Preparation:

caliper, X-ray views requested, X-ray log book, pen

Procedure:

1. Place the fixed portion of the caliper at the site where the X-ray beam is to exit.
2. Slide the moveable arm over the site the beam is to enter.
3. Move the caliper along the body area to the thickest portion of tissue.
4. Read the centimeter (cm) scale at the portion of the moveable arm closest to the body. Read at the area just below the arm.
5. Record the measurement in cm along with the view in the X-ray log.
6. Repeat for any additional views.
7. Clean the caliper after each use by disinfecting.
8. Put caliper in storage area.

Technique Chart

An X-ray **technique chart** is a listing of settings on the X-ray machine based on the thickness of the area to be radiographed. It is set up in rows and columns and lists the thickness in centimeters (cm). Once the thickness of a body part is determined, the technique chart is used to determine the machine settings. This is done by noting the measurement in the column listed cm and moving across the row to determine the kVp, mA, and exposure time in seconds or mAs. Technique charts will be different for a grid technique and a tabletop technique. The **grid technique** is the plate that holds the film below the X-ray table and causes the **X-ray tube** holding the radiation source to be lower. The film is not in contact with the patient. The **tabletop technique** is the distance between the X-ray tube and the top of the X-ray table surface and the film cassette is placed on top of the table and in contact with the patient.

Technique charts are formulated for a specific machine. The constants of the machine are predetermined before the chart is created. These factors include the following:

- The distance from the source of the X-ray beam to the film. This is usually between 36 and 40 inches. This is a fixed distance based on the machine and changes when the grid is used versus the tabletop technique.
- A filter is located between the window of the X-ray tube and the collimator, which is usually between 2 to 2.5 mm in thickness. The filter absorbs the scatter radiation to prevent excessive exposure amounts.
- The grid height and width within the table.
- Film speed that depends on exposure time. Fast film requires less exposure time but lacks definition and detail, whereas slow film requires greater exposure time but produces greater detail.
- **Intensifying screens** that are located within the film cassette to help produce a better exposure to the film. They are rated according to speed and relate to exposure time with high speeds requiring less exposure to radiation. Slow film speeds have greater detail but cause blurry appearances with any movement.

A technique chart should be developed for both a grid technique and a tabletop technique. Most common procedures include a tabletop technique used for views of the skull, extremities, and avian and rodent or exotic animals. The grid is used for larger animals and the thorax, abdomen, and chest.

Machine Setting Procedures

The control panel of the machine has several dials, switches, and knobs. It is important to first locate the on/off power switch. This turns the machine on and off. It is important to make certain the X-ray machine is on during use. Some machines have a buzzing sound and others are silent. The three important selector knobs used for setting the machine are the kVp, mA, and the timer. Some machines have the mA and timer linked and also provide the mA setting. The goal is to use the highest mA setting and the shortest exposure time. The knobs should be set to meet the readings on the technique chart based on the patient's body measurement. It is important for the assistant and technician to locate the exposure button on the console panel, which may also be in the form of a foot pedal that enables the staff to take a picture while simultaneously restraining the patient in the proper X-ray position. When the exposure button is pressed, a red light flashes or a buzzer sounds to indicate the emission of radiation. The age of the machine will also determine how the machine is set up and used. All settings should be double checked and confirmed for accuracy. All staff members working in radiology should be properly trained and experienced in taking radiographs.

Film Identification

Radiographs are a part of a patient's medical record and are also considered legal documents. Most X-rays are filed separately from the medical record but must be properly labeled and identified to locate and review. Each film that is taken should be permanently marked with patient and client information, as well as the veterinary facility information. Each state requires specific information to be placed permanently on the film, meaning it must be placed on the film prior to X-ray exposure or X-ray development. Information that must be on the label includes the following:

- Hospital name, address, and phone number
- Veterinarian's name
- X-ray number
- Client name
- Patient name
- Date

The film should also be marked with a directional label or marker to note which side of the animal is being viewed. This is usually in the form of a lead L or R placed on the proper side of the cassette film prior to X-ray exposure. The markers identify the left and right side of the patient when using a V-D, D-V, or AP view and the down side when using a LAT or oblique view. Make certain the marker is placed properly on the film cassette and within the area of the X-ray beam. Some facilities use lead tape that contains the patient information labeled on it and placed on the X-ray film cassette to be exposed onto the film during the X-ray. Other facilities use an electronic film identification printer that stamps the information onto the film prior to film development. If an electronic flasher or printer system is used, an area must be blocked on the film cassette prior to exposure to prevent that area from being occluded.

Developing Film

There are two methods for developing film in the veterinary facility. The methods are **manual developing** or **automatic film processing**. The older method is manual developing through using **hand tanks**. Manual development is cheaper to set up and maintain than an automatic processing system, but takes longer to develop a film than the automatic method. The manual method also requires temperature control of the hand tanks, which hold the chemicals used to develop the film. The automatic film processor is a costly piece of equipment that has advantages to hand developing. The most noted is the speed of development and quality of the film. The solutions are temperature controlled by the machine and reduce errors and increase the film quality and life of the film. The time for a person to develop the film is significantly reduced. Professional maintenance is also required with the automatic processor unit. Table 49-2 highlights the pros and cons of manual versus automatic developing.

TABLE 49-2
Pros and Cons of Development Methods

	PROS	CONS
Manual Developing	■ Low cost ■ Easy to use ■ No backup system required ■ Low maintenance	■ Lengthy developing time ■ Must maintain chemical temperatures ■ Must stir and prepare chemicals ■ Less life span of developed film
Automatic Processing	■ High speed of development ■ Temperature controlled chemicals ■ Reduced developing errors ■ Increased life span of film ■ Higher quality film	■ High cost ■ Machine warm-up and setup time ■ Requires maintenance and servicing ■ Requires backup method if equipment breaks or fails

Film processing involves several steps independent of the method of developing. These steps include film developing, film **rinsing**, film **fixing**, and film drying. **Processing** involves being in a darkroom that has no light source or light leaks from the outside area. Light will ruin the film and make it undevelopable. The darkroom is equipped with a **safe light**, which is a red light that is low in intensity and a filter that doesn't damage the film. The entrance door should be secured firmly to prevent anyone from entering during film development. A light or sign should be placed on the door when the room is in use. The undeveloped film is removed from the cassette before it is developed. A new film is replaced within the cassette.

Film Cassettes

Cassettes hold the film that is used to take an X-ray and prevent the film from being exposed to light (see Figure 49-8). They have latches that secure the cassette tightly to keep light from entering. It is important to work in the darkroom when loading and unloading film from a cassette. The cassette should be placed face down so the back latches can be unlocked. The cassette is then turned over face up and the top open. Film is removed and should be handled with care. Only handle the film at the corners and as carefully as possible, avoiding dropping the film to prevent streaks, smudges, dirt marks, static electricity, and light exposure. film is refilled into the cassette, it is removed fro film box, which is kept in a film bin that is light The appropriate film size should be selected and removed. Each sheet of film is covered by a pap plastic cover that protects the film. A single sheet should be carefully removed and placed in the cas The cassette is closed and properly locked. The cas is ready for use or storage in its customary place. sette should never be left without film.

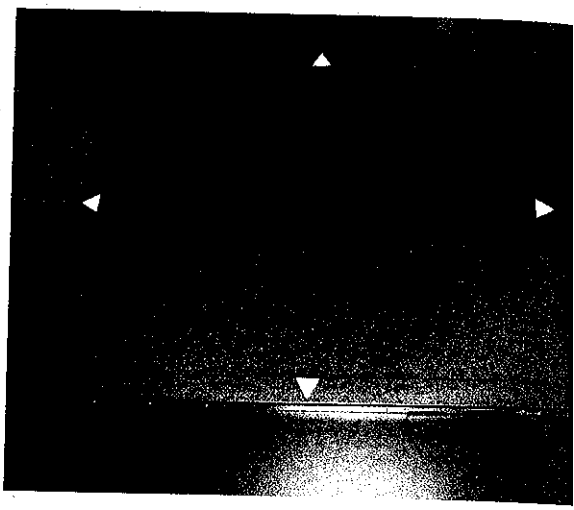

FIGURE 49-8 Film cassette.

Competency Skill

Unloading Film from a Cassette

Objective:

To properly remove film from a cassette while maintaining the integrity of the film.

Preparation:

film cassette, film, darkroom, safe light

Procedure:

1. Place the cassette upside down and unlock.
2. Turn cassette face up and open cover.
3. Remove film from cassette by one corner, grasping firmly with the fingertips.
4. Leave the cassette open while developing film.

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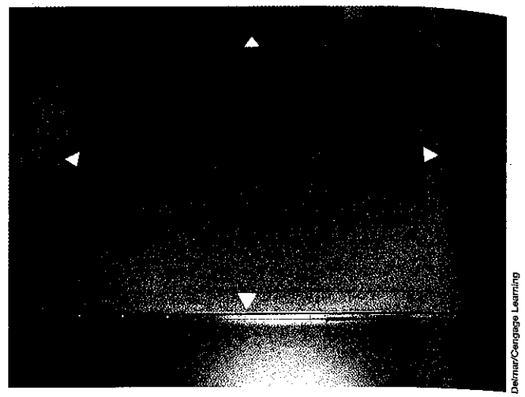


FIGURE 49-8 Film cassette.

Competency Skill

Unloading Film from a Cassette

Objective:

To properly remove film from a cassette while maintaining the integrity of the film.

Preparation:

film cassette, film, darkroom, safe light

Procedure:

1. Place the cassette upside down and unlock.
2. Turn cassette face up and open cover.
3. Remove film from cassette by one corner, grasping firmly with the fingertips.
4. Leave the cassette open while developing film.

Competency Skill

Loading Film to a Cassette

Objective:

To properly prepare a cassette to maintain the integrity of the film.

Preparation:

film cassette, film, darkroom, safe light

Procedure:

1. Place cassette face down and unlock.
2. Open cassette.
3. Place the film box containing the same size film next to cassette.
4. Remove the box lid.
5. Open paper or plastic cover and remove one sheet of film.
6. Place film in cassette and close. Lock cassette.
7. Fold paper or plastic cover over film box and place in storage bin.
8. Place cassette in storage area.

Competency Skill

Cleaning a Cassette

Objective:

To properly maintain equipment for use in obtaining X-rays.

Preparation:

film cassette, mild soap, warm water, paper towels

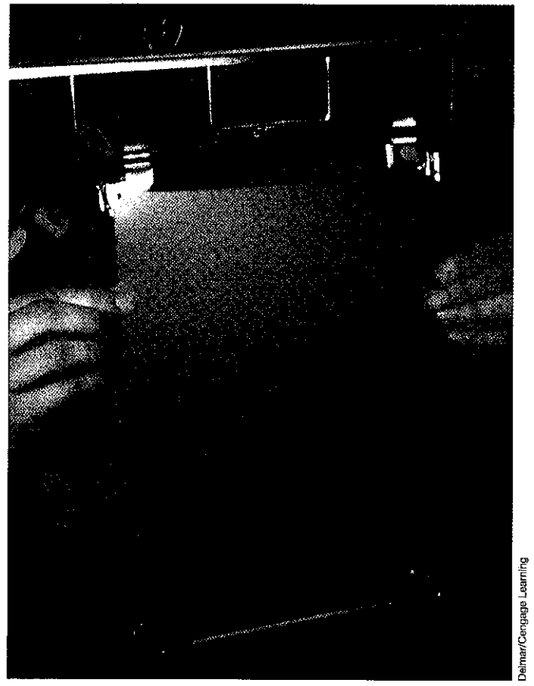
(*Continues*)

Procedure:

1. Open cassette.
2. Apply small amount of warm water and soap to paper towel and wipe cassette screens on both surfaces.
3. Dry each screen surface.
4. Allow cassette to remain open until dry.

Film Hangers

Film hangers are used to secure film for manual processing and development. These tools hold the film onto a metal frame with clips and hold the film as it is submerged in chemicals during developing (see Figure 49-9). The film is removed from the cassette and the proper hanger size is selected to hold the film. The film hanger is held upside down as the film is attached to clips. Once the bottom clips are secured into the corners of the film, rotate the film and secure the film to the top clips by pulling them downward and snap onto the corners. The film holder should secure all four corners of the film. The film is then handled by holding the bar at the top of the hanger. This bar allows the film to hang in the tank during the developing process.



Delmar/Cengage Learning

FIGURE 49-9 Film hanger.

Manual Developing

Developing tanks are required for hand-processing films. These tanks may be metal or heavy plastic and hold large volumes of chemicals. The solutions require periodic changing at which time the chemicals are drained. The tanks are cleaned well to remove bacteria and algae, rinsed, and then refilled. The frequency of this practice depends on how much use occurs and any debris and contaminants that may get into the chemicals. The tanks contain the developer solution, the fixer solution, and a wash tank that contains water. The **developer solution** is usually located on the left-hand side of the tank. The developer solution develops the X-ray film. The **fixer solution** is usually located on the right-hand side and is a smaller tank compared to that of the water. The fixer solution fixes the X-ray film and helps maintain the life span of the film, allowing it to stay readable. The water rinse tank is usually located to the far right side and is larger than the other two tank sections. When the processing method is complete, the film should hang to dry.

Automatic Film Processing

The automatic film processor unit should be started early to allow it to warm up and the chemicals to reach the desired temperature. All chemical tanks should be

Competency Skill

Manual Film Processing

Objective:

To properly develop X-ray film using the manual method.

Preparation:

film cassette, film, darkroom, safe light, automatic film marker, patient identification card, pen, hand developing tanks, developer solution, fixer solution, water, timer, thermometer

Procedure:

1. Make patient identification card and place in automatic film marker.
2. Stir developer and fixer solution and make certain proper temperatures are noted.
3. Place film cassettes face down in the darkroom and unlock back.
4. Place film cassettes face up and open top.
5. Remove film by one corner.
6. Place unexposed corner of film into automatic film marker over card and lower top to expose film corner.
7. Begin attaching film to bottom corner of film hanger; attach to both clips.
8. Rotate hanger and attach top clips to both corners.
9. Place film hanger in the developer on the left side of the processing tank.
10. Lift film up and down several times.
11. Set times for proper time required for developer.
12. While film is in developer, refill film into cassette.
13. Put cassette away.
14. Place film box in storage bin.
15. When timer sounds, remove film from developer and rinse in water tank by moving film hanger up and down several times.
16. Place film hanger in fixer solution and lift up and down several times.
17. Set times for proper time required for fixer.
18. Cover tanks with the correct lids.
19. Exit darkroom.
20. When timer sounds, return to darkroom and remove film from fixer and rinse in water tank.
21. Place in water for 30 minutes. After 30 minutes, hang film to dry.
22. When film is dry, unclip the film from the hanger.
23. Notify veterinarian when film is ready to read.

checked for proper levels. The roller racks should be removed and washed on a regular basis. The process of using the automatic process for film developing is simple. The film cassette is taken to the darkroom and the exposed film removed from the cassette. The film should be grasped by the edges and placed on the feeder tray of the processor. The film is aligned with the roller bar and placed against it. The film will be pulled into the processor and developed automatically. The completed film will be removed on the opposite end of the feeder tray dry and ready to view. X-rays are viewed on a viewing box that illuminates the film and allows the veterinarian to make a diagnosis (see Figure 49-10).

Digital Radiology

Many facilities are beginning to switch from using chemical processing to produce radiographs to using digital radiology. Digital X-rays are transferred onto a computer disc rather than on a film. This type of diagnostic imaging has multiple advantages including ease of use, production of high-quality images, affordability, and improved neatness and cleanliness of images. This radiology practice is quite common in veterinary medicine and in the coming years will be considered the norm in radiology.

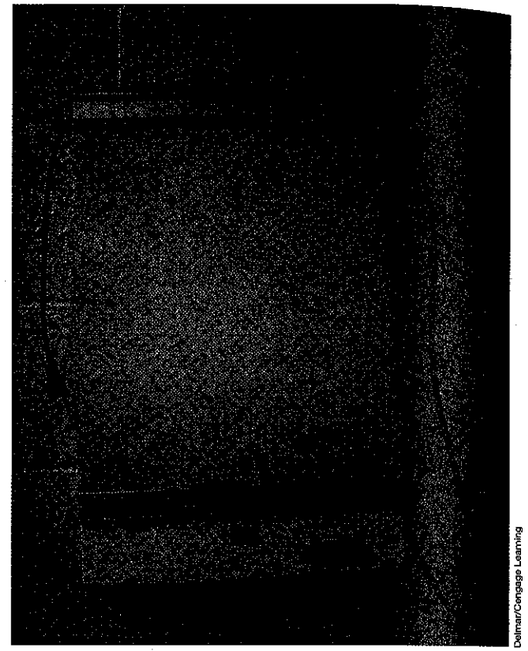


FIGURE 49-10 X-ray view box.

Competency Skill

Automatic Film Processing

Objective:

To properly develop X-ray film using the automatic method.

Preparation:

film cassette, film, darkroom, safe light, automatic film marker, patient identification card, pen, automatic processor, developer solution, fixer solution

Procedure:

1. Make certain the processor is ready to use.
2. Make certain all chemicals are replenished.
3. Place cassettes face down in darkroom and unlock.
4. Turn cassettes over and open cover to remove film.
5. Grasp film by one corner and align film with feeder tray.
6. Gently place film against roller bar.
7. The film will enter the processor automatically.
8. While the film is being processed, refill the film cassette. Replace film box in storage bin.
9. Remove film from opposite end of feeder tray.
10. Give film to veterinarian to be read.

Filing Film

Radiographs must be filed just as medical records are filed for ease of location. X-rays are too large to be filed with the medical record and are often stored in a nearby file area in large protective X-ray folders or paper envelopes. Several systems have been used to file radiographs, such as alphabetical or numeric filing. Most facilities file the radiographs by the X-ray number and then store them in numeric order. All X-rays for the patient are stored in one file envelope. Once a film has been developed, an envelope and number should be recorded in the patient's medical record and a file folder labeled with the X-ray and patient information. The information label should include the following:

- X-ray number
- Patient name
- Client name
- Veterinarian name
- Dates of radiographs
- Type of study or view
- Diagnosis

The file folder is labeled properly, the film placed within the file folder, and the folder then properly filed in the storage location. Filing should be done accurately as a misfiled folder creates disorder in a clinic.

Darkroom Care and Maintenance

The darkroom is an area that should be kept clutter free and clean at all times to help improve film quality and proper developing methods. The darkroom should be checked on a regular basis for any light leaks from the outside. The door should be observed for cracks around the door. The safety light should be checked by closing the door and keeping the darkroom dark with only the safe light source illuminated. An unexposed film should be placed on the counter with a metal object, such as a paper clip or nail over the film. The film should be exposed for 2 minutes and then the film should be developed. If the object appears on the film, the safety light is not working properly or some other light source is entering the room. This test evaluates the proper lighting environment of the darkroom.

The counter workspace should be cleaned on a daily basis and all items placed in their storage locations for ease of working in the dark. There should be two areas to the darkroom: a wet side and a dry side. The wet side holds the processor and hand developing tanks. The dry side is the counter workspace where cassettes are loaded and unloaded with film. The film storage boxes should be stored in a bin under the work area to decrease light exposure.

Floors and work areas may become wet and towels should be kept in the area to clean up leaks and spills. A mop should be used to clean the floor as spills occur. A cleaning regimen should be developed for darkroom maintenance and materials and chemicals monitored for reordering. Figure 49-11 shows an example of a darkroom maintenance schedule.

Ultrasound Diagnostics

Ultrasound is a diagnostic tool using ultrasonic sound waves to view images of internal organs and structures. The sound waves bounce off the patient and create an echo within the tissues and respond back to the ultrasound machine and are projected on a screen (see Figure 49-12). The stronger the ultrasound signal during the return phase, the brighter and whiter the image.