AbstractID: 7376 Title: Independent Point Dose Verification using TomoTherapy Quality Assurance Phantom

Purpose: To detect TomoTherapy planning errors by relating a point dose in the patient treatment plan to the dose calculated at the corresponding point in the quality assurance phantom.

Methods and Materials: Standard TomoTherapy patient-specific quality assurance applies the patient treatment plan to a cylindrical QA phantom and then compares measured phantom dose to calculated phantom dose. However, there is no check of dose in the phantom to dose in the patient. We applied a ratio of TMRs to a point dose in the patient treatment plan in order to estimate the dose to the corresponding point in the phantom. Rotational delivery of TomoTherapy was approximated using either a 360° arc, 8 equally-spaced angles, or 4 equally-space angles. For each approximation, calculations were done using average physical depth and average radiological depth. The method was tested using data from 87 TomoTherapy patients. TMR ratio method doses were compared to treatment planning system doses. Agreement within ±5% was considered clinically acceptable.

Results: Using average radiological depth, the pass rates were 70.6%, 69.4%, and 65.9% for the 360°, 8-, and 4-angle approximations, respectively. Using average physical depth, the pass rates were 63.5%, 56.5%, and 58.8% for the 360°, 8-, and 4-angle approximations, respectively. The best results were obtained for centrally-located tumors such as prostate (83.9% pass rate for radiological depth and 360° arc approximation). The pass rates were worst for superficial tumors (50.0% pass rate for radiological depth and 360° arc approximation).

Conclusions: The TMR ratio method was used to relate dose in the QA phantom to dose in the patient. For each beam approximation, radiological depths gave better results than physical depths. The site-specific pass rates could be used to determine action levels for implementing this method in the clinic.

Supported in part by a research agreement with TomoTherapy, Inc.