

AbstractID: 7537 Title: Assessment of CyberKnife's Heterogeneity Dose Calculation Algorithm and Respiratory Tracking System using an Anthropomorphic Thorax Phantom

Purpose: To assess two CyberKnife components: MultiPlan's heterogeneity dose calculation and the accuracy of Synchrony, the respiratory tracking system.

Method and Materials: The Radiological Physics Center's anthropomorphic thorax phantom contains TLD in the tumor, heart, and spinal cord to measure absolute dose and EBT radiochromic film in coronal, sagittal, and axial planes through the tumor. A treatment plan was developed using Accuray's MultiPlan planning system. The prescription was 500 cGy to the 77% isodose line, and the constraints followed the specifications of the RTOG 0236 protocol. The phantom was irradiated while stationary, with a 2 cm cosine motion, and with an irregular breathing pattern three times each. The calculated doses were compared with the measured TLD results, and the stationary TLD doses were compared with both moving scenarios. Dose profiles were measured in the AP, RtLt, and Sup/Inf directions with EBT film and the stationary and moving conditions were compared.

Results: The average measured TLD tumor dose was 13.5% lower than the calculated dose; the measured cord and heart doses were 40.9% and 32.8% lower than the calculated doses, respectively. All tumor TLD doses for the moving cases were within 1.3% of the non-moving TLDs, with the largest %SD being equal to 1.2%. In addition, 99.7% of the measured cosine motion dose profile and 92.3% of the measured irregular motion dose profile fell within $\pm 3\%/1.5\text{mm}$ of the measured stationary dose profile.

Conclusion: Multiplan overestimated the dose to the PTV and critical structures. This may be due to the simplistic pencil beam heterogeneity calculation. According to the dose profiles of this study, the Synchrony system precisely tracks lung tumors throughout the course of treatment.

Conflict of Interest:

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