

INTRODUCTION

Linac-based stereotactic radiosurgery (SRS) patient specific quality assurance is challenging due to the small target size. Radiochromic film (RCF) is water-equivalent and has high resolution but is labor intensive and has a delay between delivery and evaluation. Point dose measurements using other non-water-equivalent detectors are challenging due to the field size dependence of the detector.

AIM

A plastic scintillator detector (PSD) was evaluated for intracranial VMAT SRS plans since this water equivalent detector doesn't perturb small field dose distributions.

METHOD

- The W2 (Standard Imaging, Madison, WI) is a PSD having a 1 mm x 1 mm cylindrical active volume.
- The PSD was placed in an acrylic phantom (StereoPHAN, Sun Nuclear Corporation, Melbourne, CA)
- 60 VMAT SRS plans using HyperArc™ (Varian Medical Systems, Palo Alto, CA) and the 10 MV FFF beam of an Edge linear accelerator (Varian Medical Systems) were selected from our database. The plans were previously measured using RCF (EBT-XD, Ashland Global Specialty Chemicals Inc., Covington, KY).
- Half of the plans had multiple targets. For multitarget plans, the smallest and largest targets were measured.
- The PSD dose was compared with the corresponding location on RCF.

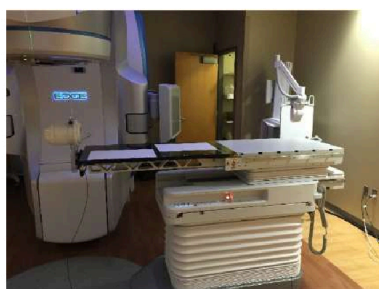


Figure 1: W2 detector setup for vertex fields to avoid optical fiber collecting radiation

RESULTS

The equivalent target diameters ranged from 2.4 to 45 mm. The mean dose difference between RCF and PSD for all plans was 0%. For single-target plans, the mean dose difference was only 0.2%. For multi-target plans, the mean dose difference was -0.2%. No significant target size dependency was observed for equivalent target diameters less than 4 cm. The difference was $\pm 5\%$ for equivalent target diameters smaller than 40 mm.

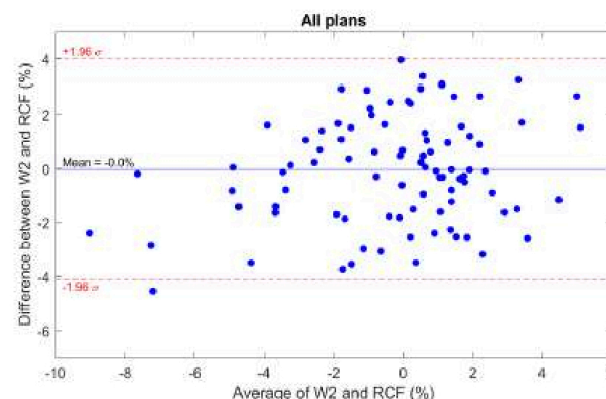


Figure 2: Bland-Altman plot of W2 (PSD) and Radiochromic film (RCF) dose relative to calculated dose at isocenter for all plans.

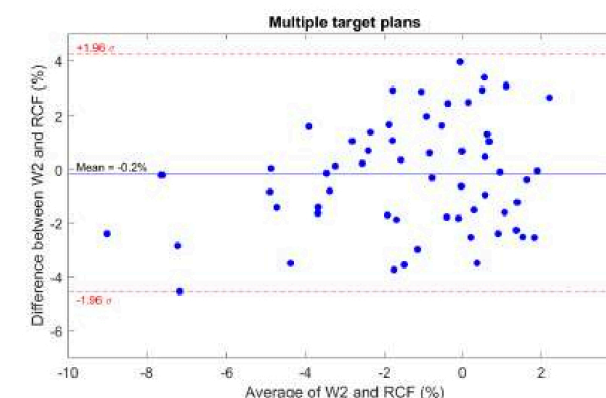


Figure 4: Bland-Altman plot of W2 (PSD) and Radiochromic film (RCF) dose relative to calculated dose at isocenter for all multi-target plans.

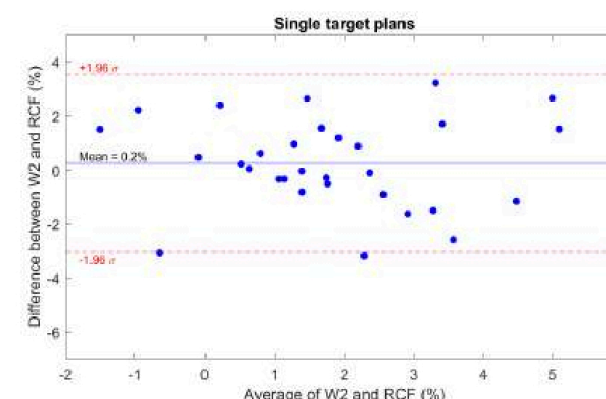


Figure 3: Bland-Altman plot of W2 (PSD) and Radiochromic film (RCF) dose relative to calculated dose at isocenter for all single-target plans.

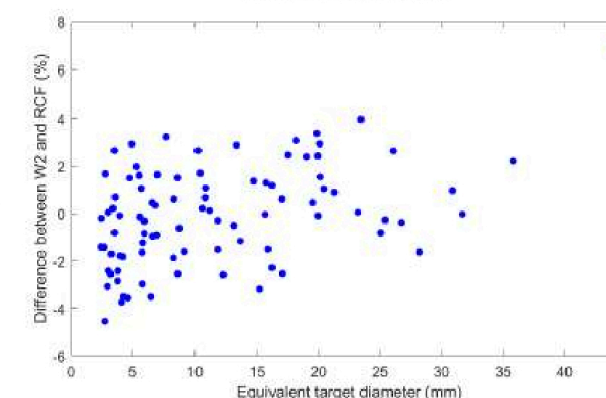


Figure 5 : Difference of point dose measurement at the center of the target of interest between W2 (PSD) and RCF.

CONCLUSIONS

- This study shows that the PSD measurements have good agreement with RCF measurements for both single- and multi-target plans.
- PSD is suitable for patient specific QA of VMAT SRS, especially for time-sensitive cases.

REFERENCES

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- [2] S Hossain, *et al.* Normal brain sparing with increasing number of beams and isocenters in volumetric-modulated arc beam radiosurgery of multiple brain metastases. *Technol Cancer Res Treat*. 2016;15:766-771.
- [3] S, Jesse *et al.* Use of a plastic scintillator detector for patient-specific quality assurance of VMAT SRS. *J Appl Clin Med Phys*, 2019, 20:9: 143-148.