

**THE DARKROOM**

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It is important that the darkroom be designed to make film processing an **efficient, precise** and **standardized** procedure. Since processing procedures are carried out in near total darkness, every piece of equipment must be in its specific place. For efficiency's sake, the room should be large enough to avoid crowded conditions and the equipment should be arranged so as to expedite the flow of work and be within arms reach. A dark room does not mean that one is obligated to process manually.

It should be located as close as possible either to the X-ray clinic or the reading area. A light-tight darkroom does **not** mean that the walls must be painted black; walls should be of a light pastel color to reflect the room illumination.

If **humidity** is a problem, especially in certain parts of the country, air conditioning is a must. When the temperature of the processing room exceeds 90. degree F, the X-ray films may become sensitized (fogged) by heat alone.

**MINIMUM REQUIREMENTS FOR A DARKROOM.**

- a) Light-tight room
- b) Both safe-light and white-light illumination
- c) Processing tanks and / automatic processor
- d) Hot and cold running water
- e) Accurate thermometer and interval timer
- f) Drying racks or dryer
- g) Adequate storage space
- h) A radiograph viewer
- i) Has a light-tight storage draw for unexposed extra-oral film

**a) LIGHT-TIGHT PROCESSING ROOM**

The first requisite of a processing room is the **exclusion** of all external white light when radiographs are processed. Photosensitive crystals in dental film emulsions are extremely sensitive to visible light, and any light leaking around a door or window may fog and ruin the films. Many people advocate a door that can be locked to avoid accidental exposure of film to white light. Alternatively a light outside the door indicating that the darkroom is in use. When the white light in the darkroom is switched off, the indicating light outside automatically goes on. A **maze** walk in is helpful for heavy traffic in and out of the darkroom. Where a maze is incorporated, the maze must be painted black to prevent white light from scattering into the darkroom.

Inevitably there will be some light leaks in the darkroom and may be tested as follows. Place 6 coins on unexposed films that have been removed from the wrapping, on the working surface. Process one of the films every 30 seconds. The first four films should not show the outline of the coin indicating that it takes at least 2 minutes of the film being exposed before fogging will occur. The same test should be carried out to test the "safe-light". Check ceiling tiles and doorways for light leaks.

**b) SAFELIGHT**

The processing room must be provided with both white and safelight illumination. White light for such work as cleaning tanks and preparing the solutions is done. Reliable “**safe-light**” lamps are indispensable - their function is to provide adequate light of quality that is “safe” for exposed X-ray films during handling and processing. Always remember that X-ray films are sensitive to light until after fixation.

Since excessive exposure of the film to safelight illumination will result in fog, three factors concerning safelight lamps must be carefully considered:

- i) Type of filter
- ii) Intensity of illumination
  - a) Wattage of bulb
  - b) Distance of safelight lamp above working area
- iii) Time film is exposed to the safe light. **No** light is completely safe

#### i) **TYPE OF FILTER.**

X-ray films have the highest sensitivity to the **blue-green** part of the light spectrum . The X-ray film is less sensitive to light in the opposite region of the spectrum - i.e. the **yellow** and **red** region. It is obvious that the blue filter cannot be used, neither a green color filter as it is so close to the blue. Therefore safelights are safest when made with **amber** or **red** filters. Since yellow is closer to green than red in the spectrum, one can see better under a yellow filter than a red filter. This is the basis of using film emulsions which are not sensitive to the yellow light.

Never use a ruby or red light bulb as a safelight. While the light from such a bulb may look safe because it is dim, such illumination will probably cause fogging of the X-ray films. In order to use the least amount of light for the safelight lamp, the **Wratten series 6B** OR **Morlite 2 (ML 2)** filter is the filter of choice. This filter transmits light predominantly in the yellow-red portion of the spectrum.

#### ii) **INTENSITY OF ILLUMINATION**

The intensity of illumination of the safelight is controlled by wattage of the bulb and the distance of the safelight from the working surface. The recommended minimum distance for the safelight lamps is **120cms (4 feet)** above the working surface. Thus, if using the E- speed plus film you should use a **7 1/2** watt bulb at this distance. The inverse law applies to light illumination: the intensity of light varies inversely as the square of distance. In brief, if we have X intensity at 4 feet, we will have 4 x intensity at 2 feet and 1/4 x intensity at 8 feet. Therefore, the intensity of safelight illumination on the film varies with distance and also with the wattage of the bulb. The correct intensity can be obtained by adjusting either the distance or the bulb wattage or both.

Textbooks quote a 15 watt bulb but that is for D speed film.

#### iii) **THE TIME THE X-RAY FILM IS EXPOSED TO SAFELIGHT**

It must be made clear that there is **no** such thing as an absolutely safe safe-light. The film will be fogged if it is exposed too long to any intensity light. The question arises now for how long can a film be exposed to safelight illumination before fog becomes apparent.

### ILLUMINATION SAFETY TEST

A simple method of checking the safelight is the same as for the dark room: remove 6 dental film from their packets and lay them on the working surface of the bench beneath the safelight lamp. Place a small coin on each film. Expose each film to the safelight conditions as explained above. Process in the usual manner. Examine each film before an illuminator. If you can see the faintest outline of the coin on the film exposed to the safelight illumination for 1 minute, the safelight is not safe. Next determine which film you can first see fogging - this will indicate the maximum time that is safe for the film to be exposed to the safe-light.

If the safelight is not safe, you should do one of the following to correct the problem:

1. Replace the bulb with one of lower wattage
2. Raise the safelight lamp higher from working surface
3. Check the filter - may be cracked or broken

In short, the film should be exposed to safelight illumination for the shortest possible period

### iii) **WHITE LIGHT**

Fluorescent lights should **not** be used as overhead lights in the darkroom because there is often a short afterglow that may fog the first few films opened after the light has been turned off.

### c) **PROCESSING TANKS**

Tank processing is the simplest and most efficient procedure for developing, rinsing, fixing and washing films with accurate temperature control. The fresh water tank plays an important role:

- i) in temperature control
- ii) In eliminating the alkali ( $\text{Na}_2\text{CO}_3$ ) from the developer and the acid (acetic) from the fixer solution

The processing tank contains two parts: The master tank and the insert tanks.

1. MASTER TANK: This tank serves as a water jacket to hold the insert tanks and is usually large enough to provide space between insert tanks for rinsing and washing of films. The water assists in maintaining the same / constant temperature in the insert tanks.
2. INSERT TANKS These are removable containers for the individual processing solutions - (developer and fixer), and are spaced in the master tank

The master tanks are made of either enamel, **stainless steel** or plastic. Never use reactive metals containing tin, copper, zinc, aluminum or galvanized iron. The removable inserts of the tanks should ideally be made of stainless steel in order to accommodate more rapidly to changes in temperature of the water in the master tank. Also, stainless steel is more easily cleaned.

These tanks should be supplied with **covers**. The lid should have a large lip to reduce exposure to light and to reduce exposure to air (oxygen). Cover the developer and fixer tanks when not in use to keep out dirt and to reduce the **rate** of evaporation and **oxidation**.

#### d) **HOT AND COLD RUNNING WATER**

X-ray processing solutions are most effective when used with a comparatively narrow range of temperatures. Below 60 degree F, some of the chemicals are sluggish in action, which causes underdevelopment and inadequate fixation. Above a temperature of 75 degree F they work too rapidly and may cause fogging of the film. A **temperature of 68 degree F (20 degree C) for 5 minutes** is recommended for these reasons:

- a) The optimum quality of radiographs are attained at this temperature. The contrast and density of the film are most satisfactory and fog is kept to an acceptable low level.
- b) The processing time is practical i.e. 5 minutes
- c) With modern solution-tempering devices, a temperature of **68 degree F - 20 degree C** is usually conveniently maintained. The temperature of the water in the water tank is controlled by a **thermostatic** or manual mixing valve in the water supply. (This is why hot and cold running water is essential). The temperature of the water in the master tank in turn controls the temperature of the solutions in the insert tanks

#### e) **THERMOMETER AND INTERVAL TIMER**

- i) A thermometer is an indispensable processing-room accessory - a tank thermometer that is plainly marked with both Centigrade and Fahrenheit scales, and has a steel clip that forms a hook to hang the thermometer in the tank (or a floating type)
  - ii) An interval timer is also important in order to control time of development and fixation.
- f) if development and drying are done in the same room it is recommended that some means of **ventilation** be provided to supply the room with fresh air as well as eliminating the heated air from the dryer. Suitable **drying racks** should be present where no automatic dryer is present
- g) **STORAGE PLACE** for chemicals and films is essential. Processing rooms cannot be used as storage rooms or for any other procedure in the dental office that will contaminate the films with dust or fumes. However, the darkroom should not be a general store room
- h) A **radiographic viewer** is used in the darkroom when making use of the

techniques of time temperature or wet viewing and to examine the final product

## PREPARING PROCESSING SOLUTIONS

Developer and fixer chemicals come in powder form, as ready-mixed solutions, or in liquid concentrates. Powdered chemicals must be mixed thoroughly to ensure that the crystals are dissolved. Powdered chemicals are not often used these days. Mixed solutions stored for later use must be kept in tightly stoppered brown bottles. Liquid concentrates are convenient for most offices; they are usually of good strength, occupy little storage space, and are quickly mixed with water. Today most offices use ready mixed chemicals

## UNDER - AND OVER DEVELOPMENT

Underdevelopment will produce light density radiographs and under fixing will produce cloudy, partially opaque radiographs. Greatly prolonged over development will produce chemically fogged radiographs and greatly prolonged underdevelopment will produce light density radiographs. Some radiographs tend to judge the development of a film by sight. This is not a good procedure. since consistently good quality radiographs cannot be produced in this manner. However, **sight - development** is useful when a film is known to be accidentally overexposed and a reduced developing time is needed to obtain a usable density radiograph and avoid repeated x-ray exposure of the patient

## CLEANING PROCESSING TANKS

The action between the mineral salts in the water and carbonate in the developing solutions produces a deposit on the inside wall of the processing tanks. A commercially prepared stainless steel tank cleaner can be used to remove these deposits. After using the tank cleaner, rinse with fresh water and wipe sides dry with clean cloth. Don't use abrasives such as "kitchen cleaners" - these react unfavorably with the developing solution. Or simply brush thoroughly with a brush and water.

## ADVANTAGES OF TWO EMULSION LAYERS (DOUBLE COATED EMULSION)

### Increase in Sensitivity

Since there is an emulsion on both sides of the film base, there is an image formed on both sides of the base, each emulsion being exposed simultaneously with the other. These two images are seen as a single image. The two sides together consequently form an image which has twice the silver deposit obtained if a single-sided material were used. This enables much shorter exposures to be used, with less risk of blurring from the movement of parts being radiographed, and with markedly less radiation dose to the patient.

When changing from a packet with one film to one with 2 films, the exposure time remains the same and thus the amount of radiation that the patient receives is the same.