AbstractID: 6459 Title: Optimization of Position Compensated Plans (PCPs) for Adaptive Radiotherapy

Purpose: Position compensated plans (PCPs) have been proposed as a method to adapt treatment delivery based on the daily patient position. In this approach, multiple plans are created in which the isocenter is displaced based on anticipated daily offsets. The plan that most closely matches the daily position is then selected for treatment. The goal of this study is to determine the optimal isocenter spacing of PCP for intensity-modulated whole-pelvic radiotherapy (IM-WPRT).

Method and Materials: The setup errors for 46 patients treated with IM-WPRT were measured and the dosimetric effect of these errors on the volume of normal tissue and PTV irradiated was quantified. This analysis demonstrated that the anterior/posterior (AP) setup error had the greatest effect on the change in volume of normal tissue irradiated. Thus, PCPs were created with the isocenter shifted in the ±AP direction. In order to determine the optimal PCP spacing, random errors (σ) were varied from 0.1 to 1.0 cm in steps of 0.1 cm. For each random error, the daily setup deviation was sampled for 25 fractions for 100 hypothetical patients. The PCP correction scheme used the original plan plus two plans with isocenter displacements ranging from 0-2 cm in steps of 0.1 cm. The optimal PCP spacing was defined as the one which minimizes the RMS error in the AP direction.

Results: A linear relationship was observed between the random setup error and the optimal PCP spacing. In particular, for the case of two additional PCPs, the required spacing is equal to $\pm 1.22\ \sigma$. That is, for a random error of 4 mm, two PCP plans with spacings of ±4.9 mm will minimize the RMS variations in daily setup uncertainties.

Conclusion: PCPs with AP isocenter displacements of $\pm 1.22\ \sigma$ represent an effective means of adapting treatment in IM-WPRT based on the daily set-up deviations.