AbstractID: 6550 Title: Dose-Guided Radiation Therapy Strategies with Megavoltage Cone-Beam CT

Dose Guided Radiation Therapy (DGRT) is an extension of adaptive radiation therapy where dosimetric considerations constitute the basis of treatment modification and validation. The objective of this work is to elaborate two DGRT scenarios, treatment-time and progressive, and gather all the required functionalities within the same workstation to use it in a clinical environment.

The proposed DGRT strategies use a density-calibrated Megavoltage Cone-Beam CT (MVCBCT) image acquired at treatment time, the reference dose plan imported from the planning system and an independent dose calculation engine. A DGRT workstation was created to compare the initial plan with the dose distribution of the day. The beam arrangement is copied to the pre-registered MVCBCT and dose distribution is calculated. Side by side comparison, dose difference maps and DVH differences are used to assess the clinical situation. Phantom experiments and patient data were used to test the DGRT scenarios. A Pinnacle dose calculation was performed to validate the local dose calculation engine.

The DGRT workstation integrates the following steps; image registration, correction and conversion of MVCBCT images into density, dose re-calculation, dose comparison with the reference plan and a data extraction module for statistical analysis. Dose re-calculation on MVCBCT images is performed with a precision better than 3%, enabling the progressive DGRT scenario. When performed on a patient treated for a base of tongue tumor with IMRT, the DGRT scenario showed a mean dose increase from 26 to 42 Gy in the left parotid.

DGRT brings together the knowledge of 3D imaging and the 3D dose distribution to assess the clinical situation. By making dose re-calculation fast and accurate, the DGRT workstation allows dosimetric studies on a large scale. Results from on-going clinical studies will determine how frequently significant dose differences occur and lead to site-specific adaptation strategies.

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