Purpose: To examine small field dosimetry of flattening filter free (FFF) beams.

Methods: Output and relative profiles were measured at 10 cm depth in water equivalent plastic for the 6 MV FFF, 10 MV FFF, and the flattened 6 MV beams of a TrueBeam accelerator (Varian Medical Systems) using EDR2 film. Measurements were obtained for square field sizes of 3, 2, 1, and 0.5 cm, and for 1 and 0.5 cm MLC defined fields with collimator jaws set to 10 cm x 10 cm and to the vendor's recommendation (margins of 8 mm in the leaf direction and 2 mm in the perpendicular direction). Dose on a 1 mm grid was calculated using the analytic anisotropic algorithm (AAA), which was commissioned using fields >= 3 cm x 3 cm.

Results: For 2 cm and 3 cm, the output agreement was better than 2%. At 1 and 0.5 cm, the differences ranged from 6% to 9% and 31% to 44%, respectively. For the 1 cm MLC field, differences were < 2.5%. For the 0.5 cm MLC field, differences up to 7.5% were observed. Agreement for the relative profiles was < 1 mm except for the non-MLC fields in the y-direction (defined by the upper collimator jaws) for which AAA overestimated the profile width in the inner portion of the penumbra (dose > 50%) by up to 2 mm. Interestingly, the agreement in the y-direction was best for 0.5 cm, although the width for the outer (dose < 50%) portion of the penumbra was underestimated up to 1.5 mm for both 6MV beams.

Conclusion: AAA can be used for FFF beams for fields >= 2 cm without additional commissioning. For smaller fields, additional output factors may improve the absolute dosimetry. Adjusting target spotsize may improve the profile agreement in the y-direction.

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