AbstractID: 10327 Title: Determination of minimum number of segments for direct machine parameter optimization (DMPO) for IMRT plans and impact on treatment delivery time

Purpose:

Direct machine parameter optimization in IMRT plans offers flexibility in controlling the number of segments. The objective was to device a method to determine the DMPO optimal minimum number of segments and to evaluate its impact on treatment delivery time.

Method and Materials:

IMRT plans for 10 different prostate patients and 10 different head and neck patients were generated using conventional IMRT planning, where intensity maps are optimized prior to conversion into deliverable MLC apertures. Converted plans were then copied and re-optimized with DMPO using differing numbers of segments, each time maintaining the same prescription objectives and constraints. The process was repeated until a significant difference in the isodose distributions and Dose-Volume Histograms (DVHs) between the DMPO and the conventional IMRT plans occurred. The ratio of the minimum DMPO number of segments to the conventional IMRT number of segments was calculated. Three plans from each treatment site were performed using DMPO starting from scratch and the treatment planning time evaluated.

Results:

The maximum target and organ doses with DMPO were found to be about 3% higher than the conventional IMRT maximum doses, resulting into higher hot spots and slightly less dose homogeneity. DMPO reduced the number of segments by 45% for prostate cases and 40% for head and neck cases. DMPO took an average of 3 hours longer to plan from scratch. DMPO provided an average of 50% decrease in treatment delivery time.

Conclusion:

It is easier and faster to do a conventional IMRT plan first and then apply DMPO to the resultant plan. An acceptable DMPO would need about 55% of the total number of segments of a conventional IMRT prostate plan, and 60% of a conventional head and neck plan. We did not find DMPO to offer any benefit over conventional plans with less than 60 segments.