AbstractID: 8520 Title: Comparative Analysis of Peripheral Doses for Base of Tongue Treatment by Linear Accelerator and Helical Tomotherapy IMRT

Purpose: To determine which Intensity Modulated Radiation Therapy (IMRT) modality, either linear accelerator or helical tomotherapy, delivers higher peripheral (out-of-field) doses to various structures from a typical tongue treatment.
Method and Materials: The principal investigator developed a method of placement of human organs onto the limited-organ anthropomorphic phantom. Multiple human CT data sets were segmented for 18 critical structures and organs at risk, and fused to the anthropomorphic CT data set. The GTV and PTV of a base-of-tongue plan were overlaid on the phantom CT for clinically acceptable tumor delineation and nodal involvement. Eighteen contours, distributed throughout the phantom, were designated for thermoluminescent device (TLD) placement; and using geometry and fluoroscopy each TLD location is established in the phantom. Following the RTOG IMRT Protocol 0522, treatment of the primary tumor and involved nodes (PTV70) and subclinical disease sites (PTV56) was planned using IMRT to 70Gy and 56Gy. Two comparable, clinically acceptable treatment plans were produced: one utilizing a linear accelerator treatment planning system and one using a helical tomotherapy planning system. Each treatment plan was delivered to the anthropomorphic phantom four times.
Results: Assessment was based on total treatment doses. Within 2.5 cm (one helical tomotherapy field width) superior and inferior to the field edges, normal tissue doses were on average 45% lower using linear accelerator based treatment. Beyond 2.5 cm, the average helical tomotherapy treatment dose was 52% lower. The majority of points were proven to be statistically different using the Student's t-test with $p>0.95$.
Conclusions: Helical tomotherapy IMRT delivers one addition field width of radiation above and below the treatment field, contributing to the higher peripheral doses adjacent to the field. At distances beyond one field width, where leakage is dominant, helical tomotherapy doses are lower than linear accelerator doses.