

AbstractID:8836Title:AninvestigationoftheconsistencyandrobustnessofthePRESAGE/optical-CT3Ddosimetrysystem

Purpose: The potential of the PRESAGE™/Optical-CT system as a comprehensive 3D dosimetry tool has been demonstrated. Detailed characterization of intra-dosimeter uniformity, temporal stability, inter-dosimeter reproducibility and robustness has been performed, and is the focus of this study.

Methods: Four identical PRESAGE™ dosimeters (10 cm diameter and 7 cm height cylinders) were irradiated with a treatment plan using a Varian accelerator. The treatment consisted of a symmetric arrangement of 9 small open-fields (1 x 3 cm²) impinging on the upper flat surface of the cylindrical dosimeter. The nine beams consisted of 3 groups, corresponding to low, medium and high dose. Beams in the same group delivered the same dose to the phantom. The significance of this beam arrangement is that a completely symmetric distribution is achieved at all depths in the phantom, with multiple regions at different spatial positions, receiving identical doses, thereby enabling rigorous investigation of consistency within the dosimeter. All dosimeters were scanned by optical-CT at daily intervals to study temporal stability. Dose comparisons were made between PRESAGE, Eclipse, and independent measurement with EBT film to select depths.

Results: The use of improved optics and acquisition technique yielded substantially higher quality 3D dosimetry data from PRESAGE than has been achieved previously (noise reduced to ~1%, accuracy to within 3%). Excellent intra-dosimeter uniformity (2% dose-difference, 1 mm distance-to-agreement) was observed even at low dose levels. Excellent temporal stability of response (1% dose-difference, 1 mm distance-to-agreement) was evident for >90 hours post-irradiation. Excellent inter-dosimeter reproducibility (2% dose-difference, 2 mm distance-to-agreement) of dose readout was observed between all four dosimeters. The PRESAGE™ dose-distribution was found to agree better with EBT than with Eclipse calculations especially in penumbral regions.

Conclusion: These results demonstrate excellent consistency and robustness characteristics of the PRESAGE™/optical-CT dosimetry system for relative 3D-dosimetry and represent a significant step towards incorporation in the radiation oncology clinic.