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Eye protection for interventionalists

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Background

- The eye lens in one of the most radiosensitive organs.
- ICRP has alerted that there may not be a threshold dose for eye lens opacities [1].
- European regulation has reduced the dose limit for the eye lens of workers from 150 mSv / year to 100 mSv / 5 years (i.e. 20 mSv/ year) [2].
- Interventionalists are among professionals with the highest risk.

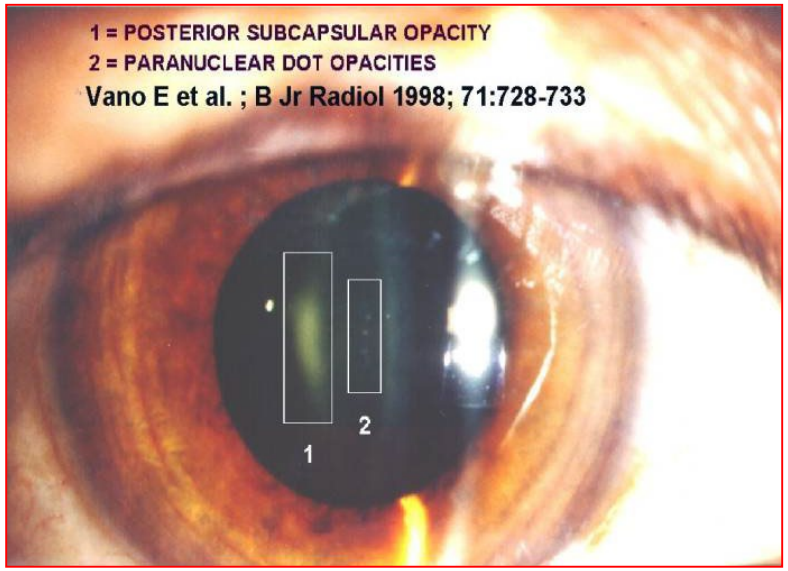
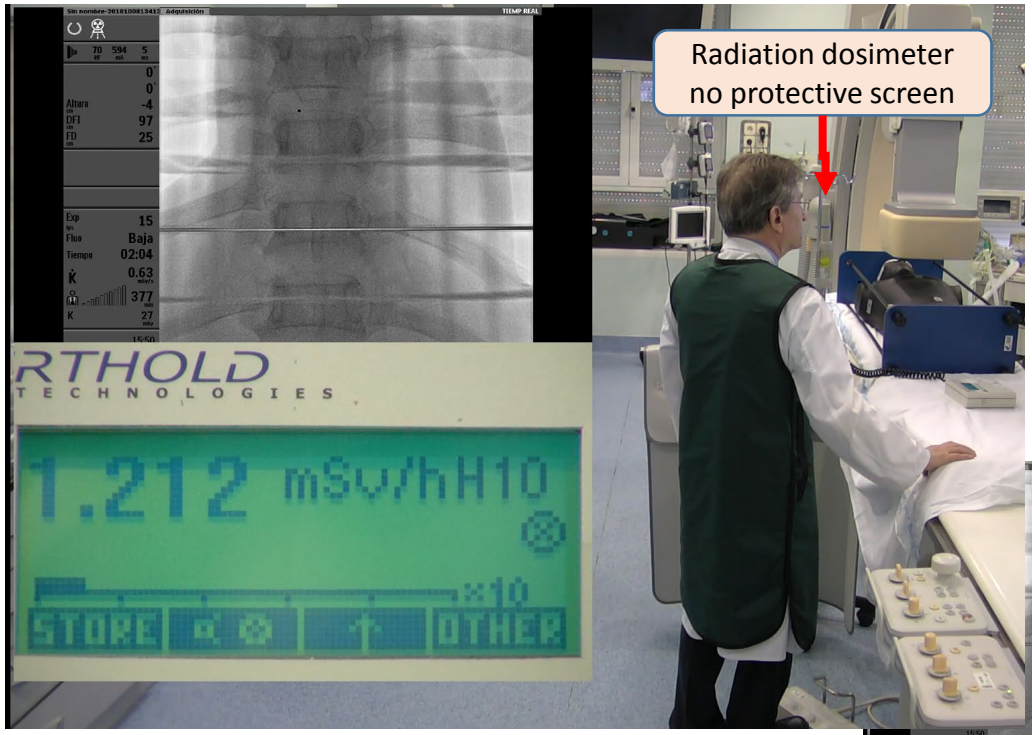


Image courtesy of E. Vano.

Efficacy of protection tools: Protection screens

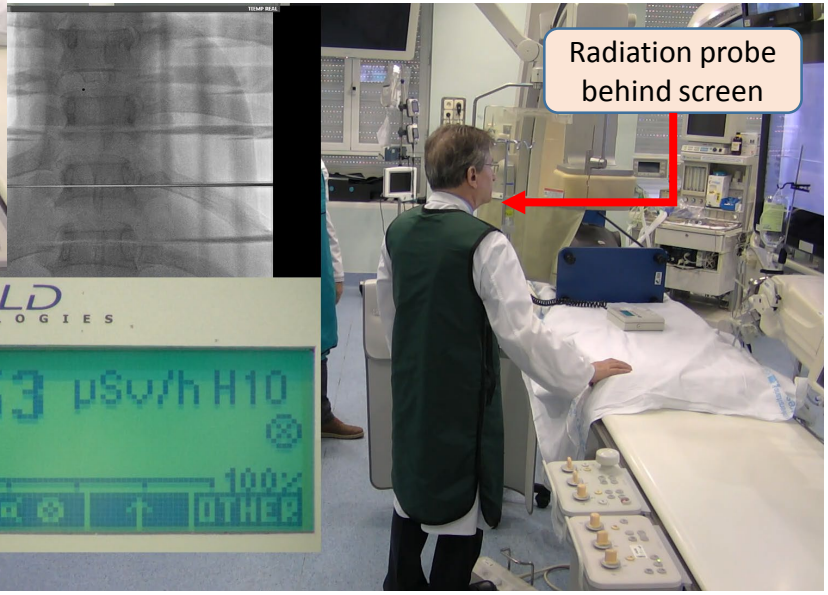
- Ceiling suspended screens are the most effective dose reduction tool for the eye lens.
- Usually 0.5 mm Pb equivalent. Absorbs 95-97% of radiation.
- CIRSE and SIR recommend: Ceiling-suspended shields can provide significant additional dose reduction, especially to unprotected areas of your head and neck. Leaded eyewear is recommended if ceiling-suspended shields cannot be used continuously during the entire procedure [3].
- Dose reduction factors (factor dividing dose) reported from different authors ranged from 3 to 33 [5] (depending on its position relative to the operator).
- It is essential to position the screen appropriately to get effective protection.

Efficacy of protection tools: Protection screens



1. The operator has a radiation dosimeter close to his face to measure scatter radiation. Without protective screen the operator's dose rate was 1,2mSv/h.

Images courtesy of R. Sánchez.



2. When the suspended screen was correctly positioned (close to the patient & in front of the operator), the radiation reading fell to 46 µSv/h **Reduction factor of 26 (96% attenuation)!!!**

Efficacy of protection tools: Protection screens

- Under some circumstances, other types of mobile screens might be used:

An anaesthesiologist stands close to the patient during a TAVI. Interventional cardiologists are at the patient's right side and used a ceiling suspended screen, while the anaesthesiologist is at the opposite side and uses a **mobile protection screen**.

Image courtesy of R. Sánchez.

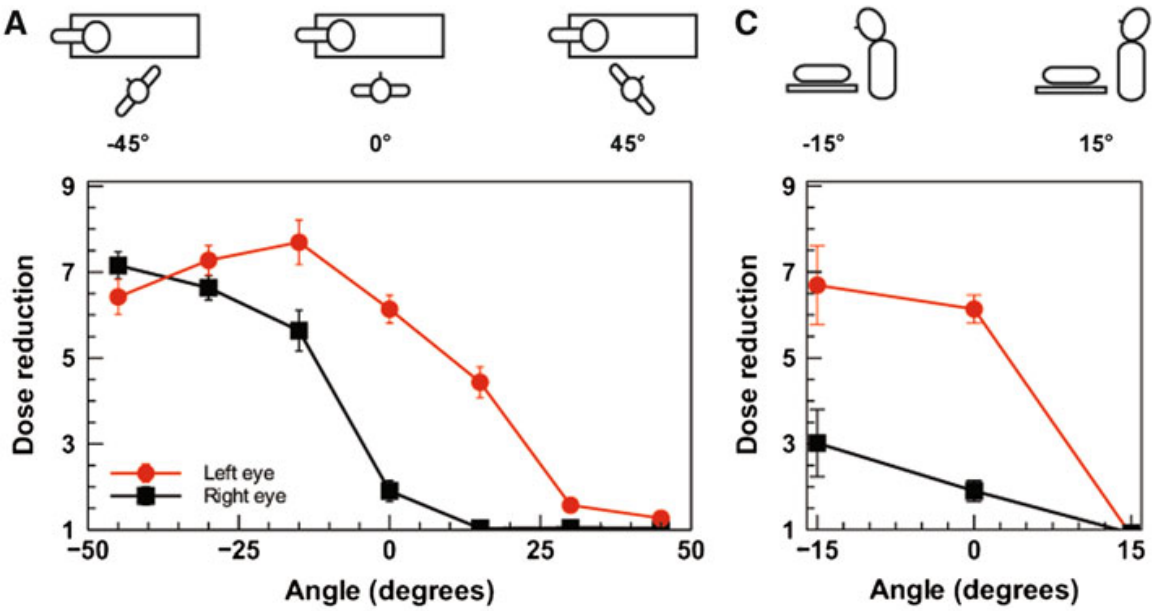
Efficacy of protection tools: Glasses

- Protection glasses are the second-best protection means for the lens of the eye, after ceiling suspended screens [3,4,5,6].
- They are usually manufactured with 0,5-0,75 mm lead equivalent with different designs.
- Dose reduction factor using 0.5 mm lead equivalent protective glasses is approximately 33 (i.e. 97% of the radiation is attenuated)
  - the radiation attenuation factor of the eyeglass lenses is not an adequate descriptor, by itself, of the effectiveness of the eyewear [4].

- **Some authors have reported from their clinical practice a mean dose reduction factor of 2** (instead of 33) [6].

Efficacy of protection tools: Glasses

- The efficacy of radiation protection glasses depends on the orientation of the operator's head relative to the irradiated volume [6].



Phantom dose measurements at different angular positions of the head. **A** - dose reduction of the protective eyewear (model 5) for both the left (tube side) and right (non-tube side) eye. The angle of 0 was defined as the head facing the table and a positive rotation as rotating the head away from the tube. A schematic top view of the phantom head rotation in the axial plane relative to the tube is shown on top. Image obtained from [6].

Efficacy of protection tools: Glasses

- Design of the glasses is very important.
- They should provide not only frontal protection but also lateral protection.
- Calculations showed that ‘wrap around’ glasses are the most efficient eyewear models reducing, on average, the dose by 74% and 21% for the left and right eyes respectively [7].

Image courtesy of R. Sánchez.

Summary

- Interventionalists have their eyes exposed to scatter radiation and need to protect their eyes.
- Suspended screens are the most effective protection means for the eyes.
- Effectiveness of protection screens depends on the proper positioning.
- Protection glasses also help to reduce eye lens doses.
- Wrap around glasses providing lateral protection are the most efficient.

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