AbstractID: 4824 Title: Time-resolved 4D dynamic arc therapy

Purpose: To develop a 4D dynamic arc therapy with the capability of MLC-shaped irradiation field tracking for moving tumor targets.
Method and Materials: 4D CT images at 10 different breathing phases were acquired and transferred to a treatment planning system. The tumor target was contoured and a 3D conformal arc therapy (3DCAT) plan was generated for each phase. For each 3DCAT plan, the selected control points (gantry angles) and the MLC-defined conformal apertures were correlated to the patient's respiration phases. A program was developed to obtain a 4D DMLC leaf sequence with the capability of tracking the target motion based on the ten 3DCAT DMLC leaf sequence files. To evaluate the 4D plan, a deformable registration was adopted to combine dose distributions and DVHs and the results were compared with those obtained using the conventional 3D and gating plans. Five lung cancer cases and film measurements embedded in a moving phantom were used to investigate the feasibility of the proposed technique.
Results: An efficient 4D dynamic arc therapy was implemented. Experimental measurements indicated that the dose distribution in the moving target delivered using the proposed technique is equivalent to that in a static target delivered using a conventional 3D arc therapy. Compared with the 3D plans, the target received more conformal doses and the sensitive structures, especially the lung, were better spared in the 4D plans for all the test cases. The treatment time for the 4D plan is comparable to the 3DCAT plan, much more efficient than the gating treatment.
Conclusion: It is feasible to incorporate the intra-fraction organ motion into a 4D dynamic arc treatment planning to track the moving targets. Compared with conventional treatment strategies, this technique has great potentials to provide more conformal dose distribution and better sensitive structure sparing with extremely high efficiency.