Portal dosimetry for pretreatment verification of IMRT plan: a comparison with 2D ion chamber array.

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Abstract
Portal dosimetry (PD) was performed for 181 fields from 14 IMRT plans of various clinical sites at gantry zero and source-to-detector distance (SDD) of 100 cm. PD was realized using aSi1000 electronic portal imaging device (EPID) and portal dose prediction (PDP) algorithm implemented in Eclipse treatment planning system (TPS). Agreement of PDP predicted and EPID measured photon fluence/dose distribution were evaluated using gamma ($\gamma$) index set at 3% at 3 mm distance to point agreement (DTA). Three gamma scaling parameters, maximum $\gamma$ ($\gamma$\text{max}), average $\gamma$ ($\gamma$\text{avg}) and percentage of points with $\gamma \leq 1$ ($\gamma\% \leq 1$) were estimated for each field. An independent measurement was carried out using MatrixXX 2D ion chamber array with detector plane at 100 cm and $\gamma$\text{max}, $\gamma$\text{avg} and $\gamma\% \leq 1$ were estimated using OmniPro IMRT analyzing software. Effect of extended SDD and gantry rotation on portal dosimetry outcome was also investigated for another 45 IMRT fields. PDP predicted and EPID measured photon fluence agrees well with overall mean values of $\gamma$\text{max}, $\gamma$\text{avg} and $\gamma\% \leq 1$ at 2.02, 0.24 and 99.43%, respectively. $\gamma$\text{max} value was lower in 15 MV compared to 6 MV IMRT plan. Independent verification using MatrixXX showed comparable overall mean values of $\gamma$\text{avg} and $\gamma\% \leq 1$ at 0.25 and 99.80%. However, in all plans, MatrixXX showed significantly lower $\gamma$\text{max} ($p < 0.05$) with an overall mean value of 1.35. In portal dosimetry, compared to gamma values at 100 cm SDD, $\gamma$\text{max}, $\gamma$\text{avg} and $\gamma\% \leq 1$ values improve from a mean of 0.16, 0.03 and 0.26 at 110 cm SDD to 0.35, 0.05 and 0.29 at 140 cm SDD. PD outcome was independent of gantry rotation. In conclusion, both MatrixXX 2D ion chamber array and portal dosimetry showed comparable results and can be use as an alternative to each other for relative photon fluence verification.

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