

AbstractID: 12831 Title: Per-Patient Dose QA based on Clinically Relevant Metrics: Validation of the Planned Dose Perturbation Method to Estimate Patient Dose/DVH using Conventional QA Data

Purpose: In patient-specific IMRT QA, there is a need for patient dose/DVH-based metrics. A method called "Planned Dose Perturbation" (PDP) uses conventional IMRT QA to estimate patient dose by perturbing the 3D TPS planned dose based on conventional QA comparisons. The accuracy of the PDP method is assessed here.

Materials and Methods: 3D IMRT doses were generated using an accurate beam model. Then, various errors were induced in each beam of each plan to produce an incorrect 3D patient dose and corresponding incorrect planar QA calculations. The error-free beams were used to generate "virtual measurements" per beam. Then, conventional planar IMRT QA methods were used to generate per-beam 2D dose error maps which became inputs to the PDP system. PDP perturbs the error-induced 3D Patient Dose to generate a revised 3D Patient Dose. This revised dose was compared voxel-by-voxel to the error-free 3D Patient Dose to generate matching rate scores at 2%/2mm DTA over the 3D grid. Anatomical Region-of-Interest dose metrics (mean and max) were also assessed per ROI. This process was repeated for many cases, from simple IMRT plans (single beams on phantom) to very complex clinical IMRT plans (head/neck, prostate). Multiple beam energies were studied along with a range of severity of induced errors.

Results: All the PDP Patient Dose estimates achieved passing rates of 99.1% vs. error-free Patient Dose (2%/2mm DTA, absolute, volumetric, global percent difference, 10% lower threshold). When analyzing absolute dose metrics per ROI, the mean dose and max dose errors of PDP Patient Dose vs. Gold Standard averaged less than 1.00% error for all ROI (max error was 0.58%).

Conclusions: The PDP method is extremely accurate at estimating patient dose/DVH impact based on conventional IMRT QA phantom methods.

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