

AbstractID: 4319 Title: Role of Collimator Angle Optimization in Intensity Modulated Radiation Therapy

Purpose: IMRT optimization involves several treatment parameters producing a complex, unstable and computationally challenging problem during its search of an optimal plan in a reasonable time. Most parameters have been studied in IMRT optimization except the collimator angle, which is investigated in this study.

Method and Materials: Five head-and-neck and five prostate cases are selected. The head-and-neck and prostate PTVs range between 79.6-441 cm³ and 86.2-250 cm³ respectively, whereas the OAR volumes vary from 11.0-46.3 cm³ and 41.1-312 cm³ respectively. The patients are treated with five or seven fields equally distributed, 0-degree collimator angle, using the 1 cm leaf MLC from a Siemens Primus accelerator based on the plan generated using the Nucletron Oncentra treatment planning system. While dose-volume constraints are kept the same as in the patient's initial treatment plan, collimator angles are varied systematically (0-90 degrees) and a new treatment plan is optimized for each collimator angle. The number of beamlets, monitor units (MU) and DVHs for each collimator angle are compared.

Results: The variation of the total number of beamlets with collimator angle follows the shape of a parabola and peaks at 45° collimator angle for all patients. However, the MUs appear to be relatively independent of the collimator angle. The PTV dose coverage statistics for each patient are relatively independent of the collimator angle. Similar observations are noted for all the OARs, except for the small structures for which differences could be observed in the DVHs between the different collimator angles.

Conclusions: Collimator angle does not play a significant role in IMRT optimization, as long as the PTV coverage is adequate. This provides an additional freedom to choose from 0- 90 degree of the collimator angle for long fields without compromising the coverage with limited MLC range or treatment time.