

AbstractID: 10813 Title: Dosimetry Performance Comparison of Proton IMPT Versus Photon IMRT for Ocular Tumors using Monte Carlo Simulation and Pinnacle3® TPS

Purpose: We aim to provide accurate proton dose calculations for ocular tumors and adjacent critical organs using intensity modulated proton therapy (IMPT) using a human anatomy-based Monte Carlo model. Dose is simulated using Monte Carlo code MCNPX and compared to standard photon IMRT planning using Pinnacle3® TPS.

Method and Materials: The human anatomy model was adapted from the Visible Human Project from the National Library in Medicine. Sectioned images were assigned physical properties. Two independent trials delivering 90% prescription dose to 100% tumor volume were developed using IMRT and IMPT, respectively. Dose profiles for each transverse, sagittal and coronal view of the model were provided for evaluation. Both treatment plans were optimized to deliver maximum dose to the tumor and minimize dose elsewhere. The dose volume histograms for the PTV (tumor), eye, lens, optic nerve, lacrimal gland, brain, chiasm, and pituitary gland were compared between IMRT and IMPT, respectively.

Results: IMPT delivered superior isodose coverage to all tissues. Comparing IMRT and IMPT, the mean dose was 4499 cGy and 4750 cGy-Eq (PTV), 2334 cGy and 1700 cGy-Eq (eye), 2705 cGy and 1330 cGy-Eq (lens), 156 cGy and 181 cGy-Eq (optic nerve), 142 cGy and 23 cGy-Eq (lacrimal gland), 21 cGy and 0.0 cGy-Eq (brain), 31 cGy and 0.0 cGy-Eq (chiasm), and 43 cGy and 0.00 cGy-Eq (pituitary gland), respectively. The PTV was well covered by 90% isodose to 100% of the tumor volume with an average % prescription dose of 99.9% and 105.6 % for IMRT and IMPT, respectively.

Conclusions: IMPT provided conformal dose to the ocular tumor and significantly spared dose to critical organs compared to IMRT. The human-anatomy dose model performs very well in dose calculation; however, further validation using additional human anatomy-based models and more specified proton source configuration is needed for optimization purposes.