Abstract ID: 18310    Title: Monte Carlo Dosimetric Study of SAVI HDR Applicator for Partial Breast Irradiation

Purpose:
To investigate the dosimetric variation by Monte Carlo and experimentally simulating the situation with and without tissue invagination and the potential translation and rotation of the SAVI applicator for partial breast irradiation.

Methods:
The SAVI applicator with the cavity filled with air and water was merged into a water phantom and the delivered dose was simulated by MCNP monte carlo program. The results verified using an ion chamber and film were compared with a homogenous dose calculation by the treatment planning system. A dose variation from the SAVI translational shift was simulated and measured by moving an ion chamber along with the central axis direction. A dose change from the SAVI rotation was simulated and measured by placing an ion chamber at a fixed point while rotating the SAVI device about the central axis.

Results:
The dosimetric variations for the SAVI device were found to be related to the cavity dimension, source arrangement, and dwell times. For the single dwell source placed in the center of the applicator, the maximum difference of the dose with the air cavity at 1cm away from the air-water boundary is about 7% higher than that with water filling in the cavity. But the simulation and measurements with nearly fully loaded multi-sources for the same situation show a difference of less than 3%. The 3% dose variation in average was found from either the 3 mm translation or 3 degree rotation of the SAVI applicator.

Conclusions:
The maximum dosimetric effect of an air cavity is 7% off compared with a water filled cavity when a single dwell source position is used in the center of the central catheter. Multiple catheters of the SAVI applicator with a nearly fully loaded dwell source position produce the discrepancy of less than 3% and allow for optimal and conformal dose distribution to a lumpectomy cavity while minimizing the dose to adjacent normal structures.