

Sensitivity of a novel external x-ray treatment for age-related macular degeneration to size and movement of the eye.

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Purpose: Age-related macular degeneration (AMD) is the leading cause of blindness of the elderly in the United States. A novel external beam treatment has been developed for the treatment of AMD that delivers a 16-Gy prescribed dose to the CTV using three overlapping low-energy x-ray fields while adequately sparing normal tissues in the eye and brain. The purpose of this study was to test the sensitivity of the successful delivery of the prescribed dose to the fovea (clinical target volume, CTV) and of the adequate sparing of normal tissues to plausible variations in the position and movement of the eye during treatment.

Method and Materials: In the standard case, the axial length of the eye is 24 mm and the gaze angle is straight ahead. Using Monte Carlo simulations, we varied the gaze angle by $\pm 5^\circ$ vertically and laterally and the displacement of the eye ± 1 mm in all orthogonal directions. For each case, we calculated the absorbed dose in the CTV and structures at risk.

Results: For all plausible variations in size and movement of the eye, the dose to the CTV fluctuated <6%, the dose to the sclera was <30 Gy, the dose to the optic disc was <1 Gy, and the doses to the optic nerve, lens, and cornea were <0.4 Gy.

Conclusion: The results of this study provide strong evidence that variations in the size of the eye and position of the eye during treatment will not hinder the successful delivery of the prescribed dose to the CTV and the sparing of critical structures for this novel external beam treatment of AMD.

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