

THOUGHTS ON RADIOLOGY

Every veterinary dental text book, including my own, has a chapter on radiology. There are even two books (one now out of print) devoted entirely to veterinary dental radiology. So, much of the information you need on positioning, exposure, interpretation and storage of images is already available from many sources. I want to take some time now to answer some of the common questions asked of me that may not be covered in those other resources.

Working with the Ministry of Labour:

This section is written specifically for my colleagues in Ontario. In different jurisdictions, the rules may vary, but many concepts will be the same.

In Ontario, the installation of any source of radiation must have approval from the Ministry of Labour. There are a number of guidelines in place to minimize the risk of exposure for both employees and members of the public. While some feel these regulations are difficult to adhere to, they are there for a reason and they are not going to change to make your life easier. So, rather than trying to find ways around the regulations, you would be better off finding ways to adhere to them.

One colleague took this approach. He contacted the inspector responsible in his area and said to him “What can I do to make your job easier?” Dr. B. recognized that Inspector D. had a job to do and that working co-operatively with him would make things run smoother than trying to work around him. As my Great Aunt Mary used to say, “You catch more flies with honey than with vinegar”.

Where to Place the X-Ray Machine?

In order to incorporate intra-oral radiography into your day-to-day dental practice, you will want a wall-mounted dental x-ray machine mounted immediately beside your dental treatment table. With this arrangement, taking a dental radiograph involves simply placing a film in the patient’s mouth, positioning the tube head and leaving the room to push the exposure button. On the other hand, if you mount the dental x-ray machine in your radiology suite,

taking a film involves moving the patient and



My wall mounted dental X-ray unit. This one happens to be a Gendex 770. There are many brands on the market and all do a fine job. Place after-market service high on the list of criteria when making a decision.



My machine is mounted on the wall at the foot of my treatment table. Out of view in this image is our second table that is off to the right. When I get busy enough to be running two tables at a time, the machine can swing back and fourth to service both stations.

anesthetic machine down the hall to radiology, taking the film, then moving everything back to the dental area. Trust me, this will prevent you from using the machine as often as you should and will add considerable time and stress to every dental procedure.

So, if you are going to get a dental X-ray machine (and you must), you have to find a way to mount it right beside (or very near to) your dental treatment table(s). The challenge here is not the construction requirements, but the ministry requirements, which will want to see the machine located in a single-purpose, low-traffic, blind-ended room, not in the main treatment centre of the practice. For practices that currently do their dental work on a table in the middle of the central treatment area, this will mean some major changes (for the better).

There are many reasons to designate a room as the dental suite.

- Use of an ultra-sonic scaler will liberate a bacteria-laden aerosol that may stay suspended in the air for hours, gradually settling out on all the horizontal surfaces, contaminating them. Therefore, dental work should be done in a single-purpose “dirty” room to contain the contamination to a small area away from recovering surgical patients, medical cases that may be compromised, surgical prep areas, personnel and non-dental equipment.
- Dental work requires strict attention to detail. It is hard to concentrate on the dental procedure if people are wrestling with an animal a few feet away trying to collect a blood sample or what-not. Put the dental team in a room of their own where they can focus on their patient and not the circus that is general practice.
- Having a dedicated dental suite to show off to clients will be very impressive. They will better understand how seriously you take dental treatment and so better appreciate the value (not the expense) involved in providing proper dental care for their pets.
- Having a blind-ended, low-traffic room dedicated to dental work will make it a snap

to get ministry approval for your installation.

This dental suite need not necessarily be totally single-use. It might also be used as the ultra-sound and/or endoscopy suite, for example. However, when you consider how much revenue (and profit) can be generated from a proper dental service in a general practice, this room will likely be the most profitable area of the facility.

So find a room that has only one way in or out and put your dental equipment in there.

Back to Ministry Issues

Depending on who you purchase your machine from, you may have to deal with the ministry yourself, or the dealer may take care of all the paper work for you. Either way, the ministry will want to see a floor-plan of the proposed installation location. They will want to know what is on the other side of each wall that defines the space as well as what is above and below (upstairs and downstairs). They will want to know the materials that make up the walls, floors and ceiling and the distances from the radiation source to each of the walls. They will also want to know what percentage of the time the X-ray source will be pointing east, west, north, south, up and down. With a dental x-ray machine, it will spend most of its time aiming between 45 degrees above to 45 degrees below the horizontal plane.

If the distance from the tube head to a wall is more than six feet and the wall consists of two layers of dry wall (one on either side of the studs), there may be no need for any further shielding. In my case, my office is sandwiched between a pizza restaurant and a convenience store and the wall separating us consists of one

Decide to get a wall-mounted dental X-ray machine.

Find a room to designate as the “Dental Suite”.

Work with the ministry, not against them.

Start realizing the incredible benefits of intra-oral dental radiography.

sheet of dry wall, studs and airspace and another sheet of dry wall.

Since I have no knowledge or control over where the employees of the neighboring businesses are when I activate my machine. I was told to assume that there is a person standing on the other side of these walls, potentially directly in the path of the x-ray beam, 100% of the time.

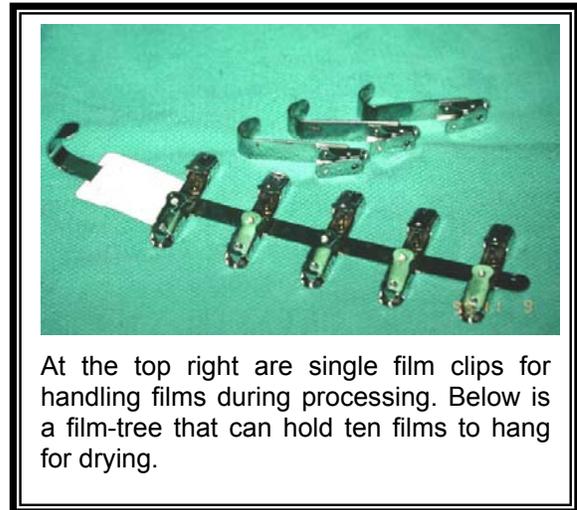
My tube head is more than six feet from the shared walls and so the inspector said that for all practical purposes, a standard dry-wall:frame:dry-wall partition would afford acceptable protection. However, he suggested that if, five years from now, an employee next door developed leukemia and then found out that we had a radiation source that might have been pointing at them, it could open a nasty can of worms. Therefore, more for legal than medical reasons, he required that I shield portions of these shared walls with 0.8mm of lead. This involved hanging a sheet of lead (much like very heavy wall paper) on the existing walls and then laying on a new covering of dry-wall. Not a big deal.

If you have cinderblock partitions between you and your neighbors, no lead will be needed.

The activator button for the dental x-ray unit should be mounted on the wall outside of the dental suite. A film is placed in the anesthetized patient's mouth, the tube-head positioned and then everyone leaves the room. The door is closed, the button pushed and then everyone can go back in. Since no personnel are in the room during exposure, there is no need to wear protective clothing (gowns, gloves, thyroid shields, glasses...). We wear our dosimeter badges every day and take thousands of dental radiographs each year. Our dosimeter reports always show zero exposure.

Dental X-ray Film

While a dental X-ray unit is designed to make positioning far easier than with a standard machine, it is the dental film that makes the difference when it comes to image clarity. In fact, if you have any x-ray machine, you *can* be taking intra-oral dental radiographs right away. All you need to do is buy some dental film. But



At the top right are single film clips for handling films during processing. Below is a film-tree that can hold ten films to hang for drying.

trust me, you really *want* a wall-mounted dental machine.

Dental film comes in five sizes as follows:

| Size | Width | Length |
|------|--------|--------|
| 0 | 23mms | 35mms |
| 1 | 23 mms | 40mms |
| 2 | 31mms | 43mms |
| 3 | 26mms | 53mms |
| 4 | 57mms | 77mms |

Each film comes packaged in a paper or vinyl envelop ready for use. These flexible little films fit nicely into the patient's mouth, allowing for exposure of one side of the mouth with no overlap (unlike skull rads).

Single-film packs contain one film whereas duplicate film packs contain two pieces of film. If you use duplicate film, you will have a copy for yourself and one to send home with the owner or to send to the referring veterinarian.

The fine-grained, non-screen films give excellent clarity and detail for evaluating tiny dental structures and are so vastly superior to regular x-ray film as to be in a league of their own.

The industry standard in dental x-ray film for the past many years has been D-speed (Ultra-Speed™). About 8 years ago, Kodak™ came out with E-speed (Ekta-Speed™). This film requires less exposure (is faster film), but has coarser



My chair side darkroom that allows me to develop and read my dental films in less than a minute without leaving my patient's side.

grain. The reduction in quality was seen by most as too high a price to pay to the reduced radiation exposure. About 3 years ago, Kodak™ introduced F-speed (Insight™) film, which is as fast as E-speed but has the image quality very similar to D-speed. This is the film I currently use. Yes, it does cost more the D-speed, but it allows me to reduce my exposure times by about 50%, which means less exposure for my patients and less wear-and-tear on my tube-head (so maybe it will last longer and save money in the long run).

Processing Dental Radiographs

While regular chemicals can be used to process intra-oral films, speed and quality can both be increased by using chemicals designed for use with dental films.

I use Kodak™ Rapid Access™ chemicals as I have found them to be the fastest. Developer and fixer are sold together premixed in 473ml bottles. With these chemicals at room temperature, I develop for about 15 seconds, quick swish in rinse water, fix for about 15 seconds and then can read the film. If the film is good and I want to keep it, it goes back in the fixer for 5 minutes, then rinse water for 20 minutes before drying and storing. But the key is that from the time the film is exposed until I have retrieved the information I need to proceed can be less than a minute.

Handling these diminutive films is facilitated by the use of nickel-plated film clips. The fixer is



This size-4 dental film is an intra-oral D/V projection of the maxilla of a dry skull preparation. I have had this skull for about 21 years and much of the turbinate bone is gone, but you can see the marvelous detail intra-oral technique and dental film provide.

very corrosive, but nickel is unaffected by it. These clips have small teeth that bite into the film and hold it securely while the film is swished around in the chemicals.

You can do the processing by placing the chemicals in small pots (margarine tubs) in your regular darkroom. An even more efficient method is to get a chair-side darkroom. These light-tight boxes allow you to process the films without leaving your patient's side and there is no waiting in line for the regular dark room.



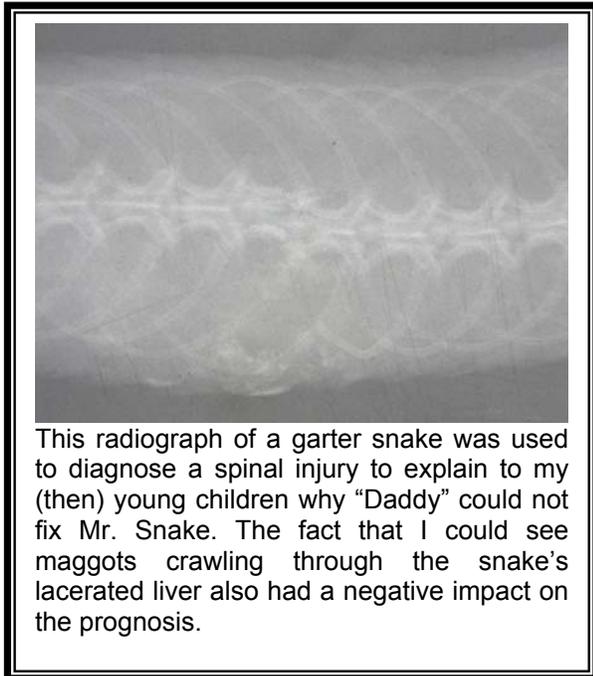
Kodak™,Rapid Access™ dental film developer and fixer. They are sold together and are ready to go right out of the bottle.

Inside are small plastic jars to hold the chemicals. Hands are placed through the neoprene cuffs and you can see what you are doing inside through the safety-filter lid.

Other Uses for Your Dental X-ray Film

Dental x-ray film is much finer-grained than standard film. Therefore, it is the film of choice for imaging small structures. Size 4 dental film is great for radiographing small creatures such as mice and gerbils, small birds, bird wings, as well as paws and tails of various sized creatures. I once used a dental film to diagnose a fractured spine in a garter snake.

For nasal tumors and foreign bodies, CT and MRI are likely the best option, but not many of us have the equipment for that. An intra-oral D/V view of the maxilla using dental film gives excellent detail and clarity of the nasal passages and can reveal (radiodense) foreign bodies as well as fluid densities and areas of bone destruction suggestive of neoplasia.



The Next Thing in Dental Radiography

The next step in the evolution of dental radiography is digital (no surprise there really).

There are two main types of digital systems. The first uses a radiosensitive sensor about the size

of a size 2 film which is attached by wire to a USB interface and then to a computer. Within a few seconds of exposing the sensor to radiation, the image appears on the computer screen. There is no processing to worry about (or processing errors) and the images cannot get scratched or misplaced (unless your hard drive crashes). Advantages include:

- Image ready in seconds.
- Image can be enhanced to aid interpretation but the original is always saved for legal purposes.
- Images can be annotated (arrows, text, circles) for demonstration and client education purposes.
- Images appearing on the computer screen are much larger than the sensor eliminating the need for magnification and allowing many people to view the image simultaneously.
- Images do not degrade with time.
- Sensors are very "fast" and so exposure can be reduced by as much as 80% compared to D-speed film.
- Eliminates the cost of purchasing film, chemicals and film mounts.
- No chemical-disposal issues.
- Images immediately ready to send by email or for printing on photographic paper.
- High-end systems have an image quality superior to film.

Disadvantages include:

- Cost. High-end systems can cost over \$10,000. More affordable systems are available, but as with all things, you get what you pay for.
- Though sensors are available in size 1 and size 2, it is the sensors that are the expensive part, so most people can only justify one size in their practice.
- At present, no size-4 sensors are available and they likely never will be. Those I have spoken with that have gone digital say that

they really do not miss the size-4, so this may be a non-issue.

- Sensors are inflexible and may be too large for very small mouths (kittens, ferrets...).

The other type of digital system uses phosphor-coated plates about the same size and shape as regular dental films (size-1, size-2 and size-4). These plates are positioned and exposed exactly like regular film and then are placed in a reader. Images are then sent to the computer screen within about a minute. The plates are re-usable a number of times but they have a finite life.

Advantages of this system include:

- More variety of sensor size.

Disadvantages compared with the other digital systems include:

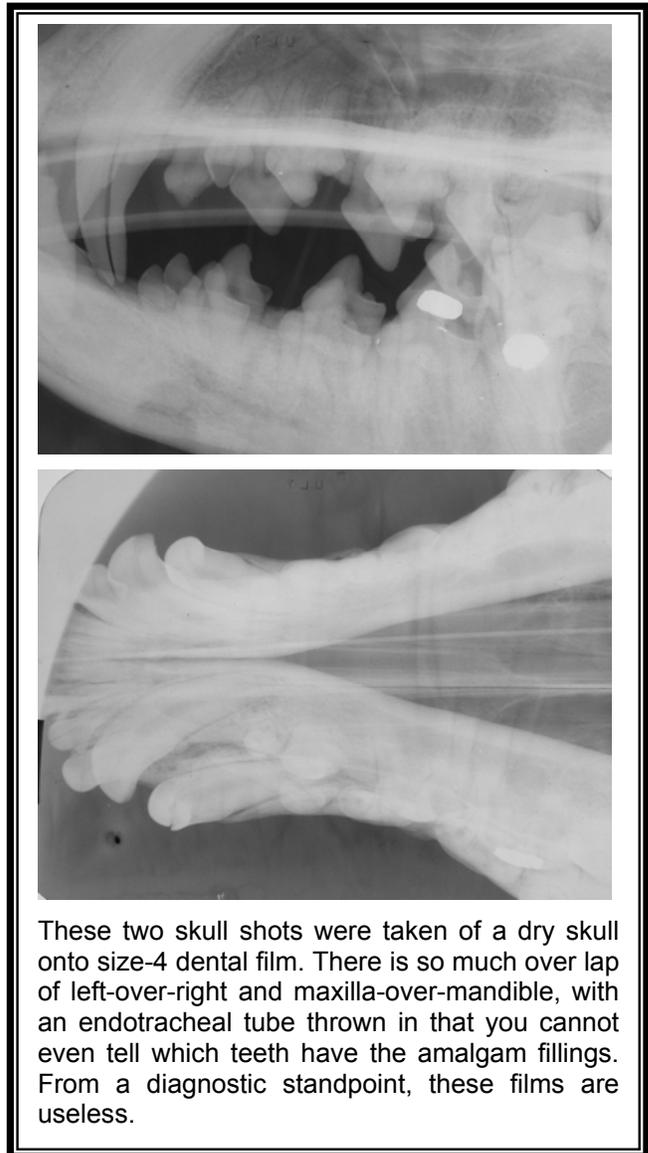
- Cost. This system can cost over \$20,000.
- Takes about as long to get the image on the screen as it takes to develop standard film.
- Still need to manipulate the “film” for “processing”.

At time of writing, I have not yet gone digital, but I know it is only a matter of time. Fortunately, the longer I wait, the better the systems (hardware and software) are getting.

What Not To Do

While I am always telling you I need radiographs to make an assessment of your patient's condition, not all radiographs are created equal.

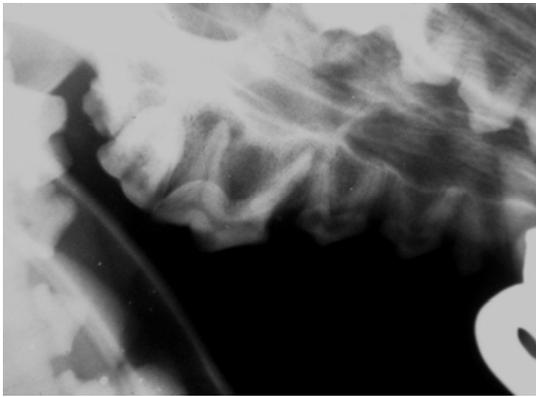
Over the years I have had dozens of lateral and VD or DV skull radiographs sent to me for analysis. To my memory, I have never seen one of these views upon which I would be willing to base either a diagnosis or a treatment recommendation with respect to any oral or dental issues. Sometimes the view hints at pathology that is not present, other times the view misses pathology that is present. Most of the time there is just so much overlap of structures, that nothing certain can be said of the dental or oral tissues. Also, standard



These two skull shots were taken of a dry skull onto size-4 dental film. There is so much over lap of left-over-right and maxilla-over-mandible, with an endotracheal tube thrown in that you cannot even tell which teeth have the amalgam fillings. From a diagnostic standpoint, these films are useless.

radiographic film is too coarse and grainy for accurate evaluation of the dental and paradental tissues.

It is my very firm opinion that there is no justification for obtaining lateral or ventro-dorsal/dorso-ventral skull radiographs for the purpose of evaluating dental and oral tissues. Well positioned, open-mouth lateral-oblique views can sometimes be of value, but only if the positioning is such that there is no superimposition of left over right or endotracheal tube or mouth gag over tissues of interest.



This is a table-top open-mouth lateral-oblique view of the left maxillary premolars and molars shot onto standard 8X10 x-ray film. The mouth is wide open. The endotracheal tube is moved ventrally so it does not lie over the left maxillary teeth. The head is rotated sufficiently so that the right maxillary teeth are not superimposed over the left maxillary teeth but not so much that the mandibular teeth are superimposed either. Though the quality of the image is compromised by using standard film, the positioning has achieved the objective of isolating the left maxillary posterior teeth with no superimposition of other structures. Such a film might prove useful.

While radiographs are essential for the accurate assessment of virtually every dental/oral complaint, they should be intra-oral views that isolate one side with no superimposition.

So, I admonish you to consider the following. If you suspect an oral or dental lesion that needs radiographic assessment, you must purchase the appropriate film and become familiar with the technique so that you can obtain images that will be of reliable diagnostic value. If you choose not to do that then you should not anesthetize the patient to obtain diagnostically useless images. There is risk to the patient, cost to the owner and benefit to neither.

I will now climb down off my soap box.