AbstractID: 8123 Title: Dosimetric Characterization and Biological Validation of a Phantom for Three Dimensional IMRT-Based In Vitro Experiments

Purpose: To characterize the dosimetry of a previously described cylindrical phantom for use in 3-dimensional intensity modulated radiation therapy (IMRT)-based *in vitro* cell experiments and validate the phantom by comparing its performance *in vitro* to a standard experimental setup.

Method and Materials: The phantom was loaded with a stack of three 6-well tissue-culture plates. An IMRT plan with a single PTV encompassing all plates was created and delivered in the phantom. Calculated doses were compared to those measured using both an array of thermoluminescence dosimeters (TLDs) and film placed in the phantom. *In vitro* validation was performed by delivering an array of doses from 0–10 Gy to two human cancer cell lines (A549 and SCC116) using both the phantom and a standard experimental setup employing a single open field. Percentage of viable cells post-irradiation (%Via) was compared for both setups using the diphenylamine (DPA) assay.

Results: The percent differences between TLD measurements and corresponding points in the treatment plan ranged from -1.3%-2.9% ($p>0.05$ for all cases). Average point-by-point percent dose difference ($\%D_{diff}$) between each film and the corresponding calculated dose plane ranged from 1.6%-3.1%, while the $\%D_{diff}$ at which 95% of the film points agreed to $\leq$3.0% ranged from 2.8%-4.1%. These results show good general agreement between measured and predicted dose. Comparison of the two experimental setups revealed average differences in %Via of 1.28% and 3.26% for SCC116 and A549, respectively ($p>0.05$ for all cases).

Conclusions: Good general agreement between calculated and TLD and film measured dose within the phantom under experimental conditions, along with strong agreement in cell response when using the phantom versus a standard experimental setup show that the phantom is a useful, efficient, and dynamic tool for 3-dimensional *in vitro* cell experiments.

Conflict of Interest: Supported by a grant from MedImmune.