AbstractID: 5668 Title: 3-D Dosimetric Evaluation on Isocenter Positioning Error in the Dynamic Arc Stereotactic Radiotherapy Based on Optical CT Based Polymer Gel Dosimetry

Purpose: Accurate isocenter positioning is very important for patient setup in the treatment of stereotactic radiosurgery. In this study, the effect of positioning error of the planned isocenter on the 3-D dose distribution was evaluated for brain lesions treated with Novalis dynamic arc stereotactic radiotherapy, using an optical CT based polymer gel dosimeter.

Method and Materials: Recent developments in mechanic accuracy of gantry and couch rotation and IGRT devices have shown that the patient setup can be corrected with sub-millimeter shift along the three vertical axes. This leads to an important question: What is the impact on the dose-volume-histogram for both target and critical organs, if the isocenter positioning error is not corrected. To assess this impact, two plastic cylinders filled with BANG® polymer gel (MGS Research, Inc) were used for dose measurements. One gel was irradiated with an adjustment on the isocenter shift due to couch rotation between couch positions. One gel was irradiated without any correction for isocenter shift. The irradiated gels were then scanned with 1 mm resolution using an optical CT scanner, OCTOPUS™ (MGS Research, Inc). Dose distributions and DVHs from two gel measurements and the treatment planning calculation were compared.

Results: Comparison of dose distributions between the gel measurement and the treatment planning calculation showed that the agreement was within 2% in dose or 2 mm in distance. The DVH obtained from the gel measurement without any correction for isocenter shift showed smaller dose coverage at the target volume and a larger volume at the low dose (50%-80% isodose).

Conclusion: Polymer gel dosimeter can provide a method of acquiring 3-D dose distribution for a complex treatment modality. The clinical impact of sub-millimeter error in isocenter positioning depends on disease site, target size, and other clinical information.

Conflict of interest: Research sponsored by MGS Research, Inc.