

AbstractID: 5105 Title: Physical and Biological Characteristics of Megavoltage Grid Radiation Therapy

Purpose: Dosimetric characteristics of a newly designed GRID block for megavoltage radiotherapy were investigated using TLD, film, and ionization chamber. Therapeutic advantage of this treatment modality was determined using a linear quadratic model in terms of treatment dose, GRID hole size, center-to-center spacing between the holes, and sensitivity of tissues to radiation.

Method and Materials: Recently a newly redesigned GRID block has been introduced by Radiation Product Design, Inc. for different linear accelerators. Dosimetric characteristics (i.e. GRID output, dose profiles, and %DD) of three GRID blocks with different hole size and spacing were experimentally investigated. These GRID blocks were designed for a Varian 21EX linear accelerator. The measurements were performed using radiographic films and thermoluminescent dosimeters (TLDs) in Solid Water™ phantom materials and an ionization chamber in water. The measured dose profiles were then utilized to evaluate the therapeutic advantage of the GRID therapy as a function of dose, grid hole size and spacing, and also radiosensitivity of tissues with a linear-quadratic (LQ) model. Therapeutic advantage of these GRID blocks was determined for a single fraction dose of up to 30 Gy.

Results: Dosimetric characteristics of the GRID field were determined as a function of field size, beam energy, and Grid geometry. The results had shown that the therapeutic advantage of GRID increases by increasing the hole size, decreasing the spacing between the holes, and increasing the treatment dose. Moreover, the advantage of the GRID therapy was more pronounced for the radioresistant cells than radiosensitive cells.

Conclusion: GRID radiotherapy exhibited a significant therapeutic advantage over the open field radiotherapy when the tumor cells were more radioresistant than normal cells. In addition, the therapeutic advantage of the GRID therapy is dependent on the treatment dose, GRID hole size and spacing between the holes.