AbstractID: 5755 Title: microRT/microRTP: a conformal small animal planning and irradiation system

Purpose: We have developed a novel small animal radiation therapy device (microRT), which integrates multi-modality imaging, radiation treatment planning, and conformal radiation therapy. In this study, we evaluated the accuracy of the treatment planning and positioning systems of the microRT device.

Method and Materials: The microRT system utilizes a clinical ^{192}Ir HDR source collimated via machined tungsten inserts to deliver photon beams at a source to target distances of 1-8cm at four angles (0, 90, 180, and 270). Beams were modeled using Monte Carlo and a parameterized analytic dose engine was created. Radiochromic film (5mm steps) in a solid water phantom was used to evaluate actual delivered doses in multiple planes. Treatment plans using these beams were created by a custom treatment planning system (microRTP) based on imported fiducial-registered imaging (CT, MR, PET) of animals immobilized in the treatment position. A three-axis computer-controlled stage supports and positions animals in the beams according to the microRTP plan. Validation of the positioning system was performed using a phantom and images of phantom and collimator via a kV C-arm.

Results: The analytic dose model agreed with the Monte-Carlo predicted dose within 5% and 10% outside and inside the 1 mm deep build-up regions, respectively. Film dosimetry agreed with the analytic model within 10% and also demonstrated an effective field diameter of 8mm at 17mm from the source. The ^{192}Ir line source geometry caused a radial anisotropy of up to 12% at 17 mm depth from the source. The positioning accuracy of the animal support hardware was sub-millimeter.

Conclusions: The microRT system provides conformal radiation therapy based on pre-treatment imaging and planning for small animal models of cancer and tissue injury.

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