AbstractID: 6898 Title: Radiation characteristics and hypo-fractionation dose response for the DVS® implantable MOSFET dosimeter

Purpose: Evaluation of the radiation characteristics and performance of the DVS® implantable MOSFET dosimeter for typical and hypo-fractionated protocols.
Method and Materials: The commercially available DVS is calibrated for use in the range of 150-250 cGy per fraction up to 80 Gy. The dosimeter was evaluated to determine its radiation characteristics, including response to energy, angular dependence, temperature, and dose shadowing. Dosimeter performance was also validated in a phantom simulating different radiation treatment conditions. A high dose calibrated dosimeter for use with hypo-fractionated protocols is introduced. Phantom measurements were performed to validate this dosimeter in the dose per fraction range of 400-1200 cGy. All phantom data was validated using a NIST-traceable calibrated ion chamber.
Results: The DVS was found to have a very small energy dependency ($\leq$1.5%) in the Co^{60}-18 MV range. With kV on-board imaging, an over-response was only measurable for doses from kV-CBCT. The radial angular dependence was found to be within 1.4% and the maximum angular dependence (6%) was obtained for beams traveling through the coil and electronics. A dosimeter implanted in close parallel alignment with the sagittal body axis would minimize this effect. Since the DVS is calibrated at 37^{o}C (for use at body temperature), measurements performed at room temperature require a correction factor of approximately 1.033. Phantom measurements (23^{o}C, 37^{o}C) resulted in values well within the specified accuracy of 5%. The dosimeter calibrated for use in hypo-fractionation applications resulted in an average variability of -0.3% (σ=2.2%) from predicted dose in the range of 400-1200cGy per fraction.
Conclusions: This data suggests that DVS can be used, together with current delivery and planning techniques, to optimize radiation treatment by measuring the dose delivered in the treatment area. Testing shows the potential to use the high-dose calibrated dosimeter with hypo-fractionated radiation treatments.

Research sponsored by Sicel Technologies, Inc.