AbstractID: 10423 Title: MRI-based polymer gel dosimetry for validating plans with multiple matrices in Gamma Knife stereotactic radiosurgery

Purpose: To validate the three-dimensional (3D) dose distributions calculated by Leksell Gamma Plan (LGP) for Gamma Knife stereotactic radiosurgery. (GKSRS) cases with multiple matrices using MRI-based polymer gel dosimetry.**Method and Materials:** BANG3 polymer gel contained in a head size glass bottle simulated the entire treatment process of GKSRS. All phantoms were fixed in the Leksell stereotactic frame. For the first study one phantom was used for calibration and the second was irradiated with five 18-mm shots in five dose matrices. For the second study the calibration was performed with 8-mm shots and a treatment plan was generated with three 18-mm shots and one 8-mm shot. The 3D-dose distribution recorded in the gel dosimeter was read using a 3T MRI scanner (Siemens Magnetom Trio). Scanning parameters were CPMG pulse sequence with 32 equidistant echoes, TR = 7 s, echo step = 13.6 ms, pixel size = 1mm x 1mm. Interleaved acquisition mode was used to obtain 15 to 45 2mm-thick slices. Using a calibration relationship between absorbed dose and spin-spin relaxation rate (R2), we converted R2 images to dose images. The dose comparison was accomplished using an in-house MATLAB-based program.**Results:** Calibrations indicate the dose response of the current polymer gel was non-linear for doses higher than 10 Gy. The artifacts mainly caused by the metallic pins used to immobilize the phantom distorted the measured dose distributions. Away from the pin positions, however, we could compare the LGP dose distributions with measured dose distributions. Preliminary analyses indicated some spatial position discrepancies in addition to the dose differences.**Conclusion:** Through this study we could perform a true comparison between 3D dose distributions measured with a polymer gel dosimeter and LGP calculations for plans using multiple matrices/targets.