

AbstractID: 6808 Title: Robustness of proton versus IMRT treatment plans in the presence of target motion for prostate cancers

Purpose: To compare dose distributions and DVHs of proton vs. IMRT prostate plans and their robustness in the presence of target motion.

Method and Materials: Proton treatment plans with two lateral or lateral oblique fields are compared to 5-field or 7-field IMRT plans for low- and intermediate-risk prostate tumors respectively. Both the proton and IMRT plans are designed such that $D_{95, PTV} = 100\%$, and $V_{95, PTV} = 100\%$. The beam angle, distal and proximal margins, smearing and border smoothing of range compensator are designed for each double-scattered proton beam to achieve an optimal dose distribution. IMRT inverse planning constrains the 90% isodose line to fall within 0.5 cm of the PTV and the pelvic wall dose to below 70% of the prescribed dose. A triangular cylinder along the length of the rectum limits the anterior rectal wall dose. Dose volume histograms for PTV and CTV, rectal and bladder walls, and femoral heads are compared. The robustness of the two approaches is investigated by introducing CTV movements of 0.5 or 1.0 cm and reevaluating the DVHs.

Results: Compared to IMRT, proton plans provide more uniform PTV coverage and significantly reduce volumes of doses to critical organs, especially the rectal wall, while maintaining excellent PTV coverage. CTV coverage in proton therapy is very robust against lateral movements of CTV, similar to or slightly better for superior-inferior movements, but worse for posterior movements larger than 0.5 cm. This is due to the larger lateral and smaller anterior-posterior extensions of proton dose profiles beyond the PTV, and the smearing and smoothing used for proton treatments.

Conclusion: Proton plans generally provide better target coverage and better or comparable sparing of critical organs. They are more robust than IMRT with regard to prostate motion except for large posterior movement.