

Intensity Modulated Radiation Therapy with Tomographic Reconstruction: MLC Leaf Width and Beam Number Influence on Dose Conformation to Cranial Targets

Dose intensities for IMRT are calculated with a tomographic reconstruction algorithm. Measured dose distributions are used in both the inverse and forward calculations. The delivery of dose is modeled and the conformation of dose-to-target for 1.5cm, 1cm, and 0.5cm width beams, representing different MLC leaf widths, is investigated. Three geometric targets are studied and the number of IMRT beams varied from 4 to 32. Dose volume histograms compare target volume dose uniformity and dose conformation, as measured by the dose volume histogram of surrounding normal tissue (SNT).

The targets, each in a 16 cm diameter water cylinder, are: (a) an elongated ellipse (4cm x 0.5cm), (b) an ~2cm peanut, and (c) a torus (4cm x 1.5cm ellipse surrounding a 3cm x 0.5cm critical structure). In each case the SNT is a structure 2cm larger than the target. All results were computed in two dimensions, although the algorithms are applicable to full three-dimensional treatments. The delivered dose contours are shown for 32 equally spaced beams with beam resolution of (b) 0.5cm, (c) 1.0cm, and (d) 1.5cm.

The improvement in dose conformation with narrower leaf widths is significant for these targets, which are representative of cranial targets. This will be quantified and discussed. The conformation of dose improves from 4 to 8 beams; improvement is much reduced beyond 12 beams, indicating that clinically 8-12 beams will be sufficient in most cases.