DENTAL RADIOLOGY

Identify basic facts and terms of radiology, to include fundamentals of chemistry relating to radiology, with 70% accuracy.
Radiation Physics
Radiation Health and Safety
Components of the Dental X-ray Unit
Control Devices
Image characteristics
Radiographic Film
Extra-oral radiography
Patient positioning guidelines
Exposure Techniques
Film Placement
Film Processing
Troubleshooting Radiographic errors
Mounting Radiographs
Disposition of Radiographs
6b. Utilizing the necessary equipment and materials, expose, process, and mount dental radiographs for a Type I examination.
6c. After viewing panoramic radiograph procedures demonstrated by an instructor, perform step-by-step procedures of a panoramic radiograph exposure, exercising radiation safety.
Radiation Physics

**Atomic Structure** - relates directly to generation, emission, and absorption of radiation

- **Nucleus** - (positive charge)
  - Protons - positive charge
  - Neutrons - no charge
- **Electron** - negative charge; orbit nucleus
**Ionizing Radiation** - electrons are removed from electrically stable atoms by collision with photons

- **Ion** - atom with positive / negative charge due to gain or loss of electrons

- Can be absorbed by body & cause permanent damage
Extent of affect measured by:

- Quantity (amount) of radiation exposure
- Quality (intensity) of radiation exposure
- Length (time) of exposure
- Type of tissue irradiated
Properties of Radiation

Travels at 186,000 miles/second (speed of light)

Short wavelength:

Hard x-rays .... Soft x-rays ....

Not perceptible by the senses

Affects photographic plate/film

Cause certain chemical crystals to give off light
Types of Radiation

**Primary** - Useful beam that comes directly from the center of the tubehead

**Secondary** - (Scatter) radiation emitted from objects through which the primary beam has passed
Radiation Health and Safety (ranked in order of sensitivity)

(1) In pregnancy - cells of the embryo
(2) Blood forming tissues (bone marrow) RBC & WBC’s
(3) Reproductive tissue
(4) Epithelial tissue
(5) Nerve tissue
Protection from Radiation

**Patient:** ALARA concept - As Low As Reasonably Achievable

- Endorses use of lowest possible exposure of the patient to x-radiation to produce a diagnostically acceptable radiograph

**Film speed** - faster film less exposure to radiation
Patient - con’t

**Intensifying screen** - reduces radiation required to to expose film 1/10 amount of full mouth x-rays

**Proper operator techniques** - reduces retakes
Lead apron - should cover: chest, throat & gonadal areas for optimum protection
Filtration -(2.5 mm aluminum) **absorbs** low energy ....

**Collimation (lead diaphragm)** - **limits** size of primary/useful beam

**Lead lined cylinder (cone)** - reduces scatter radiation

**X-ray analyzer/step wedge** - checks radiographic **process and processor daily**
Operator:

**ALARA Concept**

**Education / Proper operator techniques**

**Lead barriers (screen) - stand behind during exposure**

**Dosimeter/Film Badge - detects accumulative operator exposure**
Other personnel (exposure room)

- Walls, floor, and ceiling lined with lead, concrete, or steel

- Lead impregnated glass
Components of the Dental /X-ray tubehead

**Cathode**  ( - ) negative terminal) : 
- Tungsten filament- source of electrons
- Focusing cup - **directs** electrons

**Anode**  ( + ) positive terminal) : 
- Tungsten target - **stops** flow of electrons
- Copper head / stem - **dissipates** heat during radiation production
Control Devices

**Milliamperage** (mA) - controls amount or “quantity” of electrons

**Kilovoltage** (KVp) - controls “quality” of electrons

**Exposure time** - controls **length of time** x-rays are emitted
Characteristics of Developed Film

Density - degree of darkness (blackness)

Contrast - darkness & lightness on various areas of film

**Radiopaque** - dense structures that do not permit passage of x-radiation; more radiopaque ....

**Radiolucent** - less dense tissues that do permit passage of x-radiation; more radiolucent ....
Detail and definition

Ability of film to reproduce sharp outlines of objects radiographed, often referred to as the quality of the film.
Radiographic film

Types of intra-oral film (inside mouth)

**Bitewings**

**Horizontal** - records crowns, alveolar crest and interproximal areas (max and man) of posterior teeth; detects proximal caries on posterior teeth

**Vertical** - measures alveolar bone level in periodontal patients
Periapical

- Records crowns, roots, and supporting structures of **individual** teeth
- Detects abnormalities of **individual** teeth and supporting structures

Occlusal

- Records **large areas** of max/man
- Detects gross pathological conditions and/or fractures
Extra - oral radiography (Panoramic)

Records complete mandible and maxilla

Used for screening or evaluation of oral pathology / injuries
Patient positioning guidelines

Midsagittal plane

Plane that divides the body at the midline into left and right sides
Perpendicular to floor for ALL exposures

Occlusal plane

Curvature from incisal edges of central ....
Maxillary radiographs - ....
Mandibular radiographs - ....
Exposure techniques

Paralleling technique

- Central ray projected at right angle to film
- Film placed parallel to long axis of tooth

Extension Cone Paralleling instruments (XCP)

- Anterior/Posterior/Vertical bitewing
- Consists of biteblock, indicator rod, and locator ring
Bisecting Angle technique

Three (3) imaginary lines help position the tube head for radiographs
- Through long axis of tooth
- Through film packet
- Line dividing in half

Film placed against lingual surface

Cone directed at 90 degree angle to bisecting line
BISECTING ANGLE TECHNIQUE

X-RAY BEAM

LONG AXIS TOOTH

FILM
Film placement

Periapical, general

Anterior - long dimension vertical to floor
Posterior - long dimension horizontal to floor

Embossed dot - place toward incisal occlusal edge
Periapical, specific

Incisors - centered on midline behind central...
Cuspids - centered on cuspid
Bicuspid — centered on 2nd bicuspid
Molars - centered on 2nd molar
Horizontal bitewings

- Long dimension horizontal to floor
- Forward edge of film positioned to distal 1/3 of most anterior cuspid
- Use +8 degrees vertical angulation
Vertical bitewings - (4 periapicals)

- Long dimension vertical to floor

- Bicuspid view - center on 2nd bicupiid

- Molar View - center on contact between 1st & 2nd molar
Film processing

**Darkroom** - light proof room with a small 7 1/2 watt filtered light that does not affect x-ray film

**Processing solutions** - Developer, Fixer, Water
Automated processing - enclosed transport system; radiographs available for immediate use; Consistency of results through automated control of temperature and time

Portable manual developer (Quick-fix) - fully self contained developer / fixer with a light safe plastic lid and two light safe hand holes on front
Troubleshooting radiographic errors

Exposure errors

Foreign images - dentures, jewelry, glasses
**Blurred image** - movement of patient, film, & tubehead

**Double exposure** - exposing same film twice
Herringbone image - exposing film packet on wrong side
Cone cutting - failure of primary beam to expose entire film
Overlapping - improper horizontal angulation
Elongation - decreased vertical angulation
Foreshortening - increased vertical angulation
No image - operator / equipment malfunction

Thin / light image - underexposure

Dense or dark image - overexposure
Processing Errors

No image
- Film unexposed
- Fixing before developing

Thin or light image
- Cold, exhausted /diluted developer
- Insufficient developing time
Dense or dark image
- Hot or concentrated developer
- Excessive time in developer

Partial image
- Film not completely immersed in developer (manual)
- Overlapping films (automatic)
Spots, streaks, or stains
- Contaminated/dirty work area, ....
- Insufficient rinsing between dev./fix.

Fogged film
- Light leaks; improper safe light
- Contaminated solutions
- Outdated film
- Improper film storage
Static marks - static electricity (procedure / patient)
Mounting radiographs

Mount

Standard mount -

14 periapicals, 2 bitewings

Patient’s name, SSAN, and date radiographs taken recorded on each mount
Procedure

- Films Identified by anatomical landmarks then mounted
- Embossed dot (convex) - all exposures mounted and viewed from the facial aspect
Specific Film Identification

Maxillary molars - Three roots, Max sinus, Max tuberosity
Maxillary bicuspids - 1st bicuspид has two roots / maxillary sinus
Maxillary cuspids - longest root, maxillary sinus
Maxillary incisors - Maxillary sinus, Maxillary suture, nasal cavity
Mandibular molars - Angle of mandible, two roots, Mandibular canal
Mandibular bicuspид - Single root, Mental foramen visible near apex
Mandibular cuspsids - mental foramen near bicuspids
Mandibular incisors - small crowns /roots
Horizontal bitewings

- distal 1/3 of most anterior cuspid to third molars
Disposition of radiographs

Maintained in patient record

Remove when obsolete - determined by Dentist

Radiographs retained for silver recovery program
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