

Purpose: The majority of eye plaques used in the U.S. are of Collaborative Ocular Melanoma Study (COMS) design with I-125 brachytherapy seeds. Treatment planning is usually done using the TG-43 formalism, not accounting for the gold alloy backing and Silastic insert, which significantly reduce the dose, as calculated by BrachyDose Monte Carlo (MC) (www.physics.carleton.ca/clrp/eye_plaque/). Dosimetric characterization of a fully loaded 20 mm COMS plaque using radiochromic film is reported.

Methods: A 20 mm COMS eye plaque was uniformly loaded with 24 6711 I-125 seeds at 6.75 U/seed. Measurements were performed using specially designed single layer GAFCHROMIC EBT1 film sandwiched perpendicular to the plaque's central axis at depths 0 – 19 mm between inserts of a Solid Water "eye" phantom located at the center of a 30x30x30 cm³ full scatter Solid Water phantom. The films were calibrated using a 6711 I-125 seed in Solid Water, applying the TG-43 formalism.

Results: Dose distributions in planes perpendicular to the central axis of the plaque are radially isotropic and uniform. Measured depth dose on central axis as well as off-axis profiles, agree well with the results of MC. At 3 mm from the inner sclera, the measured dose rate is 12.5% lower than TG-43 dose rate in homogenous water, similar to 11.9% for MC. The thin flexible film enabled measurements of the dose at the surface of the plaque. Results on duplicate films agree within 5.5%.

Conclusions: GAFCHROMIC film in a Solid Water phantom is a convenient, accurate, and reproducible dosimeter for I-125 eye plaque dosimetry. Dose measurements on the inner surface of the plaque enable precise assessment of the scleral dose and its homogeneity, and of the active area of the plaque for coverage determination. This work validates the MC simulations about the dose reduction effect by the plaque's backing and insert.

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