

AbstractID: 11277 Title: Estimating Dose Uncertainty in Minimally Deformable Sites Treated Without Daily Imaging

Purpose: To investigate a method to estimate the uncertainty in delivered dose distributions and tumor control for minimally deformable treatment sites undergoing radiotherapy without daily imaging.

Method and Materials: Total dose distributions were simulated for three prostate cancer patients by translating and adding dose grids based on probabilistic sampling of shifts based on actual patient shift data. Dose-volume histograms (DVHs) were created for each simulated total dose distribution for a 28 fraction course. Tumor control probability (TCP) was also calculated for each simulated dose distribution and compared relative to the TCP expected from the planning dose distribution.

Results: Broadening of DVH lines shows the dose-volume uncertainties introduced by treating without the anatomically-based shifts determined through the use of daily imaging. Uncertainty is relatively uniform at all doses and volumes for the femoral heads, rectum, and bladder. The prostate volume receiving at least 63 Gy had a mean of 96% and varied from 94% to 96.5%. Dose to 96% of the prostate volume had a mean of 63 Gy and varied from 61.5 Gy to 64.5 Gy. For one patient, TCP did not change significantly as a result of the random shifts. The other two patients exhibited larger reductions in TCP, with maximum TCP losses of 1.6% and 3% and average losses of 0.5% and 1.1%, respectively.

Conclusion: The relatively small estimated losses in TCP indicate that the planning PTV margins (2mm posterior, 5mm elsewhere) and fractionation schedules present in these plans are well suited to be used where daily imaging might not be readily available. Any loss in TCP must be balanced against other factors to decide whether or not daily imaging is required, and greater care in patient setup may decrease this loss in TCP further.

Conflict of Interest: TRM has a financial interest in Tomotherapy, Inc.