A Radiology Portfolio: Today’s Solutions for Successful Imaging

Course Description:

Advances in technology have made a significant impact on the field of dental radiography. For dental practices to make a smooth transition to new technology, an understanding of the basic principles of intraoral radiography and the modifications to these principles required by new technology is beneficial. This course provides the dental professional with techniques to utilize with their current technology, analog or digital, to produce quality, diagnostic images on the first exposure.

Course Objectives:

Upon completion of this course, the participant will be able to:

- Compare and contrast the differences between analog and digital technique with modifications.
- Recognize advantages and limitations of new radiographic technology, digital systems and new designs in aiming devices and holder.
- Review technology changes and the impact of radiation exposure

1. HISTORY

- 1895: Wilhelm Conrad Roentgen
- 1896: Otto Walkhoff
- 1896: C Edmund Kells
- 1901: William Rollins

2. BASICS and TERMINOLOGY

- Radiation: Form of energy carried by waves, streams, or particles
- X-Radiation: High energy radiation produced by the collision of a beam of electrons with a metal target in an x-ray tube
- X-Ray: Beam of energy that has the power to penetrate substances and record image shadows on a receptor(film/sensor)
- Radiograph: Photographic/electronic image produced by the passage of x-rays through an object
- Matter: Anything that occupies space and has mass
- Atom: The most fundamental unit of matter. It is composed of nucleus(center), protons(positive charge), neutrons (no charge) and electrons(negative charge with binding energy)
- Ion: Electrically unbalanced ion
- Ionization: Converting atoms to ions
♦ Ionizing Radiation: High power to overcome
♦ Ion Pair: Atom with an electrical charge
♦ Impulses: Length of time that radiation is produced and controls exposure time
♦ Density: Overall darkness of a radiograph affects diagnostic quality
♦ Contrast: Difference in degrees of blackness between adjacent areas
  ➢ High/contrast/low kVp: black and white=caries disease detection
  ➢ Low contrast/high kVp: many shades of grey=periodontal disease detection

3. SOURCES of RADIATION
♦ Radioactive decay and radon gas from soil
♦ Airline travel

4. EQUIPMENT
♦ X-Ray tube
♦ Extension arm
♦ PID
♦ Angulation scale
♦ Activating button
♦ Sensor

5. TYPES of RADIATION
♦ Primary radiation
♦ Secondary radiation
♦ Scatter radiation

6. TYPES of MEDIA
Analog-film

- F speed
- 97.9% active area

Indirect Digital: Phosphor plate (PSP)

- Cannot be sterilized
- Less expensive
- No technique modifications
- Requires 1 plate per exposure
- Scanner needed
- Size 0, 1, 2, 3, 4
- Wireless

Direct Digital: Sensors

- CCD-Charged coupled device
  - Most common
  - Oldest method - 1960's
  - Silicon chip with electronic circuit
  - Specialized fabrication - costly
  - Stored on computer
  - X-ray radiation activates electrons

- CMOS/APS - Complementary metal oxide semiconductor/Active pixel sensor
  - Silicon based - differs from CCD
  - Claims 25% better resolution
  - Lower production cost of chip than CCD
  - More durable than CCD

Sensors in general

- Active vs inactive area
- Easy to transfer information
- Enhances diagnostic image
- Expensive to start
- Improves workflow
- Infection control difficult
- Instant image
- Lack of industry standardization
- Less expensive long-term
- No chemical processing
- Patient education tool
- Reduces exposure 60-90%
- Rigid and thick
- Sensor size difficult to position
- Size 0, 1, 1.5, 2
- Wired or wireless

Not drawn to scale
7. SAFETY

- **Patient**
  - Medical, dental social histories
  - **Filtration**
    - Filters out non-penetrating (long) wavelengths
    - Sheets of 0.5mm thick aluminum
    - Machines operating at or below 70 kVp requires 1.5mm aluminum
  - Machines operating above 70 kVp requires 2.5 mm aluminum
  - **Collimation/PID shape**
    - Restricts the size of the x-ray beam
    - 2.75” maximum diameter
    - Round or rectangular to match shape of PID
    - Up to 60% reduction with rectangular PID
  - **Protective apron with thyroid collar**
    - Minimizes scatter radiation
    - Check YOUR STATE requirements
    - NCRP requires collars for all children
    - ADA recommends collars for all patients
    - Thyroid collars reduce exposure levels by over 30%
    - No thyroid collar with panoramic images
  - **Receptor**
    - Sensor
    - Film
    - PSP
  - **Appropriate exposure factors**
    - If applicable: adjust kVp and mAs
    - Appropriate exposure time
  - **Aiming devices**
    - Parallel technique is preferred
    - Dimensional accuracy of images is reproduced
  - **Exposure technique**
  - **Film handling and processing**
  - **Operator**
    - Dosimeters to monitor exposure
Stand 6 feet away from source
Stand 90-135 degrees to the direct beam

Equipment
- State inspection with registered service company
- Machines maintained per manufacturer’s specifications
- Keep copies of service tickets and records

8. GUIDING AGENCIES, ORGANIZATIONS and BEST PRACTICES
- NCRP: National Council on Radiation Protection; Report 145
  - Justification
  - Optimization
  - Dose Limitation
  - These 3 principles are applied to evaluation of occupational and public exposure
- ADA: American Dental Association
- ALARA: As Low As Reasonably Achievable
- Best practices

9. INFECTION CONTROL
- Autoclavable
- Barrier protectors
- Disposable
- PPE’s
- Universal Precautions
10. MODIFICATION and EXPOSURE TECHNIQUES WITH TIPS and TRICKS

- **Technique**
  - Parallel
  - Bisecting

- **Modifications, Tips and Tricks**
  - Touch what you want to take
  - Sensor parallel with tongue
  - Touch tooth area with bite block
  - Tell the patient to close SLOWLY
  - Roll into position and place cotton roll

- **Kick the door open**
  - Opened in anterior, closed in posterior

- **Center receptor in center of mouth**
  - More comfortable

- **Cotton rolls**
  - Patient doesn’t have to close as far
  - Patient is more comfortable
  - Stabilizes
  - When apices are cut off
    - Place cotton roll below bite block
  - When occlusal or incisal edges are cut off
    - Place cotton roll on top of the bite block

- **Horizontal alignment**
  - Determine how the interproximal is aligned
  - Use Q-tip or probe
  - When using aiming devices, place slot over interproximal
11. SPECIAL CONSIDERATIONS

<table>
<thead>
<tr>
<th>Condition</th>
<th>Special Consideration</th>
</tr>
</thead>
</table>
| Gagging         | Be organized and act quickly  
Move receptor more toward the midline  
Don’t touch anything during placement!  
Use distraction techniques            |
| Shallow Palates | Move receptor more toward the midline  
Allow sensor to find its place in mouth; adjust angulation  
Use bisecting angle technique         |
| Presence of Tori| Ensure maxillary tori are between the teeth and receptor  
Place receptor behind mandibular tori |
| Narrow Arches   | Place receptor as far lingual as possible  
Use size 1 receptors in anterior  
Allow sensor to find its place in mouth; adjust angulation |

12. LOCALIZATION

- SLOB rule
  - Localizes structures
  - Method: 2 images exposed at different angles
- Right-angle technique
  - Localizes structures
  - Primary mandible
  - Method: 2 images, one periapical and one occlusal

13. WEAR and TEAR

- Sensors
  - Caution patient not to bite on cord
  - Do not pull on cord to remove barrier
  - Gently walk barrier on by pinching ends of bag
  - Handle with care
- PSP
  - Do not bend edges/ends
Easily scratched; limits lifespan
Exercise caution with use

14. PROTECT YOUR INVESTMENT

• Sensor
  ➢ Booties
  ➢ Hook
  ➢ Soap box
• Protective apron
  ➢ Clean with soap and water
  ➢ Fluoroscopic examination yearly
  ➢ Monthly inspection
  ➢ Use disinfecting wipes
• Manikin
  ➢ Protect teeth when storing
  ➢ Utilize foam cushions and place in a “home”

15. PANORAMIC RADIOGRAPHY

• Basic concepts
  ➢ Extraoral radiograph
  ➢ Rotational
  ➢ Provides an overall view of maxilla and mandible
  ➢ Frankfort plane
    ✤ Top of ear canal to bottom of eye socket
    ✤ Parallel to the floor
  ➢ Midsagittal
    ✤ Divides patient’s face into right and left sides
    ✤ Perpendicular to the floor
16. COMMON PANORAMIC ERRORS

17. CONE BEAM IMAGING
- 3D imaging
- Multiplanar views
- Reduced exposure vs CT scan

18. REFUSAL of RADIOGRAPHS
- Requires dentist to refuse treatment when a patient refuses x-rays
  - Previous radiographs can be used
    - Must be recent and acceptable quality
- No document will release a dentist of liability
  - Legally cannot consent to negligent care
- Patient education
  - Should be educated on radiographs
- Disclosure process must be conducted by a competent dental professional

Bibliography for Radiology Portfolio Series

Burns Archive of Radiology

Burns Collection of Radiographic Photography

Council on Dental Benefit Programs-ALARA

Council on Dental Practice-ALARA

Council of Scientific Affairs-ALARA


https://www.youtube.com/watch?feature=player_detailpage&v=xh4OB0rn0cw

https://www.youtube.com/watch?v=ShYYtZa5vqY&feature=player_detailpage

https://www.youtube.com/watch?feature=player_detailpage&v=rEQHDcgtqY

Jaynes R, Oral Radiology Group, The Ohio State University College of Dentistry http://www.dent.ohio-state.edu/courses/ds45/


Dentsply Sirona, Inc. is an ADA/CERP recognized provider. ADA CERP is a service of the American Dental Association to assist dental professionals in identifying quality providers of continuing dental education. ADA CERP does not approve or endorse individual courses or instructors, nor does it imply acceptance of credit hours by boards of dentistry.

CLE04-0815-3-Rev. 2