

Teaching Oral Radiology. Strategies for Faculty

**Saturday, 6/26/2010
2:30pm-5:30pm**

Teaching Oral Radiology Strategies for Faculty

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Oral Radiology

- ✚ Educators' role to prepare students for competent and safe practice
- ✚ Practical skills required are based on theoretical concepts in physics and geometry
- ✚ Challenge students to link radiographic principles with patient assessment, diagnosis, and evaluation

Objectives

- ✚ Apply sound strategies/methodologies for teaching radiology
- ✚ Link concepts learned in the classroom to laboratory practice, to clinical client care
- ✚ Evaluate curriculum for maximum effectiveness
- ✚ Incorporate tangible tips / techniques into teaching activities
- ✚ Identify resources that enhance / augment learning

Why we teach what we teach

- ✚ Many oral health care educators are also clinicians
- ✚ Possess knowledge and skills needed for safe practice / effective client care
- ✚ Experience = knowing where emphasis needs to be

Ruple JA, Dalton A, Lee W: Teaching Health Careers Education Tools for Classroom Success, Elsevier 2010.

Goals for Educators

- ✚ Assist students with making connection between knowledge (in books) with how it will be used in practice (patient care)
- ✚ Students must be able to identify the WHY to grasp the WHAT and HOW.
- ✚ ...

Ruple JA, Dalton A, Lee W: Teaching Health Careers Education Tools for Classroom Success, Elsevier 2010.

Foundation for successful teaching

...

- ✚ Instructor expertise
 - Subject matter expertise establishes credibility
- ✚ Preparation

Ruple JA, Dalton A, Lee W: Teaching Health Careers Education Tools for Classroom Success, Elsevier 2010.

COMPENDIUM OF CURRICULUM GUIDELINES
ALLIED DENTAL EDUCATION PROGRAMS
ADEA AMERICAN DENTAL EDUCATION ASSOCIATION
FEB 2005

<http://www.adea.org/SiteCollectionDocuments/Compendium of Curriculum Guidelines for Allied Dental Education Programs.pdf>

The study of radiology encompasses principles of:

- ✦ Radiation physics
- ✦ Radiation biology
- ✦ Radiation safety
- ✦ Radiographic quality assurance
- ✦ Imaging theory
- ✦ Alternative imaging modalities and receptors

<http://www.adea.org/SiteCollectionDocuments/Compendium of Curriculum Guidelines for Allied Dental Education Programs.pdf>

Didactic and Laboratory Instruction

- ✦ Lab practice may follow or run parallel with didactic.
- ✦ Basic instruction in radiobiologic effects and protection should be presented prior to operation of equipment that produces ionizing radiation.
- ✦ If the initial instruction is minimal, radiation biology and health and safety must be presented in greater detail and depth later.

<http://www.adea.org/SiteCollectionDocuments/Compendium of Curriculum Guidelines for Allied Dental Education Programs.pdf>

Goals

- ✦ Knowledge of the scientific principles underlying effective and efficient use of x-radiation will help develop a self-directed, self-assured practitioner.
- ✦ The student must develop values, attitudes, and skills that lead to production of the highest technical quality radiographs with minimum patient and operator exposure.

<http://www.adea.org/SiteCollectionDocuments/Compendium of Curriculum Guidelines for Allied Dental Education Programs.pdf>

Goals

- ✦ The student must effectively be able to critically evaluate and solve problems encountered in the practice of radiography.
- ✦ Such competency should be promoted during radiology instruction and clinical application.

<http://www.adea.org/SiteCollectionDocuments/Compendium of Curriculum Guidelines for Allied Dental Education Programs.pdf>

CODA COMMISSION ON DENTAL ACCREDITATION

ACCREDITATION STANDARDS FOR DENTAL HYGIENE EDUCATION PROGRAMS Jan 1 2010

- ✦ The faculty-to-student ratios for radiographic clinical and laboratory sessions must not exceed one to five.

<http://www.ada.org/sections/educationAndCareers/pdfs/dh.pdf>

**ADA AMERICAN DENTAL ASSOCIATION JOINT
COMMISSION ON NATIONAL DENTAL EXAMINATIONS**

NATIONAL BOARD DENTAL HYGIENE EXAMINATION
2010 Guide

http://www.ada.org/sections/educationAndCareers/pdfs/nbdhe_examinee_guide.pdf

Discipline-based Component A

Obtaining and Interpreting Radiographs [14] (7*)

- ✚ Principles of radiophysics and radiobiology [1]
- ✚ Principles of radiologic health [3]
- ✚ Technique [1]
- ✚ Recognition of normalities and abnormalities [2]

Discipline-based Component A

Professional Responsibility [17] (1*)


- ✚ Ethical principles, including informed consent [8]
- ✚ Regulatory compliance [3]
- ✚ Patient and professional communication [5]

Case-based Component B

- ✚ Obtaining and Interpreting Radiographs
- ✚ Professional responsibility

When to introduce topics

- ✚ Most text books begin with radiation physics, biology, protection ...
- ✚ Radiographic techniques are not usually introduced until later



Date	Topic	Reading Assignments
1	LECTURE Orientation to course I. Historical perspective II. Image receptors A. Radiographic film 1. Composition 2. Latent image formation 3. Classifications 4. Types of projections 5. Care and storage	Chapter 1-History of Dental Radiography Chapter 7-Dental X-ray Film (consider introducing digital image receptors) In class activity-film packet construction
2	LABORATORY* Darkroom orientation and film processing procedures Component of the dental x-ray machine Introduction to radiation safety	Chapter 8-Dental X-ray Film Processing Lab Exercise 1-Radiographic Film Processing and Darkroom Design and Maintenance Handout-Components of the Dental X-ray Machine *Blackboard-Lab Attire Guidelines, Lab Assistant Role & Responsibilities

Sample Lab Activity

Students process pre-exposed films

- ✦ Automatic / manual / chair side rapid
- ✦ Individual / pairs / groups
- ✦ Normal / under- / over- developing
- ✦ Compare / discuss
- ✦ Introduction to radiolucent / radiopaque / mounting
- ✦ Darkroom design

Sample Lab Activity

Instructor guided radiation safety demonstration

- ✦ Handout to guide exploration of equipment
- ✦ Direct students to position themselves 6 feet from tube head or each other, then measure their estimates
- ✦ Guide through turning on unit, positioning tube head via support arms, setting activating exposure

Sample Objectives

1. Trace the history of radiography, noting the prominent contributors.
2. List the uses of and explain the importance of dental radiographs in quality oral health care for the client.
3. List and specify function of the components of the intraoral film packet.
4. Identify the parts and explain the functions of a dental x-ray control panel.

Sample Test Questions

What New Orleans dentist first made practical use of x-rays in the treatment of dental patients?

- A. W. A. Price
- B. W. D. Collidge
- C. C. E. Kells
- D. G. M. Fitzgerald
- E. F. W. McCormack

The purpose of the lead foil in the film packet is to


- A. control latent image formation.
- B. protect film from accidental light leaks.
- C. absorb back-scattered x-rays to reduce film fog.
- D. eliminate the need for an intensifying screen

Date	Topic	Reading Assignments
3	LECTURE* III. Bitewing radiographs A. Assessment of radiographic need B. Bitewing technique 1. Packet placement 2. Vertical angulation 3. Horizontal angulation 4. Centering the beam	Chapter 14-The Bitewing Examination Blackboard-Guidelines for Prescribing Dental Radiographs *Bring Guidelines to class In class activity-Case studies using Guidelines
4	LABORATORY Bitewings on manikin Begin Bitewing Practical #1	Lab exercise 2-Bitewing Radiographic Technique

Sample Lab Activity

Students expose bitewings on manikin

- ✦ "Process" and "Product" evaluations
- ✦ Provide student with stress-free environment
- ✦ Use errors as learning opportunities
- ✦ Control film use with sign out log
- ✦ Relate retakes to real-life patient
- ✦ Consider using an image receptor holder that requires learning geometric principles that can enhance skills required for determining angulation




Consider introducing students to digital imaging BEFORE film-based imaging ?

Would seeing “instant” results assist students with learning accurate techniques and applying appropriate correct actions ?

Pop Quiz !

What type of radiograph is this?

- Molar periapical
- Molar bitewing
- Premolar periapical
- Premolar bitewing



Sample Objectives

1. Assess the radiographic need of the client as to what type of projection and number of films are required for treatment planning and implementation of quality oral health care.
2. Explain the steps of packet placement, vertical and horizontal angulations, and centering to achieving diagnostic quality bitewing radiographs.
3. Differentiate between and indicate the uses of horizontal and vertical bitewing radiographs

Sample Test Questions

<p>Which of these clinical situations would indicate the need for bitewing radiographs?</p> <ul style="list-style-type: none"> A. Evidence of a fractured tooth B. Tooth mobility or mal-position C. Growth and development abnormalities D. Suspected interproximal caries E. Unexplained sensitivity of teeth 	<p>Which of the following is correct angulation for bitewing radiographs?</p> <ul style="list-style-type: none"> A. 10 degrees positive vertical B. 10 degrees negative vertical C. 10 degrees positive horizontal D. 10 degrees negative horizontal
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Date	Topic	Reading Assignments
5	LECTURE IV. Periapical radiographs A. Introduction to bisecting and paralleling techniques-shadow casting principles B. Packet placement C. Vertical angulation D. Horizontal angulation E. Centering the beam	Chapter 12-Intraoral Radiographic Procedures In class activity-flashlight (or overhead projector) demonstration of shadow cast principles
6	LABORATORY Anterior periapicals on manikin-Stabe holder Complete Bitewing Practical #1	Lab exercise 3-Periapical Radiographs-Paralleling Technique Chapter 13-The Periapical Examination Chapter 18-Mounting and Introduction to Interpretation

Sample Lab Activity

Students expose periapicals on manikin

- ⚡ “Process” and “Product” evaluations
- ⚡ Build on skills learned with bitewings
- ⚡ Consider using an image receptor holder that requires learning geometric principles that can enhance skills required for determining angulation
- ⚡ Demonstration of errors with digital imaging

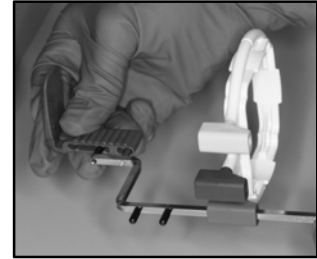
Sample Objectives

1. Explain the steps of packet placement, vertical and horizontal angulations, and centering to achieve diagnostic quality periapical radiographs.
2. Using an exposure chart set correct mA, kVp, exposure time for periapical radiographs.
3. Operate the disposable Stabe® film holder device to place and expose periapical radiographs.

Sample Test Question

The radiographer is assembling this Rinn XCP-ORA™ film holding device to expose which of the following radiographs?

- A. Anterior periapical
- B. Posterior periapical
- C. Horizontal bitewing
- D. Vertical bitewing



Date	Topic	Reading Assignments
7	LECTURE V. Radiation physics A. Types of radiation B. Characteristics of x-rays C. Sources of radiation exposure VI. Units of Measurement	Chapter 2-Characteristics and Measurement of Radiation, pg. 9-13 and pg. 15-19 In class activity-Radiation Trivia
8	LABORATORY* Bitewings and anterior periapicals- Rinn XCP-ORA™ holders Begin Bitewing Practical #2	Lab exercise 5-Radiographic Techniques with Supplemental Film Holders *Bring Rinn XCP-ORA™ to lab

Sample Lab Activity

Students continue PA technique & new practical

- ⬇ “Product” practical on vertical bitewings or bitewings with a different holder (tabs, XCP, etc)
- ⬇ Introduce anterior PAs one session, posterior PAs the following session, allowing lecture to proceed to topics that do not have a lab component

Sample Objectives

1. Define ionization.
2. Identify the sources of natural/background and man-made artificial ionizing radiation.
3. Apply the units of radiation measurement in traditional and SI units for: exposure, absorbed dose, dose equivalent and effective dose equivalent

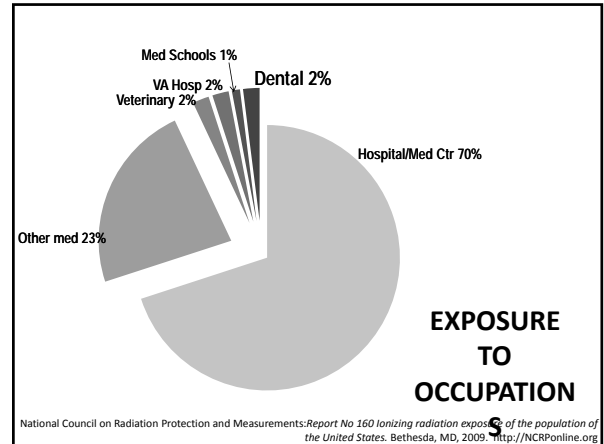
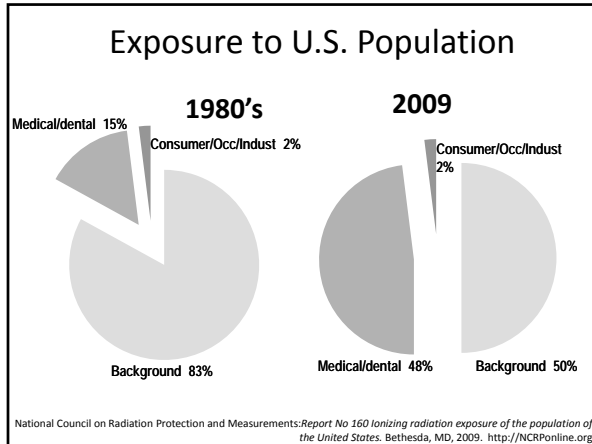
Sample Test Questions

Which of the following is an example of background (naturally occurring) ionizing radiation?

- A. Cosmic rays from the universe
- B. Nuclear fuel cycle fallout
- C. Microwave cooking
- D. Medical-dental radiation
- E. Consumer products (ie: smoke detectors)

The effective dose equivalent is expressed by the term

- A. sievert.
- B. centisievert.
- C. millisievert.
- D. microsievert.
- E. nanosievert



Date	Topic	Reading Assignments
9	LECTURE VII. Production of x-rays A. Requirements for controlled production B. Processes 1. General/bremsstrahlung 2. Characteristic C. Basic interaction with matter 1. Coherent 2. Photoelectric 3. Compton	Chapter 2-Characteristics and Measurement of Radiation, pg. 13-15 Chapter 3-The Dental X-ray Machine: Components and Functions, pg. 25-33
10	LABORATORY* Bitewings and posterior periapicals- Rinn XCP-ORA™ holders Complete Bitewing Practical #2	Lab exercise 5-Radiographic Techniques with Supplemental Film Holders *Bring Rinn XCP-ORA™ to lab

Sample Lab Activity

Students complete PA technique & practical

- ⬇ Complete lab exercises to provide self assessment prior to continuing

Instructor guided handouts

- ⬇ Provide study guides, outlines to assist with organization of learning

- ### Sample Objectives
1. Given a schematic drawing, identify the components of an x-ray machine.
 2. Trace the production of X rays from the time the exposure button is activated until x-ray photons are released from the tube aperture.
 3. Describe and compare the basic interactions of x-radiation with matter (photoelectric, Compton, and coherent).

- ### Sample Test Question
- Amperage measures the electric potential or force which moves electrons along a conductor.
- Increasing the force with which the electrons move increases the penetrating potential of the x-ray beam.
- A. The first statement is true, the second statement is false.
 - B. The first statement is false, the second statement is true.
 - C. Both statements are true.
 - D. Both statements are false

Sample Test Question

If an x-ray machine could produce 10,000 x-ray photons in 1 second, but you want it to produce more than that, what would you change to get the greatest increase?

- A. Milliamperage
- B. Impulses
- C. Kilovoltage
- D. Filtration
- E. Collimation

Date	Topic	Reading Assignments
11	LECTURE VIII. Radiation biology A. Ionization Theories 1. Direct 2. Indirect B. Factors influencing a biological response C. Dose response curves D. Risk estimates and comparisons	Chapter 5-Effects of Radiation In class activity-Risk Trivia
12	LABORATORY Begin FMS Practical	Handout on FMS practical quality parameters and self evaluation.

Sample Lab Activity

Students test skills learned so far

- Begin self directed FMS practical with limited number of retakes.
- Calculate radiation dose at:
<http://www.epa.gov/radiation/understand/calculate.html>

Instructor guided handouts

- Link real life situations with radiological concepts.

Sample Objectives

1. Compare the direct and indirect theories of biological damage by ionizing radiation.
2. Identify factors influencing a biological response to irradiation.
3. Weigh risks versus benefits of radiation exposure when recommending radiographs for clients.

Sample Test Questions

Whole body radiation induced biological damage depends on each of the following **EXCEPT** one.

- Which one is this **EXCEPTION**?
- A. Client's gender
 - B. Amount of radiation
 - C. Type of radiation
 - D. Size of irradiated area
 - E. Dose rate

A 2004 study published in JAMA indicates that dental x-rays exposed on pregnant clients may be associated with an increased incidence of

- A. miscarriage.
- B. leukemia.
- C. birth defects.
- D. premature delivery.
- E. full-term low birth weight.

Risks that increase chance of death in any year by 1 in 1 million ...

- Smoking 1.4 cigarettes (*cancer, heart dis.*)
- Living 2 months with a cig. smoker (*cancer, heart dis.*)
- Drinking 0.5 liters of wine (*liver dis.*)
- Traveling 150 miles by car (*accident*)
- Flying 1000 miles by jet (*accident*)
- Flying 6000 miles by jet (*cancer from cosmic radiation*)
- 10 miles of biking (*accident*)
- 6 minutes of canoeing (*accident*)

Eating 40 tbsp. peanut butter (*cancer from aflatoxin B*)
 Drinking 30 12-oz cans diet soda (*cancer from saccharin*)
 Eating 100 charcoal broiled steaks (*cancer from benzopyrene*)
 Living 2 months in average stone/brick bldg. (*cancer from natural radiation*)
 Spending 1 hour in a coal mine (*black lung dis.*)
 Spending 3 hours in a coal mine (*accident*)
 Risk of accident by living within 5 miles of a nuclear reactor for 50 years (*cancer*)

The Skeptical Environmentalist:
 Measuring the Real State of the World, 2001, page 337.

Date	Topic	Reading Assignments
13	LECTURE IX. Film mounting X. Recognition of normal radiographic anatomy A. Radiographic appearance of teeth and supporting bone B. Radiographic anatomy of the maxilla C. Radiographic anatomy of the mandible	Chapter 18-Mounting and Interpretation Chapter 19-Recognizing Normal Radiographic Anatomy In class activity-slide identification
14	LABORATORY* Film mounting and identification of normal maxillary anatomical landmarks Continue with FMS Practical	Lab exercise 8-Radiographic Interpretation *Bring textbook and supplemental textbook to lab.

Sample Lab Activity

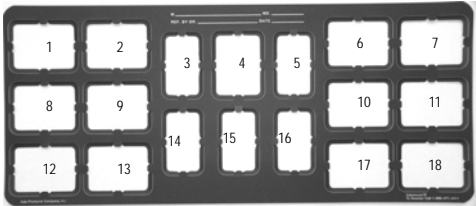
Students work with mounting exercise

- ✚ For ease of grading, use duplicate sets
- ✚ Become familiar with digital software for moving and reorienting images within mounts.
- ✚ Utilize skull while viewing radiographs.


Sample Objectives

1. Value the importance of film mounting for improved diagnostic results.
2. Correctly mount a full mouth series of radiographs including bitewings using both the labial and the lingual method of film mounting.
3. Locate maxillary anatomical landmarks on a radiographic image.

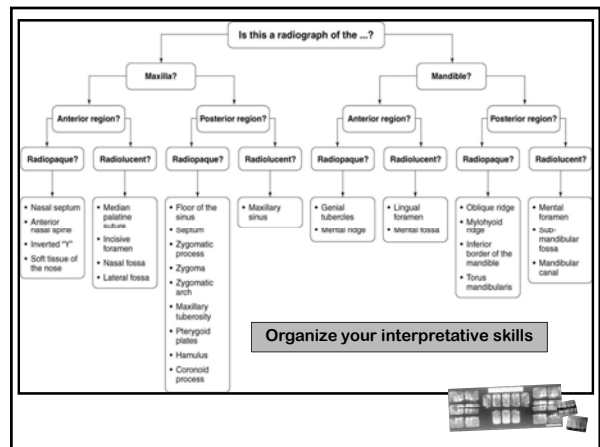
Sample Test Question



Assuming this radiograph is positioned with the embossed dot convex (raised), into which numbered space on the mount would it be placed when mounting labially.



A. 1 B. 7 C. 12 D. 18



Date	Topic	Reading Assignments
15	LECTURE XI. Factors affecting the radiographic image A. Density and contrast B. Beam factors C. Subject factors D. Film factors E. Geometric factors F. Inverse square law	Chapter 4-Producing Quality Radiographs In class activity-Reflect-Case Study
16	LABORATORY Exposure variables exercise Continue with FMS Practical	Lab exercise 9-Exposure variables-Factors Affecting the Radiographic Image

Sample Lab Activity

Students work with exposure variables

- ✚ Expose objects of various densities at varying settings. Explain results.
- ✚ ISL problems

Instructor guided handouts

- ✚ Exercises on changing variables to meet patient needs.
- ✚ Exposure settings are “average”. Need to determine based on patient characteristics.

Sample Objectives

1. Analyze factors which affect the radiographic image according to the inter-relationship of beam factors, subject factors, film factors, and geometric factors.
2. Appropriately adjust the x-ray unit exposure time, mA, or kVp to change the film image density or contrast.
3. Perform the inverse square law to correctly determine radiation intensity at varying distances.

Sample Test Questions

With all other variables remaining constant, an increase in the exposure time will

A. decrease the density.
B. increase the density.
C. decrease the contrast.
D. increase the contrast

Based on the inverse square law, what happens to the intensity of the x-ray beam when the x-ray source-to-image receptor distance is doubled?

A. Intensity is doubled.
B. Intensity is four times more.
C. Intensity is one half.
D. Intensity is one fourth.
E. Intensity remains the same

Date	Topic	Reading Assignments
17	LECTURE XII. Technique, processing, and handling errors that compromise diagnostic quality XIII. Quality Assurance	Chapter 16-Identifying and Correcting Undiagnostic Radiographs Chapter 17-Quality Assurance in Dental Radiography In class activity-Error Identification
18	LABORATORY* Radiographic errors identification Complete FMS Practical	Lab exercise 10-Radiographic Technique and Processing Errors *Bring textbook and supplemental book to lab

Sample Lab Activity

Students work with error exercises

- ✚ Identify errors
- ✚ Create errors to understand result

Instructor guided activities

- ✚ Collect errors from previous classes. Assign students to turn in one error with cause, evaluation, corrective active. Save for the following year.

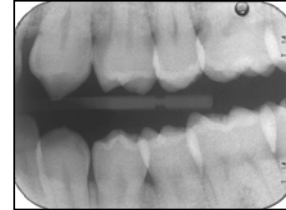
Sample Objectives

1. Critique a radiograph for diagnostic quality.
2. Match radiographic image errors with mistakes made in radiographic technique, processing, and film handling procedures.
3. Assess the need for, and identify components of, a radiographic quality assurance program.

Sample Test Question

To correct the error noted in this radiograph shift the P.I.D. so that the x-ray beam will be directed to strike the film packet from the

- A. mesial.
- B. distal.
- C. occlusal.
- D. apex.



Date	Topic	Reading Assignments
19	LECTURE* XIV. Radiation Protection A. Patient Protection B. Operator Protection C. Regulatory Agencies D. State Required Radiation Safety Certification XV. Material Safety and Environmental Health A. Chemical Safety B. Radiographic Wastes	Chapter 6-Radiation Protection Chapter 20-Safety and Environmental Responsibilities in Radiography In class activity: Obtain MSDS for chemical used in radiography. Bring laptop to class.
20	Laboratory Quality Assurance- <i>This exercise serves as the annual QUALITY CONTROL for the radiography equipment in the dental hygiene care facility.</i>	Lab exercise 11-Radiographic Quality Assurance Chapter 17-Quality Assurance in Dental Radiography Kodak booklet-Quality Assurance in Dental Radiography

Sample Lab Activity

Students perform quality control tests

- ✚ Assign students to prepare inventory of chemicals, hazardous radiographic materials. Obtain MSDS.

Instructor guided activities

- ✚ Prepare quality control tests the students can carry out. Link oral care facility needs with students' learning.
- ✚ Eye wash station demonstration

Sample Objectives

1. Identify agencies with responsibilities for regulation of radiant energy.
2. Serve as educator and effective communicator between clinician and client, when discussing benefits/risks of ionizing radiation exposure.
3. Perform appropriate quality assurance tests on radiographic equipment and take appropriate corrective measures.

Sample Test Questions

The step-wedge can be used to test each of the following **EXCEPT** one. Which one is the **EXCEPTION?**

- A. X-ray machine output
- B. Processing chemistry
- C. Density/contrast of image
- D. Adequacy of safelight

A Material Safety Data Sheet (MSDS) would NOT need to be obtained for which of the following?

- A. Lead foils from intraoral film packets
- B. Radiographic fixer
- C. Radiographic developer
- D. Low-level disinfectant

Date	Topic	Reading Assignments
21	LECTURE XVI. Bisecting Technique XVII. Managing Patients with Special Needs	Chapter 15 The Periapical Examination-Bisecting Chapter 23 Radiographic Techniques for Children Chapter 24 Managing Patients with Special Needs Web: http://www.dimensionsofdentalhygiene.com/ddhrig/ht.aspx?id=1315
22	LABORATORY* Placement of Intraoral Radiographs on Partners	Lab Exercise 6-Infection Control and Student Partner Lab Exercise 7-Special Clients / Student Partner Chapter 9 - Infection Control Chapter 10 – Legal/ Ethical Responsibilities Chapter 11- Patient Relations / Education *Bring PPE (mask, glasses, gloves) sterilized XCP-ORA™

Sample Lab Activity

Students simulate FMS on partners

- ✚ Students perform infection control protocols for radiography
- ✚ Role play special needs patients
- ✚ Instructor feedback.
- ✚ Opportunity to use special products.
- ✚ Learn sterilization procedures for image receptor holders / digital sensors.


Sample Objectives

1. Distinguish between situations that call for the bisecting or paralleling technique.
2. Appropriately set up and secure the radiology operatory following accepted infection control protocol.
3. Demonstrate appropriate chair side manner, attitude, verbal and non verbal listening skills and facilitative skills that will enhance client trust during the radiographic procedure.

Sample Test Question

Which of the following best describes the vertical angulation depicted in the drawing? (Refer to picture)

- A. Accurate for the bisecting technique.
- B. Excessive, will result in elongation.
- C. Excessive, will result in foreshortening.
- D. Insufficient, will result in elongation.
- E. Insufficient, will result in foreshortening.



Date	Topic	Reading Assignments
23	LECTURE XVIII. Radiographic Interpretation A. Dental Materials B. Trauma and Periapical Lesions C. Developmental and Acquired Abnormalities	Chapter 20 – Recognizing Deviations from Normal Radiographic Anatomy <u>Supplemental Reading:</u> <i>Chapter 5: Identification of Restorations, Dental Materials and Foreign Objects</i>
24	LABORATORY Bisecting Technique-Practical on manikin Radiographic Interpretation-Dental materials	Lab Exercise 4-Periapical Techniques-Bisecting Lab Exercise 12-Radiographic Interpretation *Bring Textbook and supplemental interpretation book to lab

Sample Lab Activity

Students begin interpretation exercises

- ✚ Begin with more obvious interpretive findings such as dental materials.

Students begin bisecting technique on manikins

- ✚ Work in two groups with partners. Switch half way to avoid interpretation fatigue.

Sample Objectives

1. Define the terms "interpretation" and "diagnosis."
2. View radiographs under conditions appropriate for radiographic interpretation.
3. Use appropriate vocabulary for radiographic descriptions.
4. Recognize deviations from normal radiographic anatomy

Sample Test Question

The periapical radiolucencies associated with the mandibular first premolar and canine pictured here is most likely

- A. incomplete root formation.
- B. periapical abscess.
- C. external resorption.
- D. apicoectomy.
- E. odontoma



Date	Topic	Reading Assignments
25	LECTURE D. Periodontal Disease	Chapter 22 – The Use of Radiographs in the Evaluation of Periodontal Diseases <u>Supplemental Reading:</u> Chapter 7: Periodontal Disease
		In class activity: Slide identification
26	LABORATORY Bisecting Technique-continue practical on manikin Radiographic Interpretation-Periodontal Disease	Lab Exercise 12-Radiographic Interpretation *Bring Textbook and supplemental interpretation book to lab

Sample Lab Activity

Students continue with interpretation exercises

- ⬇ Periodontal interpretation.
- ⬇ Utilize magnification. Probe.
- ⬇ Discuss standards and objective and subjective interpretation.

Students continue bisecting technique practical

Sample Objectives

1. Describe uses and limitations of radiographs in periodontal assessment.
2. Use the appropriate radiographic projections to best image periodontal changes.
3. View and interpret radiographs for periodontal disease.
4. View and interpret radiographs for conditions that predispose for periodontal disease.

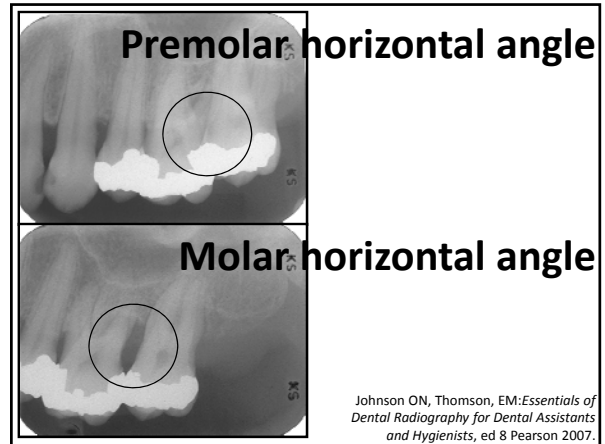
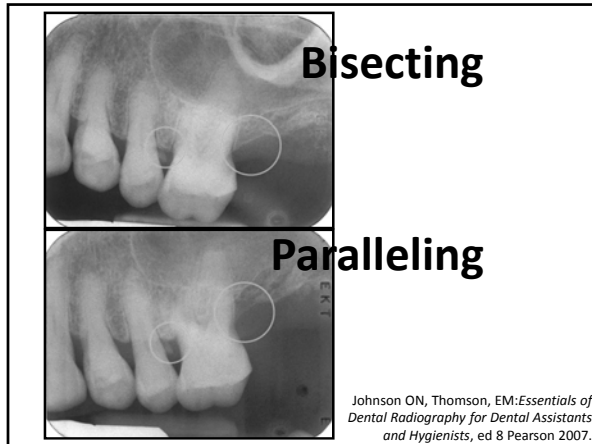
Sample Test Questions

An early radiographic sign of periodontal disease is

- A. enlargement of the gingiva.
- B. furcation involvement.
- C. loss of density in the alveolar crest.
- D. vertical boney defect.
- E. periodontal abscess.

Bone loss in furcation areas may go undetected on a dental radiograph, because the image is two dimensional.

- A. Both the statement and reason are correct and related.
- B. Both the statement and reason are correct but NOT related.
- C. The statement is correct, but the reason is NOT.
- D. The statement is NOT correct, but the reason is correct.
- E. NEITHER the statement NOR the reason is correct



Date	Topic	Reading Assignments
27	LECTURE E. Caries	Chapter 21-The Use of Radiographs in the Detection of Dental Caries <u>Supplemental Reading</u> Chapter 6, Dental Caries In class activity: Slide identification
28	LABORATORY* Bisecting Technique-Complee practical on manikin Radiographic Interpretation-Caries and Conditions that mimic decay	Lab Exercise 12-Radiographic Interpretation *Bring Textbook and supplemental interpretation book to lab

Sample Lab Activity

Students continue with interpretation exercises

- ⬇ Use of radiographs to detect caries.
- ⬇ Utilize magnification. Identification of incipient, moderate, advanced, severe caries.
- ⬇ Identify conditions that mimic decay.
- ⬇ Discuss role interpretation findings play in patient oral health care instructions.

Students complete bisecting technique practical

Sample Objectives

1. Describe uses and limitations of radiographs in caries assessment.
2. Use the appropriate radiographic projections to best image caries.
3. View and interpret radiographs for caries.
4. Differentiate between conditions which radiographically resemble caries (cervical burnout, Mach banding, abrasion, attrition, indirect pulp capping).

Sample Test Questions

Each of the following may resemble dental caries radiographically **EXCEPT** one. Which one is the **EXCEPTION**?

A. Amalgam
B. Attrition
C. Abrasion
D. Composite
E. Cervical burnout

The bisecting technique is preferred for imaging caries. The paralleling technique is preferred for imaging periodontal disease.

A. The first sentence is correct, the second sentence is incorrect.
B. The first sentence is incorrect, the second sentence is correct.
C. Both sentences are correct.
D. Both sentences are incorrect.

55 kVp Short-scale contrast 100 kVp Long-scale contrast

- Some practitioners prefer to interpret caries from radiographs with HIGH contrast.
- High contrast images = more distinct black and white with less shades of gray. Purported to image subtle changes in enamel better than images of low contrast.
- Not everyone agrees with this. **But it is important to be aware of this theory.**

Date	Topic	Reading Assignments
29	LECTURE XIX. Digital Radiographic Imaging	Chapter 26-Digital Radiography In class activity: Bring laptops – On-line video
30	LABORATORY Digital Imaging-FMS	Lab Exercise 15-Digital Imaging Web: http://www.dimensionsofdentistry.com/ddright.aspx?id=3612

Sample Lab Activity

Students begin digital imaging FMS practical

- Work in pairs if equipment is limited. Direct students to left or right side.
- Students to demonstrate knowledge of software manipulations of images.

Instructor guided handouts

- Practical parameters.

Sample Objectives

1. Demonstrate knowledgeable operation of equipment used for digital radiographic imaging.
2. Place, expose and evaluate for acceptability digital radiographs.
3. Demonstrate competent operation of digital radiographic software

Sample Test Questions

Which of these is an advantage of digital sensors over radiographic film?

- Increased patient comfort.
- Images a larger area.
- Less complicated infection control.
- Less radiation to required.
- Reduces the risk of radiographic errors

Which of the following sensor technologies stores the digital information produced by x-rays until later stimulated by a laser to produce an image?

- PSP
- CCD
- XCP
- CMOS

What are the legal implications of digital radiographs?

***X-ray Touch up Is Simple!
If You Have Our Full Featured
Cosmetic Imaging Program***

<http://www.dentalcam.com/closeups.htm>

Date	Topic	Reading Assignments
31	LECTURE XX. Panoramic Radiography A. Panoramic Errors	Chapter 28 - Panoramic Radiography Blackboard posting:KODAK Successful Panoramic Radiography In class activity: Error identification
32	LABORATORY* Panoramic demonstration and partner positioning practice Panoramic Errors	Lab Exercise 14-Panoramic Radiographic Technique *Bring textbook and Carestream/KODAK booklet to lab

Sample Lab Activity

Students oriented to panoramic equipment

- ✚ Work in pairs if equipment is limited. Divide into two groups if film-based and digital equipment is available. Switch half way through session.
- ✚ Students to demonstrate knowledge of how to determine focal trough location.
- ✚ Half class work through errors while half orients to panoramic equipment. Switch.

Sample Objectives

1. Describe the theory of panoramic image production.
2. Assess client need for panoramic radiographs.
3. Demonstrate the correct technique for operation of the film-based and digital panoramic units.
4. Identify common panoramic radiographic errors and apply accurate corrective actions.

Sample Test Questions

According to selection criteria guidelines noted in the Dimensions of Dental Hygiene article on producing error-free panoramic images for the pediatric patient, panoramic radiographs are NOT recommended for assessment of growth and development for asymptomatic children/adolescents

- A. under age 6
- B. between age 6 and 12
- C. between age 13 and 17
- D. between age 18 and 21

Date	Topic	Reading Assignments
33	LECTURE B. Panoramic Anatomy C. Panoramic Artifacts	Chapter 28 - Panoramic Radiography Blackboard posting:KODAK Successful Panoramic Radiography In class activity: Error identification
34	LABORATORY* Panoramic practical Panoramic Anatomy and Artifacts	Lab Exercise 14-Panoramic Radiographic Technique Handout on Pan Practical *Bring Panoramic Corporation handout to lab

Sample Lab Activity

Students begin panoramic practical

- ✦ Work in pairs if equipment is limited. Direct students to left or right side.
- ✦ Work through panoramic anatomy and artifact Power Point on lap tops

Sample Objectives

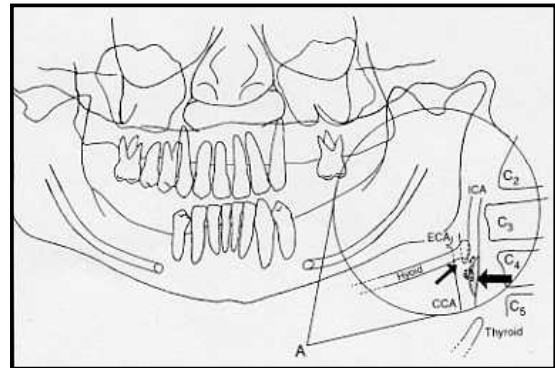
1. Identify normal radiographic anatomy as imaged on a panoramic radiograph.
2. Identify panoramic imagery artifacts, ghost images, and negative shadows.

Sample Test Questions

Interpretation of a panoramic radiograph should include examination of the region posterior and inferior to the angle of the mandible at a 45° angle BECAUSE a possible carotid artery calcification can be recorded near the 3rd or 4th cervical vertebra.

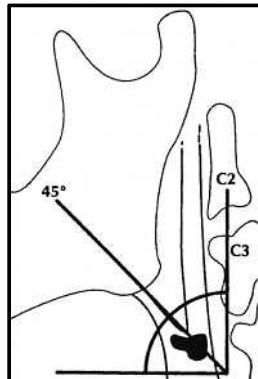
- A. Both the statement and reason are correct and related.
- B. Both the statement and reason are correct but NOT related.
- C. The statement is correct, but the reason is NOT.
- D. The statement is NOT correct, but the reason is correct.
- E. NEITHER the statement NOR the reason is correct.

Location of bifurcation of carotid



1.5 to 2.5 centimeters ...
(½ to 1 inch)

... posterior and inferior to the angle of the mandible at a 45 degree angle

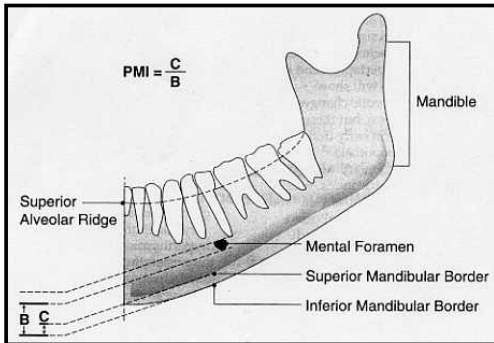


General Dentistry - 2000

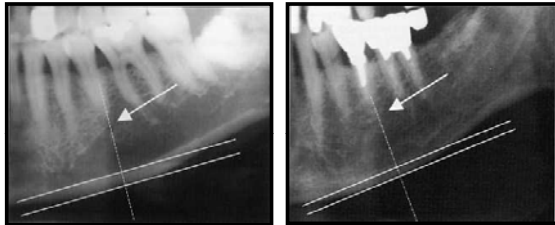
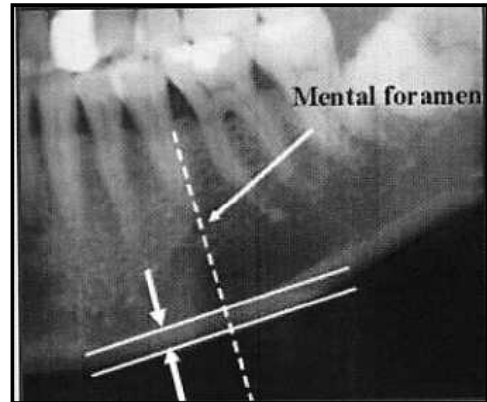
Carotid artery calcification



Panoramic Evidence of Osteoporosis



Journal of Dental Research - 2003



Normal cortical width Severely eroded and very narrow

Dentomaxillofac. Radiology - 1996

Date	Topic	Reading Assignments
35	LECTURE XXI. Occlusal Radiography XXII. Supplemental Techniques A. Disto-Oblique Periapical Radiograph B. Localization Techniques	Chapter 15-The Occlusal Examination Chapter 25-Supplemental Radiographic Techniques In class activity: video
36	LABORATORY Lab Exercise 13 Occlusal, Disto-Oblique Periapical and Localization	Lab Exercise 13-Supplemental Radiographic Techniques

Sample Lab Activity

Students practice supplemental techniques

- Occlusal radiographs : topographical and cross sectional.
- Dist-oblique periapical radiographs to image foreign object taped to manikin.
- Localization techniques. Taped objects.

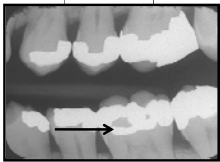
Sample Objectives

1. Expose, process, mount and critique for acceptability occlusal radiographs of the maxilla and the mandible.
2. Appropriately alter the horizontal and vertical angulations and exposure time as indicated for the dist-oblique periapical radiographic technique.
3. Identify the position of objects (facial-lingual) when viewing radiographs by applying rules of localization

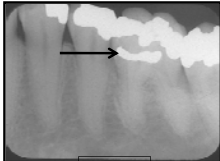
Sample Test Questions

Looking at Film 1 and Film 2, what surface of the tooth is the amalgam restoration (pointed out by the arrow) on?

Film 1



Film 2



A. Buccal
 B. Lingual
 C. Occusal
 D. Mesial
 E. Not possible to determine position

Date	Topic	Reading Assignments
37	LECTURE XXIII. Film Duplication XXIV. Extraoral Radiography A. Film identification methods XXV. Alternate imaging modalities A. Cone Beam Computed Tomography	Chapter 27-Extraoral Radiography Blackboard postings
38	LABORATORY* Lab Exercise on film duplication and lateral jaw extraoral radiography	Lab Exercise Handout-Lateral Jaw Radiographic Technique * Bring a set of 4 bitewing radiographs taken from a previous session to duplicate

Sample Lab Activity

Students practical duplication

- ✚ Operate duplicator.
- ✚ Duplicate at less and more time. Explain results.

Students expose an extraoral radiograph

- ✚ Practice at loading extraoral cassette. Setting exposure for screen-film. Identifying film.

Sample Objectives

1. Demonstrate use of radiographic film duplicating equipment.
2. Match types of extraoral radiographs of the head and neck regions with diagnostic need.
3. Explain cone beam computed tomography (cone beam volumetric imaging) and describe its role in oral healthcare.

Sample Test Questions

What is the purpose of antihalation coating on duplicating film?

A. Prevents a blurry image
 B. Protects emulsion
 C. Increases image density
 D. Absorbs reflected light
 E. Provides sensitivity to x-rays

Digital dental imaging uses a pixel to capture data for processing into a radiographic image. To capture more data for enhanced imaging CBCT uses a

A. Sensel
 B. Texal
 C. Voxel
 D. Grid
 E. Megapixel

Suggested Topic Order Summary

- ✚ Teach lecture prior to lab sessions.
- ✚ Film processing activity or guided orientation exercise can be used prior to safety protocol lecture.
- ✚ BW technique allows time for study of projection principles needed to grasp paralleling and bisecting techniques.
- ✚ Digital imaging provides immediate feedback and may assist with understanding projection geometry.

- ✚ Paralleling technique best learned to competency prior to introducing bisecting technique.
- ✚ Components of x-ray machine and production of radiation can occur while labs continue with the development bitewing and periapical techniques.
- ✚ Followed by radiation biology.
- ✚ Film mounting, while introduced should now be covered in depth. Grade labs for correct mounting.
- ✚ Radiology should not “teach” anatomy, but the recognition of radiographic appearance. Introduce this topic after a few weeks when it has been covered in the anatomy course and students are familiar with the terms.

- ✚ Once student have begin to learn anatomy and how to ready radiographs, they have an understanding of the importance of image density and contrast. Introduce factors effecting the radiographic image now.
- ✚ Error identification and quality assurance may best follow after the student understands the importance of quality.
- ✚ Radiation protection now will place this topic closer to the time when students will begin to exposure patients. Also, right before partner simulation practice, the student my value this topic as a need-to-know.

- ✚ Introduce partner practice after students have had experience with positioning the dental chair and maneuvering around the oral cavity in the pre-clinic course.
- ✚ Simulation with special needs patients can occur simultaneously with infection control during partner practice. Students will have learned the basics of hand washing, PPE, etc. in preclinic and can usually easily transfer this working knowledge to radiographic techniques.

- ✚ Introduce interpretation for deviations from the normal to follow periodontal and pathology courses. Coordinate this topic with when students will need these skills in clinic course.
- ✚ Introduce digital once film-based skills are acquired. (If not already introduced.)
- ✚ Panoramic, extraoral, and supplemental techniques are usually introduced toward the end of the course.

- Suggested Teaching Strategies Summary**
- ✚ Limit introducing similar topics (paralleling and bisecting) together.
 - ✚ Build on what the students learn in other courses. Allow other courses to contribute to radiographic skill development.
 - ✚ Organize techniques into minimal, distinct steps. Link errors and corrective actions back to these.
 - ✚ Errors are teachers.

- ✚ Provide multiple ways to provide feedback. Practice does not make perfect. Practice makes permanent.
- ✚ Utilize process and product graded skills.
- ✚ Provide students the tools to evaluate their competency level.
- ✚ Provide students with link between what is being learned in radiology and how they can expect to apply to other courses.
- ✚ Coordinate topic selection with clinic courses and other faculty.