Validation of a high resolution solid-state detector array for SBRT/SRS patient specific QA

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Purpose

The **myQA® SRS device** (IBA, Brussels, Belgium), a recently released high resolution detector array, was **validated** as a patient specific quality assurance (**PSQA**) tool for stereotactic radiosurgery (**SRS**) and stereotactic body radiation therapy (**SBRT**) by comparing PSQA field measurements with **TPS calculations and radiochromic film**.

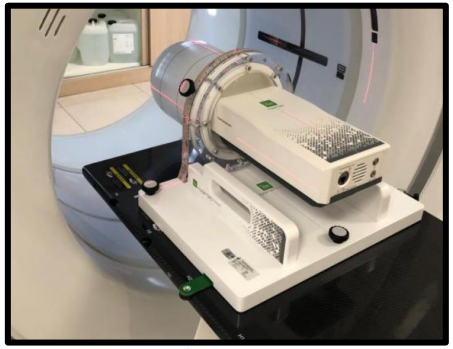

Figure 1. The myQA SRS detector with dedicated phantom.

myQA SRS detector

The **myQA SRS detector** (Figure 1) is a high resolution **solid-state detector array** based on complementary metal oxide semiconductor technology (CMOS). It has an **active detector area of 12 x 14 cm²** accommodating **105 000 pixels** with a **spatial resolution of 0.4 mm**. The myQA SRS detector resides in a dedicated end-to-end phantom, alternatively the detector can be interchanged for several other inserts including a film insert [1]. Density overrides were 1 g/cc and 1.05 g/cc for the sensor area and phantom respectively, as recommended by the vendor.

Methods

Data from **35 SBRT and 15 SRS fields** were collected using the **myQA® SRS detector** and dedicated phantom (**Table 1**). The corresponding PSQA plans were delivered by a Truebeam STx (Varian, Palo Alto, USA). In addition, **radiochromic film** measurements were performed in the same setup for 10 SBRT and SRS fields each. Positioning of the myQA SRS dedicated phantom was facilitated with CBCT image guidance. For the SRS PSQA plans all table angles were collapsed to zero. Detector measurements were compared to TPS calculated dose as well as to film measurements using gamma analysis. **Absolute global gamma analysis** with a criterion of 3% dose difference and 1 mm distance-to-agreement was performed considering a 10% low dose threshold using the myQA software. TPS calculations and Film measurements were considered as the reference.

Table 1. Overview of PSQA plan characteristics.

	SBRT	SRS
Number of Fields (N)	35	15
Planned energy	6 FFF	6 FFF
Technique	VMAT	DCA
TPS	Eclipse (Varian, Palo Alto, USA)	Elements (Brainlab, Munich, Germany)
Dose algorithm	AAA	Pencil Beam
Dose grid	1,25 mm	1,00 mm
GTV volume range	0,25 - 1,74 cc	0,11 - 0,30 cc
PTV volume range	4,82 - 22,53 cc	0,44 - 1,20 cc

Table 2. Mean gamma passing rates (GPR) for 3%/1mm.

	SBRT		*SRS*	
	Detector vs TPS	Detector vs Film	Detector vs TPS	Detector vs Film
N	35	10	13	10
Mean GPR ± SD (%)	97,6 ± 2,2	96,5 ± 1,6	98,2 ± 1,4	97,8 ± 1,0

Results and Discussion

An overview of the mean gamma passing rates is given in **Table 2**. Only two fields out of 20 did not exceed a 95% passing rate comparing detector with film measurements, both being VMAT fields. Note that two of the SRS Fields measurements (vs TPS) were removed from the dataset because they consisted completely out of low dose spread (< 25 cGy) that is not correctly estimated by the Pencil Beam algorithm. This low dose spread fields arise from the fact that the lesion under consideration was shifted towards the center of the array, while not essentially every arc targets every lesion. Without removing these measurements the mean GPR was 93,5 ± 13,5%.

Conclusion

The **myQA SRS detector** is a valuable tool for PSQA of SBRT and SRS treatments. The device yields measuremetns that are **nearly equivalent to film**.

Acknowledgments

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References

1. Fletcher, S. and Stepanek, C., 2022. Clinical Validation: myQA® SRS detector and software. [online] Iba-dosimetry.com. Available at: <https://www.iba-dosimetry.com/fileadmin/user_upload/products/02_radiation_therapy/myqa_srs/myQA-SRS_User-Article-Bristol_Rev.1_0721.pdf> [Accessed 12 April 2022].