AbstractID: 9286 Title: Dose - position verification of 4D radiotherapy using the RADPOS system in a deformable lung phantom

Purpose: To evaluate a novel 4D dosimetry system (RADPOS) in conjunction with a deformable lung phantom as a quality assurance tool for 4D radiotherapy.
Method and Materials: RADPOS probes, consisting of a MOSFET dosimeter combined with an electromagnetic positioning sensor were placed inside the deformable lung phantom: one detector inside and the other outside the tumour, inside the lung portion of the phantom. CT scans were taken with the phantom in three breathing phases, end of inhale (EOI), middle of inhale (MOI), and end of exhale (EOE). The detector position inside the phantom was read with the RADPOS software and compared to the position determined from the CT data. A three-field treatment plan was created using as "planning dataset" the CT image of the phantom in the EOE phase, with the two detectors at the positions described above. The breathing cycle was divided into two states, EOE and EOI. The same treatment was delivered twice, with the phantom in the EOE and in the EOI phases. RADPOS measured doses during both irradiations were compared to the treatment plan calculated values.
Results: The detector displacements measured by the RADPOS system were within 1.4 mm, -0.1 mm, and 1.5 mm of measurements from the CT registration for movement between the EOE and EOI, EOI and MOI, and MOI and EOE phases, respectively. There was no trend in the differences in RADPOS-measured and the calculated doses for individual beams and breathing states, with a maximum deviation of 3.52 cGy (2.2% of total dose) for the detector inside the tumour and 4.66 cGy (4.2% of the total dose) for the detector in the lung tissue.
Conclusions: Our results indicate that RADPOS combined with deformable lung phantom can be a useful tool for quality assurance in 4D treatment delivery.

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