

Purpose: To assess treatment plan selection in a multiple plans adaptive IGRT strategy in routine clinical workflow.

Methods: Continuous Offline Replanning (COR) is an adaptive IGRT treatment strategy where patient treatment plan is selected from a pool of offline previously calculated plans based on the patient repositioning CBCT images. A treatment sequence with n=19 fractions was simulated and, with COR strategy, different selection approaches based on numerical analysis of DVH extracted values (COR_PTVV95, COR_CF) or on qualitative human selection (COR_H) were investigated. In numerical analysis, PTV coverage and multi-objectives cost function were investigated. Each COR strategy was compared with the standard IGRT strategy using prostate center of mass translations (IGRT_0), and an optimal online replanning strategy (IGRT_Opt). In COR_H, operators were asked to select the most appropriate plan available from a screen display, prioritizing geometrical fit of prostate, rectum and bladder contours on CBCT images.

Results: Cumulative average values of PTV V95 range from 92.9 to 95.5% for COR_H; 93.2 to 97.7 % for COR_PTVV95; 92.7 to 93.2% for IGRT_0 and 99.9 to 100% for IGRT_Opt, which ranks IGRT_Opt as the best treatment option and the COR_PTVV95 as second best option. Values of the multi-objectives cost function were consistent with PTV coverage and were in the range 0.71 to 2.62; 0.36 to 2.40; 1.74 to 2.69 and 0.014 to 0.021 respectively for COR_H, COR_CF, IGRT_0 and IGRT_Opt. Operators were asked to choose preferentially among the first 10 contour sets to see if 10 plans were sufficient to represent the diversity of anatomical configurations routinely seen. They succeeded for 17/19 fractions.

Conclusions: For multiple plans adaptive prostate IGRT treatment, numerical selection process of daily plan based on target dose coverage or cost function values appear to be superior to human visual selection. Further development aim to minimize time selection procedure.

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