

AbstractID: 3173 Title: Fractionated Radiosurgery by Adaptation of Resources.

Purpose: Our goal was to integrate broadly accessible, multi-purpose tools to form a system for non-invasive MLC-based fractionated radiosurgery. We investigated the use of a Varian Millennium MLC (mMLC, 5mm-leaf resolution) in conjunction with an aSi electronic portal imaging device (EPID) and Varian ZMed RadioCamera system for this purpose.

Method and Materials: Pinpoint and RK chambers were used to measure data from small fields (mMLC shaped). Profiles for field sizes ranging from 4x4 to 1x1-cm were measured in water, while output measurements were taken in a MedTec IMRT phantom. These data were used to commission an mMLC radiosurgery (fRS) beam in Theraplan Plus v3.8. Dose distributions created with this beam were compared both to measurement and circular collimator-based SRS distributions. The RadioCamera system consists of an infrared camera and customized biteblock equipped with infrared markers. This detects motion in real time and allows the beam to be halted when a threshold is reached. The radio-opaque markers are also used as a fiducial system for EPID. The motion sensitivity threshold and consistency of the biteblock-mounted fiducials were both examined. Finally, the full system was tested using a film phantom outfitted with a biteblock.

Results: Planning system predictions using the fRS beam match measured profiles, depth doses and output factors. Plans created with this beam were shown to approach those created using radiosurgery cones, based on DVH, homogeneity and conformity analyses. The IR camera system is sensitive to 0.2mm motion in all directions. Overall system test indicated that we can treat 1cm lesions with 0.3cm PTV and MLC margins.

Conclusion: Our studies indicate that the combination of mMLC, infrared motion tracking, and EPID verification is sufficient to form a practical system for non-invasive, fractionated radiosurgery, comparable to conventional linac-based radiosurgery. This system is being used clinically at our institution.