Purpose: This work determines how variations in eye size will influence the radiation absorbed dose delivered to non-targeted tissues within the eye during stereotactic radiosurgery of age-related macular degeneration (AMD) using the IRay™ treatment.

Methods: Stylized models of the eye were created with axial lengths of 20, 22, 24, 26, and 28mm. Each model was based upon the reference eye model from NCRP Report 130 and then scaled appropriately for each axial length. Models were incorporated with MCNPX radiation transport code in order to simulate the three beam IRay™ delivery system. Simulation results were assessed for both the mean absorbed dose and dose-volume histograms (DVH) for both target (macula) and non-targeted eye tissues, including the lens, retina, central retinal artery, and optic nerve.

Results: For each of the three beams, an average dose of 8Gy was delivered to the macula resulting in a total average dose of 24Gy for each eye model. The lens of the eye received a total average dose ranging from 146 to 189mGy, with the larger doses occurring in the smaller eye models since the beams traverse through the sclera closer to the limbus. The distal tip (1.5mm) of the central retinal artery received a total average dose ranging from 499 to 567mGy, with the larger doses occurring in the larger eye models due to increased scatter resulting from longer tissue path length to the nominal target. The optic nerve received a total average dose ranging from 207 to 225mGy, with the larger doses occurring in the smaller eye models.

Conclusions: The small variation in dose to the lens, central retinal artery, and optic nerve suggests that eye size does not significantly affect radiation dose to non-targeted eye tissues.

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