AbstractID: 13213 Title: Energy and Spatial Distribution of Photon Fluence Emanating from the Head during Stereotactic Radiosurgery for Age-Related Macular Degeneration

Purpose: Kilovoltage stereotactic radiosurgery (SRS) is currently being explored as a treatment option for wet age-related macular degeneration (AMD), a leading cause of vision loss in the United States. An evaluation of the distribution of photons exiting the head during treatment will be useful in determining safety parameters regarding clinical staff present.

Method and Materials: A male reference head phantom was computationally modeled with Rhinoceros 4.0 using CT slice segmentation scaled to ICRP Publication 89 reference values. The head phantom was voxelized and a three-beam photon treatment (100 kVp) was modeled using the MCNPX radiation transport code. The beams enter through the sclera at a 30^{o} polar angle relative to the geometric axis of the eye, and deliver a cumulative therapeutic dose of 24 Gy to the macula (8 Gy per beam). An F1 tally sphere, with its origin at the macula target and normal vector aligned with the geometric axis, was used to evaluate the energy and angular distributions of photon fluence at a radius of 0.5 meters. Two-dimensional matrices were implemented using type 1 mesh tallies, flush with the head tissue, which were used to characterize the spatial distribution of photons emanating from each side of the model.

Results: Photon fluence was mostly forward directed with respect to the patient's gaze (backscattered in reference to beam entry) with maxima in the $50\text{-}60^{o}$ and 44.4-50 keV bins. A portion of the beam traverses through the head unattenuated, resulting in a smaller peak around 150^{o}. Color coded contour fluence maps will be created from the mesh tallies to supply a visual representation of fluence.

Conclusion: The results of this study will contribute towards the design development of safety parameters related to the treatment device.

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