AbstractID: 7116 Title: Simulated Real Time Image Guided Intra-Fraction Tracking-Delivery Method for Prostate IMRT

Purpose: The magnitude and frequency of intrafraction target motion (due to anatomical, physiological and physical changes) has an important role in delivery accuracy for image-guided radiotherapy. This motion could show significant variations even in few-second timeframe. However, there are no standard characteristics of target motion that can be assumed for a particular patient. This work aims to study the feasibility of tracking real time prostate motion with subsequent irradiation using Step-and-Shoot IMRT.

Method and Materials: The prostate motion for actual patient was recorded using image-tracked Cyberknife system during a 150-minute single fraction treatment, and subsequently analyzed. Single fraction IMRT plan was planned for the same patient. The plan was normalized such that 95.1% of the CTV received 100% of the prescribed dose. To study the effect of intra-fraction prostate motion and how the dose delivered was affected, two groups of IMRT plans were generated, one for 30 (group1) and one for 15 (group2) minutes total delivery time. Group 1 and 2 has 5 and 10 plans, respectively, to reflect the 150 minutes intrafraction prostate movement recorded. In these plans, for each segment, time averaged displacements of the target (AP, LR, and SI movements) were introduced and the MLC positions were shifted accordingly.

Results: The dose coverage of the CTV was reduced from the original 95.1% to 92.5 ± 2.6 % in group1, and to 90.4 ± 7.2 % in group2. Plan 5 of group2 shows the lowest dose coverage of 71.2 % due to significant prostate movement (0.5 - 2 cm) within 3601– 4500 second period. Dose coverage without plan 5 increased to 92.6 ± 2.7 % for group2. Transformed plans receive lower dose to the selected organs-at-risk (OAR) compared to original plans.

Conclusion: This result indicates the necessity of real time image-guided compensated IMRT delivery for moving target.