AbstractID: 11024 Title: Retrospective RapidArc dose reconstruction based on MLC dynamic and delivery log files recorded during treatment

Purpose: To develop a methodology for retrospectively reconstructing the dose delivered to head-and-neck (HN) patients in RapidArc treatment based on dynamic log-files which record the actual leaf positions, gantry angles, and delivered monitor units (MUs) during the RapidArc delivery.

Method and Materials: After a RapidArc treatment was finished, two dynamic log-files were retrieved from the linear accelerator: (1) MLC log-file which recorded the actual leaf positions and respective gantry angles every 50 ms and (2) delivery log-file which recorded the actual delivered MUs and gantry angles at the control points defined in the RapidArc plan. Through the common parameter of gantry angle recorded for both dynamic log files, the actual delivery status such as leaf positions, delivered dose indices, and gantry angles for every control points were re-constituted. This data was compiled and converted into a DICOM radiotherapy plan (RP) file using in-house developed software written in MatLab code (Mathworks, Natick, MA). The DICOM RP file was then imported into Eclipse treatment planning system (Varian Medical Systems, Palo Alto, CA) and the actual delivered dose was reconstructed on the on-treatment CBCT acquired for the patient.

Results: A retrospective dose reconstruction procedure has been established for RapidArc and applied to a phantom and two dummy HN cases. For the case in which the tumor shrinkage is minimal, the reconstructed and planned doses were consistent to within 3-5% in high dose region. The DVHs of the target and other organs do not have significant differences. However, large dosimetric changes (10-15%) were observed for the case with tumor shrinkage, indicating the need for re-planning or adaptive measure to be taken.

Conclusion: RapidArc dose reconstruction provides a pragmatic way to probe the actual dose delivery at a particular fraction and represents an indispensable step toward adaptive radiotherapy for this highly conformal treatment.

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