

Feasibility of Pencil Beam Scanning Proton Therapy of Ocular Melanoma with Gantry

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Abstract

Objective: To evaluate the feasibility of proton therapy of ocular melanoma using none-dedicated treatment planning system(TPS) and proton pencil beam scanning gantry beam line.

Methods: The commercial Eclipse TPS was used to generate robust multifield optimized (rMFO) intensity modulated proton plan for representative ocular tumor patient. Doses were compared among the initial plan and 40 scenarios of combined setup errors and range uncertainties. An in-house fast Monte Carlo dose calculation platform was used to assess the dosimetric impact of 3 tantalum fiducial markers for imaging-guidance treatment.

Results: Retina, optic nerve, cornea, lens, lacrimal gland, conjunctiva, sino-nasal mucosa and GTV were contoured on the treatment planning CT. 3-dimensional rMFO planning accounting for 2mm setup uncertainty and 3.5% range uncertainty was performed, utilizing 3 fields at different optimal gantry angles. Plan achieved target coverage(TC), at least 95% of CTV receiving 50 Gy RBE in 5 fractions while within clinical dose limits of organ at risks. The average target coverage remained D95=97.7% over 40 scenarios. Monte Carlo dose calculation revealed up 11% local dose shadow within target and D95 decreased by 3.2% if tantalum marker is in the field of beam path.

Conclusion: None-dedicated TPS and gantry beam line can be used to treat ocular tumor. This procedure is feasible with relatively low doses to anterior structures and acceptable plan robustness. Fiducial marker, in certain circumstances, cause dose shadows and theoretically compromise local tumor control. Optimized beam angle and fiducial positioning should be considered in the procedure.