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13:00 - 14:00
ORAL PRESENTATIONS
Quality Assurance and dosimetry

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#40170-OR034 | Evaluation of the HYPERSCINT scintillation dosimetry platform for small-field characterization of a Leksell Gamma Knife.

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The performance of the HYPERSCINT scintillation dosimetry research platform (RP-200, Medscint, Canada) for the characterization of small radiation fields administered using a Leksell Gamma Knife Perfexion radiosurgery device was evaluated.

The HYPERSCINT detector has a cylindrical sensitive volume of 0.5-mm diameter by 0.5-mm length coupled to a 20-m long optical fiber that connect to the hyperspectral reader at the console. Sensitive volume of the detector was chosen to be smaller than the dose plateau for the smallest of radiation fields produced by the Gamma Knife. Hyperspectral calibration of the detector according to manufacturer's recommendation was performed using a conventional linear accelerator (TrueBeam, Varian, USA) and allowed for complete stem-effect removal (Cerenkov and fluorescence). Inserts for both solid water and ABS spherical phantoms (Elekta,Sweden) were adapted from the blank ones provided with the phantoms and allowed for positioning the scintillator at the center of each spherical phantom.

Output factors of the machine for both solid water and ABS phantoms were obtained by subjecting the detector to consecutive 120-second shots from the 4, 8, and 16 mm collimators, with the sensitive volume positioned at the focal point of the Gamma Knife. Dose profiles of a 4 mm collimator shot were also measured in the X, Y and Z directions. This was performed by irradiating a sequence that moved the phantom using the patient positioning system by increments of

0.2 mm. Results were compared to those obtained using a radiochromic film at the focal point (4 mm collimators, irradiation of 60 seconds).

The measured output factors and the Monte Carlo reference agreed within 0.5% for the ABS phantom and within 0.9% for the solid water one. Measurement of the full width half maximum (FWHM) for the 4 mm shot with the detector and the radiochromic films showed maximum differences of 0.22 mm in all directions and was within 0.03 mm along the z-axis. Overall, our results show that the detector response was in close agreement with Gamma Knife Monte Carlo reference data and film measurements. Slight differences could be explained by the fact that the phantom had to be moved to obtain the profiles for the scintillator, which was not the case for the film measurements.

Based on the obtained results, the plastic scintillation detector shows the potential for rapid validation of output factors and validation of film measurements as well its use in challenging small-field situations encountered with the Gamma Knife.

Table 1

Effective output factors			
Collimator (mm)	Reference	Measurements (ABS Phantom)	Measurements (Solid water phantom)
16	1.000	1.000	1.000
8	0.900	0.904	0.892
4	0.814	0.811	0.814

Table 2

Collimator 4 mm			
	FWHM film (mm)	FWHM detector (mm) (Solid water Phantom)	FWHM detector (mm) (ABS Phantom)
X	6.23	6.03	6.19
Y	6.25	6.03	6.08
Z	4.99	5.02	5.01

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