

AbstractID: 12581 Title: Dose verification of SRS Monte Carlo plan with a moving anthropomorphic phantom

Purpose: Dose verification of Stereotactic Radiosurgery plan using Monte Carlo for tissue heterogeneity correction with a moving anthropomorphic phantom

Method and Materials: An anthropomorphic lung phantom has gold fiducials, TLD capsules and GAFChromic films imbedded in a target in the left lung, TLD capsules are also inserted in heart and cord structures. The phantom was scanned, CT images were sent to Cyberknife Multiplan for planning. Target and critical structures were contoured. A SRS treatment plan with no tissue heterogeneity correction was generated to give 6Gy to 95% of the target, 5.4Gy to 99% of the target, no point > 2cm from target > 3.5Gy, conformal index < 1.2, cord < 1.8Gy, heart < 3Gy, 10% of whole lung < 2Gy. The plan was recalculated with Monte Carlo with 2% uncertainty for tissue heterogeneity correction for dose delivery. During delivery the phantom moved in superior/inferior and anterior/posterior direction, Cyberknife Synchrony tracking system took orthogonal x-ray images of the phantom while infra-red camera tracked LED diodes placed on the phantom to track phantom motion in real time. After the fiducials were identified by the tracking program and correlated with the motion of LED diodes, a motion model of the target was built; radiation started with the Cyberknife robot following the predicted target motion and adjusted its position during irradiation. Throughout delivery, the motion model was updated and adjusted with new x-ray images of the fiducials.

Results: Target TLD was 98.3% of Monte Carlo dose; heart and cord TLD were within 7% acceptability. Profiles from 3 orthogonal films were displaced L/R 0mm/3mm, P/A 1mm/5mm and I/S 1mm/2mm from treatment plan profiles, within 5mm acceptability.

Conclusion: Cyberknife Multiplan with Monte Carlo accurately predicts dose in heterogeneous tissue; Cyberknife Synchrony tracking system delivers dose accurately to a target in a moving phantom.