AbstractID: 8562 Title: Uncertainty of real time in vivo dosimetry with MOSFET linear array in I-125 prostate permanent implant brachytherapy

Real-time dose monitoring is important to improve the accuracy of prostate permanent implant brachytherapy (PI). However, few data about in vivo dosimetry in PI have been reported because dosimetry of low energy photons from I-125 sources is challenging. The purpose of this study is to estimate the dosimetric uncertainty in I-125 permanent implant brachytherapy using 5-linear array MOSFET.

We evaluated the physical characteristics including angular response variability, linearity, calibration factor, and detector response variability for photon beams from I-125 seed. All experiments were performed using I-125 seeds to eliminate the energy dependence. Furthermore phantom study was performed to estimate the dosimetric uncertainty in preclinical settings.

For isotropic analysis, the response of 270 and 90 degrees were 8 to 15 % lower than 0 degree and in another angle, the differences of responses were within 5%. However, the deviation of each angle was within 6%. The linearity of the readings is excellent (R2=0.098). The fading effect of MOSFET was not observed. Calibration factor was obtained with the standard deviation within 4%. We found that calibration factor was changed by seed-detector distance (SDD) by 10% in shorter distance (5mm and 7mm) and 4% in greater distance compared with SDD 10mm. The same tendency was observed by Monte Carlo Simulation. Monte Carlo simulation showed that the beam hardening effect occurred as the SDD increased, which can increase additional deviation. In phantom study, treatment planning was performed with 47 seeds in a modified peripheral loading manner. We measured the urethral dose at base, midland, and apex positions during 20 minutes. In mid grand and base regions, measure dose agreed within 6% and in apex region less than 15% differences were observed.

These data suggest that in vivo dosimetry in permanent implant brachytherapy with the appropriate correction can be performed within 15%.