**Purpose:** To characterize several 3D dosimeters and identify one that is best-suited for use by the RPC in its anthropomorphic phantoms. This study will also provide useful data to other researchers when selecting a 3D dosimeter.

**Methods and Materials:** Three different dosimeters were investigated in this study: PRESAGE™ (a polyurethane and leuko dye dosimeter), and BANG® and PAGAT polymer gels. Each dosimeter was characterized to determine the dose response, linearity, reproducibility, spatial stability, and dose resolution. Both MRI and OCT were used to identify the best-suited imaging modality for each polymer gel formulation. Goals were established for each parameter. These were used to evaluate the dosimeters’ characteristics and identify the dosimeter best-suited for use by the RPC.

**Results:** Each 3D dosimeter demonstrated a useful dose range up to 10 Gy. Only the BANG® dosimeter provided a linear dose response over this range. The uncertainty in the determination of the response of the dosimeter was ~2% when imaged with OCT; however, MRI yielded uncertainties < 1%. The low uncertainties achievable with MRI resulted in improved dose resolution. OCT required shorter imaging times than MRI; OCT produced planar images in 30 seconds. The BANG and PAGAT dosimeters displayed overshoots in response adjacent to regions of high dose gradient. No response overshoots were observed in PRESAGE™ dosimeters irradiated with steep gradients. The intra and inter-batch reproducibilities of PRESAGE™ exceed the goals established for these parameters. The spatial stability and reproducibility of the polymer gel formulations is in progress.

**Conclusion:** This study provides a framework for evaluating 3D dosimeters and identifying one best-suited for a particular use. This study also provides the first comparison of polymer gels characterized with both MRI and OCT.

The investigation was supported by PHS grant CA 10953 awarded by the NCI, DHHS.