

AbstractID: 13668 Title: Impact of Daily Patient Setup Error on Proton Beams Passing Through the Couch Edge

Purpose: Proton treatments are sensitive to radiological pathlength in the beam path. The goal is to assess the amount of dose variation caused by the changes of couch edge in the beam during daily treatment.

Method and Materials: Daily couch positions were obtained from the R&V system to compute lateral setup variations. Couch positions were simulated by shifting the isocenter and the patient's CT images above the couch-top for two standard-deviations (2SD). One and two-field passive scatter proton plans were designed to cover 95% of ICTV to 74Gy in the reference planning CT. The single beam plan was always chosen to bisect the couch edge. Two-field plans were designed by adding a second beam not intersecting with the couch. Doses were re-calculated in the shifted CT images for 10 patients.

Results: The one standard-deviation of couch lateral variation for 11 patients in 388 daily setups was 0.53cm. We found that lateral couch variations increased for light-weighted patients (Spearman's correlation=0.76, $p=0.007$). For single-beam plans, dose decreased for all organs-at-risk when patient setup caused the couch to move into the beam. The reverse effect was true when couch moved out of the beam. The largest change in DVH at any dose level was -1.31% and -0.64% for the ipsilateral and total lungs when the couch moves into the field, and 1.53% and 1.88% when the couch moves out of the field. Compared to the corresponding single-beam plan, dosimetric uncertainty was reduced to 1.16% and -2.7% with a 2-beam plan.

Conclusion: The overall dosimetric impact is limited if a single beam is allowed to shoot through the couch edge, although attention should be given to light-weight patients whose position on couch tends to be more uncertain. Selection of a good beam angle for planning is perhaps more important than the couch-induced dosimetric uncertainties.