Purpose: Describe the dosimetry of an episcleral brachytherapy device.

Methods: The SMD-I device is designed to treat exudative age-related macular degeneration (AMD) and employs a Sr-90/Y-90 source encapsulated in a stainless steel cylinder. The source is welded to a flexible wire allowing it to travel from a shielded vault in the SMD-I handle to the distal end of a curved cannula to deliver a therapeutic dose of radiation through the sclera to the neovascular target in the subchoroidal space. The SMD-I handle and vault are comprised of Ultem, a lightweight radiation tolerant plastic, which shields the surgeon.

Dose calculations were performed using the MCNPX radiation transport code. The absolute dose rate was determined using radiochromic film (GAFChromatic© MD-55) at a point in solid water 2.0mm from the source center perpendicular to the cannula. Dose rates at several depths were measured using Kodak EDR2 film in water equivalent phantoms to compare with the absolute dose rate measurement and MCNPX calculations. The surgeon's hand dose received while manipulating the device with the source in the vault was measured using standard TL (thermoluminescence) finger ring dosimeters, TL ChipstratesTM, and calculated with MCNPX.

Results: The absolute dose rate 2.0mm from the source center is 0.45 Gy/min/mCi. The EDR2 film results agree with the absolute dose measurement and the MCNPX calculations. The dose rate decreases rapidly with depth so that the dose at the target depth (3mm) is approximately 8 times less than at 1mm depth (sclera). The dose distribution is sensitive to the angle between the cannula and the neovascular plane. Both TL methods yield a maximum dose rate of 6 µSv/min mCi to the surgeon's fingers consistent with the MCNPX calculation.

Conclusions: The SMD-I device permits accurate delivery of a therapeutic radiation dose for the treatment of exudative AMD.

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