

AbstractID: 4975 Title: Modeling Dose Delivery Accuracy of IMRT Head-and-Neck Cancer Treatment

Purpose: To evaluate the impact of internal organ variations on IMRT treatments of head-and-neck cancers using different daily alignment techniques.

Method and Materials: Eleven head-and-neck cancer patients were imaged twice weekly during their course of treatment (141 CT scans total) using an integrated CT-linear accelerator (EXaCT, Varian Oncology Systems). The clinical IMRT plans were copied onto the daily CT images. The plans were aligned with (1) the daily marked isocenter using three radio-opaque markers (BBs) and (2) bone alignment, using in-house software to align the cervical vertebrae. Daily dose distributions were mapped from the daily CT images onto the planning CT image with an in-house deformable image registration algorithm. Cumulative dose-volume histograms from the planning CT image were analyzed.

Results: The differences in the clinical target volumes (CTV) gEUD between the planned and delivered doses (with BB or bone alignment) were typically ≤ 1 Gy; therefore the differences in target coverage were most likely clinically insignificant. However, the alignment method did have a statistically significant impact on the percentage-volume of the CTV at the prescription dose. Neither BB alignment nor bone alignment maintained the planned coverage (average=98.2%), which was reduced to 95.6% with bone alignment ($p=0.000$) and 94.3% with BB alignment ($p=0.000$).

BB alignment significantly increased the average percentage-volume receiving ≥ 25 Gy above the original plan for the ipsilateral (59.6% vs. 51.4%, $p=0.003$) and contralateral (42.0% vs. 36.4%, $p=0.016$) parotid glands. The parotid gland gEUD increased by more than 5 Gy in 35% of BB alignments and 15% of bone alignments. However, there was no statistically significant difference between BB and bone alignments in parotid dose received.

Conclusions: The differences in CTV coverage between bone and BB alignment were statistically significant but small. Bone alignment more closely reproduced the planned parotid dose than BB alignment, although both gave higher dose than the original plan.