

AbstractID: 7151 Title: Measurement of Gamma Knife Collimator Factors using Optically Stimulated Luminescence (OSL) Dosimeter

Purpose: Optically stimulated luminescence (OSL) technology is considered a breakthrough in radiation detection. The advantages of OSL technology includes: good linearity and energy response, non-destructive readout, cost effective, easy to use, etc. It has been widely used in personnel and environmental radiation monitoring, and more recently it finds applications in radiation dose measurement in radiation therapy. The purpose of this study is to evaluate the Landauer microStar dosimetry system and its application in measurement of Leksell Gamma Knife collimator factors.

Method and Materials: Landauer OSL Dot dosimeter, aluminum oxide crystals ($\text{Al}_2\text{O}_3:\text{C}$), was placed in the center of the Elekta standard 80 cm spherical phantom to be irradiated in the Gamma Knife Co-60 beams. A calibration curve of doses vs. dosimeter readouts was established by irradiating the dosimeters in the 18 mm helmet with a series of known doses. The dosimeters were then mounted in other helmets and irradiated in order to measure the collimator factors. Multiple readouts on the dosimeters were carried out to evaluate consistency and reproducibility.

Results: The dose calibration curve demonstrated a linear relationship between irradiated doses and dosimeter readouts. Least-square fit of measured data shows a straight line with a slope of 1039 counts/cGy, and a correlation coefficient of 0.9998. Collimator factors for 14 mm and 8 mm helmets measured with the OSL dosimeters are 0.979 ± 0.025 and 0.942 ± 0.021 , respectively. These values are in good agreement with the values provided by the Gamma Knife manufacturer. Measurement of the 4 mm collimator factor requires taking into account of the dosimeter dimensions and applying further corrections. More measurement results are to be presented.

Conclusion: Preliminary result has shown that radiation dose measurement using the OSL dosimetry system is accurate and reproducible. The OSL dosimeter can be used to measure or verify Gamma Knife collimator factors.

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