

AbstractID: 6949 Title: Geometric Aspects of Intensity Modulated Radiation Therapy Planning

Inverse treatment planning was performed to study the effect of changing the multileaf collimator (MLC) leaf width, MLC collimator angle, and couch rotation on shaping dose.

A head phantom was used to obtain an axial computed tomographic study. The phantom contained two targets: 2.5cm-diameter sphere and 2.5cm x 4.5cm ellipsoid. The latter was with long axis oriented cephalad-caudad. Targets and a 0.5cm-wide rind surrounding each, were contoured as separate structures. Conformal plans were planned with fixed optimization criteria for 5 or 7 coplanar beams. Isodose curves, dose volume histograms and dose statistics were computed for each structure as a function of changing MLC leaf width (3mm, 5mm, 10mm), collimator and couch angle (180, 225, 270 degrees) relative to the targets.

In all cases, narrowing leaf width gave lower average dose (~1.5-2.5% per mm width) in the rind of tissue that surrounded each target, regardless of whether the shape was spherical or ellipsoidal. Isodose curves demonstrated that the steepest gradients achieved were perpendicular to the plane of the beams. Narrow leaves are optimized with leaf travel parallel to the target long axis.

These results promote four rules of practice. 1) Use narrower leaf widths provide better conformity of isodoses to small irregularly shaped targets. 2) When treating with multiple coplanar beams, it is desirable to avoid parallel opposed beams. 3) Orient the beam plane away from critical structures. 4) Possibly, orienting MLC leaf travel parallel to long axis of targets may be advantageous.