AbstractID: 8180 Title: Performance of an Improved Optical Computed Tomography Polymer Gel Dosimeter System for 3-D Dose Verification of Static and Dynamic Phantom Deliveries

Purpose: Performance of an improved 3D dosimetry system consisting of polymer gel dosimeters and a next-generation optical CT scanner (OCT) is characterized. Following improvements are discussed: increased acquisition speed of the scanner; increased useful dosimeter volume achieved by reducing image reconstruction artifacts through background subtraction; efficient calibration procedure using single high-energy electron field. The characteristics of dose response (range, linearity, saturation) are determined. Feasibility of high-resolution (<1mm) 3-D dosimetry is demonstrated under stationary and dynamic delivery conditions. **Method and Materials:** Large-volume (2.2 L) polymer gel dosimeters (BANG®-3) with specially designed TomoBANG™ Virtual Water™ phantom were used to record cumulative, volumetric dose distributions from single- and multi-field deliveries. Calibration procedures using photon (6 MV) and electron (18 MeV) beams were based on using a depth-dose relationship to correlate delivered dose to the change in optical density of the dosimeter. The accuracy of this approach was verified by delivering a conformal photon plan and comparing the dose distribution to that calculated by the treatment planning system. The feasibility of use for motion (4-D) dosimetry was demonstrated by comparing dose distributions from static and dynamic deliveries (using a motion phantom) with radiochromic film measurements. **Results:** Both calibration procedures yielded equivalent results, with the electron-based method deemed preferable because of its higher efficiency. Dose distributions derived from optical density measurements show good agreement with the treatment planning system and radiographic film measurements. The average distance to agreement between the pairs of isodose curves is below 1 mm for stationary as well as dynamic deliveries. The capability to visualize three-dimensional dose distributions is also illustrated. **Conclusion:** In addition to its ability to provide high-resolution, reliable dosimetric information, the improved gel/OCT dosimetry system allows for 3D visualization and analysis of motion-induced dosimetric effects, which is unique to this type of dosimeter.