Canadian Association of Physicists
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Contribution ID: **3105** Type: **Oral Competition (Graduate Student) / Compétition orale (Étudiant(e) du 2e ou 3e cycle)**

(G*) Dosimetric characterization of modified radiochromic materials: Comparison of photon to proton beam irradiation

Tuesday, 7 June 2022 16:00 (15 minutes)

A quantitative real-time in vivo evaluation of ionizing radiation delivered to patients during a radiotherapy procedure is critical to assure patients receive treatments with rigorous quality control. Current dosimeters are not well suited for simple and direct measurements due to atomic composition, requiring correction to dose distribution, and probe size limitations. We are developing a fibre optic probe dosimeter based on a radiochromic sensor for real-time in vivo dosimetry. The calibrated change in optical density of the radiochromic sensor is used to quantify the absorbed ionizing radiation. The radiation sensitive material is composed of lithium-10,12-pentacosa diynoate (LiPCDA), which polymerizes upon exposure resulting in an increased optical density. We have observed that monomers of LiPCDA have two distinct dose-sensitive crystalline forms with distinct polymerized optical absorption maxima at 635 nm (635-LiPCDA) and 674 nm (674-LiPCDA). We have characterized and compared the dose sensitivity and dose rate response of the two crystal morphologies produced by adjusting the Li+ concentration using a linear accelerator (LINAC). Alternatively, in dense tumours near sensitive organs, direct ionization through charged particles (Hadrontherapy) may be used as an effective treatment. We investigate here the dose response of both radiochromic LiPCDA crystal forms comparing dose response behaviour to X-ray vs. proton ionizing irradiation. This enables our dosimeter to expand its application to a broader variety of new radiotherapy methods. Radiochromic crystals were fabricated to produce both 635 nm and 674 nm forms by adjusting the ratiometric concentration of Li+ to active material and exposed to 50-7000 cGy using a clinical LINAC with either a 6 MV X-ray beam (University Health Network) or a cyclotron producing a tunable 74 MeV proton beam (TRIUMF). Preliminary results from photon and proton irradiation show that 674-LiPCDA crystals are significantly less sensitive to dose but have a broader dynamic range. In conclusion, we demonstrate that radiochromic LiPCDA crystals can be preferentially grown to exhibit differing dose response based on their crystal structure under photon irradiation, and this dosimeter can be generalized to proton therapies (including FLASH).

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