Pre-treatment Verification of Large-Field IMRT Dose Painting Plans for Head and Neck Cancer Using a Commercial QA Device

Objective: To develop a practical procedure for routine pre-treatment verification of large dose painting fields using a commercial IMRT QA device, MapCheck.

Materials and Methods: Optimized dose painting intensity maps were applied to a $40\times40\times40$ cm^3 digital phantom. With a voxel size of 1 mm^3, the dose distributions were re-calculated for a coronal plane at a depth of 5 cm. The DMLC files were then transferred to a Varian Clinac for plan verification. We first delivered a beam with MapCheck at isocenter. The isocenter was then shifted superiorly and inferiorly by 4 cm, respectively. Two more exposures were made. The isocenter was shifted to the left and right by 4 cm, respectively. Two more exposures were made. To detect accurately the steep dose gradient regions, we doubled the effective detector surface density by shifting the isocenter by 5 mm along the X and Y axes. Two more exposures were made. Finally, we merged all these files to yield a desirable dose distribution. We used three different criteria for data analysis: percent difference, distance to agreement (DTA), and γ index. We set the percent difference threshold to 3% and the DTA to 3 mm.

Results: Using these criteria, 99% ~ 99.5% dose points passed the test for most of our IMRT dose painting plans. For a ten-field plan, it took about 35 minutes to complete the data acquisition and post-analysis.

Conclusions: The proposed procedure not only improves the efficiency, but also enhances the accuracy of measured dose distribution in the steep dose gradient regions. MapCheck is a handy, fast, and practical tool for routine pre-treatment verification of large-field dose painting plans.