

Dental Radiology

Ø Radiation discovery and history:

X-ray was discovered by (Wilhelm Roentgen).

Radiology was first introduced to dental education by Dr. Raper.

1. Fundamental concepts:

- a. Atomic structure.
- b. Ionization & excitation.
- c. Ionizing radiation: particulate radiation – electro magnetic radiation.

2. Electro magnetic radiation:

X-rays and gamma rays.

X-rays can be produced with photon energy greater than 100 Mev.

3. Characteristics of x-ray:

- a. Penetrability:
Increase penetrability by increase frequency decrease wave length and increase photon energy
Penetrability decreases by increase atomic number, densities & thickness of object.
- b. Photographic effect.
- c. Fluorescent effect: useful in extra oral films.
- d. Initiates biological damage.

Ø X-ray machine components:

1. Machine components:

- a. X-ray head.
- b. Adjusting arm.
- c. Tube.
- d. Control panel.
- e. Accessories of the tube (filter-collimator-cone).

2. X-ray tube:

The heart of x-ray machine evacuated tube of glass with two electrodes cathode and anode.

- a. Cathode is a source of electrons.

- b. Anode is a source of x-ray beam.
- c. Heat dissipation.
- d. Transformers.
- e. Tube accessories:
 - Ø Filter: sheet of aluminum that improves the quality of the radiation by removing low photon energy.
Types of filtration: inherent filtration - added filtration.
 - Ø Collimator: it is made of lead and determines the size and shape of x-ray.
 - Ø Cone: it is a device used to direct x-ray beam.
 - Ø Position indicating device (PID).

Ø Image characteristics:

- 1. Visual:**
Density and contrast.
- 2. Geometric:**
Sharpness and resolution.
- 3. Exposure parameters affecting image characteristics:**
 - a. KVP used.
 - b. Milliamper.
 - c. Exposure time.
 - d. Collimation.
 - e. Filtration.
 - f. Distance.

Ø Dental x ray films:

- 1. Composition of the film:**
Base – emulsion – protective layer.
- 2. Types of films:**
Intra oral – extra oral – duplicating films.
- 3. Film packet:**
Outer wrapping - black paper - lead foil sheet – film.
- 4. Intra-oral film types:**
Periapical film - bitewing film - occlusal film.
- 5. Intra oral film size:**
Size 0 – 1 – 2 – 3 – 4.

6. Film speed is controlled by:

- a. Emulsion coating.
- b. Size of the silver halide crystals.
- c. Shape & thickness of the crystal.
- d. Addition of sensitizing dyes.

7. Extra-oral film type:

Screen film - none screen film.

8. Intensifying screen and cassette.

Ø X ray film Processing:

1. Radiographic developer:

Developing agent – preservative – activator – restrainer.

2. Radiographic fixer:

Fixing agent – preservative – hardening agent – acidifier.

3. Basic requirements of processing room:

- a. Site.
- b. Size.
- c. Light tightness
- d. Ventilation, temperature & humidity.
- e. Cleanliness.
- f. Essential equipments:
Safe light - normal incandensation light - processing tank –
timer – dryer - storage space – thermometer.

4. Chemistry of processing:

Developing – rinsing – fixation – washing – drying.

5. Methods of radiographic processing:

- a. Manual processing.
- b. Automatic processing.
- c. Polaroid land radiography.

Ø Radiation protection:

1. Traditional units for measurements of radiation:

- a. Radiation:
Unit of x-ray is roentgen which is measurement of ionization.
- b. Rad:
It is the unit of absorbed dose of radiation.
- c. Rem:
It is the unit of biological damaging effect of radiation B.D.E

2. Practical aspects of radiation protection in dental office:

- a. Protection for the patient:
 - Safe equipments:
Filtration – collimation – timer – cone - film speed - lead apron and thyroid collar.
 - Proper technique:
Avoid routine full mouth x-ray – source skin distance.
- b. Operator s protection from x-ray radiation:
Protection from primary and secondary radiation - radiation monitoring - protection from leakage of radiation.
- c. Protection of the environment:
Shields - area monitoring - primary beam - patient's position - radiation survey.

3. Dosimeters:

It is a device or instrument that measures the irradiation dose accumulated by individuals over any given period of time.

Ø Intra oral radiographic techniques:

1. Periapical radiographic techniques:

- a. Paralleling technique:
Patient position: up right position with head support.
Film placement: parallel to the tooth.
Cone adjustment: perpendicular to the long axis of the tooth and the film.
It gives accurate image with little magnification and maximum sharpness.
- b. Bisecting angle technique:
Patient position: up right position.
Film placement: in contact with the tooth.
Cone adjustment: vertical angulations – horizontal angulations – points of entry.

2. Bite wing radiography:

It shows the coronal two thirds of upper & lower teeth in one film.

3. Occlusal radiography.

Ø Extra oral radiographic techniques:

1. Lateral skull views:

Mandibular body projection – mandibular ramus projection – true lateral projection - lateral cephalometric - lateral tempromandibular joint view.

2. Antero posterior views:

Submentovertex view – frontal tempromandibular view.

3. Postero anterior views:

True postero anterior view – sinus view (Water s view) – reverse Towne s view.

Ø Other radiographic techniques:

1. Computed tomography:

It depends on imaging a section of the object & blurring the above & below sections.

2. Scintigraphy or nuclear medicine:

It is a radionuclide imaging.

3. Ultra sonography:

It measures the reflection & transmission of ultrasound.

4. Magnetic resonance image (MRI):

It is a non invasive method used to visualize soft tissue.

5. Panoramic radiography:

It is based on two principles scanography & tomography.

a. Advantages:

- Field size.
- Simplicity.
- Patient cooperation.
- Radiation dose.
- Education tool.
- Limited mouth opening patients.

b. Limitations:

- Image quality.
- Distortion.
- Focal trough limitations.
- Cost.
- Lack of clarity.

Ø Radiographic errors:

1. Technique errors:

- a. Patient preparation errors.
- b. Film placement errors.
- c. Projection errors.

2. Exposure & processing errors:

- a. Blank image.
- b. Light radiography.
- c. Dark radiography.
- d. Insufficient contrast.
- e. Film fog.
- f. Yellowish brown discoloration.
- g. Reticulation.
- h. Developer cut off.
- i. Fixer cut off.
- j. Dark spots or lines
- k. Light spots or lines.