Micro Irradiator / Animals

How accurate is image guided radiation therapy (IGRT) delivered with a micro-irradiator?

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There is significant interest in delivering precisely targeted small-volume radiation treatments, in the pre-clinical setting, to study dose-volume relationships with tumor control and normal tissue damage. In this work we investigate the IGRT targeting accuracy of the XRad225Cx system from Precision x-Ray using high resolution 3D dosimetry techniques. Initial results revealed a significant targeting error of about 2.4mm. This error was reduced to within 0.5mm after the IGRT hardware and software had been recalibrated. The facility for 3D dosimetry was essential to gain a comprehensive understanding of the targeting error in 3D.

Commissioning a Small Animal Irradiator Using 2D and 3D Dosimetry Techniques

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Purpose: To commission and characterize a novel small animal irradiator, the XRad225cx from Precision X-Ray Inc. This system is capable of delivering both square and circular fields ranging in size from 1mm to 40mm. The combination of very small field size and relatively low energy (225kV) represents a substantial challenge in acquiring accurate dosimetry beam data. This work reports on commissioning studies using 2 independent dosimetry systems: EBT2 radiochromic film and PRESAGE /optical-CT 3D dosimetry. Methods: Initial measurements were made with 6×8cm pieces of EBT2 radiochromic film. Output factors were determined at 3 depths (0, 0.5 and 2cm) from films irradiated normally resting on the surface or sandwiched in solid water. Percent-depth-dose (PDD) measurements were made from films also sandwiched in solid water and irradiated edge on. Independent 3D dosimetry measurements were obtained using PRESAGE radiochromic dosimeters and imaged with the Duke Large field-of-view Optical-CT Scanner (DLOS). Output factors and PDD's were obtained using a combination of small fields. Results: The relative output factors and PDD's obtained from EBT2 and PRESAGE showed agreement below 1 cm depth. For field sizes >1cm, relative output factors were found to be stable (1.00) with differences between PRESAGE and EBT2 <6%. At smaller field sizes the output relative to the 20 mm cone decreased substantially, down to 0.5 for the smallest 1 mm cone. A slightly greater drop was observed in the PRESAGE measurements, which is currently being investigated.

Conclusions: Output factors and PDD curves were successfully obtained for all cones using a combination of EBT2 and PRESAGE. Consistency was observed between both independent measurements after correcting for the lack of exact water equivalence of both the solid water and PRESAGE. The 3D dosimetry system has potential advantages in terms of convenience, efficiency and comprehensiveness when commissioning small fields