

## ***Information Statement***

# **Radiation Safety**

*This Information Statement was developed as an educational tool based on the opinion of the authors. It is not a product of a systematic review. Readers are encouraged to consider the information presented and reach their own conclusions.*

### **Radiation Safety Overview:**

***The AAOS is committed to the safety of all patients and healthcare staff.***

Patient safety is a top priority and a principle component of all areas in orthopaedic care. To improve quality of care and outcomes surgeons rely on various imaging modalities to identify, diagnose, and treat many orthopaedic conditions. In addition, many newer, less invasive surgical techniques rely on simultaneous use of advanced imaging methods. And, with increased use of imaging comes an increased risk of radiation exposure to patients, orthopaedic surgeons and associated staff. For the safety of patients, surgeons and support staff, the AAOS **strongly** supports efforts to minimize the risks of using ionizing radiation (X-Rays) in all orthopaedic surgery settings.

### **The AAOS supports risk reduction recommendations in three areas:**

1. **Education** – Everyone using imaging should be trained in the safest techniques to reduce patient and staff exposure.
2. **Protective Equipment** -Proper use of protective shielding for patients and staff. This includes dose measuring methods (dosimeter badges) to confirm those with frequent use are not exposed to unsafe cumulative doses of radiation.
3. **Maintenance** – Imaging equipment and shielding devices should be maintained properly.

### **Education**

1. Education materials should be made available to all staff using ionizing radiation for any procedure.
2. Only those with appropriate radiation safety training and appropriate licenses (i.e. MD, RT) should operate the fluoroscopy equipment.
3. It is the consensus of the AAOS and its membership that a testing of radiation knowledge should be once every two years with renewal of privileges, and the materials can be made available digitally or in print with appropriate testing of key radiation safety points. The testing and materials should be equivalent to no more than 1-2 CME credits.

4. The information should include but not limited to:

- Annual safe limits of radiation exposure
- The Inverse square rule for exposure (half the distance equals four times the exposure)
- Beam positioning to reduce scatter
- Relative sensitivity of different body parts (hands/ feet least thyroid most)
- Safety limits during pregnancy
- Ideal location for safety radiation tags (dosimeters) and rules for use
- Patient shielding and positioning
- Scatter risk
- Effect of magnification
- Techniques for reducing time of use (single shot verses live fluoroscopy) – shortening burst, reduction in cine frame rates
- Use of table skirts
- Risk of patient skin radiation burns
- Techniques for keeping voltages low
- Keep x-ray beam source furthest from patient to reduce exposure to patient and scatter
- Limit Mini C-arm use with the same rules as all ionizing radiation equipment, Mini C arm is not meant for thick structures

### **Protective Equipment**

1. All staff should be shielded and/or appropriately gowned.
2. Facilities should maintain gowns, stand up solid shields, patient shields, thyroid protection shields, leaded gloves and leaded glasses for daily use.
3. Sterile gloves with some radiation protection for cases when the surgeons have extensive hand exposure.
4. All new protective gear should be tested for defects prior to being used.
5. Radiation badges should be worn outside the lead gowns.
6. Gowns and shields should be inspected for cracks, creases, and thinning before each use.
7. Shields should be placed on patients to reduce exposure to the reproductive organs when possible.

### **The Proper Maintenance of Imaging Equipment**

1. Fluoroscopy and all X-ray or ionizing radiation producing equipment should be calibrated annually.
2. Lead gowns and shields should be tested for cracks and defects annually.
3. Connections, cables and support imaging equipment (i.e. image storage, printers or digital recording media) should be tested before each case begins to avoid the need for secondary radiation due to the need for repeat imaging for hard copies and documentation purposes.
4. Local safety, Joint Commission, or Association of Surgical Technologists (AST) standards should be used when they apply. Ambulatory Surgical Centers (ASCs) owned by surgeons should be particularly sensitive to the need for patient, staff and surgeon safety in this regard.

5. Use of a buzzer or warning system (exposure timer) to advise the operator of excessive use.
6. Naming a radiation safety officer for each facility and keeping a safety log of all testing and maintenance records.

### **Additional information from Association of Surgical Technologists Standards of Practice for Ionizing Radiation Exposure in the Perioperative Setting**

“Health care facilities should establish criteria for rejecting devices, provided the following guidelines for removing a device from service: defect is greater than 15 square mm, unless the defect is not located over a critical organ; defect is 670 square mm along a seam, overlapped area, or back of the device; thyroid lead shields with defect greater than 11 square mm.” (From published AST standards reference - Lambert K, McKeon T: Inspection of lead aprons: Criteria for rejection. *Health Phys.* 80(5 Supplement), 2001;S67-69.)

#### **Primary Resources:**

AST (Association of Surgical Technologists): Standards of Practice for Ionizing Radiation Exposure in the Perioperative Setting. October 8, 2010 <http://www.ast.org>

Yale New Haven Hospital radiation safety course 2014. <http://slideplayer.com/slide/3558994/>

#### **Other Resources:**

American College of Radiology: ACR–AAPM Technical Standard for Diagnostic Medical Physics Performance Monitoring of Fluoroscopic Equipment, new 2016.  
[http://www.acr.org/~media/ACR/Documents/PGTS/guidelines/Fluoroscopic\\_Equipment.pdf](http://www.acr.org/~media/ACR/Documents/PGTS/guidelines/Fluoroscopic_Equipment.pdf)

American College of Radiology: ACR Practice Parameter for Imaging Pregnant Women or Potentially Pregnant Adolescents and Women with Ionizing Radiation, 2008, amended 2014.  
<http://www.acr.org/~media/9E2ED55531FC4B4FA53EF3B6D3B25DF8.pdf>

Centers for Disease Control and Prevention: Radiation and Health  
<https://www.cdc.gov/nceh/radiation/ionizing.htm>

Dyson, ED: Shoe-fitting X-ray Fluoroscopes. *Br Med J*, 1956 Aug 4;2(4987):269-272  
<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2034993/?page=1>

Lambert K, McKeon T: Inspection of lead aprons: Criteria for rejection. *Health Phys* 80(5 Supplement), 2001;S67-69.  
[https://www.ncbi.nlm.nih.gov/pubmed/?term=Health+Phys.+80\(5+Supplement\)%2C+2001%3BS67-69](https://www.ncbi.nlm.nih.gov/pubmed/?term=Health+Phys.+80(5+Supplement)%2C+2001%3BS67-69)

Mehlman CT, DiPasquale TG: Radiation exposure to the orthopaedic surgical team during fluoroscopy: How far is far enough? *J Orthop Trauma*, 1997;11(6): 392-398.  
[https://www.ncbi.nlm.nih.gov/pubmed/?term=J+Orthop+Trauma.+1997%3B11\(6\)%3A+392-398](https://www.ncbi.nlm.nih.gov/pubmed/?term=J+Orthop+Trauma.+1997%3B11(6)%3A+392-398)

Michel R, Zorn MJ: Implementation of an x-ray radiation protective equipment inspection program. *Health Phys*, 2002;82(2 Supplement),S51-53.

[https://www.ncbi.nlm.nih.gov/pubmed/?term=Health+Phys.+2002%3B82\(2+Supplement\)%2CS51-53](https://www.ncbi.nlm.nih.gov/pubmed/?term=Health+Phys.+2002%3B82(2+Supplement)%2CS51-53)

Norris TG: Radiation safety in fluoroscopy. *Radiol Technol*, 2002;73(6):511-533.

[https://www.ncbi.nlm.nih.gov/pubmed/?term=Radiol+Technol.2002%3B73\(6\)%3A511-533](https://www.ncbi.nlm.nih.gov/pubmed/?term=Radiol+Technol.2002%3B73(6)%3A511-533)

Vano E, Gonzalez L, Fernandez JM, Haskal ZJ: Eye lens exposure to radiation in interventional suites: Caution is warranted. *Radiology*, 2008;248(3): 945-953.

[https://www.ncbi.nlm.nih.gov/pubmed/?term=radiology+2008%3B248\(3\)%3A+945-953](https://www.ncbi.nlm.nih.gov/pubmed/?term=radiology+2008%3B248(3)%3A+945-953)

©March 2017 American Academy of Orthopaedic Surgeons®.

This material may not be modified without the express written permission of the American Academy of Orthopaedic Surgeons.

Information Statement 1050

For additional information, contact the Public Relations Department at 847-384-4036.