

AbstractID: 10864 Title: Small animal stereotactic irradiator

Purpose: We have developed an image-guided small animal stereotactic irradiator capable of high dose rate radiation delivery and high accuracy in target localization in a manner that mimics clinical stereotactic delivery. In this study, we characterized radiation beams for small animal radiosurgery treatment planning.

Method and Materials:

The irradiator employs a commercial x-ray device (XRAD 320, Precision X-Ray, Inc.) with custom made collimation system consisting of a brass collimator holder and variable tungsten alloy collimators with apertures ranging from 1 to 10 mm in diameter. The image guidance system consists of a high resolution x-ray intensifying screen (Kodak Min-R2) coupled to a computer-controlled digital camera. The x-ray tube is operated at 30 kVp for imaging, and at 250 kVp for therapeutic delivery. To characterize the radiation beams, we measured percent depth dose curves (PDD), off-axis ratios (OAR) and absolute dose rates for each collimator using radiochromic film (Gafchromic EBT, International Specialty Products, Wayne, NJ) at 19.76 and 24.76 cm source-to-surface distance (SSD).

Results: For a 5 mm circular collimator, at 19.76 cm SSD, the penumbra, defined as distance between 80% and 20% isodoses, for in-plane and cross-plane measurements was 0.7 and 1.1 mm, respectively. For the 5mm collimator, PDD values of 55% and 20% were at depths of 25 and 50 mm respectively, indicating more than adequate penetration for deep seated targets in small animals. Absolute dose rates ranged from 6.7 to 11.6 Gy/min for the 1 to 10 mm collimators at SSD of 19.76 cm. At 24.76 cm SSD, for 5 and 10 mm collimators, measured dose rates were 7.1 and 7.7 Gy/min, respectively.

Conclusion:

The irradiator offers high dose rates and sharp beam profiles, and has been systematically characterized for a set of source-to-surface distances and field sizes relevant for a number of animal experiments already successfully performed.