AbstractID: 3481 Title: The dosimetric stability of the prostate and critical structures in the presence of internal motion for an adaptive correction strategy

Purpose: An adaptive correction strategy has been proposed in which internal motion is corrected for by repositioning the MLC aperture as an alternative to the current practice of patient repositioning. The study purpose was to investigate the dosimetric stability of this strategy in the presence of internal motion.

Method and Materials: Internal motion shifts were introduced in 25 prostate plans by shifting the PTV, rectum and bladder contours with respect to the bony-anatomy. Thirty-six randomly selected isotropic displacements of magnitude 0.5, 1.0, 1.5 and 2.0 cm were sampled for each patient, totaling 3600 errors. The adaptive correction strategy, which shifted the beams-eye-view of the MLC aperture to match the contours, was used to correct each of these errors. Recomputed plans were compared to the original treatment plans via dose–volume histogram analysis. Changes of more than 5% of the prescription dose were deemed clinically significant.

Results: The adaptive correction strategy produced small dose discrepancies for all structures considered apart from the femoral heads. Coverage of the PTV was excellent: D_5, D_{95} and D_{mean} where changes were <5% for all of the 3600 simulated internal motion shifts. D_{33} of the rectum was increased by >5% in 9/3600 sampled internal motion shifts, while the bladder D_{20} deviated by >5% in 9/3600 samples. The femoral heads D_{mean} increased by >5% for 651/3600 (18%) internal motion shifts. However, D_2 was not increased by >5% for any of the internal motion shifts.

Conclusion: These data demonstrate the robustness of the proposed adaptive correction strategy for correction of internal motion. The corrections can be performed remotely, thus eliminating errors resulting from increases in treatment time or from patient repositioning. This method has the ability to correct for both interfraction displacement of the prostate and for intrafraction prostate motion.

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