

FILM

Sensitivity and variability of Presage dosimeter formulations in sheet form with application to SBRT and SRS QA. Dumas, M., Rakowski, J.T.

Medical Physics. Volume 42, Issue 12, 2015, Pages 7138-7143.

To measure sensitivity and stability of the Presage dosimeter in sheet form for various chemical concentrations over a range of clinical photon energies and examine its use for stereotactic body radiation therapy (SBRT) and stereotactic radiosurgery (SRS) QA. Methods: Presage polymer dosimeters were formulated to investigate and optimize their sensitivity and stability. The dosimeter is composed of clear polyurethane base, leucomalachite green (LMG) reporting dye, and bromoform radical initiator in 0.9-1.0 mm thick sheets. The chemicals are mixed together for 2 min, cast in an aluminum mold, and left to cure at 60 psi for a minimum of two days. Dosimeter response was characterized at energies Co-60, 6 MV, 10 MV flattening-filter free, 15 MV, 50 kVp (mean 19.2 keV), and Ir-192. The dosimeters were scanned by a Microtek Scanmaker i800 at 300 dpi, 216 bit depth per color channel. Red component images were analyzed with ImageJ and RIT. SBRT QA was done with gamma analysis tolerances of 2% and 2 mm DTA. Results: The sensitivity of the Presage dosimeter increased with increasing concentration of bromoform. Addition of tin catalyst decreased curing time and had negligible effect on sensitivity. LMG concentration should be at least as high as the bromoform, with ideal concentration being 2% wt. Gamma Knife SRS QA measurements of relative output and profile widths were within 2% of manufacturer's values validated at commissioning, except the 4 mm collimator relative output which was within 3%. The gamma pass rate of Presage with SBRT was 73.7%, compared to 93.1% for EBT2 Gafchromic film. Conclusions: The Presage dosimeter in sheet form was capable of detecting radiation over all tested photon energies and chemical concentrations. The best sensitivity and photostability of the dosimeter were achieved with 2.5% wt. LMG and 8.2% wt. bromoform. Scanner used should not emit any UV radiation as it will expose the dosimeter, as with the Epson 10000 XL scanner. Presage dosimeter in this form was sensitive enough for use in SRS and SBRT QA. The lower gamma pass rate for Presage compared to Gafchromic film can be attributed to the simple equipment used in the fabrication process, which limited the dosimeter's sensitivity uniformity by agglomeration of air bubbles in the material, nonuniform concentration of chemicals throughout the material, and thickness variations. This demands improvements in mixing tools and molds.