AbstractID: 10442 Title: Effect of cardiac motion on the Cyberknife Synchrony tracking system for radiosurgical cardiac ablation.

Purpose: To characterize the effect of cardiac motion on the CyberKnife Synchrony respiratory tracking system for radiosurgical cardiac ablation.

Method and Materials: A high precision programmable haptic device (Force Dimensions Omega.6) was used to simulate cardiac and respiratory motion of a ball cube phantom. The CyberKnife Synchrony system was used to track the position of the 25 mm diameter target via spatial correlation of a fiducial within the phantom with the external LEDs placed on a second haptic device simulating chest wall motion. The targeting and tracking error were analyzed by comparing the actual target positions with the linac offset positions predicted from the Synchrony model. Film dosimetry was used to evaluate the effect of cardiac motion on target coverage.

Results: Examination of log files revealed that the Synchrony modeling averaged out cardiac motion not present in the surrogate with some error. Superior-inferior motion from both respiratory and cardiac motion contributed to the largest Synchrony modeling error. This modeling error led to misdirection of the beams from the time averaged target position. Additionally, untracked motion resulted in the target moving into and out of the radiation beams which manifested as softening of the dose gradient changes. Analysis of the films indicated that this was most severe in the superior inferior direction consistent with the extent of motion in that direction.

Conclusion: A small additional margin would enable treatment of cardiac targets with the current CyberKnife if Synchrony tracking were used. For the motions and dose distributions tested, a 2 mm margin was sufficient to provide good target coverage in the presence of untracked cardiac motion.

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