AbstractID: 5292 Title: An Exploration of New Formulations for PRESAGE^{TM} 3D Dosimetry

Purpose: Presage is a new radiochromic material with substantial promise as a practical and convenient 3D dosimeter. Here we investigate new formulations of PRESAGE™ to determine formulations that have high sensitivity, high stability, and/or are amenable to repeat measurements.

Method and Materials: PRESAGE™ formulations were manufactured in 2 mL glass vial samples and were irradiated in a 6MV photon beam to a dose of 5 Gy. Fifteen formulations were studied, eight of which were variations containing leucomalachite green (LMG) and seven variations containing leuco crystal violet (LCV). The transmission spectra (500-700 nm) were measured in a spectrophotometer for each sample pre-irradiation and then approximately one hour post-irradiation. Subsequent spectrum acquisitions were recorded at 2, 24, 48, and 72 hours post-irradiation to ascertain the stability of optical density changes.

Results: Overall, the LCV formulations show greater sensitivity than the formulations containing LMG. The most promising LCV formulations exhibit a 15 – 33 % increase in post-irradiation absorption relative to pre-irradiation. The LCV formulations had minimal post-irradiation color bleaching from 2 to 72 hours, while the LMG formulations varied widely in stability post-irradiation. A number of the LMG samples returned to their pre-irradiation optical density, suggesting the possibility of a formulation which could be reusable. In addition, two of the formulations which contained polymeric acrylates along with the leuco dyes increased transmission relative to pre-irradiation, illustrating the intriguing potential of an 'inverse radiochromic dosimeter' (i.e. a dosimeter that becomes clearer after irradiation).

Conclusions: Absorption changes post-irradiation identified LCV formulations with the initial response and stability for application in 3D dosimetry. In addition, LMG formulations were identified that may permit the unique potential for 'inverse radiochromic dosimetry' and reusability.