

AbstractID: 7578 Title: Development of a modified 3D radiochromic dosimeter for clinical proton beams

Purpose: To develop a formulation of PRESAGE™, a three-dimensional radiochromic dosimeter, that does not under-respond in the high LET region of a proton beam. Previous investigations with PRESAGE™ report a 38% under-response when irradiated in the SOBP of a proton beam compared to 6 MV photons.

Method and Materials: A new PRESAGE™ formulation was developed for this study by replacing the reporter molecule in the original formulation, leucomalachite green (LMG), with a new LMG derivative. Dosimeters were manufactured using LMG and the LMG derivative and irradiated in the SOBP region of a 250 MeV proton beam to doses from 1 Gy to 5 Gy to develop a dose response curve for each formulation. An additional dose response curve was developed for the LMG derivative by irradiating dosimeters to doses from 1 Gy to 5 Gy using 6 MV photons.

Results: The response of the LMG derivative was 52% more than that of the original formulation when irradiated using a proton beam. The response of the LMG derivative to protons and photons was within 3% over the entire dose range. The LMG derivative was also found to be more stable post-irradiation than the original formulation.

Conclusion: The under-response of PRESAGE™ to protons has been corrected by replacing the LMG reporter molecule with a new LMG derivative. The molecular structure of the new derivative was based on the presumption that the under-response in the original formulation was due to shifting of the equilibrium of the colored malachite green form back to the non-colored leuco form when irradiated in high LET beams. The data for the new LMG derivative supports this mechanism. Additional studies will be presented that further characterize the response of the new PRESAGE™ formulation.

The investigation was supported by PHS grant CA 10953 awarded by the NCI, DHHS.