

AbstractID: 7382 Title: Dosimetric Comparisons of DMPO and Two-Step Approach Step-and-Shoot IMRT Plans

Purpose: To systematically evaluate step-and-shoot Intensity-Modulated-Radiation-Therapy (IMRT) plans generated by Direct-Machine-Parameter-Optimization (DMPO) and by Two-Step-Approach (TSA) using identical optimization parameters in Pinnacle³ treatment planning system.

Method and Materials: Using Pinnacle³ version 7.6c, TSA plans of total eight patients with Head-and-Neck, Prostate and Lung cancers were generated using identical optimization parameters from clinical plans used DMPO. The dose of planned-target-volume (PTV) in TSA plan was scaled to closely match at prescribed dose volume in the DMPO plan. Three PTV dosimetric indices: dose-coverage, dose-conformity and dose-inhomogeneity, were generated for each plan. Dosimetric comparisons were performed for organ-at-risk (OAR) with both “maximum-dose-objectives” and “dose-volume-based-objectives”. Final dose recalculation using EGS4-based in-house Monte-Carlo program for each plan was performed and corresponding dosimetric data were obtained. Film-based IMRT QA was performed for three patients.

Results: On average, total monitor-units (MUs) are about 25% higher of TSA than DMPO. The averaged segment-numbers and PTV dosimetric indices are almost identical between plans from DMPO and TSA. The maximum-dose (defined at 0.1cc) of Head-and-Neck and Lung OARs with “maximum-dose-objectives” of TSA are, on average, ~2.5Gy and ~0.9Gy lower than those of DMPO, respectively. The averaged dose difference in prostate OARs with “maximum-dose-objectives” is small. For OARs with “dose-volume-based-objectives”, there is little difference between TSA and DMPO for all sites. The Monte-Carlo dose recalculations showed similar trends. The agreement between Pinnacle³ calculations and film measurements is 99% for all fields using 3%-3mm criteria.

Conclusion: Dosimetric comparisons between DMPO and TSA IMRT plans demonstrated that using identical optimization parameters, DMPO plans have less total MUs and similar averaged segment-number as well as almost identical PTV dosimetric index values as TSA plans. For Head-and-Neck and lung plans, TSA has noticeable better sparing of OARs with “maximum-dose-based-objectives”, which is confirmed by Monte-Carlo recalculations. Film QA demonstrated both TSA and DMPO plans are very accurate.