AbstractID: 8986 Title: Quantification of IMRT Patient Dose Deviations due to Daily MLC-leaf Positional Variations

Purpose: To develop a tool utilizing MLC-log files and Monte Carlo (MC) dose recalculation that will allow cumulative deviations of IMRT patient plans to be assessed over the treatment course by taking into account the possible inaccuracy in the IMRT delivery.
Method and Materials: Prostate, head and neck and lung IMRT patients were selected. The delivered MLC positions during the IMRT delivery were recorded in the form of MLC-log files which were converted to MLC leaf-sequence files. These files were then transferred back to the TPS and were attached to the original planned IMRT fields to regenerate the delivered dose distribution. Delivered fractional dose to each patient was then re-produced using MC calculation. The recalculated fractional doses calculated via MC, which utilized the delivered MLC leaf-sequences, were then combined to produce correct cumulative dose distribution received by the patient during treatment. Both delivered fractional and cumulative dose distributions and corresponding Dose-Volume statistics were then compared with the ones obtained from the original IMRT plan.
Results: For H&N IMRT case, the fractional changes in delivered dose-volume indices were <1%. The changes in critical structure doses were negligible. For lung IMRT case, the differences in all dose-volume parameters with MC re-calculation using the delivered MLC-sequences and the original planned MC dose calculation were less than 1.1% for PTV and all critical structures, except for the esophagus where differences in D_{30} were 2.4%. The similar results have been obtained for the prostate case in the study.
Conclusion: The utilization of Monte Carlo for the recalculation of actual fractional doses delivered to the patients using the delivered MLC leaf sequence files for each IMRT field provides a powerful tool for offline QA of IMRT patients and can also be utilized for the verification of adaptive radiotherapy.

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