

Chapter 1

Radiation Safety and Protection

There is no question that diagnostic X-rays have the potential to improve health and save lives. But each time a dentist orders a dental image to aid in the examination of a patient, he or she makes a risk vs. benefit decision: "Is the risk associated with this patient's exposure to low-level radiation outweighed by the health benefits of the examination?" That's why there is no such thing as routine dental image. Each image needs to be ordered by the dentist.

The goal of dental radiation safety and protection is to obtain diagnostic dental images while keeping exposure to a minimum. ALARA (As Low As Reasonably Achievable) is the key. Essentially, ALARA involves using safety and protection practices when taking dental images. These practices will reduce unnecessary X-ray exposure to both patients and dental staff.

Digital imaging consists of using the x-ray unit with either a computerized sensor or PSP (phosphor storage plate). The term receptor in the *Dental Digital Imaging Study Guide* could mean either a sensor or PSP. Digital imaging reduces radiation exposure to the patient and offers quick, convenient image acquisition, viewing and storage and eliminates darkroom processing that leads to many film-based errors. Even with the reduction in radiation exposure, you need to protect patients and yourself.

Protecting the Patient

Here's a list of practices to protect your patients from unnecessary X-ray exposure during dental imaging procedures:

- Place a protective device on the patient.
- Use rectangular collimation.
- Use good techniques to reduce retakes.

Place a protective device on patients.

It is a fact that living cells can be altered and even destroyed by radiation.
Yes... X-radiation!

It is therefore essential that you try to protect the radiation sensitive areas of the body by confining the X-rays to only the area under examination.

You are able to provide patients protection by covering them with safety devices like the apron and the thyroid collar that are lead lined. Now companies make protective devices with lead-free materials that equal the protection of lead, yet are lighter to handle. Use of the apron and thyroid collar can minimize unnecessary cell damage. It is important that protective devices be used on each patient.

In 2004, the National Council on Radiation Protection (NCRP) eliminated the requirement for the leaded apron because there is no scatter radiation below the neck of the patient provided all the recommendations of the NCRP Report are rigorously followed. These recommendations include using a long PID, rectangular collimation, and correct settings. However, some patients have come to expect the apron and may request that it be used. Its use remains a prudent but not essential practice. Thyroid shielding should be provided.

If the apron is used as the protective device, it should be large enough to cover the average patient's chest, abdomen, and lap area during exposures. Two sizes of aprons are available, so both children and adults can be properly protected.



The apron provides protection to the abdomen and reproductive organs. Why do you think you should be concerned about protecting these areas?

Let's discuss the reasons.

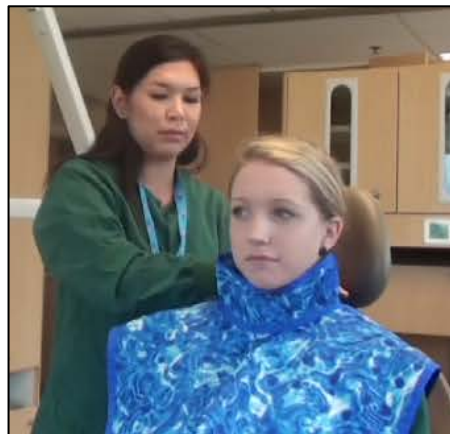
1. You cover the chest and abdomen to protect internal tissues. This may be of particular significance to women of childbearing age. You do not want to expose an unborn baby to radiation. Be sure to use a protective apron when taking dental images on pregnant women. Check with clinic policy about taking digital images on pregnant women.
2. Reproductive organs contain cells that are rapidly dividing. These cells are sensitive to radiation. Therefore, it is especially important that your patient's reproductive organs are protected when taking digital images. This is true for male as well as female patients.

Now let's consider the thyroid collar. The thyroid is among the most radiation sensitive tissues in the neck area. The thyroid helps control the body's ability to change food into energy.



Thyroid collars are recommended with the exception of panoramic imaging where the collar may interfere with the X-ray beam.

Note: Some aprons come with thyroid collars attached. The apron protects the reproductive organs, and a thyroid collar protects the neck area, where the thyroid gland is located.



Protective devices like the apron and thyroid collar need to be properly stored. This is to protect them from possible damage, and keep them clean and safe between use.

Why not just fold them up and put them away?

Because...

Folding an apron or thyroid collar will eventually result in the development of cracks in the protective lining. Cracks could allow radiation to reach the patient!

To properly store an apron or thyroid collar you can use an apron hanger or use a round towel bar of large enough diameter to avoid creasing the apron or collar.



Apron hanger



Round bar

Use rectangular collimation.

Like the chest, abdomen, reproductive organs, and thyroid, the eyes are radiation sensitive. Protecting the patient's eyes from radiation can be accomplished by using rectangular collimation. As you can see in the illustration below, radiation exposure to a patient is limited to the size of the receptor. This reduces the overall radiation exposure to a patient. The eyes and thyroid would be protected.



Use good technique to reduce retakes.

Specific techniques for taking diagnostic images will be described in Chapter 3. The general rule to remember is to make certain that the receptor and the positioning-indicating device (PID or cone) are in the proper position before taking an exposure. Your motto should be “Do it right the first time!”

Sometimes you use good technique, but the equipment may need repairs. Imagine, the patient is perfectly still but the X-ray head is drifting away from the patient.



Do you think the dental image will be sharp and distinct or will it be blurred?

It will be blurred, of course! The best way to avoid blurred images is to have both the X-ray head and the patient remain still during the time of exposure.

It is also true if the X-ray head is still and the patient moves, blurring will again be the result.

Dental images with blurred images are of questionable use, and often result in retakes
and
retakes result in more X-ray exposure to the patient and the operator.

Dental Digital Imaging Certification

Probably the best way to become proficient in taking dental images is to become certified. Dental auxiliaries who work in Indian Health Service (IHS) programs must be currently certified to take dental images. Dental auxiliaries who work in Tribal or Urban programs can choose to use the IHS, DANB (Dental Assisting National Board), or State radiology certification process.

Dental digital imaging certification shows you have the knowledge and training to successfully pass a written and a clinical examination. Being competent to take diagnostic dental images with no retakes reduces radiation exposure to both the patient and the operator. It is a win-win for all concerned.



Protection of the Operator

Here's a list of practices to protect you (the operator) from unnecessary X-ray exposure during dental imaging procedures:

- Stand behind a protective shield, or at least six feet from the X-ray source, and out of the path of the primary beam.
- Never hold a receptor for a patient.
- Don't hold the X-ray head or the PID during exposures.
- Wear your dosimeter.

Position yourself behind a wall/ shield or at least six feet from the X-ray source, and out of the path of the primary beam.



Standing behind a protective barrier during all exposures, provides you with the best possible protection from X-rays.

If you are working where an acceptable barrier is not available, then distance must be used to protect you from the exposure.

How can distance protect you?

The farther X-rays are from the source, the more spread out and the less intense they become. In addition to spreading out with distance, X-rays tend to weaken, just like the beam of a flashlight.

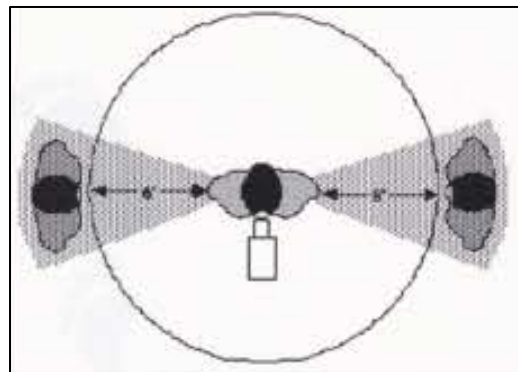
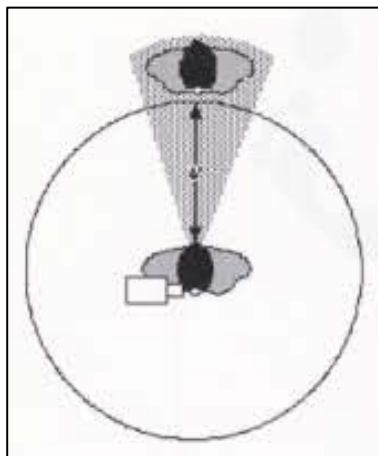
Therefore, the farther you stand from the source of radiation, the less exposure you will receive. The closer you are the greater exposure you will receive.

The few X-rays that pass through the patient and go beyond six feet are so widely spread out and weak that they become insignificant as a radiation health hazard to the operator. However, keep in mind that you should never stand in the path of the primary beam!

To receive adequate **distance** protection you should stand at least six (6) feet from the patient during exposures. Greater distance would give you even more protection.



One last point to make... when you have no physical barrier and have to rely on distance, you should stand so that the patient's head blocks the passage of the X-rays. Using this idea, your best choice of position would be within one of the shaded areas in these illustrations.



It is always a good idea to alert staff before activating the X-ray machine. A good practice is to say... **X-ray** before taking an exposure. This will let co-workers in the area know you are going to take an image and reduce their exposure to radiation.

Never hold a receptor for a patient.

Radiation may cause damage to any part of the body when repeatedly exposed to X-rays. Because the damaging effects of radiation are cumulative, some very slight, invisible damage occurs with each exposure. Over time, the cumulative effect can result in visible tissue damage. The bottom line is that dental personnel should **never** hold a receptor in place for a patient during X-ray exposure!

In the event that a small child or disabled individual is unable to hold or stabilize a sensor during exposure, it is recommended that a parent, guardian or other accompanying individual hold the sensor rather than the dentist or dental assistant. When a patient requires assistance from a parent or guardian, he/she should also be protected with an apron.



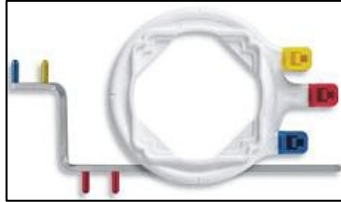
Don't hold the X-ray head or the PID when taking digital images.

X-ray heads that are in use today are carefully constructed and designed to prevent leakage of X-rays during operation. However, a small potential for radiation leakage still exists. Therefore, holding the X-ray head during operation could result in exposure to the hands or other parts of the body. This applies to both operators and patients who might attempt to hold the X-ray head during an exposure.

If the X-ray head tends to drift during exposures, it is an indication that a mechanical adjustment or repair is needed. Report the problem immediately so it can be corrected!

Under **NO** circumstances should you or your patient attempt to hold the X-ray head or PID during an exposure.

Positioning devices like the XCP (extension cone paralleling) are useful. The XCP stabilizes the receptor during an exposure. It also eliminates the need for the patient or an operator to hold the receptor. Another advantage of using the XCP is the ring will help you position the PID for the correct angulation and reduce cone cutting.



Universal XCP

Yellow for posterior PAs

Blue for anterior PAs

Red for bitewings



XCP for posterior PAs



XCP for anterior PAs



XCP for Bitewings

Illustrations for the paralleling technique in the *Dental Digital Imaging Study Guide* will show the use of the Rinn XCP, but the concept is the same for all positioning devices.

Wear your dosimeter.

Do you wear your dosimeter?

Do you wear it every day?

Do you wear it at chest height?



Let's discuss why your answer should be **YES** to each of these questions.

The dosimeter is a device used to measure the amount or dose of radiation received by an individual over a specified period of time. The dosimeter consists of a plastic case that contains one or two film packets that are approximately the size of dental periapical films. An alligator-type clip is provided on the back of the badge. This clip makes it easy for you to attach the dosimeter to the outer part of your clothing.

A computerized dosimeter is also available. It does not use film. Instead, the dosimeter uploads the information through a USB connection to your computer.



The dosimeter is worn while working in the clinic and left in the clinic at night. It is suggested that you wear the dosimeter at chest height. This is because the dosimeter is intended to measure “whole body radiation.”

One look at the dosimeter and you can see that it is not large enough to cover the whole body, so a compromise is necessary. The chest is the approximate center of an area containing our most radiation-sensitive tissues. Therefore, it is the best location for detecting unwanted radiation exposure.

You will learn about additional techniques and practices to protect the patient and the operator from unnecessary radiation exposure in other chapters in the *Dental Digital Imaging Study Guide*. Here is a list of practices discussed in Chapter 1:

- Place a protective apron and/or a thyroid collar on the patient.
- Use rectangular collimation to reduce radiation to the patient.
- Stand behind a shield or at least six feet from the X-ray source, and out of the path of the primary beam.
- Give warning before pressing exposure button to protect co-workers and patients.
- Never hold a receptor for a patient.
- Don't hold the X-ray head or the PID.
- Use good technique to reduce retakes.
- Wear your dosimeter.
- Become certified in dental digital imaging.

This completes Chapter 1: Radiation Safety and Protection. You are now ready to test your understanding of the information you learned.