Purpose: To derive beam quality correction factors for ionization chambers in small and nonstandard field calibration conditions to compare with a NIST-traceable Cobalt-60 standard.
Methods: Beam quality correction factors for three ionization chambers were determined with thermoluminescent dosimeter and alanine absorbed dose to water measurements. These measurements were performed for ten different calibration conditions ranging from the standards labs' Cobalt-60 reference conditions to small static and composite 6 MV fields, based on the proposed formalism for small and non-standard fields (Alfonso et al; 2008). The composite field was created using the Pinnacle treatment planning system and mimicked a typical IMRT head and neck treatment with one treatment volume and one organ at risk. Measurements were performed in a specially developed cylindrical acrylic phantom and a standard water phantom.
Results: The TLD-determined beam quality correction factors remained statistically within unity under most of the calibration conditions. The only exception was for the Exradin A19 in a 2 cm x 2 cm field for which it amounted to 1.30. The estimated relative combined standard uncertainty is around 2% (k=1). The alanine-determined absorbed dose to water yielded beam quality correction factors statistically significantly different from unity. The alanine-determined beam quality correction factors varied from 0.990 to 1.031 for most situations except again for the Exradin A19 in a 2 cm x 2 cm field for which it amounted up to 1.303. The estimated combined relative standard uncertainty is about 1% (k=1).
Conclusions: The results of this work indicate that the calibration coefficient from an ADCL can be applied to the proposed small field and nonstandard field formalism using beam quality correction factors with acceptably small uncertainties. Application of these beam quality correction factors offers improved uncertainty in small and nonstandard treatment techniques.