

Purpose: to assess the ability of patient-specific IMRT QA procedure using planar dose comparison in detecting MLC positioning errors.

Method and Materials: Eight IMRT plans (total of 53 fields) previously used for patient treatment with 6 MV photon beams from Varian Trilogy were randomly selected. Treatment plans were generated with a commercial planning system (Pinnacle³). Random errors (± 2 mm) and systematic errors (± 1 mm and ± 2 mm) of MLC positioning were introduced into each plan. Planar dose distribution, calculated for each field with and without MLC positioning errors, was compared to measured dose distribution using a 2-dimensional diode array (MapCHECKTM). The agreement was analyzed using absolute DTA comparison as well as γ analysis with 2%/2mm and 3%/3mm criteria. The decrease in average passing rates was used to assess the sensitivity of patient-specific IMRT QA procedure to MLC positioning errors.

Results: Decrease in average passing rates with absolute DTA comparison and γ analysis showed similar trends with the introduction of MLC positioning errors. With 3%/3mm, only slight decrease ($\sim 2\%$) was observed with random errors and ± 1 mm systematic errors. Though $\sim 7\%$ drop was noticed with ± 2 mm systematic errors, the average passing rates were all above the error detection threshold (90%). When using 2%/2mm, average passing rates with systematic errors dropped below the threshold, with $\sim 5\%$ and $\sim 15\%$ decrease for ± 1 mm and ± 2 mm errors respectively. The average passing rates with random errors were still above the threshold.

Conclusion: Our study indicates that IMRT QA procedure using either DTA criteria or γ index is not sensitive to MLC positioning errors up to 2 mm when using 3%/3mm criteria. When using 2%/2mm, only systematic errors of ± 2 mm could be detected. Patient-specific IMRT QA should be combined with a periodic MLC positioning check in order to guarantee the accuracy of IMRT delivery.