

Dental Radiology

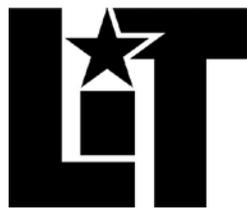
**Lamar Institute of
Technology**

DHYG 1304

Course Syllabus

Fall 2018

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DHYG 1304
Fall Semester

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LECTURE SCHEDULE

	Chapter	Chapter Title
Week 1	Course Overview	Syllabus, Safety in the Dental Radiology Lab
	Chapter 1 Chapter 3	Dental Radiology: Historical Perspective and Future Trends The Dental X-ray Machine: Components and Function
Week 2	Chapter 3 (cont'd) Chapter 6	The Dental X-ray Machine: Components and Function (cont'd) Radiation Protection
	Chapter 6 (cont'd) Chapter 2	Radiation Protection (cont'd) Characteristics and Measurement of Radiation
Week 3	Chapter 2 (cont'd)	Characteristics and Measurement of Radiation (cont'd)
	Test 1	Chapter 1, 2, 3 and 6
Week 4	Chapter 5	Effects of Radiation Exposure
	Chapter 4	Factors Affecting Radiographic Quality
Week 5	Chapter 4 (cont'd) Chapter 7	Factors Affecting Radiographic Quality (cont'd) Dental X-ray Film and Processing Methods
	Chapter 7 (cont'd)	Dental X-ray Film and Processing Methods (cont'd)
October		
Week 6	Chapter 8	Digital Radiography and Image Acquisition
	Test 2	Chapters 4, 5, 7 and 8
Week 7	Chapter 9 Chapter 10	Infection Control Legal and Ethical Responsibilities
	Chapter 11	Patient Relations and Education
Week 8	Chapter 12	Introduction to Radiographic Examinations

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	Chapter 12 (cont'd)	Introduction to Radiographic Examinations (cont'd)
Week 9	Chapter 13 Chapter 14	The Periapical Examination – Paralleling Technique The Periapical Examination – Bisecting Technique
	Test 3	Chapters 9, 10, 11, 12, 13 and 14
Week 10	Chapter 15 Chapter 16	The Bitewing Examination The Occlusal Examination
November		
	Chapter 27	Pediatric Radiographic Techniques
Week 11	Slide Test	Radiographic Evaluation
	Chapter 17	The Panoramic Examination
Week 12	Chapter 29	Radiographic Techniques for Specific Oral Conditions
	Test 4	Chapters 15, 16, 17, 27 and 29
Week 13	Chapter 28	Radiographic Techniques for Patients with Special Needs
	THANKSGIVING	NO CLASS
Week 14	Chapter 18	Identifying and Correcting Undiagnostic Radiographs
	Chapter 19	Quality Control and Environmental Safety in Dental Radiography
December		
Week 15	Chapter 30	Supplemental and Extraoral Radiographic Techniques
	Chapter 31	Three - dimensional Imaging

Final Exam
To Be Announced

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COURSE DESCRIPTION:

Fundamentals of oral radiography, including techniques, interpretation, quality assurance, and ethics.

PREREQUISITE: BIOL 2401, BIOL 2402, DHYG 1301

CO-REQUISITE: DHYG 1227, DHYG 1331

COURSE OBJECTIVE:

At the completion of this course in Dental Radiology, the student will be able to:

1. Explain the principles of radiation as it relates to physics, biology, hygiene, and safety.
2. Produce and interpret diagnostically acceptable radiographs utilizing various radiographic techniques.
3. Apply the principles of quality assurance and ethics in dental radiography.
4. Describe the fundamentals of oral radiographic techniques and interpretation.

CREDIT HOURS

Credit: 3 semester hours
Class: 50 minutes
Laboratory: 3 hours weekly

CLASS MEETING TIMES

Lecture	Tuesday and Thursday	8:00 am – 8:50 am	MPC Room 103
Lab	Monday	9:00 am - 12:00 pm	Radiology Lab
	Monday	1:00 pm – 4:00 pm	Radiology Lab
	Tuesday	1:00 pm - 4:00 pm	Radiology Lab
	Wednesday	9:00 am - 12:00 pm	Radiology Lab
	Thursday	1:00 pm - 4:00 pm	Radiology Lab

COURSE INSTRUCTORS

Kristina Mendoza, RDH, DMD
Tami Browning, RDH (Lab only)

COURSE POLICIES

1. Attendance Policy

Absenteeism

In order to ensure the students in the dental hygiene program achieve the necessary didactic and clinical competencies outlined in the curriculum, it is necessary that the student complete all assigned lecture classes, clinical and laboratory hours. It is the responsibility of the student to attend class, clinic or lab. The instructor expects each student to be present at each session.

It is expected that students will appear to take their exams at the regularly scheduled examination time. Make-up examinations will be given **only** if the absence is due to illness (confirmed by a physicians' excuse), a death in the immediate family, or at the discretion of the instructor.

If students are unable to attend lecture class, clinic or lab, it is **mandatory that you call the appropriate instructor prior to the scheduled class, clinic or lab time**. The student is responsible for all material missed at the time of absence. Extenuating circumstances will be taken into account. Extenuating circumstances might include but are not limited to: funeral of immediate family member, maternity, hospitalization, etc. If the student has surgery, a debilitating injury, or an extended illness, a doctor's release will be required before returning to clinic.

a. **Fall/Spring Semesters:**

Dental hygiene students will be allowed **two excused absences** in any lecture, clinic or lab. Absences must be accompanied by a written excuse on the next class day. In the event that a student misses class, clinic or lab beyond the allowed absences, the following policy will be enforced:

2 absences = verbal warning

Beginning with the 3 absence, **2 points** will be deducted from the final course grade for each absence thereafter.

Tardiness

Tardiness is disruptive to the instructor and the students in the classroom. It is expected that students will arrive on time for class, clinic or lab, and remain until dismissed by the instructor. If tardiness becomes an issue, the following policy will be enforced:

Tardy 1 time = verbal warning

Tardy 2 times is considered an absence.

Students should plan on attending classes, labs and clinic sessions as assigned throughout the semester. Family outings, vacations and personal business should be scheduled when school is not in session and will not be considered excuses for missing assignments, examinations, classes, labs or clinic time.

2. Disabilities Statement. The Americans with Disabilities Act of 1992 and Section 504 of the Rehabilitation Act of 1973 are federal anti-discrimination statutes that provide comprehensive civil rights for persons with disabilities. Among other things, these statutes require that all students with documented disabilities be guaranteed a learning environment that provides for reasonable accommodations for their disabilities.

If you believe you have a disability requiring an accommodation, please contact the Special Populations Coordinator at (409) 880-1737 or visit the office in Student Services, Cecil Beeson Building.

You may also visit the online resource at <http://www.lit.edu/depts/stuserv/special/defaults.aspx>.

3. Student Code of Conduct Statement

It is the responsibility of all registered Lamar Institute of Technology students to access, read, understand and abide by all published policies, regulations, and procedures listed in the *LIT Catalog and Student Handbook*. The *LIT Catalog and Student Handbook* may be accessed at www.lit.edu or obtained in print upon request at the Student Services Office. Please note that the online version of the *LIT Catalog and Student Handbook* supersedes all other versions of the same document.

4. Technical Requirements (for Blackboard)

The latest technical requirements, including hardware, compatible browsers, operating systems, software, Java, etc. can be found online at: https://help.blackboard.com/en-us/Learn/9.1_2014_04/Student/015_Browser_Support/015_Browser_Support_Policy. A functional broadband internet connection, such as DSL, cable, or WiFi is necessary to maximize the use of the online technology and resources.

5. Starfish

LIT utilizes an early alert system called Starfish. Throughout the semester, you may receive emails from Starfish regarding your course grades, attendance, or academic performance. Faculty members record student attendance, raise flags and kudos to express concern or give praise, and you can make an appointment with faculty and staff all through the Starfish home page. You can also login to Blackboard or MyLIT and click on the Starfish link to view academic alerts and detailed information. It is the responsibility of the student to pay attention to these emails and information in Starfish and consider taking the recommended actions. Starfish is used to help you be a successful student at LIT.



6. Electronic Devices

Electronic devices are a part of many individual's lives today. Devices such as tape recorders, radios, cell phones, paging devices and laptop computers, however, may be disturbing to faculty and classmates. Students, therefore, must receive the instructor's permission to operate all electronic devices in the classroom and clinic. Texting on cell phones or computers will not be allowed during class or clinic.

6. Academic Integrity

It shall be considered a breach of academic integrity (cheating) to use or possess on your body any of the following devices during any examination unless it is required for that examination and approved by the instructor: Cell phone, smart watch/watch phone, laptop, tablet, electronic communication devices (including optical), and earphones connected to or used as electronic communication devices.

Use of such devices during an examination will be considered academic dishonesty. The examination will be considered over and the student will receive a zero for the exam. Students with special needs and/or medical emergencies or situations should communicate with their instructor regarding individual exceptions/provisions. It is the student's responsibility to communicate such needs to the instructor.

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7. Student Remediation

Student remediation on concepts taught in this course is available by appointment only.

METHODOLOGY

Each day of class, students are expected to come prepared for the lecture, discussion or the planned activity scheduled for that day. This includes any assignments which have been given verbally or listed in the schedule. Due to the progressive nature of this course, lack of, or failure to prepare for class may lead to eventual difficulties or perhaps failure. Excessive lack of preparation will necessitate a discussion with the instructor.

Lecture is two hours each week, (T/TH), for approximately fourteen weeks and laboratory sessions are three hours, once a week, for approximately thirteen weeks. Attendance at all lecture and laboratory sessions is required. Please see attendance policy on page 6.

Each class day material will be covered in lecture sessions. All topics cannot always be discussed in detail in class and the student is expected to complete the unaddressed objectives. Any problems or questions with objectives or material should be brought to the attention of the instructor.

REQUIRED TEXTS

Johnson, Orlen N., Thomson, Evelyn M. (2017). Essentials of Dental Radiography for Dental Assistants and Hygienists. 10th Edition. New York, New York: Pearson.
ISBN-10: 013446074X | ISBN-13: 9780134460741

Haring, J.I. and L.J. Lind. (1993). Radiographic Interpretation for the Dental Hygienist. Philadelphia: W.B. Saunders.

REFERENCE MATERIALS

Eastman Kodak Company. (1988). *'Guidelines for Prescribing Dental Radiographs'*. Rochester, New York: Eastman Kodak Company.

Kodak, Health Sciences (1990). B.J. Glass, D.D.S., M.S. (Ed). *Successful Panoramic Radiography*. Rochester, N.Y.: Health Sciences Division, Eastman Kodak Company.

Langland, O., R. Langlais, J. Preece. (2002). Principles of Dental Imaging. Baltimore, Maryland: Lippincott Williams & Wilkins.

White, S., M.J. Pharoah. (2013). Oral Radiology Principles and Interpretation. (7th ed.). St. Louis: Elsevier.

COURSE REQUIREMENTS

Lecture Requirements

1. The following information is a tentative list of the lecture requirements. They may vary slightly depending upon the needs of the class as a whole.
 - a. Tests
 - i. 4 Unit tests
 - ii. 1 Comprehensive final
 - iii. Class quizzes

Laboratory Requirements

1. Skill Evaluations
 - a. Automatic Processing of Radiographic Film
 - b. Mounting Radiographic Film
2. Competency Examinations
 - a. Exposing a Full Mouth Radiographic Survey on the DXTR Manikin
 - b. Exposing a Full Mouth Radiographic Survey on Patient
 - c. Exposing a Panoramic Radiographic Survey on Patient
3. Radiographic Surveys
4. Self-evaluation on each survey
5. Radiographic Interpretation and Evaluation Exam

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Survey Requirements for Bitewing Radiographs	
Vertical Interproximal Survey (1 DXTRR manikin)	1
Horizontal Interproximal Survey (1 DXTRR manikin, 1 adult)	2
Total Interproximal Surveys Required	3
Survey Requirements for Full Mouth Surveys	
DXTRR Manikin (1 practice, 1 competency)	2
Adult Full Mouth Surveys (1 competency)	2
Digital DXTRR Manikin Full Mouth Survey	1
Child DXTRR Manikin Full Mouth Survey	1
Total FMX Surveys Required	6
Survey Requirements for Panoramic Surveys	
DXTRR Manikin	1
Adult Panoramic Survey	1
Panoramic Radiographic Survey	2
Survey Requirements for Occlusal Surveys	
Occlusal Survey (DXTRR manikin) (1cross-sectional, 1 topographical)	2

EVALUATION CRITERIA

A grade of **75 (C)** or better must be achieved in DHYG 1304 lecture and **all** requirements must be met in lab to pass DHYG 1304 and progress in the dental hygiene program. Failure in either part of the course results in failure of the course.

Grade Scale:

A = 92-100

B = 83-91

C = 75-82

D = 60-74

F = below 60

Laboratory Grade:

Laboratory assignments are a pass/fail grade. Each student must meet minimal competency for all requirements in order to pass DHYG 1304. Please refer to the Lab Manual for detailed requirements in Radiology Lab.

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RADIOLOGY GRADE COMPUTATION SHEET

Lecture Grade:

1. Total points made on tests
 _____ , _____ , _____ , _____ = _____ (A)
2. _____(A) / 4 = _____(B)
3. (B) x .70 = _____(C)
4. Final exam = ____ x .20 = _____(D)
5. Quizzes = total points on quizzes / by number of quizzes = _____ (E)
6. _____(E) x .10 = _____(F)
7. Final lecture grade: (C) + (D) + (F) = _____ (G)

Laboratory Grade: Pass/Fail

Requirements		
Mounting a Radiographic Survey Skill Evaluation	Pass (in 2 attempts)	Fail
Automatic Processing Radiographic Film Skill Evaluation	Pass (in 2 attempts)	Fail
Exposing an Adult Full-Mouth Radiographic Survey Competency Exam	Pass (in 2 attempts)	Fail
Exposing an Adult Panoramic Radiographic Survey Competency Exam	Pass (in 2 attempts)	Fail
Radiographic Evaluation Exam – Minimum Score of 75%	Pass (in 2 attempts)	Fail
Exposed 2 Acceptable Horizontal Bitewing Surveys (1 DXTR manikin, 1 adult)	Pass	Fail
Exposed 1 Acceptable Vertical Bitewing Surveys (1 DXTR manikin)	Pass	Fail
Exposed 2 Acceptable Full-Mouth Survey (DXTR manikin)	Pass	Fail
Exposed 1 Acceptable Digital Full-Mouth Survey (DXTR manikin)	Pass	Fail
Exposed 1 Acceptable Child Full-Mouth Survey (DXTR manikin)	Pass	Fail
Exposed 2 Acceptable Adult Full-Mouth Surveys	Pass	Fail
Exposed 1 Acceptable Panoramic Survey (DXTR manikin)	Pass	Fail
Exposed 1 Acceptable Adult Panoramic Survey	Pass	Fail
Exposed 2 Acceptable Occlusal Surveys (DXTR manikin)	Pass	Fail

*Any of the above requirements not met will result in a failing grade in DHYG 1304.

COURSE OUTLINE

CHAPTER 1 DENTAL RADIOGRAPHY: HISTORICAL PERSPECTIVE AND FUTURE TRENDS

- A. Introduction
- B. Discovery of the X-ray
- C. Important Scientists and Researchers
- D. Dental X-ray Machines
- E. Dental X-ray Film
- F. Digital Image Receptors
- G. Dental X-ray Techniques
- H. Advances in Dental Radiographic Imaging

CHAPTER 2 CHARACTERISTICS AND MEASUREMENT OF RADIATION

- A. Atomic Structure
- B. Ionization
- C. Ionizing Radiation
- D. Radioactivity
- E. Electromagnetic radiation
- F. Properties of X-rays
- G. Production of X-rays
- H. Description of X-ray Forms
- I. Interaction of X-rays with Matter
- J. Units of radiation
- K. Background Radiation

CHAPTER 3 THE DENTAL X-RAY MACHINE: COMPONENTS AND FUNCTIONS

- A. Dental X-ray Machine Components
- B. Electricity
- C. The X-ray Tube
- D. A Summary of the Principles of X-ray Tube Operation
- E. The X-ray Beam
- F. Operation of the Dental X-ray Machine

CHAPTER 4 FACTORS AFFECTING RADIOGRAPHIC QUALITY

- A. Terminology
- B. Factors Affecting the Radiographic Image
- C. Effects of Varying the Exposure Factors
- D. Effects of Variations in Distances
- E. Inverse Square Law
- F. Exposure Charts

CHAPTER 5 EFFECTS OF RADIATION EXPOSURE

- A. Theories of Biological Effect Mechanisms
- B. Dose-Response Curve
- C. Sequence of Events Following Radiation Exposure
- D. Factors that Determine Radiation Injury
- E. Radiation Effects on Tissues of the Body

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- F. Somatic and Generic Effects
- G. Short- and Long- term Effects of Radiation
- H. Critical Tissues and Radiation Risk
- I. Radiation Exposure Comparisons

CHAPTER 6 RADIATION PROTECTION

- A. ALARA
- B. Protection Measures for the Patient
- C. Protection Measures for the Radiographer
- D. Handheld X-ray Devices
- E. Radiation Monitoring
- F. Organizations Responsible for Recommending/Setting Exposure Limits
- G. Guidelines for Maintaining Safe Radiation Levels

CHAPTER 7 DENTAL X-RAY FILM AND PROCESSING METHODS

- A. Composition of Dental X-ray Film
- B. Latent Image Formation
- C. Types of Dental X-ray Film
- D. Dental X-ray Film Processing
- E. Darkroom
- F. Manual Film Processing
- G. Rapid (Chairside) Film Processing
- H. Automatic Film Processing
- I. Processing Chemistry Maintenance

CHAPTER 8 DIGITAL RADIOGRAPHY AND IMAGE ACQUISITION

- A. Fundamental Concepts
- B. Characteristics of a Digital Image
- C. Acquiring a Digital Image
- D. Types of Digital Image Receptors
- E. Radiation Exposure

CHAPTER 9 INFECTION CONTROL

- A. Fundamentals of Infection control
- B. Disinfection, Surface Barrier and Sterilization
- C. Infection Control Protocol for the Radiographic Procedure
- D. Infection Control Protocol for the Radiographic Processing

CHAPTER 10 LEGAL AND ETHICAL RESPONSIBILITIES

- A. Regulations and Licensure
- B. Legal Considerations
- C. Confidentiality of Dental Radiographs
- D. Securely Storing and Sharing Digital Radiographic Images
- E. Ethics

CHAPTER 11 PATIENT RELATIONS AND EDUCATION

- A. Interpersonal Skills
- B. Communication

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- C. Patient Education

CHAPTER 12 INTRODUCTION TO RADIOGRAPHIC EXAMINATIONS

- A. Intraoral Procedures
- B. Techniques
- C. Fundamentals of Shadow Casting
- D. The Radiographic Examination
- E. Horizontal and Vertical Angulation
- F. Points of Entry
- G. Image Receptor Positioners
- H. Preparations and Seating Positions
- I. Sequence of Procedure

CHAPTER 13 THE PERIAPICAL EXAMINATION-PARALLELING TECHNIQUE

- A. Fundamental of Paralleling Technique
- B. Holding the Periapical Image Receptor in Position
- C. Horizontal and Vertical Angulation Procedures
- D. Points of Entry
- E. The Periapical Examination: Paralleling Technique

CHAPTER 14 THE PERIAPICAL EXAMINATION-BISECTING TECHNIQUE

- A. Fundamentals of Bisecting Technique
- B. Holding the Periapical Image Receptor in Position
- C. Horizontal and Vertical Angulation Procedures
- D. Points of Entry
- E. The Periapical Examination: Bisecting Technique

CHAPTER 15 THE BITEWING EXAMINATION

- A. Fundamentals of Bitewing Radiography
- B. Size, Number, and Placement of Image Receptors
- C. Holding the Bitewing Image Receptor in Position
- D. Horizontal and Vertical Angulation
- E. Points of Entry
- F. The Bitewing Technique

CHAPTER 16 THE OCCLUSAL EXAMINATION

- A. Types of Occlusal Examinations
- B. Fundamentals of Occlusal Radiographs
- C. Horizontal and Vertical Angulation Procedures
- D. Points of Entry
- E. The Occlusal Examination

CHAPTER 17 THE PANORAMIC EXAMINATION

- A. Purpose and Use
- B. Advantages and Limitations
- C. Fundamentals of Panoramic Radiography
- D. Panoramic Imaging Receptors
- E. Components of the Panoramic X-ray Machine
- F. Patient Preparation

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- G. Patient Positioning
- H. Exposure and Image Receptor Handling
- I. Panoramic Imaging Errors

CHAPTER 18 IDENTIFYING AND CORRECTING UNDIAGNOSTIC RADIOGRAPHS

- A. Recognizing Radiographic Errors
- B. Technique Errors
- C. Processing Errors
- D. Handling Errors
- E. Fogged Images and Decreased Contrast

CHAPTER 19 QUALITY CONTROL AND ENVIRONMENTAL SAFETY IN DENTAL RADIOGRAPHY

- A. Quality Administration
- B. Radiographer Competency
- C. Quality Control for the Dental X-ray Machine
- D. Quality Control for the Darkroom
- E. Image Receptor Quality Control
- F. Quality Control for Equipment Used to View Radiographic Images
- G. Safe Handling of Radiographic Chemicals and Materials
- H. Management of Radiographic Wastes

CHAPTER 27 PEDIATRIC RADIOGRAPHIC TECHNIQUES

- A. Assessment of Radiographic Need
- B. Image Receptor Size, Number and Types of Projection
- C. Suggested Radiographic Techniques
- D. ALARA Radiation Protection
- E. Patient Management
- F. Radiographic Interpretation

CHAPTER 28 RADIOGRAPHIC TECHNIQUES FOR PATIENTS WITH SPECIAL NEEDS

- A. Patient with Apprehension
- B. Patient with Disabilities
- C. Cultural Competency
- D. Other Special Needs Considerations

CHAPTER 29 RADIOGRAPHIC TECHNIQUES FOR SPECIAL ORAL CONDITIONS

- A. Hypersensitive Gag Reflex
- B. Large Sensitive Tori
- C. Edentulous Arches
- D. Teeth Alignment and Malalignment
- E. Disto-oblique Periapical Radiographs
- F. Image Receptor and Positioner Challenges

CHAPTER 30 SUPPLEMENTAL AND EXTRAORAL RADIOGRAPHIC TECHNIQUES

- A. Radiographic Techniques for Endodontics
- B. Object Localization
- C. Handheld X-ray Devices
- D. Film Duplication

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E. Extraoral Two-Dimensional Radiographs

CHAPTER 31 THREE-DIMENSIONAL IMAGING

- A. Purpose and Use of Three-dimensional imaging
- B. Fundamentals of Cone Beam Computed Tomography
- C. Incorporating Three-dimensional Imaging in Oral Health Care
- D. ALARA
- E. Limitations
- F. Interpretation

LEARNER OBJECTIVES

Upon completion of the objectives in the following chapters, the student will be able to:

Chapter 1: Dental Radiography: Historical Perspective and Future Trends

1. Define key words.
2. State when x-rays were discovered and by whom.
3. Trace the history of radiography, noting the prominent contributors.
4. List two historical developments that made dental x-ray machines safer.
5. Explain how rectangular PIDs reduce patient radiation exposure.
6. Identify the two techniques used to expose dental radiographs.
7. List five uses of dental radiographs.
8. Become aware of other imaging modalities available for use in the detection and evaluation of oral conditions.

Chapter 2: Characteristics and Measurement of Radiation

1. Define the key words.
2. Draw and label a typical atom.
3. Describe the process of ionization.
4. Differentiate between radiation and radioactivity.
5. List the properties shared by all energies of the electromagnetic spectrum.
6. Explain the relationship between wavelength and frequency.
7. Explain the inverse relationship between wavelength and penetrating power of x-rays.
8. List the properties of x-rays.
9. Differentiate between primary, secondary, and scatter radiations.
10. List and describe the four possible interactions of dental x-rays with matter.
11. Define the terms used to measure x-radiation.
12. Match the Systeme Internationale (SI units of x-radiation measurement to the corresponding traditional terms.
13. Identify three sources of naturally occurring background radiation.

Chapter 3: The Dental X-Ray Machine: Components and Functions

1. Define the key words.
2. Identify the three major components of a dental x-ray machine.
3. Identify and explain the function of the five controls on the control panel.
4. State the three conditions necessary for the production of x-rays.
5. Draw and label a dental x-ray tube.
6. Identify the parts of the cathode and explain its function in the production of x-rays.
7. Identify the parts of the anode and explain its function in the production of x-rays.
8. Trace the production of x-rays from the time the exposure button is activated until x-rays are released from the tube.
9. Demonstrate, in sequence, steps in operating the dental x-ray machine.

Chapter 4: Factors Affecting Radiographic Quality

1. Define the key words.
2. Evaluate a radiographic image identifying the basic requirements of acceptability.
3. Differentiate between radiolucent and radiopaque areas on a dental radiograph.

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4. Define radiographic density and contrast.
5. List the rules for casting a shadow image.
6. List the variables that affect film contrast.
7. Describe how geometric factors affect image sharpness.
8. Identify the causes of image magnification and distortion.
9. Explain the effects milliamperage, kilovoltage, and exposure time have on image density.
10. Explain the effect variations in target-surface, object-image receptor, and target-image receptor distances have on image quality.
11. Demonstrate the practical use of the inverse square law.

Chapter 5: Effects of Radiation Exposure

1. Define the key words.
2. Explain the difference between the direct and indirect theories of biological damage.
3. Difference between a threshold dose-response curve and a nonthreshold dose-response curve.
4. List the sequence of events that may follow exposure to radiation.
5. Identify the factors that determine radiation injuries are likely.
6. List three conditions that influence the radiosensitivity of a cell.
7. Determine the relative radiosensitivity or radioresistance of various kinds of cells in the body.
8. Explain the difference between deterministic and stochastic effects.
9. Explain the difference between somatic and genetic effects.
10. Explain the difference between short- and long- term effects of irradiation.
11. Identify critical tissues for dental radiography.
12. Discuss the risk versus benefit of dental radiographs.
13. Utilize effective dose equivalent to make radiation exposure comparisons.

Chapter 6: Radiation Protection

1. Define the key words.
2. Adopt the ALARA concept.
3. Use the selection criteria guidelines to explain the need for prescribed radiographs.
4. Explain the roles communication, working knowledge of quality radiographs, and education play in preventing unnecessary radiation exposure.
5. Explain the roles technique and exposure choices play in preventing unnecessary radiation exposure.
6. Compare inherent, added, and total filtration.
7. State the federally mandated limited diameter of the intraoral dental x-ray beam.
8. List two function of a collimator.
9. Explain how PID shape and length contribute to reducing patient radiation exposure.
10. Identify film speeds currently available for use in dental radiography.
11. Explain the role image receptor holders play in reducing patient radiation exposure.
12. Advocate the use of the lead/lead equivalent thyroid collar and apron.
13. Explain the role darkroom protocol and film handling play in reducing patient radiation exposure.
14. Summarize the radiation protection methods for the patient.
15. Explain the roles time, shielding, and distance play in protecting the radiographer from unnecessary radiation exposure.

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16. Utilize distance and location to take a position at the appropriate distance and angle from the x-ray source at the patient's head during an exposure.
17. Describe radiation safety protocol for use with portable, handheld x-ray device.
18. Describe radiation monitoring devices.
19. Summarize the radiation protection methods for the radiographer.
20. List the organizations responsible for recommending and setting exposure limits.
21. State the maximum permissible dose (MPD) for radiation workers and for the general public.

Chapter 7: Dental X-ray Film and Processing Methods

1. Define the key words.
2. List and describe the four parts of an intraoral film.
3. Describe latent image formation and explain how it becomes a visible radiographic image.
4. List and describe the four parts of an intraoral film packet.
5. Identify the intraoral film speeds currently available for dental radiographs.
6. Explain how duplicating film is different than radiographic film.
7. List in sequence the steps in processing dental films.
8. Identify and explain the role developer plays in processing a radiographic image.
9. Identify and explain the role fixer plays in processing a radiographic image.
10. List requirements for safelighting a darkroom.
11. Identify equipment needed for manual film processing.
12. Identify equipment needed for automatic film processing.
13. Compare manual and automatic processing methods, stating advantages and disadvantages of each.
14. Explain the role chemical replenishment and solution changes play in maintaining optimal processing chemistry.
15. List conditions that will diminish the quality of stored dental x-ray film.

Chapter 8: Digital Radiography and Image Acquisition

1. Define the key words.
2. Explain the fundamental concept of digital radiography and image acquisition.
3. Describe the characteristics of a digital image.
4. List equipment needed to acquire a digital image interpretation.
5. Explain the use of software in digital image interpretation.
6. Differentiate between direct and indirect digital imaging.
7. Describe the difference between narrow and wide dynamic range.
8. Describe and compare three types of digital image receptors.
9. Discuss digital imaging's effect on radiation dose to a patient.
10. Identify benefits and limitations of digital radiographic imaging.

Chapter 9: Infection Control

1. Define the key terms.
2. List the conditions that make up the chain of infection.
3. State the purpose of infection control.
4. Identify methods of breaking the chain of infection.

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5. State the roles the Centers for Disease Control and Prevention (CDC) and the Occupational Safety and Health Administration (OSHA) play in providing guidelines for infection control.
6. List personal protective equipment (PPE) recommended for dental radiographers.
7. Explain how to maintain hand and respiratory hygiene.
8. Compare the different levels of Environmental Protection Agency (EPA)-regulated disinfectants.
9. Explain the role of surface barriers in infection control.
10. Differentiate between semicritical and noncritical objects used during radiographic procedures.
11. Demonstrate competency in following infection control protocol prior to, during, and after radiographic procedures.
12. Demonstrate competency in following infection control protocol for handling and processing intraoral image receptors.
13. Demonstrate competency in following infection control protocol when using an automatic processor with a daylight loader attachment.

Chapter 10: Legal and Ethical Responsibilities

1. Define the key terms.
2. Discuss the federal and state regulations concerning the use of dental x-ray equipment.
3. Describe licensure requirements for individuals who expose dental radiographs.
4. Identify specific risk management strategies pertaining to dental radiography.
5. Respond to a patient exercising self-determination in refusing a radiographic examination.
6. List criteria for informed consent.
7. List the details that must be documented in a patient's record regarding a radiographic examination.
8. Describe elements required before releasing a copy of a patient's radiographic images.
9. State how long radiographic images should be maintained and available.
10. Describe the role of DICOM.
11. List the advantages of cloud sharing over other methods of storing and sharing digital radiographic images.
12. Identify a cloud sharing system that is HIPAA compliant.
13. Explain Joint Photographers' Expert Group (JPEG) impact on digital radiographic images.
14. Identify the role professional ethics play in guiding the radiographer's behavior.

Chapter 11: Patient Relations and Education

1. Define key terms.
2. Value the need for patient cooperation in producing quality radiographs.
3. List aspects of patient relations that help to gain confidence and cooperation.
4. Explain how appearance and first impression affect patient relations.
5. Explain how to project an attitude of professionalism.
6. State examples of facilitation skills.
7. Explain the relationship between verbal and nonverbal communication.

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8. Explain the patient management strategy Show-Tell-Do.
9. Explain the goals of active listening.
10. Explain the goals of patient education.
11. Describe methods of patient education.
12. Respond to questions frequently asked regarding a radiographic examination.

Chapter 12: Introduction to Radiographic Examinations

1. Define the key terms.
2. State the difference between intraoral and extraoral radiography.
3. Compare the three intraoral radiographic examinations.
4. Identify the two intraoral techniques.
5. List the five rules for shadow casting.
6. Determine conditions that affect the selection of image receptor size.
7. Select the type and number of image receptors required for a full mouth survey.
8. Explain horizontal and vertical angulation.
9. Explain point of entry.
10. List five contraindications for using the patient's finger to hold the image receptor during exposure.
11. Explain the basic design of image receptor positioners/holders.
12. Describe the proper patient seating position.
13. Demonstrate a systematic and orderly sequence of the exposure procedure.

Chapter 13: The Periapical Examination-Paralleling Technique

1. Define the key words.
2. Discuss the principles of the paralleling technique.
3. List the advantages and limitations of the paralleling technique.
4. Identify, assemble and position image receptors for use with the paralleling techniques.
5. Explain the importance of achieving accurate horizontal and vertical angulation in obtaining quality diagnostic radiographs using the paralleling technique.
6. Identify vertical angulation errors made when using the paralleling technique.
7. Demonstrate the image receptor positioning, horizontal and vertical angulations, and points of entry for maxillary and mandibular periapical exposures using the paralleling technique.

Chapter 14: The Periapical Examination-Bisecting Technique

1. Define the key words.
2. Discuss the principles of the bisecting technique.
3. List the advantages and limitations of the bisecting technique.
4. Identify, assemble and position image receptor holders for use with the bisecting technique and distinguish these holders from those used with the paralleling technique.
5. Explain the importance of achieving accurate horizontal and vertical angulation in obtaining quality diagnostic radiographs using the bisecting technique.
6. List the recommended predetermined vertical angulation setting used with the bisecting technique.
7. Identify vertical angulation errors unique to the bisecting technique.

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8. Locate facial landmarks used for determining the points of entry used with the bisecting technique.
9. Demonstrate image receptor positioning, horizontal and vertical angulation, and points of entry for maxillary and mandibular periapical exposure using the bisecting technique.

Chapter 15: The Bitewing Examination

1. Define the key terms.
2. Describe the bitewing radiographic technique.
3. Match the bitewing examination with two ideal uses.
4. List the four sizes of image receptors that can be used for bitewing examinations, explaining advantages and limitations of each size.
5. Identify the size and number of image receptors best suited for a bitewing examination for a child with primary or mixed dentition. Identify the size and number of image receptors best suited for a bitewing examination for an adult with and without periodontal disease.
7. Differentiate between horizontal and vertical bitewing radiographs.
8. Explain the role occlusion plays in aligning an image receptor for exposure of premolar and molar bitewing radiographs.
9. Explain the effect of incorrect horizontal angulation on the resultant bitewing image.
10. Identify positive and negative vertical angulations.
11. State the recommended vertical angulation for bitewing exposures.
12. Identify vertical angulation errors unique to the bitewing technique.
13. Demonstrate image receptor placement, horizontal and vertical angulation, and point of entry for horizontal and vertical posterior bitewing examinations.
14. Demonstrate image receptor placement, horizontal and vertical angulation, and point of entry for a vertical anterior bitewing examination.

Chapter 16: The Occlusal Examination

1. Define the key words.
2. State the purpose of the occlusal examination.
3. List the indications for occlusal radiographs.
4. Match the topographical and cross-sectional techniques with the condition to be imaged.
5. Compare the patient head positions for the topographical and the cross-sectional techniques.
6. Demonstrate the steps for the maxillary and mandibular topographical surveys.
7. Demonstrate the steps for the mandibular cross-sectional survey.

Chapter 17: The Panoramic Examination

1. Define the key terms.
2. List uses of panoramic radiography.
3. Compare the advantages and limitations of panoramic versus intraoral radiographs.
4. Explain how the panoramic technique relates to the principles of tomography.
5. Identify the three dimensions of the focal trough.
6. Identify and describe panoramic image receptors.
7. Explain the role of intensifying screens in producing a radiographic image.
8. Identify the intensifying screen type recommended ALARA.

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9. Describe the purpose of a panoramic cassette.
10. List the components of a panoramic x-ray machine.
11. Demonstrate how to use each of the head positioner guides found on a panoramic x-ray machine.
12. Demonstrate the steps used to prepare a patient for exposure of a panoramic radiograph.
13. Explain the use of a cape-style lead/lead equivalent barrier or the use of an apron without an attached thyroid collar.
14. Match errors made in patient preparation procedures with the characteristic effect on the appearance of the panoramic radiograph.
15. Identify the anatomic landmarks and planes used to position the dental arches correctly within the focal trough.
16. Match errors made in patient-positioning procedures with the characteristic effect on the appearance of the panoramic radiograph.
17. List exposure and image receptor handling errors and describe how these will affect the appearance of the panoramic radiograph.

Chapter 18: Identifying and Correcting Undiagnostic Radiographs

1. Define the key terms.
2. Understand the need for a retake policy.
3. List the characteristics of a quality radiographic image.
4. Recognize errors caused by incorrect radiographic techniques.
5. Apply appropriate corrective action for technique errors.
6. Recognize errors caused by incorrect radiographic processing.
7. Apply appropriate corrective action for processing errors.
8. Recognize errors caused by incorrect radiographic image receptor handling.
9. Apply appropriate corrective action for handling errors.
10. Identify causes of film fog.
11. Apply appropriate actions for preventing film fog.

Chapter 19: Quality Control and Environment Safety in Dental Radiography

1. Define the key terms.
2. State the objectives of dental radiographic quality control.
3. Explain the role a competent radiographer plays in quality assurance.
4. Describe quality control tests for monitoring a dental x-ray machine.
5. Describe quality control tests for monitoring a darkroom and processing equipment.
6. Describe quality control tests for monitoring radiographic image receptors.
7. Describe quality control tests for monitoring viewboxes and computer monitors used to view radiographic images.
8. List precautions to put in place that protect digital radiographic images.
9. List data supplied by Safety Data Sheets (SDS) for radiographic processing chemistry.
10. Describe safe handling procedures for radiographic processing chemicals and materials.
11. Describe environmentally sound options for disposal of radiographic processing chemistry and materials.

Chapter 20: Image Orientation and Introduction to Interpretation

1. Define the key terms.
2. List advantages of mounting film-based radiographs.
3. Identify anatomic landmarks that assist with distinguishing radiographs of the maxilla and mandible.
4. Describe characteristics of a quality film mount.
5. Discuss the use and importance of the embossed film identification dot.
6. Compare labial and lingual methods of film mounting.
7. List steps to an orderly mounting procedure.
8. List anatomic generalizations that aid in image orientation.
9. Describe actions that will assist in correctly orienting digital images.
10. Explain the difference between interpretation and diagnosis.
11. Describe equipment used to view radiographic images.
12. Demonstrate image viewing according to the suggested steps presented.
13. Describe the use and care of radiographic images during and after patient care.

Chapter 21: Recognizing Normal Radiographic Anatomy – Intraoral Radiographs

1. Define the key terms.
2. Explain how two-dimensional radiographs present a challenge to developing interpretation skills.
3. List facial and cranial bones important to radiographic interpretation.
4. Differentiate between the radiographic appearance of cortical and cancellous bone.
5. Differentiate between the radiographic appearance of the lamina dura and the PDL space.
6. List and identify the radiographic appearance of the structures of the teeth.
7. Demonstrate use of a systematic method for interpreting dental radiographs.
8. Categorize bony landmarks as to whether they will appear radiopaque or radiolucent on a dental radiograph.
9. Identify significant anatomy recorded on dental radiographs of the maxilla and mandible.

Chapter 22: Recognizing Normal Radiographic Anatomy – Panoramic Radiographs

1. Define the key terms.
2. Describe the unique appearance of normal anatomy as recorded by a panoramic radiograph.
3. Explain why panoramic radiographs present with streaked and blurred images.
4. List the types of tissues and artifacts that will be recorded on panoramic radiographs.
5. Describe the appearance of air spaces on a panoramic radiograph.
6. Explain how the panoramic technique produces ghost images.
7. Identify maxillofacial bony anatomic landmarks of the maxilla as viewed on a panoramic radiograph.
8. Identify maxillofacial bony anatomic landmarks of the mandible as viewed on a panoramic radiograph.
9. Identify the hyoid bone and cervical vertebrae as viewed on a panoramic radiograph.
10. Identify maxillofacial soft tissues as viewed on a panoramic radiograph.
11. Identify maxillofacial air spaces as viewed on a panoramic radiograph.

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12. Identify positioning guide artifacts as viewed on a panoramic radiograph.
13. Identify ghost image artifacts as viewed on a panoramic radiograph.

Chapter 23: Radiographic Appearance of Dental Materials and Foreign Objects

1. Define the key terms.
2. Explain the need for a clinical examination in conjunction with radiographic interpretation.
3. Explain the effect two-dimensional radiographs have on the identification of dental materials.
4. Rank dental materials according to degree of radiopacity.
5. Describe the role radiographs play in evaluating dental restorations.
6. Identify the radiographic appearance of amalgam.
7. Identify the radiographic appearance of composite resin and glass ionomer.
8. Identify the radiographic appearance of full metal, PFM, and stainless steel crowns.
9. Identify the radiographic appearance of a fixed bridge.
10. Identify the radiographic appearance of retention pin and post and core restorative materials.
11. Identify the radiographic appearance of dental liners, bases, and cements.
12. Identify the radiographic appearance of endodontic fillers.
13. Identify the radiographic appearance of implants, orthodontic, and surgical materials.
14. Identify the radiographic appearance of an amalgam tattoo.

Chapter 24: The Use of Radiographs in the Detection of Dental Caries

1. Define the key terms.
2. Explain why caries appear radiolucent on radiographs.
3. Define the role radiographs play in detecting caries.
4. Identify the ideal type of projection and technique factors that enhance a radiograph's ability to image caries.
5. List and describe the four categories of the caries depth grading system.
6. Describe the radiographic appearance of proximal surface caries.
7. Describe the radiographic appearance of occlusal surface caries.
8. Describe the radiographic appearance of buccal/lingual surface caries.
9. Describe the radiographic appearance of cemental/root surface caries.
10. Describe the radiographic appearance of recurrent and rampant caries.
11. Explain the importance of radiographically monitoring arrested caries.
12. Identify conditions that resemble dental caries radiographically and discuss how to distinguish these from caries.

Chapter 25: The Use of Radiographs in the Evaluation of Periodontal Diseases

1. Define the key terms.
2. List the uses of radiographs in the assessment of periodontal diseases.
3. Differentiate between horizontal and vertical bone loss. Identify three local contributing factors for periodontal disease that radiographs can help detect.
5. Explain the purpose of using radiographs to image root morphology.
6. List the limitations of radiographs in the assessment of periodontal diseases.
7. Explain the parameters for using vertical and horizontal bitewing, and periapical radiographs to record periodontal disease.

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8. Recognize the roles vertical and horizontal angulations play in imaging periodontal diseases.
9. Describe the radiographic appearance of the normal periodontium.
10. Describe the radiographic appearance of gingivitis.
11. Describe the radiographic appearance of mild periodontitis.
12. Describe the radiographic appearance of moderate periodontitis.
13. Describe the radiographic appearance of severe periodontitis.

Chapter 26: Describing Radiographic Anomalies, Lesions, and Opportunistic Screening

1. Define the key terms.
2. Use correct terminology to describe the radiographic appearance of dental anomalies.
3. Describe anomalies and pathologic lesions by density, size, shape, border, architecture, location, and effect on surrounding tissues.
4. Differentiate between radiolucent, radiopaque, and lucent-opaque lesions.
5. Explain how to document the size of a lesion detected on a radiographic image.
6. Differentiate between regular- and irregular-shaped lesions detected on a radiographic image.
7. Differentiate between a well-defined and a poorly-defined border of a lesion detected on a radiographic image.
8. Explain the difference between lesion architecture that is unilocular, multilocular, focal opacity, multifocal, or a target lesion.
9. Explain the importance of documenting location of anomalies and lesions detected on a radiographic image.
10. Explain the importance of examining adjacent structures and surrounding tissues for changes caused by an anomaly or lesion.
11. List and describe the radiographic appearance of common developmental anomalies.
12. List and describe the radiographic appearance of common radiolucent lesions.
13. List and describe the radiographic appearance of common radiopaque lesions.
14. Differentiate between external and internal resorption.
15. List and describe the radiographic appearance of common lucent- opaque lesions.
16. Explain the significance of opportunistic screening.

Chapter 27: Pediatric Radiographic Techniques

1. Define the key terms.
2. List signs and symptoms that would indicate a pediatric radiographic need.
3. List conditions a pediatric patient might present with that would prompt a need to adapt a standard radiographic procedure.
4. Identify factors that influence the number of radiographs, and size of image receptors to be exposed on a pediatric patient.
5. Explain the reasoning behind the recommendation to use the largest size image receptor that can be tolerated by a pediatric patient.
6. Determine the type and number of radiographs, and size of image receptor to use to image primary dentition.
7. Determine the type and number of radiographs, and size of image receptor to use to image transitional mixed dentition.
8. Identify extraoral radiographic examinations that may benefit a pediatric patient.

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9. Demonstrate adaptations and modifications to standard paralleling and bisecting techniques that aid in obtaining a pediatric radiographic examination.
10. Adjust standard adult exposure settings to those settings considered appropriate for pediatric radiographs.
11. Commit to Image Gently® campaign goals.
12. Demonstrate a radiographic examination use of Show-Tell-Do.
13. Demonstrate a radiographic examination use of modeling.
14. Interpret a set of pediatric radiographic images.

Chapter 28: Radiographic Technique for Patients with Special Needs

1. Define the key terms.
2. Discuss strategies for managing apprehension during a radiographic examination.
3. Discuss strategies for managing patients with autism spectrum disorder (ASD).
4. Explain ways to manage a patient with disabilities.
5. Identify opportunities to develop cultural sensitivity and cultural competence.
6. Discuss strategies for managing radiographic procedures for a patient with age-related changes.
7. Use evidence-based guidelines to educate patients who may be reluctant to accept radiographic assessment of need.

Chapter 29: Radiographic Techniques for Specific Oral Conditions

1. Define the key terms.
2. Demonstrate the ability to appropriately adapt standard radiographic techniques to meet specific oral condition challenges.
3. List and define gag reflex stimuli.
4. Describe methods to prevent and manage a gag reflex during a radiographic examination.
5. Demonstrate recommended image receptor placement when challenged with large, sensitive tori.
6. Demonstrate image receptor placement for use with the paralleling and the bisecting techniques in edentulous regions.
7. Explain the need to expose multiple radiographs of malaligned teeth.
8. Explain how to avoid canine-premolar and molar overlap.
9. Describe the difference between a standard and a disto-oblique periapical radiograph.
10. List steps to obtain a maxillary and a mandibular disto-oblique periapical radiograph.
11. Explain the need to alter an image receptor positioner to prevent unequal distribution of the arches.
12. Explain how to overcome the challenge of not imaging distal of canines on a bitewing radiograph.
13. Explain how to overcome the challenge of not imaging root apices on a periapical radiograph.

Chapter 30: Supplemental and Extraoral Radiographic Techniques

1. Define the key terms.
2. Explain the need for multiple radiographs during endodontic procedures.
3. Describe the characteristics of an image receptor positioner used to expose working radiographs during endodontic procedures.
4. List three methods of localization.
5. Explain the relationship between shadow casting principles and the definitive method of localization.
6. Explain the role the tube shift method of localization plays in imaging root canals.
7. List the two radiographic images needed for the right angle method of localization.
8. Explain the S.L.O.B. rule.
9. Utilize the buccal-object rule to determine the buccal-lingual location of a foreign object.
10. Explain the need for a specialized image receptor positioner when using a handheld x-ray device.
11. List possible uses for duplicate radiographs.
12. Describe the difference between duplicating and radiographic film.
13. List possible uses of extraoral radiographs.
14. Identify types of extraoral radiographs used to image the oral and maxillofacial regions.

Chapter 31: Three-dimensional Imaging

1. Define the key terms.
2. Describe the purpose and use of three-dimensional imaging.
3. Describe the three suggested categories of oral conditions for the prescription of a cone beam computed tomography (CBCT) examination.
4. Explain how CBCT differs from medical computed tomography (CT).
5. Explain the purpose of changing the field of view (FOV).
6. Explain the effect changing voxel size has on an image.
7. List the three anatomical planes of CBCT slice image data.
8. List oral conditions that would most benefit from a CBCT examination.
9. Discuss how CBCT settings can reduce radiation exposure.
10. Describe the appearance of artifacts that occur on CBCT images.
11. Explain the challenges to interpretation of image data produced by CBCT technology.