

AbstractID: 10897 Title: Dosimetric Margin Assessment for Rigid Setup Error by CBCT for HN-IMRT

Purpose: High dose gradients offered by IMRT increase the sensitivity of treatment to setup errors compared to conventional treatments. We evaluated the dosimetric effects of setup error on HN-IMRT using actual patient CBCT measurements. The purposes were to evaluate the dosimetric effects of setup error and determine required planning margins.

Method and Materials: The CBCT data from 30 patients and 896 treatment sessions were collected and analyzed. They were applied retrospectively to 12 HN-IMRT patient plans to reconstruct the cumulative dose distributions received by patients. A range of setup errors was simulated by scaling up the measurement to investigate the margin adequacy. Both deliverable and ideal fluence optimization methods were evaluated to study the dependence on dose gradient. Effects on treatment dose distributions were evaluated using dosimetric indices, conformity index (CI) and conformation number (CN).

Results: Current 5 mm planning margin is more than adequate to compensate for the rigid setup error existing in the clinic. To maintain the same target coverage as in original plan, a margin of 1.7 mm to CTV1 and 1.3 mm to CTV2 is necessary. The CIs were closest to 1 for deliverable plan, and greater than 1 in cumulative dose. The CNs were significantly less than 1, making it unsuitable for treatment cumulative dose evaluation. Sharper dose gradients in FO plan increases the sensitivity to setup error with greater dose delivery errors in treatments.

Conclusion: The standard margin recipes significantly overestimate the required margins for rigid setup error in HN-IMRT, probably due to different prescription requirement. However, additional margins are necessary for other uncertainties such as tumor shrinkage and non-rigid setup error. Plans with sharper dose gradients are more sensitive to setup error and will require larger margins. The use of conformation number is not recommended to evaluate cumulative doses.

Conflict of Interest: None.