AbstractID: 13206 Title: Efficacy of the Fiducial Marker Based IGRT Approach in Prostate Tomotherapy and An Inter-fractional Motion Correction Optimization Method for Dose Coverage Improvement and Potential Margin Reduction

Purpose: To evaluate the efficacy of the target volume dose coverage in the fiducial marker based prostate Tomotherapy and to explore a correction optimization technique to improve the dose distribution. **Method and Materials**: The prostate and seminal vesicles were delineated by an experienced radiation oncologist on Tomo verification MVCT images acquired for 10 patients at different treatment fractions. The MVCT images were registered to planning kVCT images based on the implanted markers to correct for the inter-fracational deviations. This correction process is identical to that in clinical treatments. The treatment dose coverage was simulated by computing the dose coverage for the target volumes based on the MVCT verification images after the registration. The simulated treatment dose coverage was compared to corresponding plan to evaluate the efficacy of the fiducial marker based IGRT approach. Separately, a Hill-Climbing optimization algorithm was used to optimize the translational correction by maximizing a dose-based objective function. During this optimization process, the dose coverage was constantly recomputed as the translation correction was adjusted until an optimized dose coverage was reached. This optimized dose coverage was compared with the marker based treatment dose coverage to evaluate whether further dose coverage improvement and planning margin reduction could be achieved. **Results:** With the fiducial marker based IGRT approach, prostate was underdosed in about 5% of fractions and seminal vesicles were underdosed in about 10% of fractions. The amount of underdosing was much more pronounced for seminal vesicles than for prostate. In all the fractions, the translational correction optimization method improved the dose coverage beyond the prescription requirement and could prevent the underdosing, especially for seminal vesicles. **Conclusions**: The fiducial marker based IGRT approach is more reliable for prostate than for seminal vesicles. The developed correction optimization method can improve the dose coverage and holds potential to allow margin reduction.