**NCRP SC 4-5**  
*Radiation Protection in Dentistry: Cone Beam CT, Digital Imaging, and Hand-Held X-Ray Units*

Joel Gray, Ph.D.  
NCRP Staff Consultant

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- Joel E. Gray, NCRP Staff Consultant

### Supplement vs Report

Original concept—Supplement  
However—  
NCRP 145 published in 2003  
Some changes in all areas  
Updates needed  
Some areas continue to be problems, e.g., high speed film and photographic processing  
Recommendation: new report: revision with three new sections

### Target Audience

- Primary care dentists  
- Dental and maxillofacial radiologists  
- Head and neck radiologists  
- ENT physicians  
- Medical physicists  
- Radiographers and imaging technologists  
- Dental assistants and hygienists  
- Dental radiologic technicians  
- Equipment manufacturers and suppliers  
- State regulators  
- Relevant federal agency representatives
Primary Topics

- CBCT, digital radiography, and hand-held x-ray units in wide use
- No formal guidelines on safe and effective use in US
- Every dental practitioner acts as an independent radiologist
- CBCT installed as “plug and play” devices
- Perceived not as CT but exotic panoramic units
- Many states classify same as intraoral units

Topics

- CBCT including patient selection criteria
- Digital radiography
- Hand-held x-ray units
- Use of high-speed film
- Under-processing of intraoral dental film
- New data from NEXT surveys
- Synopsis of current standards
- Organizations and their roles, e.g., Image Gently

CBCT, Digital Radiography, and Hand-Held X-Ray Units

- Executive summary
- General information
- Equipment and facilities, protection of patients and staff, measurements and dose
- Administrative and regulatory considerations
- Education and training
- Summary and conclusions
- References
- Glossary
- Appendices
Timing

18 to 24 months (Summer, 2015)
Influenced by availability of NEXT data

Cone Beam CT Effective Dose

<table>
<thead>
<tr>
<th>Modality</th>
<th>Effective Dose (µSv)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intraoral</td>
<td>1.5</td>
</tr>
<tr>
<td>Panoramic</td>
<td>24</td>
</tr>
<tr>
<td>CBCT</td>
<td>48 – 1,073</td>
</tr>
<tr>
<td>CT Scan (dental program)</td>
<td>534 – 2,100</td>
</tr>
</tbody>
</table>

Concerns About CBCT

- Need referral criteria—being used inappropriately
- CBCT units in wide use— 5,000 today; 15,000 projected in five years (only dental)
- Others— ENT, extremity, ???
- No formal guidelines on safe and effective use in US
- Every dental practitioner acts as an independent radiologist
- CBCT installed as “plug and play” devices
- Perceived not as CT but exotic panoramic units
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**Computed Radiography**

Photostimulable phosphor plate
Use similar to film
Plate placed in laser scanner to obtain digital image

One unit can support several rooms

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**Digital (or Direct) Radiography**

Charge-coupled device (CCD) or complimentary metal oxide semiconductors (CMOS)
Digital data directly through USB cable to computer
Relatively costly, one or two rooms

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**Adoption of Digital Radiography**

Digital radiography is *NOT* replacing *film* radiography as rapidly as in medical imaging
25% to 45% of dental facilities using digital intraoral imaging (depending on state)
5% to 35% of those using digital use CR (depending on state)

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**Hand-Held X-Ray Units**

Minimal concerns with appropriate design and use
15,000 in use today in US
Original concern—Holding x-ray tube
Not all hand-holds are created equal!
No formal guidelines on safe and effective use in US
**All Hand-Helds Not Created Equal**

- D-speed film: 2 mGy
- F-speed film: 1 mGy
- Computed radiography (PSP) plates: 1 to 1.25 mGy
- Direct radiography (CDC or CMOS): 0.5 to 1.0 mGy

**Dental Intraoral Skin Doses**

- D-speed film: 2 mGy
- F-speed film: 1 mGy
- Computed radiography (PSP) plates: 1 to 1.25 mGy
- Direct radiography (CDC or CMOS): 0.5 to 1.0 mGy

**Patient Radiation Exposure (mR)**

- **D-Speed Film**
  - Acceptable Exposure < 260 mR
  - 45% Fail Acceptable Exposure

- **E-F-Speed Film**
  - Acceptable Exposure < 185 mR
  - 56% Fail Acceptable Exposure
Entrance Exposure
D- vs F-Speed Film

D-Speed Film, Ave = 278 mR
F-Speed Film, Ave = 217 mR

Film Contrast

Acceptable Criteria ≥ 1.35
29% Fail Criteria

Film Contrast (Optical Density Difference)

Entrance Exposure
F-Speed Film vs Digital

F-Speed Film, Ave = 217 mR
Digital, Ave = 139 mR

Funding

American Academy of Oral and Maxillofacial Radiology (AAOMR)
American Board of Radiology Foundation (ABRF)
American Dental Education Association (ADEA)
US Food and Drug Administration
Solicitations for support being sought from other dental specialty groups and health care organizations