AbstractID: 10287 Title: Design and validation of a source deployment test for an intra-ocular Sr-90/Y-90 brachytherapy source

Purpose: To determine whether a well-type ionization chamber can be used to verify proper source deployment of an approximately 2.5mm long $^{90}Sr/^{90}Y$ source pellet used to treat wet age-related macular degeneration; to optimize the measurement geometry; and to verify that the apparatus functions as predicted by the model.

Method and Materials: The Monte Carlo code MCNP5 was used to investigate optimal design parameters for a collimating well chamber insert intended to verify whether a $^{90}Sr/^{90}Y$ brachytherapy source is fully deployed to within 0.25mm of the stainless steel delivery cannula end plug. The source position for measurements was not known *a priori* with this resolution, so a precise retraction of the source for measured validation of the calculated data was not possible. An alternate method for validation of the MCNP5 model was devised to be substantially similar to the retracted source geometry but to allow corresponding measurements to be made in a well controlled geometry. As part of this investigation, a well chamber transfer standard for reference measurements was established and variations between production models of both straight reference cannulae and treatment cannulae were experimentally determined.

Results: The Monte Carlo models indicated that a fully deployed source should generate between 16% and 20% of the open field straight cannula measurement used as a reference value. For the offset source measurements, the measured data concurred with MC values to within 1% (0.1% of the reference signal), thus validating the calculations. Measured variation between reference cannulae was ±0.3% and between clinical cannulae without the collimating insert was ±0.9%. Measurements were reproducible within ±0.2% standard deviation.

Conclusion: This work validates the MCNP5 model used to calculate the signal range generated by an acceptably deployed $^{90}Sr/^{90}Y$ source in the collimating well chamber insert.

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