AbstractID: 6697 Title: Cellular response to modulated radiation fields

Purpose:

To investigate cell survival following exposure to spatially modulated beams, as created by intensity modulated radiotherapy (IMRT), using *in vitro* experiments.

Method and Materials:

We compared cell survival in modulated fields with cell survival in a uniform control field using malignant melanoma cells (MM576) exposed to a therapeutic megavoltage photon beam. Three different spatial modulations of the field were used: a control "Open" field in which all cells in a flask were uniformly exposed; a "Quarter" field in which 25% of cells at one end of the flask were exposed; and a "Striped" field in which 25% of cells were exposed in three parallel stripes. The cell survival in both the shielded and unshielded regions of the modulated fields, as determined by a clonogenic assay, were compared to the cell survival in the Open field.

Results:

In the unshielded regions of the irradiated flasks, the cell survival was seen to differ between the three fields for the same delivered dose. For the modulated fields, the regions which received only scattered and leakage dose displayed decreased survival at lower doses, relative to the "Open" field, and increased survival at higher doses.

Conclusion:

We have found three distinct ways in which the cell survival is influenced by the fate of neighboring cells. The first of these (Type I effect) is the classical Bystander Effect whereby cell survival is reduced when nearby cells receive a high radiation dose but some survive. The Type II effect is an increase in cell survival when nearby cells receive a lethal dose. The Type III effect is an increase in survival for cells receiving a high dose of radiation when nearby cells receive a low dose of radiation. Our observations of the Bystander Effects emphasize the need for improved radiobiological models, which include communicated effects.