Aiming for Success:
Radiographic Techniques from Analog to Digital
For a complete set of course materials, please attend an upcoming *Aiming for Success Intra-Oral Radiography* Course.
COURSE OBJECTIVES

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

• Identify characteristics of a diagnostic image, exposure factors, and image quality
• Recognize advantages and limitations of new radiographic technology, digital systems and new designs in aiming devices and holder
• Utilize the paralleling technique and bisecting angle technique when warranted
• Identify common exposure technique errors
  ~ implement methods to correct such errors
• Implement methods to minimize radiation exposure for patients and the operator
Success

Producing diagnostic image with first exposure
Ideal Radiograph

• Image same size as object

• Image same shape as object

• Image has good detail

• Image has good density & contrast
Diagnostic Image

Influenced by:
• Exposure factors
• Exposure technique
• Processing technique
Radiation Basics
Radiation Production

Burns Collection of Radiographic Photography
Burns Archive of Radiology
Ideal Radiograph

- Image same size as object
- Image same shape as object
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Density

The overall darkness of a radiograph
DENSITY influenced by:

- Exposure factors
  - kVp
  - mA
  - time

- Patient size
- Object density
- Film fog
Electromagnetic Spectrum
Contrast

Difference in degrees of blackness between adjacent areas
High Contrast
low KVp

- Short scale
- Black - white
  - Few gray shades

Low Contrast
high KVp

- Long scale
- Many shades of gray
  - No black – white
Equipment

Antique Dental X-Ray Unit
Digital Imaging

Advantages:
- Reduces exposure 60-90%
- Increased speed of imaging
- Improved workflow
- Enhanced diagnostic image
- Patient education tool
- No chemical processing
- No processing errors
- Easy information transfer
Direct Imaging Sensors

- Size 0, 1, (1.5), 2
- Cannot be sterilized
  - Infection control sheath
- Loss of some imaging around circumference
  - Affects placement
Indirect Imaging Plates

- Storage Phosphor Plates (PSP)
  - Wireless
  - Less expensive
  - Flexible; similar to film
  - No technique modifications
  - Scanner required to digitize image
  - Maintenance concerns
Holder vs. Aiming Device

- Holder

- Aiming Device
  - Biteblock
  - Indicating Arm
  - Aiming Ring
Radiographic Examinations

- Periapical
  PA
- Bitewing
  BWX
  - Horizontal
  - Vertical
- Full Mouth Series
  FMS or FMX
- Occlusal
- Panoramic
  PANX
Radiation Safety
Patient, Operator and Equipment
Dental Radiation Safety

Operator Safety

Equipment Safety

Patient Safety
Patient Safety
THE SELECTION CRITERIA OF PATIENTS FOR DENTAL RADIOGRAPHIC EXAMINATIONS

“Other Circumstances,” which describes the use of radiographs in assessing patients for implants, monitoring demineralization of enamel, evaluation of restorative and endodontic pathology – orthodontic diagnosis

Expanded use of panoramic examination, recognizing that panoramic technology has improved over the last 15 years

Use of both vertical and horizontal BW’s
Factors for Radiation Injury

• Total dose absorbed
• Dose rate
  – Rapid delivery does not allow time for repair
• Amount of tissue irradiated
  – The larger the area exposed, increased likelihood of adverse effects
• Cell sensitivity
• Age
  – Children more susceptible than adults
Cell Sensitivity

• Critical Organs
  – If damaged, will diminish quality of a person’s life
  – Skin
  • Thyroid gland
  • Lens of eye
  • Bone marrow
Factors for Radiation Injury

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ALARA Concept

All exposure to radiation must be kept to a minimum, or

“As Low As Reasonably Achievable”
Radiation Safety: Patient

- Medical/Dental Hx
- Filtration
- Collimation / PID shape
- Protective apron with thyroid collar
- F-speed film / Digital sensor

- Appropriate exposure factors
- Aiming devices
- Exposure technique
- Film handling & processing technique
Operator Safety
Early Radiation

Patient Undergoing Radiation Treatment, 1915
Note that both the doctor and nurse are not protected from radiation, although the patient wears a protective mask.

Burns Archive
Dental Safety

Safety and Health Training
(cont’d)

Recommended Actions:
- Ensure that supervisors carry out their safety and health responsibilities, including:
  - Analyzing the work under their supervision to identify unrecognized potential hazards
  - Maintaining physical protections in work areas
  - Reinforcing employee training through continual performance feedback and, if needed, enforcement of safe work practices
How Do We Compare to Medical X-Rays?

- DENTAL X-RAY: 5 microsieverts (μSv)
- CHEST X-RAY: 100 microsieverts (μSv)
- MAMMOGRAM: 400 microsieverts (μSv)
- AVERAGE YEARLY ENVIRONMENTAL EXPOSURE: 3,000 microsieverts (μSv)
- VIRTUAL (CT) COLONOGRAPHY: 10,000 microsieverts (μSv)
- CT SCAN OF THE ABDOMEN AND PELVIS: 15,000 microsieverts (μSv)
The Transportation Safety Administration (TSA) claims the potential for dangerous radiation exposure from the backscatter machine is low.

The agency says each scan emits less than 1/1,000 of the radiation given off in a standard chest X-ray, or the equivalent of two minutes of high-altitude flight.
Infection Control
Infection Control

Exposure Asepsis

– Operator Attire
  • Gown, mask, goggles, gloves

– Exposure Technique

• Processing Asepsis
Exposure Techniques
Technique Modifications

- Rigidity & thickness of sensor
- Reduced exposure area
Two Techniques in Dentistry – Parallel and Bisecting
Both are necessary for digital exposures
Bisecting Angle Technique

- primary beam is directed perpendicular to an imaginary line that bisects the angle between image receptor and tooth
- image receptor is placed as close to tooth as possible
Digital Sensor Holder

Snap-A-Ray DS Standard Version
with full bite area

550321 (1-Pack)
550323 (3-Pack)

Snap-A-Ray DS Endo Version

550421 (1-Pack)  550423 (3-Pack)
Aiming Device

Optional universal ring/arm kit allows for accurate alignment of CR
Technique Errors

Vertical Angulation
• Elongation
• Foreshortening

Horizontal Angulation
• Overlap
Paralleling Technique

- Image receptor is placed parallel to and at a distance from the teeth being examined.
- Primary beam is directed perpendicular to the tooth and image receptor.
Aiming Devices

XCP Instruments

(extension cone paralleling)
Universal Sensor Biteblock

- Adjusts to all sensor brands
- Fits size 1 & 2 sensors
Periapical & Bitewing Exposures
Anterior PA XCP
Digital Challenge
Narrow Palate
What about Tori
Maxillary or Mandibular?
Posterior PA XCP
Digital Solution: Shallow Palate
Technique Modifications

- Rigidity & thickness of sensor
- Reduced exposure area
Types of BWX

• Vertical BWX

• Horizontal BWX
Bitewing XCP
Technique Modifications

- Rigidity & thickness of sensor
- Reduced exposure area
Digital Challenge: Uneven Exposure
Bitewing Tab Technique

• Occlusal plane parallel to the floor
• Vertical Angulation +5 - +10 degrees for PID
• Direct primary beam through contact areas and center of the film
Cone Beam Imaging

- 3D imaging
- Multiplanar views
- Applications
  - Orthodontics
  - Implants
  - Impactions
  - IA nerve location
- Reduced exposure vs. CT scan
Legal Responsibility

- The supervising dentist legally holds total and final responsibility for all dental radiologic procedures

- Check your state practice act and laws for regulations regarding certification and supervision
Summary

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XCP / XCP-DS Instruments

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