

Purpose:

On a TomoTherapy HiArt system, x-ray target replacement is required every 9-12 months due to target degradation. Near the end of target life, the target thins and causes a softening of the beam profile at the lateral edges of the beam. The purpose of this study is to evaluate the dosimetric effects of this target degradation on recalculated helical tomotherapy treatment plans.

Method and Materials:

A measured beam profile near the end of target life was used to create a modified beam profile model. The model was then incorporated into the treatment plan sinograms for recalculation. The plans were calculated using a research version of the planned adaptive treatment planning software from TomoTherapy, Inc. Three plans were evaluated in this study: prostate, partial breast, and head and neck. The D50 of organs at risk (OARs), the D95 for planning target volumes (PTVs), and the local dose difference were used to evaluate the changes in the modified treatment plans.

Results:

For the prostate and head neck treatment plans, the D50s for OARs and the D95s for PTVs were within 1% for the original and recalculated treatment plans. The largest differences were found for the partial breast plan. The D95 for the breast PTV decreased by 1.8 % for the recalculated treatment plan. The maximum local dose difference inside the PTV was 6 cGy (3% of the prescription dose of 200 cGy). The absolute difference in the D50s for the heart and the ipsilateral lung were less than 0.5 cGy.

Conclusion:

The dosimetric effects of target degradation on calculated helical tomotherapy treatment plans were found to be small, less than 2% for DVH changes and less than 3% for local dose differences.

Conflict of Interest (only if applicable):

M. D. Anderson Cancer Center Orlando holds a research grant from TomoTherapy, Inc.