

AbstractID: 11713 Title: Error propagation in tracking geometry and dose through the course of treatment for dose accumulation in adaptive therapy of Head-and-neck cancers

**Purpose:** In making re-planning decisions in response to observed geometric changes in head-and-neck patients, the daily dose distribution is often compared to the initially planned dose distribution. A more accurate approach would evaluate the total delivered dose up the point when new patient model becomes available, making decisions based on deviations of the accumulated dose from the planned dose. The aim of this study is to compare the accuracy of two different dose accumulation methodologies that utilize deformable image registration for tracking dose.

**Methods:** In the first method, the dose is tracked directly from each fraction to the new patient model, which requires N-1 deformable registrations for dose accumulation at fraction N. In the second method, the total delivered dose is accumulated starting with fraction 2, such that at fraction N, the dose is already mapped to fraction N-1 and a single deformation map would be sufficient to track dose to the new geometry. This study evaluates the accuracy of each technique by comparing deformed contours generated using each method for a single head-and-neck patient. Contours at fractions 5, 15, and 25 are compared visually and quantitatively using distance to agreement at specific points of interest.

**Results:** Visual assessment indicates that method 1 is more accurate than method 2. The largest difference between the two simulated surfaces of CTV was observed near the edge of pharynx and was measured to be 0.49, 0.39 and 0.53 cm, for fractions 5, 15, and 25 respectively.

**Discussion:** Propagation of deformable alignment errors has the potential to negatively impact cumulative dose evaluation. Caution is recommended in evaluating adaptive therapy implementations that rely on the accumulation of deformations for summation of dose evaluation in later treatment fractions.

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