AbstractID: 10085 Title: Small field intracranial radiosurgery using intermediate energy x-rays (1 MV) to improve dose gradient and homogeneity

Purpose: The radiological penumbra of small radiosurgical dose fields is dictated by the range of secondary electrons, which in turn is determined by the primary photon energy. The purpose of this work is to experimentally compare the dose gradient and homogeneity of a multiple beam dose distribution in a radiosurgery head phantom for 6 MV versus 1 MV while minimizing geometrical penumbra. **Methods and Materials:** A commercial radiosurgery head phantom (LUCY™) containing Gafchromic EBT film was used for all irradiations. A digital microscopy imaging system resolved steep dose gradients in the films and a Siemens linac was modified to produce 1 MV x-rays. The XKnife™ RT3 TPS was modeled for both 1 and 6 MV to compare with measurements. Two-beam (90º apart) and eighteen-beam (10º apart) irradiations were done in the same plane as the film using a 5 mm tertiary collimator. The geometrical penumbra ranged from 0.2-0.4 mm, equivalent to a linac with a 1 mm focal spot with collimator 20 cm from the isocenter. Dose was normalized at the isocenter at depth 7 cm in phantom. **Results:** For the two-beam irradiations, the 90%-50% and 90%-10% dose gradients at the beam intersection were 1.7 & 4.7 mm (6MV) versus 0.5 & 1.3 mm (1 MV) for identical irradiation conditions. For the eighteen-beam arc, the 90%-80% & 90%-60% dose gradients in the plane of irradiation were 0.84 & 1.7 mm (6MV) versus 0.29 & 0.9 (1 MV). In all cases, the homogeneity across the isocenter was superior for 1 MV. The dose at the entrance of each beam was greater for 1 MV. **Conclusions:** A 1 MV x-ray beam showed superior dose gradient and homogeneity compared to 6MV for the irradiations examined at the expense of an increase in dose at the beam entrance for the lower energy.