A Review of Intraoral Radiology

A Peer-Reviewed Publication
Written by Jeffery B. Price, DDS, MS

Abstract
Dentists today receive information from more sources than ever. It is increasingly difficult to determine how to prioritize information when it comes time to make important practice decisions such as purchasing imaging systems for the modern dental office. This series of articles is intended to provide the dentist with some basic information regarding modern imaging systems. Specifically, part one of this series is geared towards a review of intraoral digital radiography. In addition to digital radiography, we will offer a basic overview of the principles of x-ray production; radiation dose and selection criteria; attenuation and image quality. We will also discuss how these aspects of radiology are meaningful to the practicing dentist. After completing this course, the dentist and dental auxiliary should have a better understanding of how intraoral radiography systems function and be better equipped to make a decision regarding which intraoral system to purchase.

Educational Objectives:
At the conclusion of this course, attendees will be able to understand and discuss:
1. The advantages and disadvantages of film and digital radiography
2. The differences between direct and indirect digital radiography
3. The advantages and disadvantages of direct and indirect digital radiography

Author Profile
Jeffery B. Price, DDS, MS is a Diplomate of the American Board of Oral & Maxillofacial Radiology. He is currently an Assistant Professor of Oral & Maxillofacial Radiology and Director of Oral & Maxillofacial Radiology at the Meharry Medical College School of Dentistry in Nashville, TN. In addition, he is an Adjunct Associate Professor of Oral & Maxillofacial Radiology at the UNC School of Dentistry in Chapel Hill, NC. Dr. Price is also a consultant with Sirona Dental and teaches many of their Galileos new users training courses. He also has an internet-based Cone Beam CT interpretation practice. Dr. Price practiced general and adult restorative dentistry in Hendersonville, NC for 24 years. While in practice, Dr. Price completed the continuum at the L.D. Pankey Institute in Key Biscayne, FL; in addition, he attained his Mastership in the Academy of General Dentistry as well as Diplomate status in the International Congress of Oral Implantologists. Dr. Price is currently on the editorial board of the ICOI-sponsored journal, Implant Dentistry; and, is a reviewer for JOMS, JDE and JADA.

Author Disclosure
Jeffery B. Price, DDS, MS has no potential conflicts of interest to disclose.

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This course was written for dentists, dental hygienists, and assistants.
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Abstract
Dentists today receive information from more sources than ever. It is increasingly difficult to determine how to prioritize information when it comes time to make important practice decisions such as purchasing imaging systems for the modern dental office. This series of articles is intended to provide the dentist with some basic information regarding modern imaging systems. Specifically, part one of this series is geared towards a review of intraoral digital radiography. In addition to digital radiography, we will offer a basic overview of the principles of x-ray production; radiation dose and selection criteria; attenuation and image quality. We will also discuss how these aspects of radiology are meaningful to the practicing dentist. After completing this course, the dentist and dental auxiliary should have a better understanding of how intraoral dental radiography systems function and be better equipped to make a decision regarding which intraoral system to purchase.

Throughout this continuing education course, we will look at the major choices in radiographic systems available to dentists today as they contemplate either building a new dental office or upgrading an existing facility. There are two premises that the reader should assume: first, the course is taught with the assumption that for the foreseeable future, there will be a place in dentistry for intraoral radiography; and secondly, as dentists build or upgrade new facilities, the major emphasis will be on digital receptors, not film-based receptors. Dentists need to focus on deciding when to switch to a digital radiography system, and not whether to switch to digital. For these reasons, the main focus of this course will be intraoral digital radiography.

In November of 1895, William Conrad Roentgen discovered x-rays, giving birth to the modern day field of medical imaging.1,2 The German dentist, Dr. Otto Walkoff exposed the first dental images soon thereafter by lying on the floor in his dental operatory with a glass negative receptor plate in his mouth; by today’s terms, the exposure time was an extraordinarily long twenty-five minutes.3 The newfound art and science of oral radiology had begun. Figure 2. shows how the speed of our receptors profoundly increased throughout the 20th century.4 Today, practitioners can opt to use film speeds rated ‘F’ speed; or, we can use digital receptors; both of these technique choices can provide dental images with low radiation exposures for our patients.

![Figure 2. Reduction of Radiation Exposure over the 20th Century:](image)


Before reviewing receptor choices, let’s take a quick look at what happens to the x-ray beam after it is generated. When the operator makes an exposure, the x-ray unit generates the primary x-ray beam that exits the cone of the unit. The primary beam then traverses the region of interest; i.e., teeth, jaw and soft tissues; as the beam exits the jaw, it is then known as the remnant beam. This remnant beam has been attenuated, or differentially absorbed, by the teeth and other structures; this means that teeth, bone, restorations, etc. have all absorbed x-ray photons at different rates depending upon their densities, with higher density structures such as gold crowns and amalgam restorations absorbing more x-rays than cancellous bone for instance. The remnant beam then finally reaches the receptor and forms the latent image. Depending on the type of imaging system in use, the different receptors all handle the latent image formed on the receptor in different ways. In film imaging for instance, the latent image is stored in activated silver specks, which are then chemically developed and processed into visible images.5
Basics of radiography

Digital radiography is obviously different than film radiography; but, what exactly, is digital radiography and what makes it different than film? This seems such a basic question, but one that is often overlooked. Before we answer that question, let’s look at an even more basic question. How does a radiographic image give us diagnostic information about the patient? The useful information obtained from radiographic images directly relates to the shades of gray in the image.

If the remnant beam doesn’t contain many x-ray photons, that means that a dense object, like a restoration, tooth enamel, or thick cortical bone, absorbed a lot of the photons and the image is bright or white. On the other hand, if the remnant beam has a lot of x-ray photons, the x-rays passed through only thin soft tissues or the airway, and that area of the image is dark. In film images, these shades of gray correspond to the amount of silver on the film—dark areas have a lot of silver, and bright or white areas have little or no silver. Now, you can understand why a dental radiograph is so vitally important in making the correct diagnosis in areas that the dentist can not visualize; i.e., periapical regions, periodontal bone, implant sites, etc. Dental radiographs are truly the foundation of the diagnosis; and, as we know, without the correct diagnosis even the best dentist cannot provide proper treatment for the patient.

Radiation dose

Many of our patients today are concerned about the radiation dose of the radiographs that we recommend in the dental office. Here are a few things to consider if you want to decrease your patients’ radiation burden in your office. One of the most efficacious ways to reduce the radiation exposure to your patients is to eliminate unnecessary radiographs by instituting office policies that say we only take necessary radiographs that have reasonable expectations of producing clinically useful information. In 2004 the FDA and the ADA published an updated set of Selection Criteria guidelines. They provide professional guidance when making recommendations for radiographs while allowing plenty of room for clinical judgment.

By following these guidelines and making individual decisions regarding the need for radiographs instead of having an office policy for all patients, your patients will appreciate the individual attention to their health. Second, eliminate D-speed film from your dental practice; F-speed film is twice as fast as D-speed film, so if for some reason, you still want to use film, switch to F-speed film. Third, consider switching to rectangular collimation. Rectangular collimation re-shapes the beam from a round x-ray beam to a rectangular x-ray beam; and, thereby eliminates approximately two thirds of the unused radiation in the primary x-ray beam.

What does digital mean?

According to the Oxford English Dictionary, the word digital means data expressed as a series of the digits 0 and 1. Computers work in the discrete world of zeroes and ones and storage units of bits, bytes, megabytes, etc. As described earlier, the film image remains on the physical piece of radiographic film in analog form unless the film is scanned and transformed into a digital image. The basic difference then between film and digital radiography is that digital images have their basic image data stored as discrete zeroes and ones in a computer while film image data is stored within the silver particles on the physical piece of film. This digital image data is stored in 2D arrays of picture elements, more commonly known as ‘pixels’. We will explore other differences later in the course; but, for now, lets look at how digital images are acquired.

There are two basic types of digital technology—direct and indirect. Most of us are familiar with digital receptors that have USB cables plugged into a computer; these are examples of ‘direct digital’ technology. In other words, the latent image is formed in the electronics of the receptor and
transferred directly to the computer by means of the USB connection; the computer then transforms the electronic latent image into the visible image within the imaging software. There are also systems that use a wireless radio transmission instead of a USB cable, but the receptor part of the system is the same. The ‘indirect digital’ technique is represented by PSP, or phosphor storage plate systems. In this system, the latent image is stored in energetic phosphor electrons within imaging plates that closely resemble intraoral dental film. After an exposure, the storage phosphor imaging plate is then scanned with a laser beam; the phosphor electrons release their energy in the form of light photons which are then processed by the computer and transformed into a visible image by the imaging software. In summary, PSP image acquisition requires the ‘indirect’ step of laser processing instead of the ‘direct’ transfer of images into the computer as in direct digital imaging.

Advantages and Disadvantages of Direct versus Indirect Digital Imaging

When evaluating the two systems, the most obvious advantage of direct systems is that they allow for practically immediate visualization of an image while indirect systems require an intermediate processing step before an image can be seen. For many dentists this is a very attractive feature; however, each dentist should evaluate the imaging requirements of his or her own practice and determine which system is the best fit before making a final decision regarding which system to purchase. Since there are several good reasons to choose either system, let’s look at the pros and cons of both direct and indirect digital imaging.

As previously mentioned, the primary advantage of direct systems is the quick generation of an image. Since the receptor is plugged into the computer via a USB cable, the image is generated almost instantly. This can be a real plus when the dentist needs to determine working length during an endodontic treatment or check an osteotomy angle during implant placement surgery. In their 2003 paper, Berkhout et al discussed what may be the number one concern for direct digital systems—does their use lead to increased numbers of retakes? Since the image is seen so quickly and the radiation dose is so low compared with film, the operator may be tempted to retake the exposure if the image is not perfect. A weakness of this study is that there is no mention made of experience levels of the operators. As with all technical skills, there is definitely a learning curve with digital radiography; however, with experience, proper training and use of updated techniques and instrumentation, the retake rate for direct digital should be comparable to film or PSP.

The primary advantage of PSP systems is that the imaging plates look like film and clinically handle similar to film; so, the transition to digital for many offices may be easier with PSP than with direct digital. In addition, existing panoramic machines can easily be transitioned to digital by purchasing PSP cassettes and a PSP scanner. If the panoramic machine is otherwise in good condition and is yielding good images, this may be a good alternative. PSP systems also have a wider exposure latitude or dynamic range than direct digital systems. The advantage of a wider exposure latitude is that the receptor will give a usable image over a wide range of radiation exposures; but, the downside is that at the upper range of these exposures, the patient will be over-exposed; thereby violating the ALARA Principle which mandates that we should keep our radiation doses As Low As Reasonably Achievable. Direct digital systems have a narrow exposure latitude; variation from this ideal, low, established radiation level will result in non-diagnostic under-exposed noisy images or over-exposed dark images. This is actually an advantage for direct digital because if the radiation settings are too high with direct digital, the initial image is too dark; and, the operator can decrease the exposure time and avoid over-exposing the patient for subsequent exposures. Regardless of the system in use, calibration of the exposure time for each x-ray unit should be done at the initial installation of the system; and, technique charts should be posted at each x-ray unit.

As far as disadvantages are concerned, the biggest concern that many dentists seem to have with direct digital systems is the size and thickness of the CCD or CMOS sensors. These solid state sensors are built on rigid, inflexible circuit boards which are covered by hard plastic for protection from bending as well as from the patient’s saliva; moisture contamination would not only cause the obvious cross-contamination problem, but would also damage the sensitive electronic circuitry within the sensors. Anatomic features such as tori, high muscle attachments, shallow palates and patients with active gag reflexes occasionally create extremely difficult challenges, not only for direct digital sensors, but for any intraoral receptor.

The biggest disadvantages of PSP plates are the delayed time before an image is visible, as well as the increased time required for handling. The plates must be erased; then, they must be re-packaged and stored in an environment safe from inadvertent light exposure or x-ray exposure before the next use. In addition, the protective coating on the phosphor plates can become damaged over time, which requires replacement of the plate. Also, the scanners require service and occasional replacement.
Modern x-ray units
Many dentists contemplating the upgrade of their system will need to evaluate their x-ray units. Digital systems require less radiation to generate images than D speed film; and, the radiation output must be delivered more precisely than in the past with older, alternating current x-ray units. The best x-ray generator to use with today’s low dose systems is a direct current system which is capable of delivering precise and reliable amounts of radiation. If your x-ray machine generates 60 or 70 kVp x-rays at 5 to 8 mA and has a digital timer that can control the time from ~0.05 to ~1.0 second then your machine should be adequate for a digital x-ray system. On the other hand, if your x-ray machine is measuring radiation output in the number of pulses per exposure, then you will need to upgrade your x-ray unit at the same time you transition from film to digital; if you do not upgrade your x-ray machines, your office will not be capable of reliably generating the low radiation doses required in modern digital radiography; and, as a result, most of your images will be non-diagnostic. Most modern x-ray units being sold today use direct current technology and are capable of supplying reliable, low dose radiation output suitable for use with digital radiography systems.

Figure 5. Direct current intraoral x-ray unit, capable of delivering precise, low dose radiation for today’s digital radiography systems.

What is your primary diagnostic task?
There are a few questions that every dentist will need to answer when deciding which type of system to purchase. The most basic question is, what is your most common diagnostic task? If you are in a busy general practice performing a variety of procedures such as managing emergencies, performing endodontic therapy, placing implants, removing teeth, etc., then the quick image generation that a direct digital sensor provides will be extremely beneficial. If you are in a group practice or if you are a busy restorative dentist, and can justify the expense, you might consider having both systems. That would provide the flexibility of PSP for full mouth series, or certain patients who find it difficult to adapt to the larger size of digital sensors; and a direct digital system when you need an image generated quickly.

Are you a pediatric dentist or a general dentist that sees a lot of children? If so, then you may want to consider the PSP system. These receptors are thin and flexible like film; and, are available in the larger #4 size for occlusal images. Some pediatric dentists find these features of the PSP system helpful in clinical practice.

What about digital enhancement or digital processing of images? Logicon is an FDA-approved software package to assist with caries diagnosis. The research has been mixed with some authors supporting the use of Logicon and others finding that it does not offer any improvement over routine caries diagnosis using BW radiographs. Likewise, image inversion and other filters have not been shown to offer significant improvements over properly exposed radiographs.

Resolution of images
When we hear the term resolution, we normally think in terms of how well we can see an object in an image. How well we can see objects in an image is determined by both spatial and contrast resolution. Spatial resolution is measured in dots per inch on the printed page and line pairs per millimeter in dental and medical images. Intraoral film systems have the highest spatial resolution available in dental radiography. The resolution of intraoral film is determined by the size of the specks of silver on the film, which, theoretically, approaches 50 line pairs per millimeter. The best digital systems have a spatial resolution of ~33 line pairs per millimeter. If spatial resolution was the only parameter of image quality, then we all might want to stay with film systems. In reality however, contrast resolution is just as important as spatial resolution in the overall diagnostic capability of an imaging system.

Contrast resolution is the ability of an imaging system to distinguish adjacent objects of similar density from one another.1 Contrast resolution depends on several factors; such as the kVp, or actually the energy of the x-ray photons
used for the exposure; speed of the receptor; the number of shades of gray the system can display; and, the technical characteristics of the computer and monitor used for viewing. There is very little that can be done to film images after they have been exposed, while there are post-exposure processing techniques that can be applied to digital images. These processing techniques include brightness, contrast and gamma adjustments. In addition, before the image is even seen on the screen, the proprietary imaging software package applies certain processing algorithms from ‘look-up tables’ to improve image quality. These processes automatically improve edge sharpness and contrast among other image features. The end result of these image manipulations is a digital image that can be enhanced and optimized to meet the diagnostic task at hand.

Figure 6. Image of posterior left maxillary teeth taken with the Schick 33 sensor and displayed with Eaglesoft imaging software.

Figure 7. The size #2 Schick 33 sensor with the CDR Elite USB Interface Module.

Overall computer system issues

If you are ‘going digital’, there are several scenarios regarding practice management and computer systems in the marketplace that are available for your practice. The most important technical decision you will make is how you will backup your image database. You will need to have an onsite backup as well as an offsite backup; which need to be reliable and tested so you are confident they work. The best approach is to make your backup system as automated as possible and check it on a regular basis. You should have a local computer tech person that you can trust to help you with your technical needs. You will probably have a technical relationship with one of the national practice management systems such as EagleSoft, Dentrix, etc.; but, unless you are located in a metropolitan area, you will also want a local computer tech who can keep you operating in the event of a technical emergency. What you do not want to hear is ‘We will see you tomorrow morning,’ when your entire digital radiology system is down due to a computer problem.

There is a very real serendipity effect when a dental office begins using digital radiography. Not only do the dentist and professional staff benefit from the digital images but, so do the patients. Now that the images are on a computer screen and are large enough to be easily seen, take the opportunity to show them to the patient and educate the him or her—perhaps even allow the patient to ‘self-diagnose.’ Patients may never get truly excited about needing endodontic treatment, but if they can at least see a periapical lesion, perhaps they will ‘own the problem’ and be more motivated to seek treatment.

Next, let’s look at just two computer specifications—the graphics, or video, card and the monitor. If all you will ever do with the imaging computer is look at routine 2D images, almost any modern graphics card should be adequate; however, if you will also use the computer for viewing CBCT images, you will need a video card with one gigabyte of dedicated memory. As far as the monitor goes, almost any modern flat panel monitor will be adequate for viewing 2D images; but, again, if you will use the computer for viewing CBCT (cone beam computed tomography) images, you will need to spend a little more money and purchase a higher quality monitor capable of rendering 0.10 mm and higher resolution pixel images.

Most offices are sending radiographs electronically, but there will be a need to occasionally print your radiographs. The simplest and least expensive way to print diagnostic x-rays is to use semi-gloss or matte photographic paper with an ink jet printer—using a laser printer with plain paper yields a printed x-ray of poor quality. There are other, more expensive printers that hospital or dental radiography departments use; but, these printers and print media are very expensive and exceed the budget for most dental offices.
Summary
More dentists are using digital radiography than ever before and more are transitioning to digital every day. We have looked at the major issues these ‘digital’ dentists faced as they made their transition. Digital radiography in the dental office is now a routine technology that continues to improve. As mentioned in the introduction, if you are using film, when will your office make the transition to digital?

Bibliography

Author Profile
Jeffery B. Price, DDS, MS is a Diplomate of the American Board of Oral & Maxillofacial Radiology. He is currently an Assistant Professor of Oral & Maxillofacial Radiology and Director of Oral & Maxillofacial Radiology at the Meharry Medical College School of Dentistry in Nashville, TN; in addition, he is an Adjunct Associate Professor of Oral & Maxillofacial Radiology at the UNC School of Dentistry in Chapel Hill, NC. Dr. Price is also a consultant with Sirona Dental and teaches many of their Galileos new users training courses. He also has an internet-based Cone Beam CT interpretation practice. Dr. Price practiced general and adult restorative dentistry in Hendersonville, NC for 24 years. While in practice, Dr. Price completed the continuum at the L.D. Pankey Institute in Key Biscayne, FL; in addition, he attained his Mastership in the Academy of General Dentistry as well as Diplomate status in the International Congress of Oral Implantologists. Dr. Price is currently on the editorial board of the ICOI-sponsored journal, Implant Dentistry; and, is a reviewer for IJOMS, JDE and JADA.

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1. Wilhelm Conrad Roentgen discovered x-rays in 1895?
   a. Gamma rays
   b. X-rays, or ionizing radiation
   c. Alpha particles
   d. The Law of Gravity

2. The field of oral radiology began in 1896 with a German dentist. How long was the first dental exposure?
   a. 10 seconds
   b. 1 minute
   c. 5 minutes
   d. 25 minutes

3. The first receptor used in oral radiology was made of?
   a. Polyester
   b. Blue plastic
   c. Glass
   d. Acetate

4. Film speeds improved a great deal throughout the 20th century. Using the graph from the article, approximately how much faster is F-speed film introduced in 1999 than film used in 1919?
   a. 100 times faster
   b. 25 times faster
   c. 10 times faster
   d. Twice as fast

5. F-speed film is faster than D-speed film; how much faster is it?
   a. 100 times faster
   b. 25 times faster
   c. 10 times faster
   d. Twice as fast

6. Which of the following phrases describes the remnant x-ray beam?
   a. The x-ray beam that leaves the x-ray machine but before it enters the object of interest (the jaw)
   b. The x-ray beam while it is inside the object of interest (the jaw)
   c. The x-ray beam that leaves the object of interest (the jaw) but before it reaches the receptor
   d. The x-ray beam that is scattered within the x-ray machine that never gets out of the machine

7. Which of the following phrases describes the primary x-ray beam?
   a. The x-ray beam that leaves the x-ray machine but before it enters the object of interest (the jaw)
   b. The x-ray beam while it is inside the object of interest (the jaw)
   c. The x-ray beam that leaves the object of interest (the jaw) but before it reaches the receptor
   d. The x-ray beam that is scattered within the x-ray machine that never gets out of the machine

8. Why do more dense objects, such as gold restorations, appear brighter or whiter on dental radiographs than do less dense objects like the soft tissues of the cheek?
   a. A lot of x-ray photons pass through dense objects and cause the radiograph to be bright from high x-ray exposure
   b. Not many x-ray photons pass through dense objects; therefore, not many x-ray photons are available to stimulate the receptor and the radiograph is white
   c. Gold and metal restorations reflect light onto the receptor
   d. Density has nothing to do with gray values on an x-ray image

9. The shades of gray in a dental radiograph correspond with?
   a. The density of the objects being imaged
   b. The atmosphere of humidity in the dental office atmosphere
   c. The type of collimation used for the exposure
   d. There is no correlation with the object being imaged

10. How does instituting ‘Selection Criteria’ in the dental office decrease radiation exposure?
    a. By using rectangular collimation on all patients
    b. By switching to F-speed film
    c. By ‘going digital’
    d. By taking radiographs only when there is a reasonable expectation of producing clinically useful information

11. Switching from round collimation to rectangular collimation for full mouth series will reduce the patient’s radiation dose by approximately how much?
    a. 10%
    b. 25%
    c. 35%
    d. 66%

12. What is the basic difference between digital imaging and film imaging?
    a. The type of x-ray collimator
    b. The way the latent image is captured—digital uses bits and bytes while film uses silver particles
    c. The way the lead aprons are positioned
    d. The distance the operator must stand from the patient

13. A pixel is a?
    a. 2D picture element, or the smallest visible part of a digital image
    b. 3D picture element, part of a CBCT image
    c. One half of an x-ray photon
    d. Special type of rectangular collimator

14. The two types of digital radiography systems are known as?
    a. Pixels and voxels
    b. Photons and muons
    c. Direct and indirect
    d. Film and filmless

15. The latent image in direct digital systems (wired digital sensors) is stored in?
    a. Activated silver particles
    b. Energetic phosphor electrons
    c. Solid state electronic circuits
    d. Developer solution

16. The latent image in indirect digital systems (storage phosphor imaging plates) is stored in?
    a. Activated silver particles
    b. Energetic phosphor electrons
    c. Solid state electronic circuits
    d. Developer solution

17. Which of the following systems allows for the quickest viewing time of an image?
    a. Intraoral F-speed film
    b. Wired direct digital sensors
    c. PSP indirect receptors
    d. Screen/film panoramic cassette systems

18. One potential weakness of direct digital systems is?
    a. Slow image acquisition
    b. Damage to the phosphor surface
    c. Increased noise rates
    d. Wide exposure latitude

19. The ALARA Principle is a way to minimize excessive radiation exposures for our patients. What does ALARA mean?
    a. About Less As Reasonably Attainable
    b. As Low As Reasonably Achievable
    c. Approximately Level Amounts of Radiation Altimates
    d. About As Low As Roentgen Achieved

20. The primary advantage of PSP systems is?
    a. Handles similar to film
    b. Fast image acquisition
    c. Quick turnaround of imaging plates
    d. The imaging plates are disposable

21. Direct digital systems can be especially beneficial with all the following clinical tasks except for which one?
    a. Endodontic therapies
    b. Implant osteotomies
    c. Checking for sequential root tip removal during a surgery
    d. Routine full mouth series

22. Wide exposure latitude refers to the ability of an imaging system to?
    a. Respond to different values of AC/DC settings
    b. Respond to a wide range of radiation exposures and still yield a diagnostic image
    c. Yield images with a wide range of gray scale values within a normal latitude
    d. Produce normal gray value histograms over a wide exposure range

23. Older x-ray units often are inadequate for use with digital radiography systems. What machine feature prevents older machines from being used with digital radiography?
    a. Older systems have square collimators
    b. Older systems have lead paint and can’t be used in modern offices
    c. Older systems have weak anodes and aren’t powerful enough
    d. Older systems use alternating current and do not produce reliably consistent radiation doses that are low enough to use with digital systems

24. Which of the following systems has the best resolution?
    a. Screen/film systems such as panoramic cassette systems
    b. Intraoral F-speed film
    c. Direct digital systems
    d. PSP systems

25. Spatial resolution for dental radiography is measured in what units?
    a. Dots per inch
    b. Line pairs per millimeter
    c. Pixels per inch
    d. Vuxels per inch

26. Contrast resolution is defined as?
    a. The ability to resolve contrast between two objects
    b. The ability of an imaging system to distinguish two adjacent objects of similar density from one another
    c. The ability of an imaging system to distinguish a white pixel from an adjacent black pixel
    d. The ability of an imaging system to resolve adjacent pixels that are the same density

27. Common image processing tools include all the following except which one?
    a. Brightness adjustment
    b. Contrast adjustment
    c. Edge sharpness
    d. Surface polishing

28. When designing your digital radiography system, don’t forget to include a _____ system.
    a. Portable radiography
    b. Backup
    c. Retina display
    d. Thumbprint identification security

29. Which of the following printers should use with digital radiography systems. What material feature prevents older machines from being used with digital radiography?
    a. Dye sublimation printers
    b. Laser printers
    c. Inkjet or deskjet printers
    d. Dot matrix printers

30. What role do digital radiography systems have in dental offices presently and in the future?
    a. The number of digital systems continue to grow and will keep growing into the future
    b. Dentists are unhappy with digital and are going back to film systems
    c. Most offices will have both a film and a digital system to use simultaneously as a backup for each other
    d. Film systems will always be the most popular radiography system in dentistry
A Review of Intraoral Radiology

Educational Objectives
1. The advantages and disadvantages of film and digital radiography
2. The differences between direct and indirect digital radiography
3. The advantages and disadvantages of direct and indirect digital radiography

Course Evaluation
1. Were the individual course objectives met? (Yes/No)
   Objective #1: Yes No
   Objective #2: Yes No
   Please evaluate this course by responding to the following statements, using a scale of Excellent = 5 to Poor = 0.

2. To what extent were the course objectives accomplished overall? (S 4 3 2 1 0)
3. Please rate your personal mastery of the course objectives (S 4 3 2 1 0)
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13. Was there a 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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5. How do you rate the author's grasp of the topic? (S 4 3 2 1 0)
6. Please rate the instructor's effectiveness. (S 4 3 2 1 0)
7. Was the overall administration of the course effective? (S 4 3 2 1 0)
8. Please rate the usefulness and clinical applicability of this course. (S 4 3 2 1 0)
9. Please rate the usefulness of the supplemental webography. (S 4 3 2 1 0)
10. Do you feel that the references were adequate? (Yes/No)
11. Would you participate in a similar program on a different topic? (Yes/No)
12. If any of the continuing education questions were unclear or ambiguous, please list them.
13. Was there a 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.

CANCELLATION/REFUND POLICY

PennWell maintains records of your successful completion of any course for a minimum of six years. Please contact our offices for a copy of your continuing education credits report. This report, which will list all credits earned to date, will be produced and mailed to you at no cost within five business days of receipt. This report will list all credits earned to date. PennWell does not approve or endorse individual courses or instructors, nor does it imply acceptance of credit hours by boards of dentistry. Concerns or complaints about a CE Provider may be directed to the provider or to ADA CERP at www.ada.org/cerp.

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We encourage participant feedback pertaining to all courses. Please be sure to complete the survey included with the course. Please e-mail all questions to: hhodges@pennwell.com.

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