AbstractID: 4374 Title: A Three-dimensional Quantitative Dose Reduction Analysis in MammoSite Balloon Due to Radiopaque Iodine-based Contrast Solution in Ir-192 for HDR Brachytherapy: Monte Carlo Calculations and MOSFET Measurements

Current treatment planning systems (TPS) for partial breast irradiation (PBI) using MammoSite brachytherapy applicator often neglects the effect of inhomogeneity, leading to potential inaccuracies in dose distributions. Previous publications have investigated only a planar dose perturbation along the bisector of the source. This investigation expanded to include the attenuation-corrected radial dose and anisotropy functions and incorporates them into a treatment planning system in a form parallel to the updated AAPM TG-43 formalism. This will delineate quantitatively the inaccuracies in dose distributions in three-dimensional space. The changes in dose deposition and distribution caused by increased attenuation coefficient resulted from iodine-based contrast solution are quantified using MCNP Monte Carlo simulations in coupled photon/electron transport. The source geometry was that of the VariSource wire model VS2000. Concentration of the iodine-based solution was varied from 5% to 25% by volume, a range recommended by the balloon's manufacturer. Balloon diameters of 4cm through 6cm were simulated. Measurements using MOSFET were done in water, using a water equivalent jig for precision positioning of balloon and instruments. Dose rates at the typical prescription line of 1cm away from the balloon surface were determined in different polar angles. According to the computations, the dose rate reduction throughout the entire region of interest ranged from 0.33% for the smallest balloon diameter and contrast concentration to a maximum of 6.29% for the largest balloon diameter and contrast. Good agreement was observed between simulations and measurements to within the acceptable error for MOSFET dosimetry (0.9%~2.8%).