

Evaluation of Radiophotoluminescent Glass Rod Detector for Small Field Dosimetry; Measurement of Output Factor in Water for Cyber-Knife

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The Cyber-Knife SRS system can deliver with a high precision, a single or several fractions of radiation doses to a well-defined small intracranial or extracranial target. There are collimators of 12 different sizes with the range from 5 to 60 mm in the Cyber-Knife. The accuracy of the output factor defined as the ratio of the dose rate for a given collimator to that of the 60 mm collimator directly affects the accuracy of dose delivery in Cyber-Knife. This is of obvious importance for any SRS system, particularly when a single large radiation dose is delivered to a small selected target with the 5 mm collimator, as in the treatment of trigeminal neuralgia. The measurements of such small output factors are generally difficult due to the sharp radial dose fall-off, the small size of the dose plateau region and the lack of lateral electron equilibrium. A radiophotoluminescent (RPL) glass rod detector (GRD) system has recently become commercially available. In this study, the model GRD-301 glass rod dosimeter and FGD-1000 automatic reader are used. The output factor measurements of the GRD are compared with those of a diode detector and normalized to that of a 60 mm circular collimator. All measurements are performed at a depth of 1.5 cm in water phantom. The GRD is irradiated in a water phantom using a holder stand. The water level is adjusted precisely to the top of the holder and the axis of the beam aligned with holder axis. The robot is adjusted so that the radiation beams pointed down vertically. The center of the GRD is set to be the center of the radiation field by alignment with a point laser built into the LINAC. The measured output factors for GRD and diode are similar except for the three smallest collimators (5, 7.5 and 10 mm). The measured difference between the above methods is approximately 3%. The mean value of the output factor for GRD in the 5 mm collimator is 0.691 ± 0.006 .

Keywords : Cyber-Knife, Output Factor, Glass Rod Detector