Optically Stimulated Luminescence dosimetry characterization with clinical photon beams and LINAC measurements

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The practical use and reliability of the Optically Stimulated Luminescence (OSL) Al_2O_3:C Landauer nanoDot dosimeters and associated readers are well established and the technique's been applied to a variety of dosimetric evaluations, since radiation protection to in vivo and external audit in radiation therapy. However, despite the great experience documented in published literature, there are still no concrete formalisms for the characterization and commissioning of these dosimeters for use in radiotherapy and related applications. This paper reports our experience with the OSL dosimetic system Landauer microStar ii and the nanoDot dosimeters for the characterization and commissioning of the system at the Hospital Israelita Albert Einstein with the aim of evaluating the output beams of linear accelerators and *in vivo* dosimetry of our patients. A good guideline for characterization and commissioning of the system was presented by Dunn et al [1] and has been used as basis for our experimental procedures. The measurements were performed in a VARIAN 6EX® linear accelerator and a VARIAN TrueBeam® linear accelerator for 6MV photon beams. Our major difference in methodology is in the form of determining element correction factors (ECF – individual correction on a known dose), with a linac-based methodology only, without need of ^{60}Co gamma rays source. Our experimental results found that the response of nanoDot dosimeters showed a more pronounced supralinearity in ~ 10% when read in the microStar ii in the 'weak beam' mode due to the POSL reading technique used in this new generation. The repeatability of the readings remained better than 1.0% in all measurements. The uncertainty budget of the commissioning analysis resulted in an overall type A uncertainty of ~1.4% in 1-sigma interval for dose calculation, compatible with Dunn's findings [2]. The results show the reliability of the applied methodology for both linear accelerator output measurements and patient in vivo fear.

Keywords: OSL dosimetry, Radiation Therapy, Al_2O_3:C

[1] Dunn L. et al. Radiation Measurements 51, 2013, 31-39.
[2] Dunn L, et al. Med Phys. 41 (3), 2014, 03210-2.