

**Purpose:**

Helical tomotherapy is subject to rotational output variation during treatment delivery. The purpose of this study is to evaluate the dosimetric effects of the rotational variation using recalculated treatment plans which include a rotational variation.

**Method and Materials:**

In order to assess the rotational output variation, the monitor chamber signal was extracted from delivered treatment data archives and analyzed. The rotational variation was then modeled and incorporated back into the treatment plan sinogram by adjusting the leaf opening times for each projection. The modified treatment plans were then calculated using a research version of the planned adaptive treatment planning software from TomoTherapy, Inc. Two treatment plans, one head and neck and one prostate, were evaluated in this study. Treatment plans were recalculated with an observed rotational variation of  $\pm 2\%$  and a hypothetical variation of  $\pm 10\%$  for comparison to the original calculated treatment plans.

**Results:**

The rotational variation from delivered treatments was found to follow a sinusoidal shape with a period equal to one gantry rotation and a magnitude of about  $\pm 2\%$  on average. For a rotational variation of  $\pm 2\%$ , the D95 for the target volumes and the D50 for critical structures were found to be different from the original plan by less than 0.26% for the recalculated treatment plans. For a hypothetical rotational variation of  $\pm 10\%$ , the difference from the original was less than 0.5% for the D95 for target volumes and 1.4% for the D50 of critical structures.

**Conclusion:**

The rotational variation for delivered helical tomotherapy treatments was found to be on the order of  $\pm 2\%$ . For this observed rotational variation, a negligible dosimetric effect on calculated helical tomotherapy treatment plans was found.

**Conflict of Interest (only if applicable):**

Our group holds a research grant from TomoTherapy, Inc.