

AbstractID: 2868 Title: A slice-by-slice CT-guided adaptive radiation therapy technique for twisting targets

Purpose: To investigate a CT-guided adaptive radiation therapy technique capable of correcting for complex shape changes, including twisting around the longitudinal axis, such as found when treating head and neck patients with a head rotation.

Methods: For co-planar beams, the dose in an axial plane is primarily associated with the positions of a single MLC pair. We start with a primary plan, and automatically generate several secondary plans with gantry angles offset by regular increments. MLC sequences for each plan are calculated keeping MUs and number of segments constant for a given beam (fluences are different). Bulk registration (3D) of planning and daily CT images gives global shifts. Slice-by-slice (2D) registration gives local shifts and rotations about the longitudinal axis for each axial slice. The daily MLC sequence is then created for each axial slice/MLC leaf pair combination, by taking the MLC positions from the pre-calculated plan with the nearest rotation, and shifting using a beams-eye-view calculation to account for local linear shifts.

A planning study was carried out using two MR images of a healthy volunteer, contoured to simulate a base-of-tongue treatment: One with the head straight (used to simulate the plan image) and one with the head tilted to the left (the daily image).

Results: On a slice-by-slice basis, local rotations in the daily image varied from 2 – 31degrees. Local shifts ranged from -0.2 – 0.5cm and -0.4 - 0.0cm in right-left and posterior-anterior directions, respectively. The adapted treatment gave good target coverage, and kept the daily cord dose below the limit used in the original plan (65%, equivalent to 46Gy over 35 fractions).

Conclusions: This technique may be useful for adaptive radiation therapy of targets where twisting around the longitudinal axis is significant. These results also demonstrate the feasibility of combining MLC sequences from different pre-approved treatment plans.