

Lecture 5

Lecture 5: Film and Development

In this Lecture

- Know the composition of radiographic film
- Know (basically)how a latent image is formed
- Know the steps of development
- Understand proper safelight use.

So, you are holding a perfectly exposed piece of radiographic film in your hand. Now what? Drop it off in the Kodak bin at Wal-Mart and get charged an arm and a leg for a bunch of crummy 4x6 inch prints that cost you $12.50 because you accidentally marked the “duplicates” box. Of course not. You will develop them yourself. Don’t know anything about developing film…no problem. Follow the steps below and you will be on your way.

The polyester you can’t make into a bowling shirt

Every good discussion of radiographic film development starts with a discussion of the physical characteristics of radiographic film. I am not yet famous enough to buck this trend so here goes.

Radiographic film consists of two major components:

- A polyester base that provides support. This base gives radiographs their blue tint
- Film Emulsion: The emulsion is a thin layer of stuff on top (actually both sides) of the polyester base. It is the part of the film that actually records the image. It is composed of two main ingredients:

  - Silver Halide Crystals: Silver Halide is the light sensitive material in the emulsion. The “halide” in silver halide is mainly bromide.
- **Gelatin**: Gelatin keeps the silver halide grains evenly dispersed and prevents clumping of the grains.
You can think of the emulsion as being kind of like a Jell-o mold...gelatin with particles of fruit cocktail floating in it. But wait. There are many types of Jell-o mold. I think they are all equally disgusting, however, some people like their Jell-o mold with little bits of fruit. Some like bigger chinks of fruit. Some like carrots instead of fruit. Different types of photographic film (there are hundreds) vary in a similar way. The size, shape, composition, and number of particles of silver halide affect the characteristics of the radiographic film. The major effects that altering the emulsion have are on film are film latitude, film contrast, film speed, film detail, and light color (spectral) sensitivity. When you go to purchase film you will have to chose between a staggering number of different films that vary in these 5 parameters. These parameters of film response alter the type of the film in the following ways:

- **Film Latitude**: Film latitude refers to the amount of error you can make when exposing a film and still get a good image. High latitude film means that you can mess up pretty bad and still have an reasonably exposed film. The trade off is contrast. High latitude film has low radiographic contrast. Conversely, low contrast film has more shades of gray.

- **Film Contrast**: Contrast is a complicated subject and is affected by many factors other than the film. Nonetheless, the film you chose will affect the contrast in your final image.
• Film Speed: Radiographic film is like photographic film. Faster film can be used to make faster exposures. This results in less patient motion and less exposure to the patient and personnel. The trade off is that faster films appear grainier and has less fine detail. Remember, in veterinary medicine speed is a virtue.

• Film Detail: Some film will give you exceptional detail and some won't. One method of accomplishing this is to put emulsion on only one side of the film. Regardless of how the manufacturer makes it faster, the trade off for detail is always speed. Higher detail film is always slower.

• Light Color Sensitivity: Remember from the intensifying screen lecture that your radiographic film must compliment your screens. If your screens emit blue light you must use film that is sensitive to blue light.

That is pretty much all you need to know to at least have an idea of what you are looking at when you open up a catalog and try to decide which film you need. Now, we turn our sights to what happens after the x-rays hit the film. What actually happens in the film emulsion to make an image?

Toward Development

I will attempt to explain, in one paragraph, how that piece of dull, radiographic film acquires and holds an image that we can later process. Think it is possible. Here goes.

Unexposed silver halide within the emulsion is green or purple in color. Metallic silver is black. When the emulsion is exposed to light from the intensifying screen, portions of the silver halide are converted to metallic silver. The pattern of this conversion parallels the light given off from the screen, which represents the anatomic part you are imaging. At this point, the exposed, metallic silver halide is called a “sensitivity speck”. Prior to development, the pattern of exposed sensitivity specks is known as the “latent image.” We cannot see this latent image until it is developed I guess that is why they call it a latent image.) When it is developed the entire silver halide crystal containing the sensitivity speck is converted to metallic silver. The remaining, unexposed, silver halide grains are removed during processing. Therefore, it is the pattern of metallic silver
crystals that remain on the emulsion after processing that are responsible for the image you see. Ta dah!

**In the darkroom**

The preceding paragraph about the physics of what is going on in the emulsion was as short as I could make it. I really like this physics stuff but “sensitivity specks” drive me nuts. Unfortunately, that is not all you have to know about developing. There are a few more things. Fortunately, these are practical and you will need to know them when you are out in practice.

The processor: More and more, veterinarians are turning toward automatic processors. They can be a significant initial investment and they require routine maintenance but the benefits of having rapidly developed film that is developed properly each time are worth it. Some of you will manually process your film. Either method is entirely acceptable. Either way, you need to know what is going on in the processor in case there is a problem.

Overall, the process of film development is exactly the same in both manual and automatic processing. Both will ultimately produce a radiograph. However, automatic processors are faster and more consistent.

There **will** be problems with development. As the veterinarian it is your job to fix the processor when it breaks. I am not sure why, but that is the way it is. It is not like you have a combined DVM/processor degree but that is the way it is. Until it changes learn the following:

Processing is composed of four separate steps:

1. Development: The first step is placing the film in a developing solution. Developer consists of reducing agents that convert silver halide crystal into metallic silver.
2. Fixer: The second step is placing the film in a fixer solution. Fixer stops the development. If film is allowed to develop for too long, it will become over exposed and turn black. The fixer also washes away unexposed and undeveloped silver halide crystals and clears the emulsion. This provides us with the white parts of the radiograph.
3. Wash: The final step is the wash. Water is used to wash off the fixer. If fixer is left on the film it will turn brown and hazy.
The whole developing process must take place at a specific temperature. This is why you must allow a processor to warm up. It is also why you must be vigilant in monitoring the temperature of your development solution if you are manually developing films. If the temperature is too hot your film will look overexposed. Too low and it will look underexposed. Also, increasing temperature decreases the amount of time it takes to develop a film. The temperature is monitored and regulated in an automatic processor. However, with manual processing you will have to adjust our developing time depending on the temperature of your developing solutions.

**Safelights**: Safelights are only safe if they are used properly. The safelight filter (like the intensifying screen) must be matched to the film you use. Using an inappropriate safelight color will fog your radiograph just like any other light. Also, the safelight must be of the correct wattage (usually 6.5-10watts) and be located the correct distance from the counter top. If the light is too strong or too close to the film, you run the risk of exposing the film.

**Did you know????** 90% of all technical errors occur in film processing. See I told you it was important. You will have a lab on film processing senior year.

**One last thing....**the radiograph is part of the medical record. It is a legal document. You are required by law to keep them around for a certain number of years. You are required by law to record on each radiograph:

1. Patients name
2. Owners name
3. Date
4. Your clinic’s name
5. Anatomic markers (right vs left leg etc.)
Since they are part of the medical record, you own them. You are by no means required to give them to a client if they request them. Again, you own them, the clients do not. They pay for your interpretation of the radiograph, not the piece of film itself.

Since it is part of the medical record, I suggest you do your best to obtain quality radiographs. You are not saving any time or money by accepting sub-par images at your practice. You are just setting yourself up for embarrassment and legal troubles if you miss a diagnosis because you took crummy radiographs. If the radiographs are crummy at the practice you go to, hire a radiologist or veterinary technician for an afternoon to come in and get you going. That is what we are here for.

While we are on the topic...what does it cost to take a radiograph? I bet it is more expensive than you think. The last page of this lecture is a publication put out by Kodak and the AAEP.

More expensive than you thought huh? Remember, always charge for what you do. Your plumber wouldn’t give you anything for free no matter how bad your toilet backed up into your living room. The guy who towed your truck wont give you your car back for free no matter how bad he felt for you. Your dentist wouldn’t fill a single cavity without getting paid no matter how bad your breath stunk. Charge for what you do. You are worth it.
Treat radiographic film like you would treat your best friend. Your friend has feelings and is sensitive to your actions. Treat them bad and they may respond in an unpredictable manner. The same goes with film. Film is sensitive. Film is sensitive to heat, pressure, light, x-rays, moisture, age, and even static electricity. If you unnecessarily expose your film to these things your film will respond in a number of unpredictable ways. Take care of your film or you will see film artifacts that will degrade your images. The top 5 ways to properly take care of your film are:

1. Store boxes of film on end to reduce pressure on the film.
2. Store film in cool room with low humidity (not on top of the processor).
3. Obviously don’t store it near your x-ray machine where it may accidentally be exposed.
4. Don’t buy large quantities of film that will expire before you can use it.
5. When handling film, be gentle placing it in and taking it out of cassettes. Never bend or wrinkle film.