AbstractID: 6975 Title: Automated computer optimization for 3D treatment planning of breast irradiation

Purpose: The conventional manual trial and error method (MTEM)for generating 3DCRT dosimetry plans for breast irradiation is time consuming and labor intensive, and does not always lead to an optimal plan. The purpose of this work is to develop an automated optimization tool to eliminate MTEM.

Method and Materials: A software package with GUI was developed with Matlab to interface with a commercial planning system (XiO, CMS). The package is capable of (1) accepting inputs of structure contours, prescription, 3D dose maps for each of 16 possible beams (two beam angles, two beam energies, open and 60 degree wedge with anterior, superior and inferior wedge orientations) from XiO, (2) optimizing beam weights to achieve uniform target dose and dose-volume constraints for critical structures, and (3) outputting optimized beam weights into XiO for final dose calculation. The dose distributions and dose volume histograms generated with the package for five representative whole-breast irradiation cases are compared with those generated from MTEM by experienced dosimetrists.

Results: All plans generated by the automated optimization package are equal to or better than those generated by MTEM in terms of their target dose uniformity and normal tissue sparing. Ratio of the uniformity index for the optimization plan and that for the manual plan ranged from 1.0 to 1.04. The average time for the optimization is approximately 15 minutes on a Pentium-4 3 GHz CPU. The entire process for generating a plan with the automated optimization is about four times faster than MTEM with an experienced dosimetrist.

Conclusion: A computer automated package that is capable of generating optimized 3DCRT dosimetry plan for breast irradiation is developed. It can generate plans equal to or better than those generated with MTEM but with significantly reduced time and effort. The optimization package is being implemented in the clinic.