AbstractID: 7090 Title: Evaluation of the Dosimetric Accuracy of a Commercial Adaptive Radiotherapy Process

Purpose: To evaluate the dosimetric accuracy and reproducibility of the TomoTherapy Planned Adaptive system using MVCT datasets.

Method and Materials: Comparisons were made between reference dose distributions computed with the TomoTherapy treatment planning system (TPS) and verification dose distributions computed on the TomoTherapy Planned Adaptive (PA) system. Both calculations were performed on TomoTherapy megavoltage CT (MVCT) datasets to eliminate differences associated with variations in CT-density tables. Simulated PTVs drawn on an MVCT of an anthropomorphic radiosurgery head phantom (CIRS, Inc.) were used as input to calculate doses on the TomoTherapy TPS. After plan optimization, a post-plan MVCT image was taken and used to calculate dose on the TomoTherapy PA system. Initially, calculations were made using the same MVCT dataset as input to both programs to investigate the agreement between the algorithms. Next, calculations were made using registered pre- and post-plan MVCT images to investigate the variation with MVCT datasets. Comparisons were made using the tools available on the PA system and in-house software to compare doses outside of contoured structures.

Results: For calculations on identical datasets, isodose and DVH comparisons between the TomoTherapy TPS and PA systems showed insignificant dose differences (< 0.2%) to all contoured structures. Dose discrepancies within the phantom but outside of contoured structures showed slightly larger variations, although well within 0.5%. Similar results were found for dose calculations using different MVCT datasets. In both cases, the doses computed in air outside the phantom showed the largest differences (up to 21%).

Conclusion: Comparisons between TomoTherapy's TPS and PA system MVCT dose calculations showed clinically acceptable agreement everywhere within the phantom. Differences between doses calculated in air are due to differences in the way the algorithms mask low density voxels.

Research sponsored by TomoTherapy, Inc.