Purpose: Recent advances in Radiation Therapy allow accurate shaping of the dose volume so that normal tissue and critical regions can be spared. However, it is important to monitor the 3D dose distribution of these complex treatment plans to verify the delivered dose distribution. Our aim was to optimize Magnetic Resonance imaging to map the 3D dose distribution of a novel radiation therapy system, TrueBeam sn1018(Varian ) using a polymer gel.
Methods: The polymer gel (BANG KIT, MGS Research) was prepared under normoxic conditions and stored in glass vials. A calibration was performed in the dose range of 3-18 Gy with irradiation using the True Beam. Several imaging sequences (Fast Spin Echo, Multi (8) Spin Echo, Single Spin Echo) were evaluated for spin-spin relaxometry (T2) at 1.5 T (GE Medical Systems) with focus on accuracy, high spatial resolution, SNR while minimizing acquisition time. Treatment plan based irradiations (simulating different volumes and shapes) were performed at a dose rate of 600 MU/min for verification of the dose maps.
Results: The calibration curve (1/T2 vs Dose) was linear in the range of irradiation. The three imaging sequences were consistent in 1/T2 values in the low dose range with the FSE sequence showing some saturation at high dose values. The treatment plan dose mapping is currently underway and will be aligned with the treatment plan simulation to evaluate the degree of match between the plan and actual irradiation.
Conclusion: The polymer gel and MR monitoring can enable generation of 3D dose maps with high accuracy and spatial resolution to verify treatment plans of small volumes and steep dose gradients.