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Comparison of dose deposition patterns of multi-slit versus single-slit collimators in synchrotron MRT and their effect on 9L cells

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Results of quantitative evaluation and comparison of dose deposition patterns and radiobiological effects in synchrotron microbeam radiotherapy (MRT) - in particular, the inter-microbeam "valley" dose - for six beam geometries and three different in-beam dose values are presented. The X-Tream dosimeter and Gafchromic film have been used to quantitatively compare the dose distribution resulting from step-and-shoot single versus multi-slit collimation for two of the six beam geometries in order to validate the use of the single-slit approach for the other four geometries. Radiobiological effects have been assessed by evaluating post-irradiation cell survival fractions on cultured 9L gliosarcoma cells.

Preliminary results from our allocated beamtime at the Australian synchrotron show that valley doses obtained with single-slit step-and-shoot collimation are between 3 and 10% lower than in multi-slit collimation with the same beam width and peak-to-peak distance. The biological effects of any difference in spatial and temporal dose deposition patterns were also investigated by irradiating in vitro 9L gliosarcoma cells (at a depth of 2 cm in water, surrounded by solid water) using both beam delivery methods. At the time of writing this abstract, the irradiated cells are in incubation and their colony formation abilities will be assessed in two weeks.

Keywords or phrases (comma separated)

MRT, Step and Shoot collimation, Radiobiological effects, clonogenic assay, dosimetry

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