AbstractID: 11101 Title: Dosimetry of a Novel Ophthalmic Stereotactic Radiosurgical Device

Purpose:
To propose a method for verifying the dosimetry of a low-energy narrow-beam stereotactic radiosurgical (SRS) device with constant source-axis distance (SAD) for ophthalmic indications.

Method and Materials:
An SRS under development delivers narrow, overlapping beams to the fovea through the sclera, avoiding the lens. The fovea is always placed at 150mm SAD, so the dose rate at the target can be determined from the air kerma rate at 150mm and the tissue air ratio (TAR) as long as the distance the X-rays travel through eye tissue is known. The TG61 "in-air" protocol is followed to calculate surface dose rate to water at 150mm, though extra precautions must be taken because of the difficulty of working with a 4mm-diameter 100kVp beam. To account for tissue attenuation, predetermined Tissue-Air Ratios (TARs) are applied based on measurements of the eye's axial length. Beam shape, overlap, and system targeting are evaluated by irradiating and analyzing radiochromic film coupons in anthropomorphic eye phantoms.

Results:
Of the TG61 corrections, end effect is most substantial, requiring explicit compensation to account for the finite ramp-up time of the source. Typical air kerma rate at 150mm for the 100kVp, 18mA treatment is 10.17Gy/min. For a nominal eye (24mm AL), the TAR at the fovea is 0.429. Film coupons show the full-power portion of the beam to have a 2mm radius at 150mm with a geometrical penumbra of 1mm. Scatter at 100kVp is minimal.

Conclusion:
The combination of the ion chamber and film provide a consistent dosimetric picture, and allow full characterization of low-energy, narrow-beam dosimetry. It is possible to collimate a narrow X-ray beam precisely enough to accurately target the macula and miss the optic nerve and the lens.

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