

Radiochromic Film Dosimetry of Small Irregular Fields Shaped by a Micro-multileaf Collimator for Stereotactic Radiosurgery

The implementation of stereotactic radiosurgery using micro-multileaf collimators (mMLC) requires dosimetric investigation, particularly for extremely small (<1cm) targets. During data acquisition for a BrainLAB mMLC, the smallest field measured was a 12mm diameter circle. The accuracy of the calculation algorithm, which interpolates between sets of measured data, is unknown in the extrapolated region of mMLC fields smaller than 12mm. For this study, a piece of GAF-chromic model 55-2 film was positioned between two axial slices of an anthropomorphic RANDO head phantom. The phantom was CT scanned with 1.5mm contiguous slices acquired parallel to the plane of the film. Using the BrainSCAN treatment planning computer, an isocenter was positioned on a radiographically-identified structure in the axial slice containing the film. A plan was generated using 12 static mMLC fields (<1cm equivalent) to deliver 26.4Gy at the isocenter. Phantom treatment was carried out according to plan, irradiating the enclosed film. A series of 10 films was exposed for doses up to 30Gy in order to generate a calibration curve. A Lumiscan 150 laser micro-densitometer (RIT 113) and a Nuclear Associates model 37-443 radiochromic film densitometer were used to analyze films. The dose at the isocenter was determined to be 28Gy from film measurements. The planned isodose distribution was overlaid onto that measured from film for direct comparison. The results will be presented, and potential limitations of the dose calculation algorithm for very small fields will be discussed.