AbstractID: 7724 Title: Sweeping Window Arc Therapy

A novel variant of intensity-modulated radiation therapy is proposed in which the dose distribution is delivered with a single rotation of the accelerator gantry while the multi-leaf collimator leaves modulate the x-ray beam. The leaves move along horizontal leaf tracks parallel to the axis of rotation of the gantry. The leaf sequence is derived from an initial leaf sequence produced by sweeping windows that lead to all voxels in the target volume being alternately irradiated at some gantry angles and then shielded from the parallel-opposed gantry angles. The result is a uniform irradiation of the target volume identical to that delivered by the classical Takahashi arc, but employing twice as many monitor units. This sequence was used to initiate an optimization algorithm that sought to minimize a traditional cost function by testing variations from the initial sweeping window sequence. An overshoot of a leaf beyond the initial window boundary can be used to produce regions where dose is reduced to spare a structure. An undershoot of a leaf back from the initial window boundary can be used to produce a region of additional dose to compensate for the target dose inhomogeneity produced by shielding. Prototype optimization codes were used to test the procedure for three-dimensional target volumes and adjacent organs-at-risk structures. The results with these simple preliminary tests approached the results of more sophisticated fixed-gantry intensity-modulated radiation therapy calculations. The delivery sequences have been verified by film dosimetry using a computer-controlled linear accelerator equipped with a multi-leaf collimator.