth, restorations and other dental materials, etiologic factors contributing to disease, foreign objects and abnormal or pathological conditions appearing on dental images.

Essential Learning Outcome Mapping:

Not Applicable: No Essential Learning Outcomes mapped. This course does not require application-level assignments that demonstrate mastery in any of the Essential Learning Outcomes.

Objective(s):

1. Identify anatomic structures viewed on each exposure of a complete mouth series of images and bitewing images.

2. Identify normal anatomy viewed on a patient panoramic image.

3. Identify and write the universal numbers for teeth appearing on a complete mouth series of images and panoramic image.

4. Identify restorations and other dental materials on a complete mouth series of images.

5. Analyze a bitewing series of images for dental caries.

6. Analyze a complete mouth series of images for periodontal disease and etiologic factors contributing to periodontal disease and/or caries.

7. Select and research a pathological condition viewed on head and neck images and develop a written simulated patient case.

Course Outcome(s):

Produce diagnostically acceptable occlusal images.

Essential Learning Outcome Mapping:

Not Applicable: No Essential Learning Outcomes mapped. This course does not require application-level assignments that demonstrate mastery in any of the Essential Learning Outcomes.

Objective(s):

1. Discuss the purpose and uses of occlusal images.

2. Expose and scan a maxillary topographic and mandibular cross-section occlusal image on a manikin.

3. Apply the occlusal technique to the right-angle localization technique.

Course Outcome(s):

Use a localization technique to identify the position of a lesion or foreign object located in the oral cavity.

Essential Learning Outcome Mapping:

Not Applicable: No Essential Learning Outcomes mapped. This course does not require application-level assignments that demonstrate mastery in any of the Essential Learning Outcomes.

Objective(s):

1. Discuss the purpose of and types of localization techniques.

2. Expose a periapical image and an occlusal image of the same arch and identify the location of a foreign object based on the right-angle localization technique on a manikin.

3. Determine the position of a foreign object using the Buccal Object Rule or Same on Lingual, Opposite on Buccal (SLOB) Rule.

Course Outcome(s):

Discuss supplemental techniques available for head and neck imaging.

Essential Learning Outcome Mapping:

Not Applicable: No Essential Learning Outcomes mapped. This course does not require application-level assignments that demonstrate mastery in any of the Essential Learning Outcomes.

Objective(s):

1. Discuss the purpose of various supplemental imaging techniques available for the head and neck.

2. Identify equipment requirements, patient preparation and positioning, and beam angulation for extraoral supplemental exposures.

Course Outcome(s):

Project a professional image and demeanor during dental imaging procedures.

Essential Learning Outcome Mapping:

Not Applicable: No Essential Learning Outcomes mapped. This course does not require application-level assignments that demonstrate mastery in any of the Essential Learning Outcomes.

Objective(s):

1. Identify the information that must be provided to a patient during disclosure to obtain informed consent or refusal from a patient.

2. Project a positive attitude and professional appearance during all imaging procedures completed on a manikin or during mock exposures with a student partner or faculty member.

3. Document all types of x-ray exposures performed in the Notes area of the Tri-C Dental Hygiene Program patient management system in Services, Assessment, Recommendation, Plan (SARP) format.

4. Maintain patient confidentiality applicable to dental imaging procedures.

5. Role play appropriate verbal responses to imaging scenarios.

Methods of Evaluation:

1. Objective examinations and quizzes covering major topics in lecture and laboratory

2. Professionalism

3. Group project

4. Second-year Imaging Assistant observation experience and paper

5. Laboratory simulation requirements on a manikin

6. Written and other laboratory assignments/learning activities

7. Student partner activities in laboratory

8. Paralleling technique competency

Course Content Outline:

1. Introduction to Dental Imaging

  a. History
  b. Equipment
  c. Safe Operating Procedures
2. Digital Imaging
  a. Terminology
  b. Purpose and uses
  c. Image production
  d. Equipment
    i. Wired versus wireless systems
      i. Charged coupled device (CCD)
      ii. Complimentary metal oxide semiconductor (CMOS)
      iii. Photostimulable phosphor plates (PSP)
  e. CCD/CMOS component parts
  f. PSP component parts
  g. Receptor size versus active area
  h. Resolution
  i. Procedure for direct digital imaging (sensors)
  j. Procedure for PSP imaging
  k. Advantages and disadvantages of digital imaging
3. Radiation Physics
  a. Review of the atom
  b. Ionization
  c. Properties of radiation
  d. Hard versus soft radiation
    i. Wavelength
    ii. Frequency
    iii. Velocity
  e. X-ray machine parts and functions
    i. Control panel
    ii. Extension arm
    iii. Tube
    iv. Tubehead
    v. Exposure button
  f. Tubehead parts and functions
    i. Cathode
    ii. Anode
    iii. Molybdenum focusing cup
    iv. Filament
    v. Target
    vi. Focal spot
    vii.Copper stem
    viii. Transformers
    ix. Circuits
    x. Other parts
  g. Production of x-radiation
  h. Types of x-radiation
    i. Primary
    ii. Secondary
    iii. Scattered
    iv. Characteristic
    v. General
  i. X-radiation interaction with matter

        i. No interaction
        ii. Photoelectric effect
        iii. Compton scatter
        iv. Coherent scatter

4. Radiation Characteristics
    a. Density
    b. Contrast
    c. Beam quality
    d. Quantity
    e. Exposure time
    f. Beam intensity
        i. Inverse Square Law
        ii. Target-to-surface distance
        iii. Target-to-object distance
        iv. Target-to-image receptor distance
    g. Half-value layer
    h. Math problems related to x-radiation

5. Image Characteristics
    a. High density versus low density structures
    b. Visual characteristics
        i. Density
        ii. Contrast
    c. Geometric characteristics
        i. Sharpness
        ii. Magnification
        iii. Distortion

6. Bitewing Exposure Technique
    a. Purpose
    b. Image receptors
    c. Receptor positioning
    d. Beam angulation
    e. Diagnostic criteria

7. Radiation Biology
    a. Ionizing radiation and cells, tissues and organs
    b. Radiation injury
        i. Sequence
        ii. Exposure versus dose
        iii. Short versus long term effects
        iv. Somatic and genetic effects
        v. Stochastic versus deterministic effects
        vi Critical organs
    c. Radiation measurement
        i. International system
        ii. Traditional system
    d. Risk versus benefit

8 Radiation Protection
    a. Patient protection
        i. Exposure guidelines
        ii. Equipment
        iii. Technique
        iv. Processing/scanning
    b. Operator protection

        i. Distance and positioning
        ii. Radiation monitoring
        iii. Review of Tri-C policies and procedures
    c. Radiation exposure guidelines
        i. Legislation
        ii.Maximum permissible dose
        iii. Cumulative effective dose
        iv. As low as reasonably achievable

9. Paralleling Technique
    a. Terminology
    b. Advantages and disadvantages
    c. Principles
    d. Beam alignment devices
    e. Receptor positioning and sequence
    f. Modifications in technique
    g. Principles of shadow casting

10. Bisecting Technique
    a. Terminology
    b. Advantages and disadvantages
    c. Principles
    d. Beam alignment devices
    e. Receptor positioning and sequence
    f. Horizontal and vertical angulations
    g. Principles of shadow casting

11. Quality Assurance Program
    a. Quality control tests
    b. Administrative procedures
    c. Digital imaging procedures

12. Normal Anatomy Appearing on Intraoral Images
    a. Terminology
    b. High-density versus low-density structures
    c. Maxillary landmarks
    d. Mandibular landmarks
    e. Teeth and teeth anatomy

13. Mounting and Viewing
    a. Purpose
    b. Film versus digital mounting
    c. Labial versus lingual mounting
    d. Mounting procedure
    e. Image viewing
        i. Equipment and lighting
        ii. Procedure and sequence
        iii. Responsibilities of dental personnel

14. Infection Prevention for Dental Imaging Techniques
    a. Rationale
    b. Personal protective equipment
    c. Preparation of the treatment area
    d. Supplies and equipment
    e. Patient preparation
    f. Operator preparation
    g. Image receptor handling
    h. Beam alignment devices

      i. Decontamination, sterilization and disposal procedures

      j. Post-exposure receptor handling procedures

15. Exposure, Technique and Processing/Scanning Errors

    a. Terminology

    b. Receptor exposure errors

    c. Patient positioning errors

    d. Periapical technique errors

    e. Bitewing technique errors

    f. Miscellaneous errors

    g. Processing errors

    h. Scanning errors

    i. Identification, cause and correction of errors

16. Dental Radiographer Basics and Responsibilities

    a. Uses of images

    b. Goals of dental imaging

    c. Interpersonal skills and communication

    d. Patient education

    e. Legal issues

    f. Patient confidentiality requirements

    g. Patient records and documentation

17. Panoramic Imaging

    a. Purpose and uses

    b. Panoramic unit and equipment

    c. Fundamentals of panoramic imaging

    d. Procedure

    e. Technique errors

      i. Identification

      ii. Cause

      iii. Correction

    f. Advantages and disadvantages

    g. Interpretation

      i. Normal anatomic landmarks

      ii. Air spaces

      iii. Soft tissue images

      iv. Artifacts

      v. Pathology

18. Client Management and Special Needs Imaging

    a. Gag reflex

    b. Physical disabilities

    c. Developmental disabilities

    d. Anatomic constraints

    e. Pediatric patients

    f. Edentulous patients

    g. Endodontic patients

19. Occlusal Imaging Techniques

    a. Terminology

    b. Purpose/uses of occlusal exposures

    c. Maxillary and mandibular topographic techniques

    d. Mandibular cross-section technique

20. Localization Techniques

    a. Terminology

    b. Purpose of localization techniques

      c. Buccal Object Rule/Same on Lingual, Opposite on Buccal (SLOB) Rule

      d. Right-angle technique

21. Radiographic Interpretation Basics

      a. Interpretation concepts

      b. Identification of restorations

      c. Identification of miscellaneous dental materials

      d. Foreign objects

22. Interpretation of Caries

      a. Appearance of caries

      b. Interproximal caries

      c. Occlusal caries

      d. Buccal/lingual caries

      e. Root caries

      f. Recurrent caries

      g. Rampant caries

      h. Arrested caries

      i. Conditions resembling caries

23. Interpretation of Periodontal Disease

      a. Periodontium in health

      b. Periodontal diagnosis and periodontal typing

      c. American Dental Association/American Academy of Periodontology Classification of Periodontal Disease

      d. Identification of predisposing factors

      e. Changes due to occlusal trauma

24. Interpretation of Trauma, Pulpal and Periapical Lesions

      a. Descriptive terminology for high-density and low-density lesions

      b. Trauma

      c. Resorption

      d. Pulpal lesions

      e. Periapical lesions

      f. Developmental cysts

25. Extraoral Imaging

      a. Purpose and uses

      b. Equipment requirements

      c. Patient preparation

      d. Lateral jaw imaging

      e. Lateral cephalometric imaging

      f. Posteroanterior projection

      g. Waters projection

      h. Submentovertex projection

      i. Reverse towne projection

      j. Transcranial/Lindblom technique

      k. Temporomandibular joint tomography

26. Three-Dimensional (3D) Digital Imaging

      a. Terminology

      b. Uses

      c. Fundamentals of 3D imaging

      d. Equipment

      e. Procedure

      f. Advantages and disadvantages

27. Dental X-ray Film

      a. Uses

      b. Dental imaging examinations

    c. Sizes
    d. Intraoral packet
    e. Film components
            i. Base
            ii. Emulsion
            iii. Silver halide crystals
    f. Speed
    g. Latent image formation
    h. Extraoral film, screens and cassettes
    i. Storage

Resources

Iannucci, J and Howerton, L. (2022) *Dental Radiography Principles and Techniques*, St. Louis: Elsevier.

Ibsen, O. and Phelan, J. (2022) *Oral Pathology for the Dental Hygienist*, China: Evolve/Elsevier.

Langlais, R. P., Miller, C. S., J. S. Gehrig. (2017) *Color Atlas of Common Oral Diseases*, Philadelphia: Wolters Kluwer.

Langlais, R. P., Miller, C. S. (2017) *Exercises in Oral Radiology and Interpretation*, St Louis: Elsevier Inc.

Leonardi, Darby, M. (2020) *Darby's Comprehensive Review of Dental Hygiene*, Philadelphia: Elsevier.

Mallya, S., Lam, E. (2019) *White and Pharoah's Oral Radiology Principles and Interpretation*, St. Louis: Elsevier.

Neville, B., Damm, D., Allen, C Chi, A. (2023) *Oral and Maxillofacial Pathology*, Elsevier Health Sciences.

Stabulas-Savage, J. (2018) *Frommer's Radiology for the Dental Professional*, New York: Mosby.

Thompson, E. M. and Johnson, O. N. (2018) *Essentials of Dental Radiography for Dental Assistants and Hygienists*, Upper Saddle River: Pearson Education, Inc.

Resources Other
Videos developed by faculty
Demo laminated phosphor plates created by faculty
App: Dental Panoramic Radiology: Panoramic anatomy identification
RINN: Sample beam alignment devices
Schick: Demo digital sensors
ScanX: Demo phosphor plates
Publication: Panorama Tomography: Troubleshooting Guide, Heraeus Kulzer, Inc
CCC Library Search: Dental Hygiene related web sites: www.tri-c.edu/library/guides/dental.htm
Ohio Department of Health: www.odh.ohio.gov
OhioLINK central library catalog: www.ohiolink.edu
Electronic Journal Center: http://journals.ohiolink.edu

Procter & Gamble/Student-Professional area: www.dentalcare.com

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