

AbstractID: 2904 Title: Monte Carlo investigation of heterogeneity effect for head and neck IMRT

Purpose: The purpose of this work is to verify the accuracy of the dose distribution calculated by the CORVUS treatment planning system and to investigate the heterogeneity effect on head and neck IMRT plans using Monte Carlo simulations.

Materials and Methods: A Monte Carlo dose calculation tool, MCSIM, was used to carry out patient-specific dose calculations. Patient-specific CT data and the IMRT RTP files generated by the CORVUS treatment planning system were used for Monte Carlo dose calculations. Ten head and neck IMRT treatment plans were re-calculated and compared with the original plans. The isodose distributions and the dose-volume histograms were used for comparison. In order to investigate the heterogeneity effect for head and neck patient, IMRT plans generated by CORVUS with and without heterogeneity correction were compared with Monte Carlo dose distributions re-calculated under the same conditions.

Results: The mean target dose and the dose at the isocenter predicted by CORVUS agreed to within $\pm 5\%$ of those predicted by Monte Carlo for all cases. Hot spots and cold spots were observed in the target volume due to the heterogeneity effect in some patients with beams going through bones, teeth and/or air cavities. D95 (dose received by 95% of the target volume) recalculated by the Monte Carlo method could be 8% lower than the original plan, which is outside the clinical acceptance criterion. More than 10% differences in the critical structure dose were also observed.

Conclusion: In general, dose distributions from CORVUS with heterogeneity correction agreed to within $\pm 5\%$ with Monte Carlo calculations. Cold spots in the target volume due to inaccurate heterogeneity correction may compromise the local control of head and neck IMRT. The dosimetry differences in critical structures are another aspect worthy to be further investigated.