

Small field dosimetry of a Varian TrueBeam High Definition MLC linear accelerator using the Hyperscint RP200 scintillation detector.

Purpose: To evaluate the performance of the new Hyperscint RP200 plastic scintillator for small field measurements of a Varian TrueBeam linear accelerator in comparison with the current state-of-the-art methodology in the clinic.

Methods: Small field measurements were performed using different detectors: a diamond detector (microDiamond, PTW), a diode (Razor, IBA), a compact ion chamber (Razor, IBA), and a 1mm x 1mm plastic scintillation detector (Hyperscint RP200, Medscint). Correction factors based on measured field sizes, following TRS483 recommendations, were applied to all measurements. Output factors of a TrueBeam linear accelerator were measured for field sizes of 0.5 cm to 2 cm for jaws and MLC configurations for 6-MV, 6-MV FFF and 10-MV FFF photon beams. Output factors for different circular collimators (0.4 cm to 2 cm) were also obtained at 10-MV FFF. Scintillator measurements were compared to the small-field dosimetry methodology used clinically.

Results: No correction factors were necessary for the plastic scintillation detector measurements. Scintillator measurements were within 1.1% of the standard methodology for all the small field geometries studied. Average relative differences were $(0.3\pm 0.5)\%$, $(0.7\pm 0.3)\%$, and $(0.2\pm 0.2)\%$ for the 6-MV, 6-MV FFF, and 10-MV FFF, respectively. Output factors of circular field sizes down to 0.4-cm diameter were obtained with an average relative difference of $(0.1\pm 0.4)\%$, including a maximum difference of 0.7% for the smallest field.

Conclusion: This new scintillation dosimetry research platform shows great promises for small field dosimetry. It has the potential to be used as part of a single-detector no-correction-factor methodology.