

Patient Management Image Selection Radiation Biology, Dosimetry & Protection

Objectives: Following this course, the participants will have the information necessary to:

1. Identify the techniques used in handling special situations, including the following:
 - a. Gagging
 - b. Children
 - c. Edentulous patients
 - d. Trismus
 - e. Special needs patients
 - f. Patients with infectious diseases
 - g. Pregnant patients
2. Identify appropriate image selection for a patient
3. Identify the sensitivity of the various tissues to radiation
4. Define the units of radiation measurement (Roentgen, rad-Gray, rem-Sievert)
5. Identify the sources and dosage of background radiation
6. Compare the dosages received from different dental images
7. List the methods of keeping patient exposure to a minimum
8. List the methods of protecting dental personnel from excessive exposure

I. Patient Management

A. General Guidelines

1. Appear confident and professional
2. Explain what you are doing and why
3. Answer questions with authority
4. Don't volunteer unnecessary information
5. Expose the more anterior images first

6. Empathize
7. Work quickly but efficiently
8. Compliment patient on their cooperation

B. Special Situations

1. Gagging: The gag reflex may be reduced by:
 - a. Proper patient management (Technique, be positive)
 - b. Distractors (Raise leg, breathe through nose, etc.)
 - c. Salt on tip of tongue
 - d. Breathe rapidly through nose
 - e. "Flavoring" receptor
 - f. Topical anesthetic spray
2. Children: Keep exposures to a minimum (BW's plus ant. Occlusals or panorex with selected periapicals). Explain procedure and be firm, but not threatening. Compliment very helpful, especially next appointment.
3. Anatomical variations
 - a. Third molars: Pan (best), periapical with altered horizontal
 - b. Maxillary cuspid: Use diagonal technique when using bisecting; use cotton rolls to keep receptor from tipping with paralleling technique.
 - c. Tori: Place receptor on opposite side of maxillary torus (paralleling); place receptor between mandibular torus and tongue.
 - d. Space limitations
 - e. Ankyloglossia: Place paralleling instrument down on the tongue.
 - f. Trismus: (Prolonged spasm of jaw muscles): Use Pan (best), occlusal
4. Edentulous patients: Use Pan (best), #4 occlusal
5. Special needs patients (Mental, physical). Use receptor holder. Enlist help of relative or friend; protect with lead apron

6. Infectious Diseases. Use universal precautions
7. Pregnancy: No definite restrictions; use professional Judgement

II. Image Selection: The selection of images needed for a proper diagnosis is determined by:

- A. Dental History (Symptomatic teeth, most recent images, frequency of visits, patient attitude, etc.)
- B. Clinical exam (Condition of teeth, # of teeth present, etc.)
- C. Professional judgement (from education, experience, finances, etc)
- D. Selection Criteria (See ADA Guidelines at link below):

<http://www.ada.org>

<http://www.ada.org/sections/professionalResources/pdf>

1. **Historical findings** (Pain, trauma, endo, implants, family history, TMJ)

2. **Clinical signs/symptoms**

- a. Large caries/restorations
- b. Periodontal disease/mobility
- c. Evidence of trauma (fracture)/swelling/fistula
- d. Potential abutment teeth
- e. Unusual appearance/position of teeth
- f. Third molars
- g. Facial asymmetry/growth abnormalities

E. Frequency of images is based on:

1. Patient's oral hygiene
2. Caries activity
3. Dental history
4. Reliability of patient
5. ADA Guidelines:
Full-mouth series: 1-5 years. Depends on caries activity, perio problems, etc.

Bitewings: 6-months (youth with high caries rate) to 3 years (adult with good oral hygiene, minimum restorative needs).

Panoramic: 1-5 years. Depends on patient history.

III. Radiobiology: The response of living systems to ionizing radiation

A. **Ionization:** The process of removing an electron from an electrically neutral atom to produce an ion. An **ion** is an atom or subatomic particle with a positive or negative charge

1. **Ionizing Radiation**

a. **Electromagnetic** (x-rays, gamma rays, etc.).

b. **Particulate** (Alpha particles, electrons, etc.).

B. **Relationship between radiosensitivity and cell type**

1. **Radiosensitive**

a. Many mitoses

b. Undifferentiated

c. Examples include lymphocytes, germ cells, basal cells of skin and mucosa, erythroblasts

2. **Radioresistant**

a. Few mitoses

b. Well differentiated

c. Examples include nerve, muscle, bone

C. **Radiation Effects Dependent Upon:**

1. Total dose

2. Dose rate

3. Type and amount of tissue irradiated

4. Age

IV. Dosimetry

A. **Whole-body vs. Specific-area radiation**

B. **Units of Radiation measurement**

1. **Roentgen:** Measures radiation exposure (in air)

1 mR = .001 R

Coulomb per kilogram: SI unit for measuring exposure in air.

2. **rad: radiation absorbed dose**
Gray (GY): SI unit for absorbed dose; = 100 rads (1 rad = 0.01 Gy)
3. **rem: roentgen equivalent man**
Sievert (Sv) : SI unit for comparing types of ionizing radiation; = 100 rems (1 rem = 1 cSv = .01 Sv).
4. 1 R = 1 rad = 1 rem; Gray = 1 Sievert 1000 mrem = 1 rem

C. Annual Radiation Exposure

1. 360 mrem (3.6 mSv = 3,600 μ Sv) per year
2. Natural (Background) Radiation: Radon (accounts for over half), cosmic, terrestrial, internal (3000 μ Sv)
3. Artificial (Man-made) Radiation: Diagnostic x-rays, consumer products, etc.. (600 μ Sv); dental radiography accounts for about 0.1% of the total background

D. Exposure levels

1. **Effective Dose Equivalent (μ Sv)**
 - a. AFM (round, F) 60 μ Sv
 - b. Natural radiation 3000 μ Sv
2. Equivalent Background Exposure
 - a. AFM (round, F) 5 days background
 - b. Panoramic (rare earth) 10 hours background

E. MPD (Maximum Permissible Dose)

1. Occupationally exposed:
Adult: 50 mSv/yr. whole-body (NCRP)
2. General Population: 5 mSv/yr. whole body (NCRP)

V. Radiation Protection

A. ALARA (As Low As Reasonably Achievable)

B. Patient

1. **Risk vs. Benefit**
 - a. Professional Judgement
 - b. Selection criteria

2. **Filtration**
 3. **Collimation**
 4. **TRD (Target-Receptor- distance)**
 - a. Target = focal spot =target=source
 - b. Receptor = object=skin
 - c. Increase TRD, decrease exposure (assuming the end of PID remains in same position relative to skin surface).
 5. **Receptor or Film speed /screen speed**
 - a. Digital fastest speed followed by F-speed film = 60% less exposure than D-speed
 6. **Lead apron/thyroid collar** (psychology, protection)
 7. **Technique**
 8. **Processing**
- C. **Operator**
1. **Time:** Do not hold receptor for patient
 2. **Shielding:** Standard walls (drywall sufficient. Must be able to observe patient during exposure (Leaded window or mirror opposite doorway)
 3. **Position and Distance Rule:** Stand at least six feet from the primary beam at an angle of 90 – 135 degrees to the direction of the primary beam
 4. **Radiation monitoring badges:** NCRP requires badges for pregnant personnel