AbstractID: 5239 Title: MLC tracking of respiration-induced target motion

Purpose: Respiration induced target motion is a challenge in achieving both target dose coverage and normal tissue sparing in external radiation therapy. This study is to develop a new technique to dynamically track the moving target when delivering either three-dimensional (3D) conformal therapy or intensity modulated radiation therapy (IMRT) for whose patients who can reproduce their recorded breathing pattern under audio/video guidance.

Method and Materials: 4D-CT scanning is triggered by respiration signal and CT images are sorted into eight respiration phases. After the physician contours the GTVs of the eight CT data sets, the GTVs' centroid positions are measured and the trajectories in the beam's eye-view (BEV) can be calculated. A treatment plan can be generated based on a reference phase CT image with the MLC's travel direction set to the target moving direction. The step-and-shoot MLC segments of the static plan are converted into dynamic segments based on the motion trajectories in the BEV. During the delivery, the beam is turned on at the reference phase and remains on as long as the dynamic MLC segments are in sync with breathing.

Results: Breathing patterns were successfully deduced from 4D CT images and the motion amplitudes were found varying with the patient and tumor position. A sinusoidal motion pattern was used in the segment conversion for verification purpose. Three films were placed on a phantom moving sinusoidally and were irradiated for the static, tracking, and no-tracking cases, and the film dosimetric study was conducted. As an indication of the dose coverage, Gamma index was measured and found to be 91.1% and 67.9% for the tracking and no-tracking cases, respectively.

Conclusions: The MLC tracking significantly improves the dose coverage. This technique provides a potential to improve dose conformity when considering the target motion induced by respiration.

Conflict of Interest: No.