Strategies for optimal intraoral digital imaging
Part I: Intraoral receptors, techniques, and instrumentation

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

Educational Objectives:
The goal of this course is to provide the reader with contemporary information on intraoral digital radiography. Upon completion of Part I of this course, the reader will be able to:
1. List and describe the types of digital receptors used for intraoral radiographic imaging;
2. List and describe the principles of paralleling, bitewing, and bisecting angle techniques for effective intraoral digital imaging;
3. List and describe the intraoral receptor instruments that can be used to acquire periapical and bitewing images.

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Author Disclosure
Gail F. Williamson, RDH, BS, MS has no commercial ties with the sponsors or the providers of the unrestricted educational grant for this course.

Abstract
Radiographic examinations should be made only when the dentist has determined they are necessary for diagnostic and treatment purposes. Radiographic selection criteria have been published by the American Dental Association (ADA) to assist dentists in decision-making and justification of the prescription (see table 11). Once such a determination has been made, it is the responsibility of the dentist to ensure that optimal radiographic images are obtained at the lowest possible dose of radiation. Because radiographic procedures are delegated to dental hygienists and dental assistants, it is important that these radiographers have the knowledge, skill, and technical acumen to obtain optimal results. Increasingly, digital radiographic imaging is being used with two types of receptors: photostimulable phosphor plates and solid-state detectors.

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Abstract
Radiographic examinations should be made only when the dentist has determined they are necessary for diagnostic and treatment purposes. Radiographic selection criteria have been published by the American Dental Association (ADA) to assist dentists in decision-making and justification of the prescription (See table 1).

Introduction
Digital Radiographic Imaging: A Primer
To meet clinical requirements, dental radiographic images must be as accurate and detailed as possible. Digital imaging has surpassed film radiography as the primary modality for acquiring and archiving intraoral images. Digital imaging offers several advantages over film radiography, including
• the visualization of images on a monitor;
• computerized archiving of images;
• the ability to enhance acquired images;
• the potential for radiation exposure reduction; and
• rapid image acquisition without the need for chemical processing, darkroom maintenance, and chemical waste disposal.

In order to produce high-quality diagnostic images, careful technique is required. A clinician’s technique must consider best practices, imaging principles, and patient comfort. Proper technique, effective patient management, and proper exposure maximize the information available from intraoral images and, therefore, their diagnostic value.

Typically, clinicians perform radiographic examinations to evaluate oral disease states such as periodontal disease, caries, and periapical pathoses. For periodontal disease and periapical pathoses, the radiographic projection of choice is usually a periapical image or series of images that record the entire tooth and supporting bone.

Table 1: Recommendations for Patient Selection in Brief

<table>
<thead>
<tr>
<th>Type of Patient Encounter</th>
<th>Child Primary Dentition</th>
<th>Child Transitional Dentition</th>
<th>Adolescent Permanent Dentition</th>
<th>Adult Dentate / Partially Edentulous</th>
<th>Adult Edentulous</th>
</tr>
</thead>
<tbody>
<tr>
<td>New Patient</td>
<td>Bitewings if contacts closed; Selected PAS/Occclusals</td>
<td>Bitewings/Panoramic or Bitewings/Selected PAS</td>
<td>Bitewings/Panoramic FM when indicated</td>
<td>Bitewings/Panoramic FM when indicated</td>
<td>Individualized exam based on signs/symptoms</td>
</tr>
<tr>
<td>Recall – Clinical Caries; Increased Caries Risk</td>
<td>Bitewings at 6-12 month intervals Closed contacts</td>
<td>Bitewings at 6-12 month intervals Closed contacts</td>
<td>Bitewings at 6-12 month intervals</td>
<td>Bitewings at 6-18 month intervals</td>
<td>Not Applicable</td>
</tr>
<tr>
<td>Recall - No Clinical Caries; Low Caries Risk</td>
<td>Bitewings at 12-24 month intervals Closed contacts</td>
<td>Bitewings at 12-24 month intervals Closed contacts</td>
<td>Bitewings at 18-36 month intervals</td>
<td>Bitewings at 24-36 month intervals</td>
<td>Not Applicable</td>
</tr>
<tr>
<td>Recall Periodontal Disease</td>
<td>Clinical judgment; Selected PAS/BWS as needed</td>
<td>Clinical judgment; Selected PAS/BWS as needed</td>
<td>Clinical judgment; Selected PAS/BWS as needed</td>
<td>Clinical judgment; Selected PAS/BWS as needed</td>
<td>Not Applicable</td>
</tr>
<tr>
<td>New/Recall Growth Development Dental/Skeletal</td>
<td>Clinical judgment as to need/type of radiographic images</td>
<td>Clinical judgment as to need/type of radiographic images</td>
<td>Clinical judgment for growth/development Panoramic or PAS to assess 3rd molars</td>
<td>Not Applicable for Growth/Development; Clinical judgment dental/skeletal</td>
<td>Not Applicable for Growth/Development; Clinical judgment dental/skeletal</td>
</tr>
<tr>
<td>Other Circumstances</td>
<td>Clinical judgment as to need for and type of radiographic images for evaluation and/or monitoring of conditions</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Bitewing radiographs are the images of choice for the detection and monitoring of dental caries in posterior teeth, as well as the detection of alveolar bone levels. Posterior bitewings can be taken in either the horizontal or vertical plane. There is preference for vertical placement in patients with moderate and higher amounts of alveolar bone loss. In addition, vertical bitewings can be taken of the anterior teeth to evaluate alveolar bone levels in those sextants.

Many factors influence which radiographs are required and when they should be obtained. These include the patient’s medical and dental history; clinical signs and symptoms of disease; risk factors; age and dentition; and new or recall patient. As previously mentioned, the ADA has published recommendations for appropriate, patient-specific selection of radiographs. It is important to note that there are several survey options the dentist can consider when prescribing radiographs. The survey determination is dependent on the factors mentioned above and the condition(s) to be evaluated. When indicated, intraoral radiographs can be taken alone or in combination with panoramic imaging or other extraoral imaging modalities. The overall objective, regardless of survey type, is to minimize exposure to radiation while maximizing the diagnostic value of the radiographs, a goal achieved with digital intraoral imaging.

**Digital Receptors**

Digital receptors are available in two formats:

- photostimulable phosphor plates (PSP) / storage phosphor plates
- solid-state detectors in the form of rigid-wired or wireless sensors

The latter category includes charge-coupled devices (CCD) and complementary metal oxide semiconductor (CMOS) receptors. Photostimulable phosphor plate and solid-state detector systems are computer-based technologies that require specific hardware and software components for operation (figure 1). Both of these digital receptor types are faster than chemically processed film and reduce the amount of radiation needed to produce a diagnostic image. They are available in sizes comparable to film, most typically 0, 1, and 2.

Both receptor types are reusable but cannot be sterilized. Therefore, it is important for clinicians to consult manufacturer instructions for proper preparation, disinfection, and coverage of the receptor as well as effective barrier-removal techniques. Care must be taken to avoid direct contact between the receptor and saliva thus preventing cross-contamination. Several studies have reported that all digital receptor types can become directly contaminated with saliva during use. This can occur through barrier perforation or poor handling techniques. Disinfection can be accomplished with high-level disinfectant products and typical disinfection techniques followed by coverage with an effective barrier. For rigid receptors, the Centers for Disease Control and Prevention recommend using both an internal and external (“double”) barrier.

**Photostimulable Phosphor Plates**

Photostimulable phosphor plate receptors are wireless and more flexible and thinner compared to solid-state detectors and traditional darkroom film. The key advantages of phosphor plate receptors are their construction, greater active area of exposure, and lower retake frequency, which reduces patient exposure. Photostimulable phosphor plate receptors have greater latitude (the ability to capture a diagnostic image with a range of exposures) than film and solid-state detectors. This helps to reduce exposure-related retakes.

Exposed plate receptors store the latent image within a europium-activated barium fluorohalide emulsion. The stored energy is released when the plate is scanned with a helium-neon laser beam. The light emitted is detected and intensified by the photomultiplier tube and subsequently converted from analog to digital data to form the visible image. Prior to reuse, the plate is erased in the digital scanner by exposure to light. This removes remnant images, returning the previously excited electrons to a “relaxed” state.

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*Figure 1 – Digital Receptors*
Disadvantages include plate scar artifacts that can result in plate replacement and a delay between image acquisition and display.5–8 This occurs through rough handling that can produce plate “scars” in the form of scratches or creases resulting in permanent image artifacts that can necessitate plate replacement.8 These problems can result in retakes, thereby increasing patient radiation exposure. Recent improvements in plate technology have been directed toward making plates more scratch resistant to improve longevity and reduce replacement.

Solid-state Detectors
Solid-state digital receptors are wired or wireless rigid devices often referred to as “sensors” or “detectors” (these terms can be used interchangeably). CCD (charge-coupled device) and CMOS (complementary metal-oxide semiconductor) detectors are composed of a matrix of pixels that function as electron wells. The X-ray or light energy generated by exposure is deposited in the wells and forms a latent image. The intensity of the energy in each pixel/well determines the brightness or density of the image.

The major difference between CCD and CMOS detectors is the manner in which data are transferred to the read-out amplifier for display.6 The actual active sensor surface area is slightly smaller than plates or film such that the overall area of coverage is reduced. In some instances, additional images may be required to cover structures fully.

Because of the rigid construction and attached wire, receptor placement can be challenging for the clinician and uncomfortable for some patients. These difficulties contribute to multiple retakes and undermine potential radiation dose reduction.5–12 Rigid digital receptors with rounded corner designs and more flexible wires tend to reduce the discomfort when acquiring bitewing images.13

The key advantages of solid-state digital receptors include rapid image acquisition and real-time image display. Disadvantages include rigid construction, placement difficulties, and a higher rate of retakes.5 Other problems associated with rigid digital receptors include:

- placement errors, especially in premolar and molar areas;
- vertical angulation errors (particularly in the anterior regions of the mouth) that result in incisal edge cut-offs;
- horizontal overlapping, especially in premolar periapicals and bitewings;
- difficulties with bitewing placement, both in premolar views and vertical bitewings; and
- discomfort due to bulk and corners.5–12

Intraoral Techniques
Equipping Your Toolkit
The quality of an intraoral image is dependent upon the clinician’s skill, command of technique, and patient management. The more tools available to address challenges, the more likely these problems can be overcome. Intraoral image receptors must be positioned accurately, which can be achieved using the proper technique for the desired radiographic projection and anatomical situation. For maxillary projections and bitewings, paralleling, bitewing, and bisecting angle techniques can be employed. Regardless of the technique selected, it is recommended that the patient’s head be positioned with the occlusal plane parallel to the floor and their midsagittal plane be placed perpendicular to the floor (figure 2). For mandibular projections, it is recommended that the chin be raised so that the mandibular arch is parallel to the floor. In addition, there are facial anatomic landmarks that can be used to guide the centering of the X-ray beam for each periapical and bitewing image, called central ray entry points (figure 2). Devices used to accomplish intraoral imaging include receptor instruments with and without ring guides, standard bite blocks, cotton rolls, and bitewing tabs.

Paralleling Technique
The paralleling technique is the preferred and most accurate method for acquiring both periapical and bitewing images. The paralleling technique can be accomplished with the use of ringed instruments as well as standard bite blocks. It is the relationship established between the receptor and the teeth that dictates the technique rather than the device used. The digital receptor should be placed both vertically and horizontally parallel with
the teeth that are being radiographed. The X-ray beam should be directed at right angles, perpendicular to the teeth and receptor simultaneously. When the receptor is placed correctly, the vertical and horizontal angulations align with the planes of teeth and receptor (figure 3).

**Figure 3 – Head Position**

In the case of periapical imaging, the digital receptor should be placed parallel to the full length of the crown and apices of the teeth (figure 4). To achieve the best placement and patient comfort, the digital receptor should be placed more toward the midline of the mouth rather than close to the teeth. It is helpful to use a cotton roll underneath the bite block to reduce the need for heavy biting forces, which often result in patient discomfort and receptor displacement. Technique guidelines call for precise location and inclusion of specific structures on each projection (figure 5).

**Figure 4 - Paralleling Diagram**

**Bitewing Technique**

Regardless of approach, instrument or tab bitewings are based on the paralleling technique. In the case of bitewings, the focus is on the crowns of the teeth and the alveolar bone crests, which assist in caries diagnosis and periodontal bone loss evaluation. The digital receptor should be placed vertically and horizontally parallel to the crowns of the teeth in the area of interest. For patients who gag easily and for children, tab bitewings are less cumbersome and often more comfortable.

Bitewing tabs hold the digital receptor in position intraorally, but they do not provide an external alignment guide for the PID (position indicating device) or X-ray cone positioning and beam direction. Careful placement and beam alignment are necessary to produce good results. The vertical angulation for tab bitewings ranges from 0° to +8° with +5° being the most typical angle used. The X-ray beam should be centered over the tab or the receptor. The lateral tab edge should be aligned parallel to the teeth contacts, which will indicate the correct horizontal angulation to use to direct the X-rays proximally. Another horizontal angulation alignment strategy is to have the patient smile so that the clinician can compare the buccal surfaces of the teeth to the open end of the PID or instrument ring. These should be parallel to each other. These strategies are important to avoid proximal horizontal overlapping, the leading cause of retakes in bitewing imaging. Central ray entry points will help the clinician with X-ray beam centering as does using the lines on the PID that indicate the direction the X-rays exit the collimator (figure 4). The latter strategy will help the clinician avoid cone cuts or partial exposure of the receptor.

**Bisecting Angle Technique**

The bisecting angle technique is an alternate approach for periapical imaging. With this technique, the receptor is placed in an angular position rather than parallel to the long axes of the teeth. The X-ray beam is then directed at a right angle (perpendicular) to the plane that divides or bisects the angle formed by the receptor and the teeth. This method produces less than optimal images because the receptor and teeth are not in the same vertical plane. However, it is a useful strategy when an ideal receptor position cannot be achieved due to anatomical obstacles or placement difficulties. This technique is more operator-sensitive and requires a good understanding of the underlying geometric principles of the bisecting angle technique. If the angle is not correctly divided, elongation (underangulation) or foreshortening (overangulation) will occur (figure 6). To achieve this, a variety of holders can be used for positioning the receptor in different locations in the mouth.

What often happens is the clinician uses a paralleling instrument but is unable to achieve a parallel placement of the receptor. Therefore, the clinician must be able to evaluate whether or not the receptor placement conforms to the parameters of the paralleling technique. A useful strategy is to check the X-ray beam entry relative to the facial central ray entry point. If the center of the X-ray beam is not in alignment with the facial central ray entry point, then the vertical angulation needs to be adjusted. It is not sufficient for the ring to be parallel to the receptor only; it must be parallel to the teeth as well.
<table>
<thead>
<tr>
<th>Projection Or View</th>
<th>Receptor Placement</th>
<th>Teeth Recorded</th>
<th>Central Ray Entry Point</th>
<th>Receptor Orientation</th>
<th>Receptor Size</th>
<th>Image</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>MAXILLARY PERIAPICALS</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Molar periapical</td>
<td>Place the receptor toward the midline and the biteblock under the 2nd molar crown, and align the mesial edge of the biteblock between the 1st and 2nd molar contact point</td>
<td>1st, 2nd, 3rd molar teeth crowns and apaxes</td>
<td>Point down from the outer canthus (corner) of the eye to midcheek area</td>
<td>Horizontal placement; dot toward crown</td>
<td>Size 2</td>
<td></td>
</tr>
<tr>
<td>Premolar periapical</td>
<td>Place the receptor toward the midline and the biteblock under the 2nd premolar crown, and align the mesial edge of the biteblock between the 1st and 2nd premolar contact point</td>
<td>Distal of the canine, 1st and 2nd premolar, 1st molar crowns and apaxes</td>
<td>Point down from the pupil of the eye to mid-cheek area</td>
<td>Horizontal placement; dot toward crown</td>
<td>Size 2</td>
<td></td>
</tr>
<tr>
<td>Canine periapical</td>
<td>Place the receptor lingual to the canine, with the biteblock centered with the cusip tip</td>
<td>Mesial and apex of the canine</td>
<td>Ala (corner) of the nose</td>
<td>Vertical placement; dot toward crown</td>
<td>Size 1</td>
<td></td>
</tr>
<tr>
<td>Lateral incisor periapical</td>
<td>Place the receptor lingual to the lateral incisor and the biteblock under the lateral incisor crown</td>
<td>Mesial, distal, and apex of the lateral incisor</td>
<td>Nares (naris) of the nose</td>
<td>Vertical placement; dot toward crown</td>
<td>Size 1</td>
<td></td>
</tr>
<tr>
<td>Central incisor periapical</td>
<td>Place the receptor lingual to the central incisors, and center the biteblock with the central incisor contact point</td>
<td>Mesial, distal, and apices of the central incisors</td>
<td>Tip of the nose</td>
<td>Vertical placement; dot toward crown</td>
<td>Size 1 or 2</td>
<td></td>
</tr>
<tr>
<td><strong>OPTION</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Canine-lateral periapical</td>
<td>Place the receptor lingual to the canine and lateral; center the biteblock with the lateral-canine contact point</td>
<td>Mesial and apex of the canine, mesial, distal, and apex of the lateral incisor</td>
<td>Ala (corner) of the nose</td>
<td>Vertical placement; dot toward crown</td>
<td>Size 2</td>
<td></td>
</tr>
<tr>
<td><strong>BITE-WINGS</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Molar bite-wing</td>
<td>Align the mesial edge of the tab between the 1st and 2nd molar contact on the mandible</td>
<td>Maxillary and mandibular molar crowns in occlusion</td>
<td>Point down from the outer corner of the eye to the occlusal plane</td>
<td>Horizontal or vertical placement; dot toward mandible</td>
<td>Size 2</td>
<td></td>
</tr>
<tr>
<td>Premolar bite-wing</td>
<td>Align the mesial edge of the biteblock between the 1st and 2nd premolar contact on the mandible</td>
<td>Distal of the maxillary and mandibular canine, premolar and 1st molar crowns in occlusion</td>
<td>Point down from the pupil of the eye to the occlusal plane</td>
<td>Horizontal or vertical placement; dot toward mandible</td>
<td>Size 2</td>
<td></td>
</tr>
<tr>
<td><strong>MANDIBULAR PERIAPICALS</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Molar periapical</td>
<td>Place the receptor toward the tongue, place the biteblock on the 2nd molar crown, and align the mesial edge of the biteblock between the 1st and 2nd molar contact point</td>
<td>1st, 2nd, 3rd molar teeth crowns and apaxes</td>
<td>Point down from the outer canthus (corner) of the eye to mid-mandible area</td>
<td>Horizontal placement; dot toward crown</td>
<td>Size 2</td>
<td></td>
</tr>
<tr>
<td>Premolar periapical</td>
<td>Place the receptor toward the tongue, place the biteblock on the 2nd premolar, and align the mesial edge of the biteblock between the 1st and 2nd premolar contact point</td>
<td>Distal of the canine, 1st and 2nd premolar, 1st molar crowns and apaxes</td>
<td>Point down from the pupil of the eye to mid-mandible area</td>
<td>Horizontal placement; dot toward crown</td>
<td>Size 2</td>
<td></td>
</tr>
<tr>
<td>Canine-lateral periapical</td>
<td>Place the receptor lingual to the canine and lateral with biteblock centered with the contact point</td>
<td>Distal of the lateral and mesial of the canine and apices</td>
<td>Point down from the ala (corner) of the nose to the chin corner</td>
<td>Vertical placement; dot toward crown</td>
<td>Size 1 or 2</td>
<td></td>
</tr>
<tr>
<td>Central incisor periapical</td>
<td>Place the receptor lingual to the central incisors, and center the biteblock with the central incisor contact point</td>
<td>Mesial and distal of the central incisors and mesial of the lateral incisors and apices</td>
<td>Point down from the tip of the nose to the chin center</td>
<td>Vertical placement; dot toward crown</td>
<td>Size 1 or 2</td>
<td></td>
</tr>
</tbody>
</table>

Figure 5 – Technique Chart

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Another strategy that the clinician can use is to initially align the PID parallel to the receptor or ring guide and then reduce (decrease) the vertical angulation by approximately 10° which will approach the bisecting angle. Also, starting angles can be used to approximate the bisecting plane in each area of the mouth when nonringed instruments or devices are used (table 2). These starting angles can be aligned using the angle meter on the X-ray head, which indicates in degrees the angulation of the PID (figure 7). Positive angulations position the X-ray head above 0° with the PID directed downward, while negative angulations position the X-ray head below 0° with the PID directed upward. Generally, positive angulations are used on the maxilla and negative angulations are used on the mandible.

Table 2: Bisecting Angle Technique Starting Angulations

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

Using the bisecting angle is more common with rigid sensors because achievement of true parallelism between the receptor and the tooth structure is more difficult. As a result, the crowns are frequently cut off due to overangulation and image foreshortening. Reduction of the vertical angulation will compensate for the lack of receptor parallelism to the structures of interest.

**Occlusal Technique**

Topographical occlusal radiography is based on the bisecting angle technique. It can be used to take periapical images in the anterior regions of the mouth when the arch is too narrow to permit normal placement of the receptor or when mouth opening is limited.

Occlusal imaging is technique sensitive in that the patient’s head alignment, the vertical angulation, and the central ray entry must be aligned correctly to produce optimal results. The receptor should be oriented vertically and placed against the occlusal plane of the teeth of interest. The patient should bite lightly to secure the receptor in position. To maintain a level and secure placement for rigid wired sensors, cotton rolls can be placed under the receptor adjacent to the wire. The technique parameters for incisor and lateral-canine views for either arch are outlined in table 2. The horizontal angulation and exposure time remain the same as conventional periapicals of the respective area of interest.

Table 3: Occlusal Techniques for Anterior Views

<table>
<thead>
<tr>
<th>Periapical View</th>
<th>Head Position</th>
<th>Central Ray Entry</th>
<th>Vertical Angulation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maxillary Incisor</td>
<td>Occlusal plane parallel to the floor</td>
<td>½” above the tip of the nose</td>
<td>+55° to +60°</td>
</tr>
<tr>
<td>Maxillary Lateral-Canine</td>
<td>Occlusal plane aligned at -45°</td>
<td>Center of the chin</td>
<td>-10° to -15°</td>
</tr>
<tr>
<td>Mandibular Lateral-Canine</td>
<td>Occlusal plane aligned at -45°</td>
<td>Corner of the chin</td>
<td>-10° to -15°</td>
</tr>
</tbody>
</table>

Occlusal techniques can be utilized to obtain anterior images on children (figure 8). In these instances, the receptor is placed in the horizontal rather than the vertical plane. One anterior view is taken on either or both the maxilla and mandible. The technique including head position and angulation is the same in both instances, but the exposure time should be adjusted to a child setting.
Intraoral Receptor Instruments

Available Instruments
As previously discussed, there is a variety of intraoral imaging instruments available to position and stabilize the receptor in the patient’s mouth during exposure (figure 5). Most instruments can tolerate heat sterilization, which permits reuse and may be more cost effective in the long term.Disposable, single-use bite blocks and tabs are available for periapical and bitewing imaging as well. Disposable bite blocks can be used in conjunction with ringed instruments for periapical imaging. The use of specific instrumentation depends on clinician preference, consistent diagnostic outcomes, the treatment schedule, patient volume, and the ability to stabilize instruments to meet imaging demands throughout the day.

Receptor instruments with X-ray beam ring guides improve accuracy and help ensure correct beam angulation and centering. Remember that the use of an instrument alone does not assure accuracy: the clinician must use the device correctly or make necessary adjustments when receptor placement is not ideal.

Summary
Dental radiographs are valuable diagnostic tools and expose the patient to minimal amounts of radiation when the examination is conducted in an optimal manner. To achieve diagnostic results, the clinician must be knowledgeable and well-versed in intraoral radiographic techniques used for patient imaging. In addition, the clinician must be skilled in receptor placement to produce optimal results. Receptor instruments are valuable tools that guide the X-ray beam and thereby assist in the accuracy of dental radiographic images and retake avoidance.

References

Author Profile
Gail F. Williamson, RDH, MS is a professor of dental diagnostic sciences in the Department of Oral Pathology, Medicine, and Radiology at the Indiana University School of Dentistry in Indianapolis, Indiana. She holds an associate’s degree in dental hygiene, a bachelor’s degree in allied health, and a master’s of science degree in education, all from Indiana University. She has served as director of allied dental radiology and course director for dental assisting and dental hygiene radiology courses. A veteran teacher, 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 serves as the associate executive director of the American Academy of Oral and Maxillofacial Radiology and serves as a radiology expert on the American Dental Association’s Joint Commission on National Board Examinations Dental Hygiene National Board Review Committee. Currently, Williamson serves as the director of faculty enhancement both at the campus and school levels.

Author Disclaimer
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Questions

1. Dental radiographic examinations are taken ______.
   a. only when indicated
   b. as prescribed by the dentist
   c. for diagnosis and treatment
   d. all the above

2. ______ is an advantage of the use of solid-state detectors over film.
   a. Computerized archiving and image display
   b. Chemical processing of the receptor
   c. Reduction in the number of retakes
   d. Active surface area for image acquisition

3. To evaluate periapical pathosis, the radiographic projection of choice is usually a ______.
   a. bitewing image
   b. periapical image
   c. series of periapical and bitewing images
   d. topographical occlusal image

4. The images of choice for the detection and monitoring of dental caries in the posterior teeth are ______.
   a. bitewing images
   b. periapical images
   c. occlusal images
   d. full mouth survey

5. Digital receptors are available as ______.
   a. charge-coupled devices
   b. photostimulable phosphor plates
   c. complementary metal oxide semiconductors
   d. all of the above

6. A common error associated with solid-state digital receptors is ______.
   a. elongation
   b. cone cutting
   c. placement
   d. exposure

7. To prepare digital receptors for use, the clinician should avoid use of ______.
   a. heat-sterilization
   b. high-level disinfection
   c. a double-barrier technique
   d. manufacturer instructions

8. Phosphor plate receptors ______.
   a. are wired digital receptors
   b. provide real-time image display
   c. require laser scanning
   d. are solid-state detectors

9. Phosphor plate receptors are susceptible to ______.
   a. overexposure
   b. scar artifacts
   c. more retakes
   d. scan errors

10. To capture the distal surface of canines with rigid sensors, it may be easier to take an additional anterior periapical on each arch to capture the ______.
    a. central-lateral incisor contact
    b. canine-lateral contact
    c. canine-1st premolar contact
    d. 2nd premolar-2nd premolar contact

11. The paralleling technique is used for ______ radiographs.
    a. periapical
    b. bitewing
    c. panoramic
    d. a and b

12. To achieve proper placement with the paralleling technique, the receptor must be placed ______.
    a. vertically parallel to the teeth
    b. horizontally parallel to the teeth
    c. toward the midline of the mouth
    d. all the above

13. For patients who gag easily or for children, tab bitewings are ______ for the patient.
    a. less convenient
    b. less cumbersome
    c. less comfortable
    d. b and c

14. Central ray entry points are most useful for ______.
    a. positioning of the receptor
    b. X-ray beam angulation
    c. X-ray beam centering
    d. patient head positioning

15. The bisecting angle technique can be used for ______.
    a. bitewing radiography
    b. periapical radiography
    c. occlusal radiography
    d. b and c

16. Application of the bisecting angle technique has become more common with the use of ______.
    a. phosphor plate receptors
    b. rigid digital receptors
    c. radiographic film
    d. none of the above

17. When taking maxillary periapicals and bitewing images, the preferred head position aligns the ______.
    a. occlusal plane parallel to the floor
    b. midagittal plane perpendicular to the floor
    c. occlusal plane perpendicular to the floor
    d. both a and b

18. When using the bisecting angle technique for a maxillary molar projection, the starting angulation will range from ______.
    a. +75° to +85°
    b. +55° to +60°
    c. +5° to +10°
    d. all of the above

19. When using the bisecting angle technique for a mandibular canine projection, the angulation ranges from ______.
    a. +10° to +15°
    b. +25° to +35°
    c. +5° to +5°
    d. -10° to -15°

20. For a periapical radiograph of the maxillary canine area, the central ray entry point should be the ______.
    a. corner of the eye
    b. tip of the nose
    c. ala of the nose
    d. center of the cheek

21. For a periapical radiograph of the mandibular incisor area, the central ray entry point should be the ______.
    a. lower border of the lip
    b. corner of the mouth
    c. nares of the nose
    d. center of the chin

22. For a maxillary central incisor periapical image, a ______ should be used for the receptor orientation.
    a. horizontal placement
    b. vertical placement
    c. diagonal placement
    d. any of the above

23. For a molar bitewing radiographic image, a ______ can be used for the receptor orientation.
    a. horizontal placement
    b. vertical placement
d. diagonal placement
    c. horizontal or vertical placement

24. Image foreshortening is caused by ______.
    a. improper beam centering
    b. overangulation in the vertical plane
d. underangulation in the vertical plane
    c. incorrect horizontal angulation

25. ______ is the most common cause for retakes in bitewing imaging.
    a. Proximal horizontal overlap
    b. Image elongation
c. Image foreshortening
d. Cone cut

26. Positive vertical angulations are most typically used for ______.
    a. maxillary periapical images
    b. mandibular periapicals
    c. bitewing images
    d. a and c

27. The correct vertical angulation for the maxillary incisor view when using the occlusal technique is ______.
    a. +25° to +35°
    b. +45° to +55°
    c. +5° to +5°
    d. +60° to +65°

28. Topographical occlusal imaging can be used ______.
    a. when mouth opening is limited
    b. to obtain anterior images on children
c. as anterior periapical replacements on adults
d. all of the above

29. Receptor instruments with ring guides ______.
    a. must be used correctly by the clinician
    b. assure image accuracy and quality
c. require disinfection before reuse
d. are disposable

30. The use of specific receptor instrumentation is a function of ______.
    a. clinician preference
    b. consistent diagnostic outcomes
c. patient volume
d. all of the above
Eduational Objectives:
1. List and describe the types of digital receptors used for intraoral radiographic imaging.
2. List and describe the principles of paralleling, bitewing, and bisecting angle techniques for effective intraoral digital imaging.
3. List and describe the intraoral receptor instruments that can be used to acquire periapical and bitewing images.

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

Please evaluate this course by responding to the following statements, using a scale of Excellent = 5 to Poor = 0.

1. To what extent were the course objectives accomplished overall? 5 4 3 2 1 0
2. Please rate your personal mastery of the course objectives. 5 4 3 2 1 0
3. How would you rate the objectives and educational methods? 5 4 3 2 1 0
4. How do you rate the author's grasp of the topic? 5 4 3 2 1 0
5. Please rate the instructor's effectiveness. 5 4 3 2 1 0
6. Was the overall administration of the course effective? 5 4 3 2 1 0
7. Do you feel that the references were adequate? Yes No
8. Would you participate in a similar program on a different topic? Yes No
9. If any of the continuing education questions were unclear or ambiguous, please list them. __________________________

10. Please rate the usefulness of the supplemental webliography. 5 4 3 2 1 0
11. How do you rate the author's grasp of the topic? 5 4 3 2 1 0
12. Please rate your personal mastery of the course objectives. 5 4 3 2 1 0
13. To what extent were the course objectives accomplished overall? 5 4 3 2 1 0

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