
Methods: 20 different linear accelerator (Varian Clinac 21 EX)-based clinical IMRT fields were transferred to the CT images of a 30x30x17 cm³ Solid Water phantom to create IMRT QA fields. The phantom position was adjusted for each QA field to place the detector or chamber at the lowest dose gradient region in a virtual PTV. The reference doses in the IMRT QA and 10x10 cm² fields were measured using a PTW micro liquid ion chamber (microLion). Based on the new dosimetry formalism, the clinical correction factor of each IMRT QA field was measured for a calibrated Exradin A12 Farmer-type chamber in a fully-rotated delivery and a delivery at a single gantry angle, a collapsed delivery. For each QA field, the measured dose with the correction factor was compared with a calculated dose using Analytical Anisotropic Algorithm (AAA) or Monte Carlo (MC) methods.

Results: The clinical correction factor deviated from unity by up to 2.4% and 3.7% in the fully-rotated and collapsed deliveries, respectively, depending on the dose homogeneity at the Exradin A12 collecting volume. In the fully-rotated delivery, the measured dose with the correction factor is different from the calculated dose to within 5% and 3% for the AAA and MC, respectively. In the collapsed delivery, the discrepancy between the measured and AAA-calculated doses was to within 8%, while it was improved to within 3.5% compared with the MC-calculated dose. When applying the clinical correction factor, the decrease of the measured and calculated dose discrepancy is more significant for an IMRT QA field having higher dose heterogeneity.

Conclusions: This work proves that the suggested dosimetry technique is effective to improve the dosimetric consistency of clinical IMRT QA.