Self-forming in vivo dosimeter for radiation therapy verification

Inventors:

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Brief Description:

An injectable dosimeter for real-time, in-vivo verification of MR-guided radiation therapy (MRgRT)

Problem:

Radiation therapy (RT) is one of the most common treatment modalities for cancer and is used in ~ 50% of all treatment plans. Approximately 30% of all cancer survivors in the USA receive RT, projected to reach 4.17 million by 2030. Although RT effectively kills cancer, it can cause damage to healthy tissues with significant treatment-related morbidity. Hence, it's vital to verify and monitor the radiation dose to the tumor and protect the adjacent healthy tissues from acute and long-term side effects.

Solution:

The inventors have developed an injectable, in-vivo dosimetry system for use in MRgRT based on Fricke dosimetry and a self-forming hydrogel system using norbornene-tetrazine click chemistry.

Competitive Advantages

- A novel injectable, MR-readable dosimeter, suitable for real-time in-vivo MRgRT dosimetry at clinically-relevant dose levels (2-100 Gy) for multiple irradiations over several weeks
- Can be used to improve dose uniformity (bolus) and reduce exposure to normal tissues (spacer).

Opportunity

- $7 billion global radiation oncology market in 2020 with expected 7.3% growth pa to 2027
- $774 million medical dosimeters market in 2017 with expected 7.1% growth pa to 2022

Stage of Development

Proof of concept – porcine tissue phantom. The system has been characterized under conditions relevant to in-vivo dosimetry: MRI dose response at body temperature over multiple irradiation sessions with variable injection-to-irradiation time intervals.

Partnerships

Co-Development, Licensing

Intellectual Property

US Provisional Patent Application

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Figure 1 shows T1-weighted image intensity values of the dosimeter at body temperature as a function of cumulative radiation dose over five weekly fractions (Fx). The signal returns to baseline between fractions, allowing for re-use during fractionated delivery.

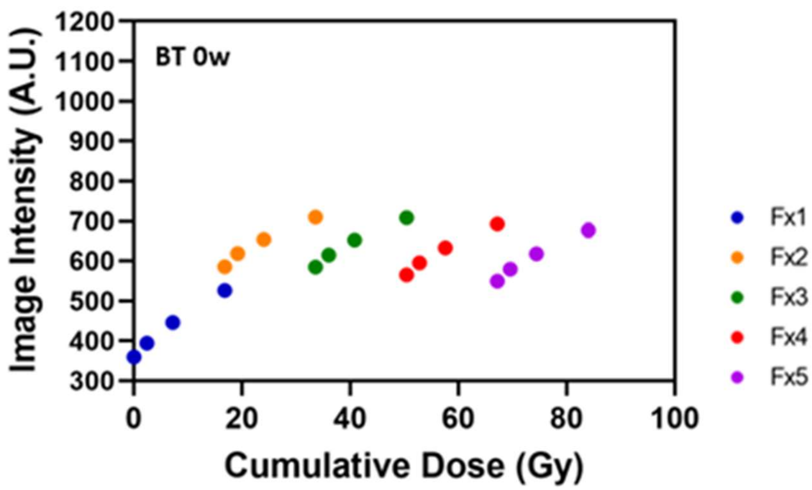

Figure 2 shows pre- and post-irradiation images of an injected pork phantom with annotation showing the image intensity change. The images show the dosimeter well-localized and showing signal change after irradiation. This is further highlighted in the difference image (Figure 2D).