AbstractID: 9640 Title: Comparison of Magnetization Transfer Imaging and CPMG for 3D Polymer Gel Dosimetry.

Purpose: To propose and evaluate a magnetization transfer (MT) imaging method for three-dimensional (3D) polymer gel dosimetry.

Methods and Materials: We used BANGKit (MGS Research In, Guilford, CT). The polymer gel was made in-house by mixing 1mM of L-ascorbic acid and 5μM of $CuSO_4$ with the base gel. MR scanning was done using a Siemens 3T MAGNETOM Trio scanner with Head Matrix coil. CPMG sequence with 32 echoes was used to measure R2 values and the range of TE was 13.6 to 435.2 ms. The repetition time was 5000ms. Eleven 2-mm thick slices were acquired using the interleaved slice acquisition method. There is a limitation of measureable maximum dose with CPMG because R2 is very large at high doses, or T2 is too short for the available echo time. The MT imaging method has the potential to measure higher doses, which cannot be measured using the R2-based approach. 3D-FLASH sequence was used to measure the magnetization ratio (MTR) and MT pulses were a Gaussian type with offset frequency=1500Hz and flip angle=500 degree. Scan times necessary to obtain a 256x256x11 dose matrix data were 21min and 6 min for CPMG and MT imaging, respectively. We experimentally obtained the relationship between absorbed dose and MTR or R2 for the dose range between 0 and 10 Gy using polymer gel-filled small vials irradiated to known doses.

Results: The linear correlation equation between dose and R2 in s^{-1} for the CMPG data was $R2 = 0.018*D+4.5$, $R^2=0.999$. Here D denotes the absorbed dose in Gy. The relationship between MTR and dose was $MTR=0.0002*D^2-0.006*D+0.9502$ with $R^2=0.9816$.

Conclusion: We showed that the MT imaging technique could be used for polymer gel dosimetry with a significant scan-time benefit in comparison to the R2-based method using CPMG.