

Impact of an auxiliary attachment for protective eyewear on operator lens radiation dose

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Disclosure of conflict of interest

We have nothing to declare for this study.

Introduction

- The number and complexity of Interventional Radiology procedures have increased
 - Transcatheter Arterial Chemo-Embolization (TACE)
 - CT fluoroscopy (CTF)-guided procedures : Biopsy, Cryoablation...

Need for surgeon eye protection from radiation exposure

- Equivalent dose limit of eye lens : 150 mSv/year  50 mSv/year and 100 mSv/5year

The auxiliary side shield

- Use in addition to radiation protection glasses
- Lead equivalence : 0.14 mmPb Weight : 17 g
- Reduce radiation exposure to lateral aspect of left (tube side) eye



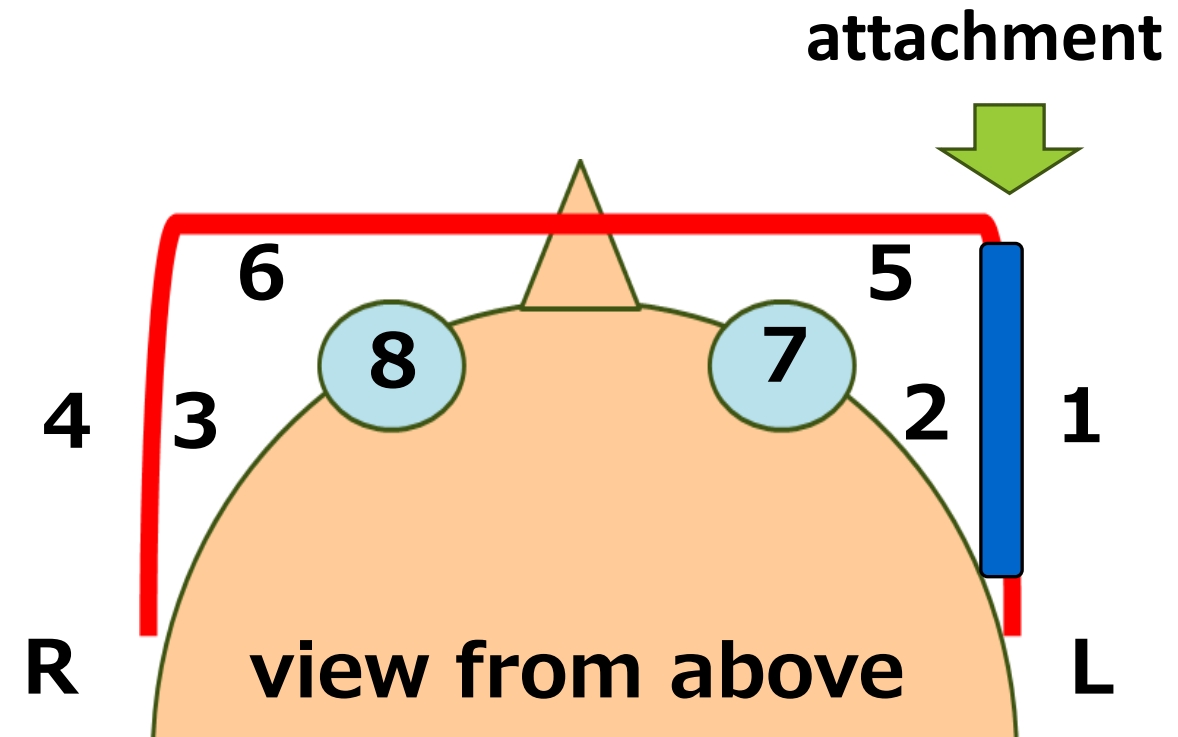
Purpose

To evaluate the dose reduction effect of
an auxiliary attachment on the operator's lens dose

Materials and Methods

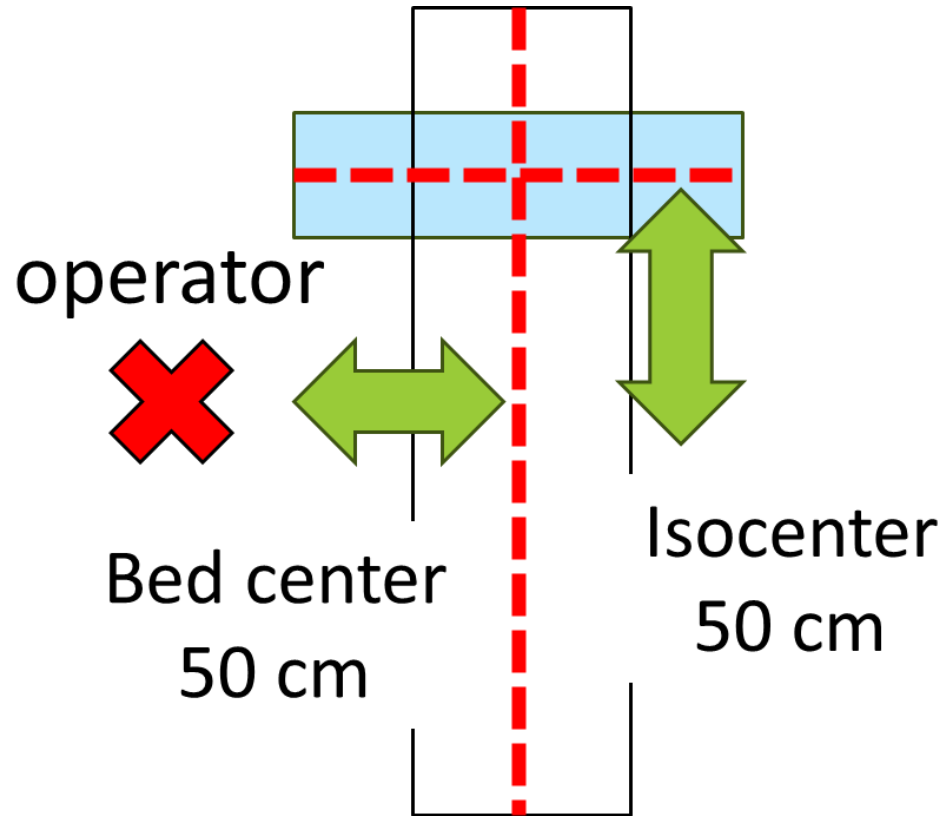
- IR-CT Suite (Artis zee i ceiling ICT; SIEMENS)
- Radiophotoluminescent glass dosimeters (RPLDs) system
 - Reader (FGD-1000; Chiyoda Technol)
 - RPLD (GD-352M; Chiyoda Technol)
- Radiation protection glasses (RPGs)
 - Lead equivalence : 0.07 mmPb (Toray Medical)
- Auxiliary side shield (D-Protect Side Shield; ENNEA Corporation)
- Acrylic, Head Phantom

Evaluation points



Measurement point

Height: 150 cm above the floor



For TACE



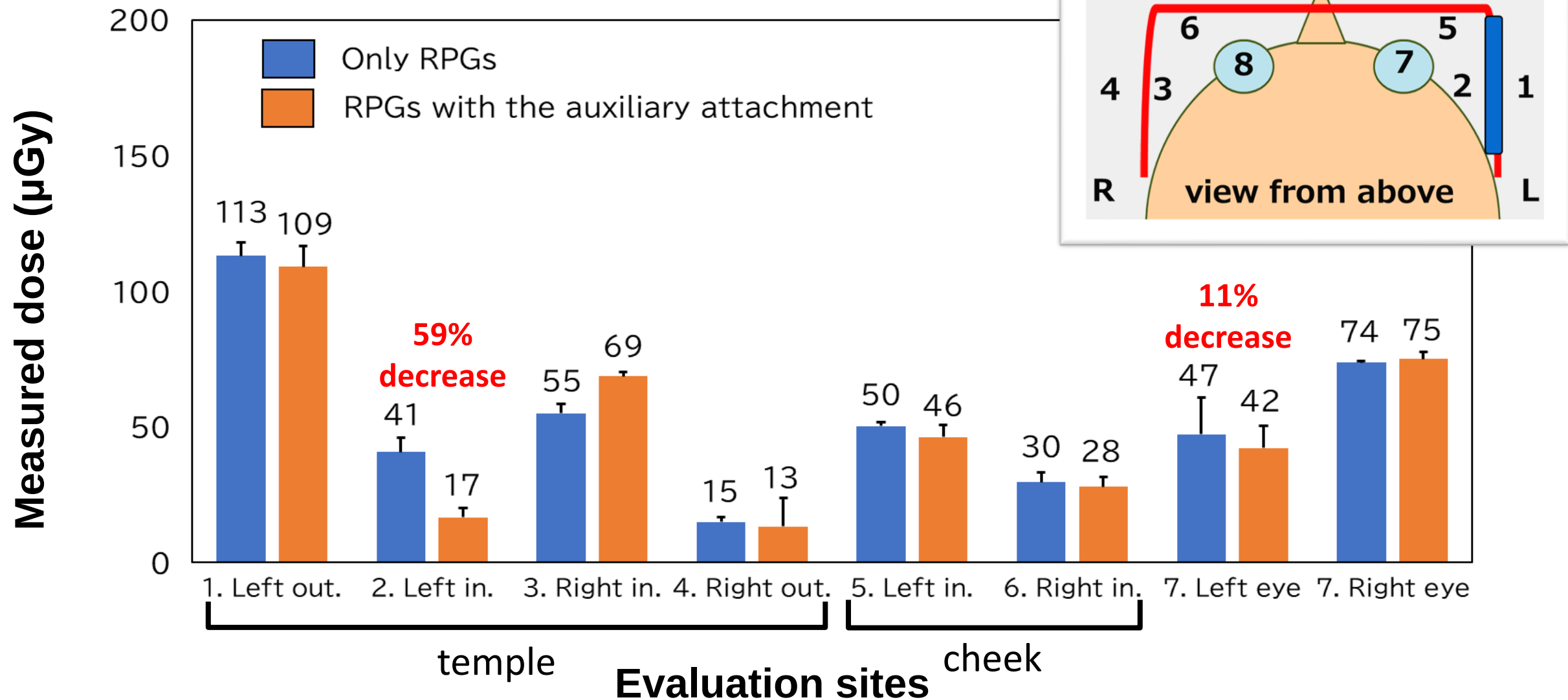
For CTF-guided
procedures

Measurement conditions

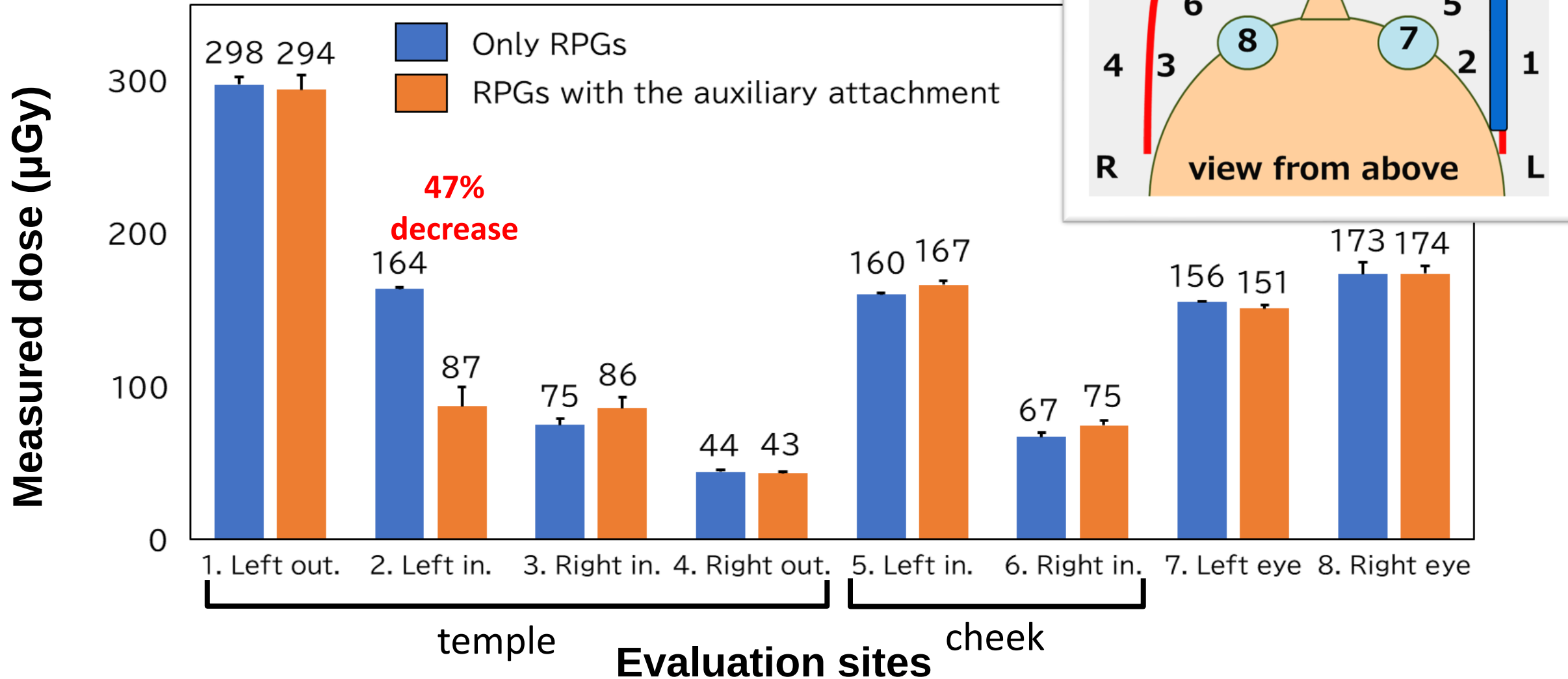
- TACE procedures
 - Fluoroscopy: 73 kV, 98 mA, 10.5 ms, Cu 0.1mm, 7.5 p/s
 - DSA: 70 kV, 302 mA, 59.4 ms, Cu 0.1 mm, 4 f/s $\Rightarrow$ 2 f/s (Variable)
 - Fluoroscopy time: 5 min
 - DSA acquisition: 20 s $\times$ 3
- CTF-guided procedures
 - Bed setting: CTF-guided position, acrylic phantom (20 cm)
 - Scan Protocols: 120 kV, 20 mAs, Rotation time 0.5 s
 - CTF time: 1 min

With and without the side shield, 3 measurements

Measurements for TACE procedures



Measurements for CTF-guided procedures



Discussion

- Highest dose observed outside the glasses at the left
 - Closest measurement point to the X-ray unit / CT system
- Previous study simulated endoscopic procedures¹⁾
 - Reported shielding rates: 40.8–81.7%
 - Endoscopic system : X-ray tube **over** the table
 - Angiography system : X-ray tube **under** the table
- **Scattered radiation from below may have a substantial impact**



1) Fukushima K, et al. Radiol Phys Technol. 2026 Mar;19(1):101-113.

Limitations

- Facial orientation and operator position assumed to be constant
- Suboptimal fit at lower edge of glasses on head phantom
- Possible greater influence of scattered radiation from below

Conclusion

- Significant reduction in lateral radiation exposure with side shield
 - 59% during TACE
 - 47% during CTF-guided procedures
- 11% reduction in left eye lens dose during TACE
- Minimal protective effect on eye lens dose during CTF-guided procedures

