A Comparison of Different Dosimetry Systems for Surface and Buildup Region Dose Measurements

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Purpose

In this study, the surface doses measured by using optically stimulated luminescence (OSL), thermoluminescence (TLD) and Markus parallel plane ion chamber for 6 MV photon beams. The measured values were compared with TPS results and the availability of the systems in surface dosimetry was investigated.

Methods

The percentage depth dose (PDD) measurements of buildup region were made by TLD, OSL and Markus pp ion chamber, at the surface, 1, 2, 5, 10 and 15 mm water equivalent depth at 100 cm source-detector distance for open fields with size of 5x5, 10x10, and 20x20 cm². DD values were measured at the depth of 0.07 mm, which was suggested for surface dose measurements by ICRU Report 39. The effective measurement depth of each dosimeter was taken into account. The water equivalent thickness (WET) was considered to make an accurate comparison. Interpolations and extrapolations were performed for all systems to obtain the doses at the same depths. Under the same conditions, surface doses were calculated by TPS for different field sizes and were recorded. The buildup region doses measured by different dosimetry systems and calculated by TPS were compared for different field sizes.

Results

The overdoses occurred in the buildup region were corrected for Markus chamber according to Gerbi’s method. The surface doses using 6 MV photon beams for 5x5, 10x10, and 20x20 cm² field sizes at 0.07 mm were found to be 14%, 24.75%, 13.17%, 7.74%; 19.69%, 31.78%, 21.63%, 11.04%; 30.87%, 43.80%, 28.71%, 13.61% for Markus chamber, TLD, OSL and TPS, respectively (Table 1 and Table 2).

Conclusions

The lowest build-up region PDD values in all field sizes were obtained with the TPS. At 0.07 mm water equivalent depth, while the OSL and Markus pp. ion chamber results are close to each other, TLD results are higher in all field sizes. However, it is seen that the TLD gives closer results to Markus pp. ion chamber than OSL after 3 mm depth in all field sizes.