

AbstractID: 6753 Title: The Effect of Detector Size on Measurement of Output Factor of 4 mm Collimator in Gamma Knife

Purpose: We investigated the effect of detector size for output factor measurement of small field in Gamma knife. Measured and corrected output factors using deconvolution to remove the effect of detector size for the 4 mm collimator were compared.

Method and Materials: The output factors were measured with a pinpoint ionization chamber, a glass rod detector (GRD) from the 14, 8 and 4 mm helmets relative to the 18 mm collimator. The measured output factors were corrected for spatial averaging effects by measuring dose profiles for the 4 mm collimator with the same detectors and deconvolving their response from the measured profiles. A Gaussian kernel was used to describe the detector response. The measuring volume of the pinpoint chamber was 0.015 cm³ and the size of the GRD was 1.5 mm in diameter and 8.5 mm in length. All measurements were performed in spherical polystyrene head phantom having a diameter of 160 mm.

Results: The 4 mm collimator output factor measured by the pinpoint chamber was 0.699 ± 0.009 and the GRD measurement was 0.861 ± 0.015 . The corrected output factor by deconvolving for the 4 mm collimator was 0.853 for the pinpoint chamber and 0.874 for the GRD.

Conclusion: The output factors obtained with a GRD are within 1.1 % in good agreement with the values recommended by the manufacture. The difference for measured and corrected value of output factor based on GRD detector is within 1.5%. The GRD may be a useful detector for small field dosimetry. However, the measured value of the 4 mm collimator output factor from the pinpoint ion chamber is significantly lower than the results obtained using the GRD. Due to the large volume of pinpoint chamber compared to other detectors used, a significant deconvolution correction is noted for the for the smaller collimator size.