AbstractID: 4743 Title: The Effect of Respiratory Rate and Radiation Timing on Dose Coverage in Dynamic Breast IMRT

Purpose: IMRT has been shown to be capable of delivering plans with desirable homogeneous dose distribution for breast cancer treatment. However, the dose distribution may be influenced by interplay between dynamic MLC and respiratory motion. The purpose of this study was to investigate the impact of respiratory rate and radiation timing on the dose distribution of breast dynamic IMRT.

Method and Materials: Using similar setup configuration, a helical CT and 4DCT image sets for six breast cancer patients were collected and contoured. Dynamic IMRT plans were designed using the helical CT images. The planned MLC sequence was segmented according to the respiratory phases with a series of respiratory rates (7.5-30/min) and radiation timing (evenly distributed in respiratory cycles). The segmented dynamic MLC sequences were applied to the radiation fields on the corresponding 4DCT phases. A program was developed to calculate the cumulative dose distribution from all the phases.

Results: For normal breathing rates (15-20/min), the dose coverage didn't change significantly regardless of radiation starting time. The change of target V_{90} was less than 2%. However, for extremely slow respiratory rates (7.5-10/min), the dose distribution and V_{90} changed significantly depending on the radiation timing. The change of target V_{90} was more than 10%. There was no significant dose coverage change for the underlying heart regardless respiratory rate or radiation timing.

Conclusions: For breast patients treated with dynamic IMRT, if the respiratory rate of the patient is within the "normal" range then the impact of such respiration on dose coverage of the target was found to be statistically insignificant. However, the dose distribution may change significantly when patient has a slow breathing rate. Respiratory gating may be required to obtain satisfactory dose coverage for such cases. There was no significant dose distribution change for heart regardless respiratory rate or radiation timing.