

## X – RAY DEPARTMENT

### Lecture 6

د. سناء القصاب

#### Dental x – ray film processing

Film processing refers to a series of steps that collectively produces a visible permanent image on a dental radiograph. The purpose of film processing: -

To convert the latent "invisible" image on the film into a visible image.

To preserve the visible image so that it is permanent and does not disappear from the dental radiograph.

#### Film processing steps

There are five steps in film processing:

1. Development.
2. Rinsing.
3. Fixation.
4. Washing.
5. Drying.

**Development:** The first step in film processing is development. A chemical solution known as the developer is used in the development process. The purpose of the developer is to chemically reduce the exposed, energized silver halide crystals into black metallic silver. The developer solution softens the film emulsion during this process.

**Rinsing:** Following development, a water bath is used to wash or rinse the film. Rinsing is necessary to remove the developer from the film and stop the development process.

**Fixation:** Following rinsing, fixation takes place. A chemical solution known as the fixer is used in the fixing process. The purpose of the fixer is to remove the unexposed, unenergized silver halide crystals from the film emulsion. The fixer hardens the film emulsion during this process.

**Washing:** Following fixation, a water bath is used to wash the film. A washing step is necessary to thoroughly remove all excess chemicals from the emulsion.

**Drying:** The final in film processing is the drying of the films. Films may be air – dried at room temperature in a dust free area or placed in a heated drying cabinet. Films must be completely dried before they can be handled for mounting or viewing.

#### Developing composition

##### 1. Developing agent

- Hydroquinone → converts exposed silver halide crystals to black metallic silver, slowly generates the black tones and contrast in the image.
- Eion → converts exposed silver halide crystals to black metallic silver, quickly generates the gray tones in the image.

##### 2. Preservation

- Sodium sulfite → prevent rapid oxidation of the developing agents.

### **3. Accelerator**

Sodium carbonate → activates developer agents provide necessary alkaline environment for the developing agents, soften gelatin on the film emulsion.

### **4. Restrainer**

Potassium bromide → prevents the developer from developing the unexposed silver halide crystals.

## **Fixer composition**

### **1. Fixing agent**

Sodium thiosulfate, ammonium thiosulfate → Removes all unexposed undeveloped silver halide crystals from the emulsion.

### **2. Preservative**

Sodium sulfite → prevent deterioration of fixing agent.

### **3. Hardening agent**

Potassium alum → shrinks and hardens the gelatin in the emulsion.

### **4. Acidifier**

Acetic acid; sulfuric acid → neutralizes the alkaline developer and stops further development.

## **The darkrooms**

The function of a darkroom is to provide a completely darkened environment where x-ray film can be handled and processed to provide diagnostic radiographs. The dark room must be properly designed and well equipped.

## **Room requirements**

A well planned darkroom makes processing easier. The ideal darkroom is the result of careful planning; it must be:

- Conveniently located.
- Of adequate size.
- Equipped with correct lighting.
- Arranged with couple work space with adequate storage.
- Temperature and humidity controlled.

The size of the dark room is determined by a number of factor.

- The volume of radiographs processed.
- The number of persons using the room.
- The type of processing equipment used.
- The space required for duplication of films and storage.

## **Safe lighting**

It is low intensity light composed of long wave lengths in the red-orange portion of the visible light spectrum. Safe lighting provides sufficient illumination in the darkroom to carry out processing activities safely without exposing or damaging the film.

Safe lighting does not rapidly affect unwrapped x-ray film and do not cause film fog.

The developer temperature must be checked prior to processing. The optimum temperature for the development is 68<sup>0</sup>F. Below 60<sup>0</sup>F, the chemicals work too slowly and result undevelopment. Over 80<sup>0</sup>F, the chemicals work too rapidly and produce film fog, the temperature of the developer determines development time.

### Processing temperature and times

Solution tempe.	Time in developer	Time in rinse	Time in fixer	Wash time
65 <sup>0</sup> F "18.5 <sup>0</sup> c"	6.0	0.5	10-12	20
68 <sup>0</sup> F "20.0 <sup>0</sup> c"	5.0	0.5	10	20
70 <sup>0</sup> F "21.0 <sup>0</sup> c"	4.5	0.5	9-10	20
72 <sup>0</sup> F "22.0 <sup>0</sup> c"	4.0	0.5	8-9	20
75 <sup>0</sup> F "24.0 <sup>0</sup> c"	3.0	0.5	6-7	20
80 <sup>0</sup> F "26.5 <sup>0</sup> c"	2.5	0.5	5-6	20

### Replenisher Solutions

To maintain adequate freshness, strength and solution levels, both the developer and fix or solutions must be replenished daily.

A replenisher is a super wnantrated solution that is added to the processing solution to compensate for the loss of volume and strength that results from oxidation.

Oxidation or the process that occur when developer and fixer solutions combine with oxygen and loss strength, takes place when the processing solutions are exposed to air. A breakdown of the chemicals in the processing solutions results, shortening the length of time the solutions can be used to produce diagnostic radiographs.

Replenishment maintains adequate concentrations of chemicals, which ensures uniform results between solution changes.

**Radiolucent:** A R.L. structure is one that readily permits the passage of x –ray beam and allows more x –ray to reach the film →deposit of black metallic silver →dark.

**Radiopaque:** A R.O. structure is one that resists the passage of the x –ray beam and restrict or limits the amount of x – rays the reach the film →no deposition of metallic silver is seen, appear white.

### The darkroom

Whenever possible, oral radiography darkroom should be designed when the dental office is planned and should be convenient and easy to work with.

### Size and location

The size of the darkroom depends on the type and amount of films to be processed.

Generator the work load need larger darkroom, large films need large processing tank. So it takes more space in the darkroom.

Extra space must be provided if more then one person. 9 sq.ft (for 1 person is enough but it is advisable to have at least 20 sq.ft of floor space average dental office.

The darkroom should be located so that it can be conveniently reach from the room where films are to be exposed and examined.

Darkroom should be located where room temperature fluctuates as little as possible because the temperature of processing solution must be kept constant.

Humidity retards drying of the processed films damages unused films stored in opened films boxes so consideration to humidity should be given.

### **Construction and design of D.R.**

It should be an efficient and pleasant place to work. The light tight room can be made through the use of a maze which is doorless circuitous corridor allows people to enter and leave the darkroom without light encoring from outside, when a maze is used an auxiliary light tight door should be constructed for the large equipment carried or out through it. Double door also used with attention given to room ventilation. The floor and surfaces of the darkroom should be made so that it resist chemical. Paint of the walls should be light enough to reflect the safe light, while the paint of the maze must be dull black to assist the maze in trapping light.

Manufacturer's recommendations should be followed for example. 10 watt bulb light can be used with a Wratten 6B filter when the fixture is located 4 feet from the work area. This is about safe light, or ordinary light in side the room and red warning light in side the room be taken in consideration.

### **Processing equipment in the D.R.**

1. Conventional processing equipments:

processing tanks should be situated immediately adjacent to the right of the film strapping area. The developer tank should be separated from fixer lank by water bath for least contamination, wash basin located next to processing tanks for washing film and cleaning purpose.

Finally the dryer placed in the area that the films can be transported easily.

2. Automatic processing equipments "Dry film"
3. Semi automatic processing equipments " wet film"

### **Film storage**

1. Film must be stored away from excessive heat and humidity.
2. Chemicals must not be allowed to come in contact with storage film.
3. Objects should not be placed on top of storage film, because pressure can cause film artifacts.
4. The boxes of storage film should be lead lined or made of steel to prevent stray radiation from fogging in films.

### **Testing for safe light**

#### **"Penny Test"**

1. Pum of all the lights including he safe light, wait for 5 minutes to obtain a fair degree of dark, adaptation of the eyes, then look for any light leaks that should be obliterated.
2. A film exposed in a normal manner is taken for it's wrappen in a total darkness and placed on a workbench directly under the safe light. A small coin is placed on it, and the safe light is turn on. The film is left in is condition for a length of time equal to the maximum time that any unwrapped film of this type may be left in a darkroom before being processed.

The film then processed, if the image of the coin is seen, the darkroom is not light safe so the safe light must be rectified.