Best Practices in Intraoral Digital Radiography

A Peer-Reviewed Publication
Written by Gail F. Williamson, RDH, MS

Abstract
Detailed, accurate radiographs are a primary diagnostic tool as well as necessary for and during some treatments. Increasingly, digital radiographic imaging is being used with two types of available receptors. Anatomical variations and patient comfort must be considered when taking intraoral radiographs. In addition, recognizing common sources of errors is important to ensure that the clinician avoids them and knows how to correct them when they occur. Techniques, as well as devices and accessories, can be used that will enable accurate image acquisition and improve patient comfort.

Learning Objectives:
1. List and describe the types of digital receptors used for intraoral radiographic imaging.
2. List and describe the principles of paralleling and bisecting angle techniques for effective and accurate intraoral digital radiography.
3. List and describe the adjustments in technique that may be necessary to accommodate anatomy, discomfort and placement difficulties.
4. List and describe best practices for patient radiation safety and protection.

Author Profiles
Gail F. Williamson, RDH, BS, MS, is a professor of Dental Diagnostic Sciences in the Department of Oral Pathology, Medicine and Radiology at Indiana University School of Dentistry in Indianapolis, Indiana. She received an A.S. in Dental Hygiene, a B.S. in Allied Health, and a M.S. in Education, all from Indiana University. She serves as Director of Allied Dental Radiology and Course Director for Dental Assisting and Dental Hygiene Radiology courses. A veteran teacher, Prof. Williamson has received numerous awards for teaching excellence throughout her career. She is a published author and presents numerous continuing education courses on Oral and Maxillofacial Radiology on the national level. In addition, she is actively involved in the American Academy of Oral and Maxillofacial Radiology and currently serves as a radiology expert on the American Dental Association's Dental Hygiene National Board Test Construction Committee B.

Author Disclosure
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ADA CERP
Publication date: June 2011
Expiration date: May 2014

Supplement to PennWell Publications
This course was written for dentists, dental hygienists and assistants, from novice to skilled.

Educational Methods: This course is a self-instructional journal and web activity.

Provider Disclosure: Pennwell does not have a leadership position or a commercial interest in any products or services discussed or shared in this educational activity nor with the commercial supporter. No manufacturer or third party has had any input into the development of course content.

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5. List and describe common errors that occur when taking intraoral digital radiographs and corrections that can be made when errors occur.

Abstract

Digital radiography is becoming the technology of choice and offers several advantages over film radiography. These include the ability to view images on the screen, computerized archiving of images, ability to enhance acquired images, reduced exposure to radiation, and rapid acquisition of images without the need for chemical processing. In order to produce high-quality diagnostic images, a careful technique is required that considers best practices and patient comfort. Accurate technique, effective patient management, and proper exposure are required to optimize the information that can be obtained from radiographs and, therefore, their value.

I. Digital Receptors

Digital receptors are available in two formats: 1) photo-stimulable phosphor plate (PSP) receptors; or 2) rigid wired for wired digital receptors, or wireless charge-coupled devices (CCDs), complementary metal oxide semiconductor (CMOS) or complementary-metal-oxide semiconductor active pixel sensor (CMOS-APS) receptors. These rigid digital receptors are often referred to as sensors and the sensor is used interchangeably. Both systems are computerized technologies that require specific hardware and software components for operation.

Digital receptors are faster than film, which reduces the amount of radiation needed to produce a diagnostic image and eliminates chemical processing errors, darkroom maintenance, and chemical waste disposal. They are available in sizes comparable to film, most typically sizes 0, 1, and 2. Both types of digital receptors are reusable, which is important for the clinician to consider the manufacturer’s instructions for proper preparation and coverage of the receptor, as well as effective barrier removal techniques. Care must be taken to avoid direct saliva contact with the receptor and prevent cross-contamination. Disinfection can be accomplished with ADA- or EPA-approved products and typical disinfection techniques followed by coverage with an effective barrier for rigid receptors. The Centers for Disease Control and Prevention recommends using a double barrier, with both an internal and external barrier.

Phosphor plate receptors are more flexible and thinner than rigid digital receptors, but have the same dimensions as film. Plate receptors are used much like film but must be handled carefully, scanned to digitize the image, and erased before reuse. Rough handling may produce plate scars, result in image artifacts, and necessitate plate replacement, making them less user friendly in these instances. These problems in turn may result in retakes, thereby increasing patients’ radiation exposure. Recent improvements in plate technology have been directed toward making plates more scratch resistant to improve longevity, and permitting immediate erasure after scanning to save time.

II. Technique Overview

Intraoral radiographic images must be positioned accurately, which can be achieved using an appropriate technique for the desired radiographic projection and anatomical situation. Devices used to accomplish this include receptor instruments with ring guides, standard bite blocks, cotton rolls, and bite-wing tabs. The techniques that can be used are the paralleling, bitewing, and bisecting angle techniques.

Paralleling Technique

The paralleling technique is used for both periapical and bitewing radiographs and is the most accurate technique for taking these projections. The digital receptor should be placed vertically and horizontally parallel with the teeth that are being examined. When aiming bitewings, the contact point should be approximately half-way between the cusp tips and the cemento-enamel junction for the mandibular anterior teeth and the cusp tips on the maxillary anterior teeth. For an intraoral periapical image, the receptor should be angled 20 degrees caudally on mandibular teeth and 20 degrees cranially on maxillary teeth to ensure adequate capture of the incisors. The beam should be perpendicular to the receptor, and the receptor should remain in contact with the patient’s teeth during the exposure. When taking a periapical image, the receptor is generally placed in a portal guide or ring guide. The portal guide is generally used in conjunction with oral radiographs, while the ring guide is used in conjunction with intraoral periapical images, with the ring guide removed from the instrument.

Bitewing Technique

Bitewings are taken to evaluate the posterior teeth and can also be used to detect alveolar bone levels in these sextants. Vertical bitewings (size 1) may also be used to take images of the anterior teeth to assess alveolar bone levels. The patient’s medical and dental history, clinical signs and symptoms of disease, risk factors, age and dentition, and new or recall patient status must also be considered when determining which radiographs are required. Recommendations are available for the appropriate patient-specific selection of radiographs (The Selection of Patients for Dental Radiographic Examinations, Revised 2004). The overall goal of this article is to provide the reader with information on intraoral digital radiography, upon completion of this course, the reader will be able to:

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Introduction

Dental radiographs are taken as primary diagnostic tools and for treatment purposes. As such, they must be as detailed and accurate as possible to meet clinical requirements. Increasingly, digital radiographic imaging is being used with two types of available receptors. Anatomical variations and patient comfort must be considered when taking intraoral radiographs. In addition, recognizing common sources of errors is important to ensure that the clinician avoids them and knows how to correct them when they occur. Techniques, as well as devices and accessories, can be used that will enable accurate image acquisition and improve patient comfort.

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The x-ray beam should be directed at right angles to the teeth and receptor. The correct horizontal angulation to use to enter the contacts. Central ray entry points will help with x-ray beam centering, as will using the lines on the PID that indicate the direction of the x-rays exiting the collimator.

Careful placement and beam alignment will produce good results. The vertical angulation is typically set at +5°, with the x-ray beam centered to the tab or the center of the receptor. The tab results. The vertical angulation is typically set at +5°, with the x-ray beam centered to the tab or the center of the receptor. Regardless of the instrument used, the placement of the receptor relative to the teeth must be correct. Instruments are available for parallelizing, bisecting, and bitewing techniques, as well as for endodontic imaging where endodontic files may impede proper positioning of the receptor behind the teeth.

Bitewing Technique

Regardless of approach, instrument, or tab, bitewings are based on the paralleling technique. The digital receptor should be placed vertically and horizontally parallel to the crowns of the teeth. For patients who gag easily or for children, tab bitewings are less cumbersome and more comfortable for the patient. Bitewing tabs hold the digital receptors in position intraorally but provide no external alignment guide for PID (Position Indicating Device, or x-ray cone) positioning and beam direction. Careful placement and beam alignment will produce good results. The vertical angulation is typically set at +5°, with the beam centered to the tab or the center of the receptor. The tab should be aligned with the teeth contacts, which will indicate the correct horizontal angulation to use to enter the contacts. Central ray entry points will help with x-ray beam centering, as will using the lines on the PID that indicate the direction of the x-rays exiting the collimator.

Bisecting Angle Technique

The bisecting angle technique is an alternate approach for periapical radiography. With this technique, the receptor is placed diagonal to the long axis plane of the teeth. The beam is then directed at a right angle to a plane that is midway between (bisects or divides) the receptor and the teeth. This method produces less optimal images because the receptor and teeth are not in the same vertical plane. However, it is a useful method when ideal receptor placement cannot be achieved due to anatomic obstacles or placement difficulties. This technique is more operator-sensitive. If the angle is not correctly divided, elongation or foreshortening will occur. A variety of holders can be used for accurate positioning of the receptor in different locations in the mouth.

III. Technique Adaptations

Technique adaptations may be required due to anatomical considerations or to avoid patient discomfort. These anatomical considerations include shallow palates, narrow arches, the presence of tori, and loss of alveolar bone (edentulous ridges). Adaptations may also be required in the presence of endodontic files when radiographs are taken during treatment. Selecting the bisecting angle technique instead of the paralleling technique is useful in the case of shallow palates; careful placement of receptors or the use of special receptor instruments (endodontic imaging) are necessary to accommodate all the listed anatomical variations (Table 2).

Digital Receptor Instruments

Receptor instruments with x-ray beam ring guides improve the accuracy of the PID alignment to ensure correct beam angulation and centering. Receptor instruments combine a receptor holder with an arm that has an attached ring indicating the position for the PID. This helps the operator avoid cone cut errors by specifically directing the x-ray beam toward the center of the receptor. Regardless of the instrument used, the placement of the receptor relative to the teeth must be correct. Instruments are available for parallelizing, bisecting, and bitewing techniques, as well as for endodontic imaging where endodontic files may impede proper positioning of the receptor behind the teeth.

Table 1. Bisecting angle instrumentation angulations

<table>
<thead>
<tr>
<th>Arch</th>
<th>Molar</th>
<th>Premolar</th>
<th>Canine</th>
<th>Incisor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maxilla</td>
<td>+15° to +25°</td>
<td>+25° to +35°</td>
<td>+40° to +50°</td>
<td>+40° to +50°</td>
</tr>
<tr>
<td>Mandible</td>
<td>+5° to -5°</td>
<td>-10° to -15°</td>
<td>-10° to -15°</td>
<td>-10° to -15°</td>
</tr>
</tbody>
</table>

Table 2. Anatomical Variations

<table>
<thead>
<tr>
<th>Shallow Palates</th>
<th>Presence of tori</th>
<th>Narrow arches</th>
<th>Edentulous situations</th>
<th>Endo</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Use bisecting technique instead of</td>
<td>• Ensure maxillary tori are between</td>
<td>• Place receptor as far lingual</td>
<td>• Place receptor more toward the</td>
<td>• Place receptor more lingual to</td>
</tr>
<tr>
<td>parallelizing technique</td>
<td>the teeth and receptor</td>
<td>as possible</td>
<td>midline/tongue</td>
<td>avoid endodontic files</td>
</tr>
<tr>
<td>• Move receptor more toward the</td>
<td>• Place receptor behind mandibular</td>
<td>• Use size 1 receptors in anterior</td>
<td>• Use cotton rolls on the bite block</td>
<td>• Use special endodontic receptor</td>
</tr>
<tr>
<td>midline/tongue</td>
<td>tori</td>
<td>or occlusal technique</td>
<td>to replace missing teeth</td>
<td>instruments</td>
</tr>
<tr>
<td>• Use special endodontic receptor</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>instruments</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### IV. Receptor Placement (Paralleling)

<table>
<thead>
<tr>
<th>Receptor Placement</th>
<th>Teeth Recorded</th>
<th>Central Ray Entry Point</th>
<th>Receptor Orientation</th>
<th>Receptor Size</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Maxillary Periapicals</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Molar periapical</td>
<td>1st, 2nd molar teeth crowns and apices</td>
<td>Point down from the outer corner of the eye to the middle ear area</td>
<td>Horizontal placement; dot toward crown</td>
<td>Size 2</td>
</tr>
<tr>
<td>Premolar periapical</td>
<td>1st, 2nd, 3rd premolar teeth crowns and apices</td>
<td>Point down from the eye to the middle ear area</td>
<td>Horizontal placement; dot toward crown</td>
<td>Size 2</td>
</tr>
<tr>
<td>Canine periapical</td>
<td>1st premolar teeth crowns and apices</td>
<td>Point down from the upper labial sulcus to the middle ear area</td>
<td>Horizontal placement; dot toward crown</td>
<td>Size 2</td>
</tr>
<tr>
<td><strong>Lateral incisor periapical</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Molar periapical</td>
<td>1st molar teeth crowns and apices</td>
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</tr>
<tr>
<td><strong>Central incisor periapical</strong></td>
<td></td>
<td></td>
<td></td>
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<td>Size 2</td>
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</table>

### V. Patient Comfort

Ensuring that patients are as comfortable as possible while taking radiographs not only helps patients but also results in a greater likelihood of successful imaging and reduced risk of retakes associated with patients moving or altering the position of a digital receptor while the radiograph is being taken. Gagging and discomfort associated with the edges of receptors are key considerations.

Gagging patients can be challenging and require patience and reassurance from the clinician. It is important to be organized, preset the exposure time, pre-align the PID, and be ready to act quickly. The most common area to elicit the gag reflex is the maxillary molar periapical view. Placement of the receptor toward the midline and away from the soft palate will reduce the tendency for gagging. A variety of strategies will help manage the gagging patient: breathing through the nose, salt on the tongue, distraction techniques (lifting one leg in the air, bending the toes toward the body, humming), use of topical anesthetics, and tissue cushions on the receptor.

Similar approaches can be useful when the patient experiences discomfort from the receptor. The use of topical anesthetic agents and receptor cushions improve comfort. Rigid digital receptors can cause more discomfort than other receptors; placing these closer to the midline can reduce patient discomfort. This is especially important in patients with a shallow palate or shallow floor of the mouth, because the edge of the receptor is more likely to dig in as there is less space for positioning and placement of the receptor, and to necessitate placing the receptor behind them. Using lightweight bite blocks and receptor arms/rings also improves patient comfort. Another option is to use a receptor holder without the accompanying arm and ring, allowing for positioning of the sensor that optimizes patient comfort without compromising accuracy; this requires knowledge of the bisecting angle technique and is useful when positioning must accommodate anatomical variations as described above.

In bitewing radiography, tabs can be used and are usually less uncomfortable for the patient, although the edges of a rigid receptor may still be a potential source of discomfort. While regular bitewing tabs are more comfortable, they are less reliable than the use of a holding device because they may allow movement or displacement of the sensor. Bitewing tabs with extended strips that wrap around the sensor solve this problem and keep the tab positioned exactly in the center of the sensor and the barrier cover without compromising patient comfort. Self-adhesive foam covers can be used over the receptor for both bitewings and periapicals to smooth the edges and provide cushioning against the patient’s oral mucosa.

### VI. Patient Protection

Patients tend to be more cooperative and receptive to radiographic procedures when radiation protection is provided. Patient protection includes the use of lead collars and lead aprons during radiographic imaging procedures. Lead collars are designed to protect the thyroid. These collars have been found to substantially reduce radiation to the thyroid during dental radiographic examinations. There are varying perspectives on the necessity of lead aprons and thyroid collar shields. Selection criteria guidelines recommend that all precautions should be taken and patient shielding be provided whenever possible, particularly for children, women of childbearing age, and pregnant women. The National Council on Radiation Protection (NCRP) Report 145, Radiation Protection in Dentistry, states that if all the safety measures outlined in the report are...
NCRP Report 145 states that thyroid collars shall be provided in order to eliminate the use of the lead apron. In addition, radiation safety measures include rectangular collimation of the x-ray beam, use of fast image receptors, application of selected radiation safety measures, centering, and exposure.

To correct, ensure light bright pressure with the use of a cotton roll under the biteblock, and use lingual placement away from the teeth with receptor, teeth, and PID all parallel to each other. Horizontal angulation errors result in overlapping of proximal surfaces and limit caries and bone loss evaluations. To correct, the horizontal angle must be directed through the proximal surfaces of the teeth. It is helpful to align the lateral sides of the bitewing parallel with the teeth contacts to better guide the x-rays through the proximal contacts of the teeth. Overlapping occurs more commonly with tab bitewings. However, overlapping can occur with bitewing instruments if the receptor is not placed parallel to the horizontal plane of the teeth.

Cone cut errors are caused by not centering the x-ray beam over the receptor. Lack of centering produces partial exposure of the receptor with a “cut” where x-rays did not interact with the receptor. Receptor instruments with beam guides facilitate beam centering over the receptor when properly assembled. Exposure errors result in light or dark images due to improper exposure time or lack of consideration of patient size and the thickness of structures. Underexposures cannot be corrected with software enhancements, but overexposures can usually be adjusted to moderate image density.

VIII. Summary
Dental radiographs are valuable diagnostic tools and expose the patient to minimal amounts of radiation. Nonetheless, dental professionals must ensure that patients are protected from the harmful effects of cumulative exposure to radiation. Patients can be protected through the use of lead collars and aprons and by ensuring that only necessary radiographs are taken and that radiation exposure is kept low. Patient comfort can be improved by placing digital receptors in a position that allows for accurate radiographs as well as using devices and accessories that improve patient comfort. One of the critical factors in minimizing the number of radiographs is to ensure that retakes are not required due to improper technique or patient management. Receptor instruments are valuable tools that guide the x-ray beam and thereby assist in the accuracy of dental radiographic images.

Table 3: Correction Of Common Errors

<table>
<thead>
<tr>
<th>Error</th>
<th>Description</th>
<th>Correction</th>
</tr>
</thead>
<tbody>
<tr>
<td>Placement</td>
<td>Improper area recorded, crowns or apices cut off</td>
<td>Place receptor according to placement guidelines to cover structures</td>
</tr>
<tr>
<td>Foreshortening</td>
<td>Image shortened and smaller than the actual object length</td>
<td>Increase the vertical angulation of the x-ray beam</td>
</tr>
<tr>
<td>Elongation</td>
<td>Image stretched and longer than actual object length</td>
<td>Decrease the vertical angulation of the x-ray beam</td>
</tr>
<tr>
<td>Overlapping</td>
<td>Proximal surfaces of the teeth are closed</td>
<td>Direct the x-rays between the contacts of the teeth</td>
</tr>
<tr>
<td>Cone Cutting</td>
<td>White zone where x-rays did not strike the receptor</td>
<td>Center the x-ray beam over the image receptor</td>
</tr>
<tr>
<td>Underexposure</td>
<td>Light or low density image</td>
<td>Increase exposure factors; check for large patient size</td>
</tr>
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Selected References

Author Profile
Gail F. Williamson, RDH, BS, MS, is a professor of Dental Diagnostic Sciences in the Department of Oral Pathology, Medicine and Radiology at Indiana University School of Dentistry in Indianapolis, Indiana. She received an A.S. in Dental Hygiene, a B.S. in Allied Health, and a M.S. in Education, all from Indiana University. She serves as Director of Allied Dental Radiology and Course Director for Dental Assisting and Dental Hygiene Radiology courses. A veteran teacher, Prof. Williamson has received numerous awards for teaching excellence throughout her career. She is a published author and currently serves as a radiology expert on the American Dental Association’s Dental Hygiene National Board Test Construction Committee B.

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Questions

1. Dental radiographs are taken __________.
   a. for treatment purposes
   b. as primary diagnostic tools
   c. as definitive tools
   d. on all of the above

2. An advantage of digital radiography over film radiography is __________.
   a. Computerized archiving of images
   b. The ability to enhance acquired images
   c. Rapid acquisition of images without the need for chemical processing
   d. all of the above

3. For periapical pathology, the radiographic projection of choice is usually __________.
   a. series of bitewing images
   b. series of periapical and bitewing images
   c. none of the above

4. Digital receptors are available in __________.
   a. rigid sealed or wireless charged-coupled devices
   b. photostimulable phosphor plate (PSP) receptors
   c. complementary metal oxide semiconductor or complementary metal-oxide-semiconductor active pixel sensor receptors
   d. all of the above

5. For rigid receptors, the Centers for Disease Control and Prevention recommends __________.
   a. using a single barrier, with an external barrier
   b. using a single barrier, with an internal and external barrier
   c. using a single barrier, with both an internal and external barrier
   d. any of the above

6. Phosphor plate receptors __________.
   a. are more flexible than rigid receptors
   b. are thinner than rigid receptors
   c. have the same dimensions as film
   d. all of the above

7. To capture the distal surface of canines, it may be easier to take an additional anterior periapical on each arch to capture the __________.
   a. canine lateral incisor contact
   b. premolar-premolar contact
   c. canine- canine contact
   d. all of the above

8. The paralleling technique is used for __________.
   a. periapical
   b. bitewing
   c. panoramic
   d. all of the above

9. For the paralleling technique, the x-ray beam should be directed to the teeth and receptor __________.
   a. parallel
   b. at an acute angle
   c. at right angles
   d. at obtuse angles

10. Patients who gag easily or for children, “tab bitewings” are __________ for the patient.
    a. less convenient
    b. less cumbersome
    c. more comfortable
    d. all of the above

11. Central ray entry points will help with __________.
    a. position of the sensor plate
    b. ray beam reduction
    c. ray beam lateralization
    d. ray beam collimation

12. The bisecting angle technique is an alternate approach for __________.
    a. taking periapical radiographs
    b. peripheral radiographs
    c. occlusal radiographs
    d. all of the above

13. Application of the bisecting angle technique has become more common in digital radiography with __________.
    a. rigid digital receptors
    b. flexible digital receptors
    c. flexible x-ray film
    d. none of the above

14. When using the bisecting angle technique, for a maxillary molar the angulation should be __________.
    a. +15° to +25°
    b. -15° to -25°
    c. +25° to +35°
    d. all of the above

15. When using the bisecting angle technique, for a mandibular canine the angulation should be __________.
    a. +0° to +15°
    b. +15° to +25°
    c. -15° to -25°
    d. all of the above

16. For a periapical radiograph of the maxillary canine, the central ray entry point should be the __________.
    a. corner of the mouth
    b. alveolus of the tooth
    c. tip of the nose
    d. none of the above

17. For a mandibular central incisor periapical radiograph, a __________ should be used for the receptor orientation.
    a. horizontal placement
    b. vertical placement
    c. diagonal placement
    d. any of the above

18. For a molar bitewing radiograph, a __________ should be used for the receptor orientation.
    a. horizontal placement
    b. vertical placement
    c. diagonal placement
    d. horizontal or vertical placement

19. Technique adaptations may be required __________.
    a. due to anatomical considerations
    b. in the presence of extrinsic fillings
    c. to avoid patient discomfort
    d. all of the above

20. If a patient has a shallow palate, the clinician can __________.
    a. use the bisecting technique instead of the parallel- ing technique and move the receptor more towards the midline
    b. use the paralleling technique instead of the bisecting technique and move the receptor further from the midline
    c. use the paralleling technique instead of the bisecting technique and move the receptor from nearer to the midline
    d. use the bisecting technique instead of paralleling technique and move the receptor from farther to the midline

21. Central ray entry points will help with __________.
    a. position of the sensor plate
    b. ray beam reduction
    c. ray beam lateralization
    d. ray beam collimation

22. The most common area to elict the gag reflex is the __________ view.
    a. maxillary periapical
    b. mandibular periapical
    c. incisor periapical
    d. mandibular incisor periapical

23. The use of __________ can improve patient comfort.
    a. receptor cushions
    b. topical anesthetic agents
    c. lightweight bite blocks
    d. all of the above

24. Self-adhesive film can be used if __________.
    a. over the receptor for bitewings
    b. over the receptor for periapicals
    c. smooth the edge and provide cushioning
    d. all of the above

25. When adaptive tabs are used, keeping the receptor firmly within the sensor barrier can be achieved by using __________.
    a. a thin film layer
    b. a thick film layer
    c. a thin polyethylene layer
    d. a thick polyethylene layer

26. Lead collars __________.
    a. are designed to protect the thyroid
    b. substantially reduce radiation to the thyroid
    c. are best practice together with the use of lead aprons
    d. all of the above

27. In radiology, ALARA stands for __________.
    a. As Level As Reasonably Achievable
    b. As Low As Reasonably Acceptable
    c. As Low As Reasonably Achievable
    d. none of the above

28. Vertical angulation errors __________.
    a. distort the length of the structure
    b. may or may not falsify information or elongation
    c. are more common in bisecting angle technique than with paralleling technique
    d. all of the above

29. Nongalving angulation errors result in __________.
    a. distorting of image
    b. over- and under-sharpening of structures
    c. sharpening of image
    d. all of the above

30. Cone cutting can be corrected by __________.
    a. increasing the vertical angulation of the PID
    b. centering the x-ray beam over the image receptor
    c. decreasing the vertical angulation of the x-ray beam
    d. all of the above

Educational Objectives

1. Place objective 1 here.
2. Place objective 2 here.
3. Place objective 3 here.
4. Place objective 4 here.

Course Evaluation

1. Were the individual course objectives met? Objective #1: Yes No Objective #2: Yes No Objective #3: Yes No Objective #4: Yes No

2. To what extent were the course objectives accomplished overall? 1) Slightly 2) Fairly 3) Markedly 4) Extremely

3. Please rate your personal mastery of the course objectives.

4. How would you rate the objectives and educational methods?

5. How do you rate the author’s grasp of the topic?

6. Please rate the instructor’s effectiveness?

7. Was the overall administration of the course effective?

8. Please rate the usefulness and clinical applicability of this course.

9. Please rate the usefulness of the supplemental weblog.

10. Do you feel that the content met your expectations? Yes No

11. Would you participate in a similar program on a different topic? Yes No

12. Ranting the same education evaluation question was not ambiguous, please explain.

13. Was there any subject matter you found confusing? Please describe.

14. How long did it take you to complete this course?

15. What additional continuing dental education topics would you like to see?

PLEASE PHOTOCOPY ANSWER SHEET FOR ADDITIONAL PARTICIPANTS.

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