



Evaluation of a commercial tungsten eye shield for Orthovoltage beams using Gafchromic film

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INTRODUCTION

Internal eye shields in orthovoltage treatments are used for limiting the doses to lens and other critical ocular structures. Several aspects should be considered before a new eye shield can be used in clinic (1,2). First, vendors suggests all dosimetric characteristics of eye shield should be checked by the customer because clinical setup might vary. Secondly, dose behind eye shield is composed of primary transmission and backscatters components. The dose evaluation and verification of an eye shield prior to clinical use is important and essential for the purpose of quality assurance. Finally, dosimetric data should be calculated to update and compare the existing data. In this study, we evaluated the new commercial eye shield using the Gafchromic films (3) and compare the dosimetric data with our existing data.

AIM

To evaluate the dose behind a commercial tungsten eye shield for Orthovoltage x-ray beams and compare it with the existing tungsten eye shield used in our clinic.

METHOD

- Medium sized tungsten eye shields, with external diameters of 23 mm (new vendor) and 19.1 mm (existing), were evaluated.
- Eye shields were placed on squared pieces of Gafchromic films in the central axis of the field on the surface of 10 cm thick solid water block (30x30cm²).
- Films were exposed with and without eye shield for 120 kV, 250 kV energies combined with three different filters and with collimated field sizes (FS) of 5x5cm², 10x10cm² and glass cone (4-cm diameter), respectively.
- Source to skin distance (SSD) for collimated field size and glass cone were 50 cm and 30 cm respectively.
- Gafchromic film was calibrated with respective Orthovoltage x-rays and acquired films were analyzed using FilmQA Pro software.
- Doses were calculated and compared for the two sets of eye shields.

MEASUREMENTS

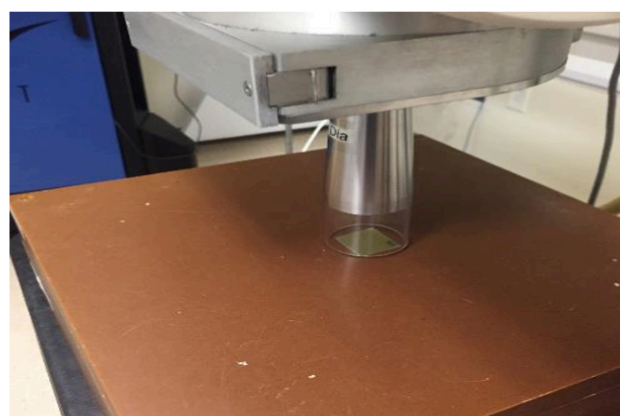


Figure 1: Measurement Setup for Gafchromic film on the surface of 10 cm thick solid water block (30cm x30cm) for solid glass cone of 4 cm for orthovoltage machine.

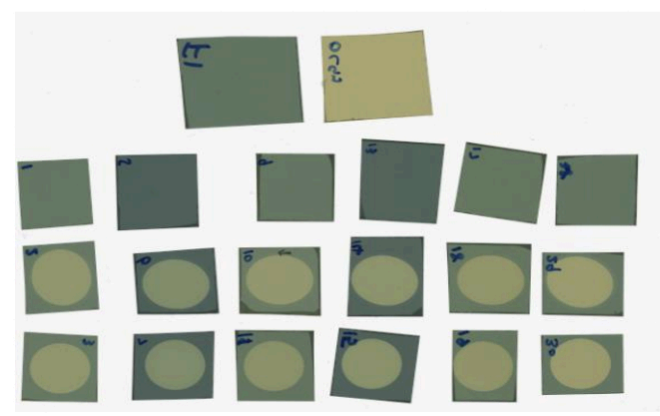


Figure 2: Scanned Gafchromic film images with and without eye shields.

RESULTS

- For 120 kV (Filter1, HVL = 4.2 mm Al), doses were 11% and 16.5% for both eye shields at 5x5cm² and 10x10cm² FS, respectively.
- For 250 kV (Filter 2, HVL = 0.54 mm Cu), doses for 5x5cm² were 11% and 13% for the new and existing shields, respectively, while doses for 10x10cm² were about 20% for both eye shields.
- For 250 kV (Filter 6, HVL=1.85 mm Cu), doses were about 12% for both shields for 5x5cm², and for 10x10cm², doses were 13.6% and 18.4% for the new and existing shields.
- For 120 kV with 4 cm Glass Cone (HVL = 2.1 mm Al), doses were 6.5% for both eye shields.

Table 1: Doses behind new and existing eye shields.

Machine Parameters	Dose (cGy) Without shield	Dose (cGy) New shield	Dose behind eye shield (%) New shield	Dose (cGy) Existing shield	Dose behind eye shield (%) Existing shield
120kV, Filter 1, 5x5cm ²	133	15	11.27	15	11.27
120kV, Filter 1, 10x10cm ²	180	30	16.66	29	16.11
120kV, Filter 1, 4cm Glass Cone	190	13	6.84	12	6.31
250kV, Filter 2, 5x5cm ²	330	37.1	11.24	43.8	13.27
250kV, Filter 2, 10x10cm ²	334	66.4	19.88	68	20.35
250kV, Filter 6, 5x5cm ²	175	20	11.42	22	12.57
250kV, Filter 6, 10x10cm ²	190	26	13.68	35	18.42

CONCLUSIONS

- The doses behind the eye shield were found similar to that of existing eye shield for most energies with different filter (combinations).
- Further verification regarding primary transmission and backscatter factors are under investigation. The new shields can be used safely to replace the existing eye shields.

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