AbstractID: 7336 Title: Real-time point-based in vivo dosimetry using radiochromic materials and remote optical fiber system

Purpose: Accurate in-situ dosimetry continues to be challenging in both radiotherapy and imaging applications. Radiochromic media (GafChromic MD-55 and EBT films) have been recently developed for application across a wide range of applied total doses, dose rates, and energies. These materials demonstrate a fast response component that allows consideration for use in a novel point-based *in vivo* dosimetry system using remote, passive optical fiber readout.

Method and Materials: Changes in optical density corresponding to the main absorbance peaks and overall absorbance spectra of the two media have been remotely detected during irradiation within Solid Water™ phantoms, which were equipped with optical fibers for real-time readout. The interrogation light source provided a spot size 650 μm in diameter, simulating the intended point-based use, and the transmitted spectrum was recorded by a spectrophotometer. The films were exposed to a wide range of doses under conditions varying in temperature, dose rate and beam energy typical of clinical use.

Results: The spectral change with time was observed to have two components. The fast response component occurred during exposure to ionizing radiation, and was easily detected in real-time. Because of the passive readout with these media, the frequency of measurements and statistical noise for any dose and dose rate was controlled by modifying the power of the light source and integration time on the spectrophotometer. The slow response component continued post-irradiation, as reported previously by others, having a small effect on real-time measurements.

Conclusion: Radiochromic formulations can be used for dosimetry in real-time during application of ionizing radiation. Their performance with respect to variations in dose rate, temperature and energy of beam were also promising, with some limitations that are being investigated further.

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