AbstractID: 6460 Title: A dosimetric study of the effect of respiratory motion on whole breast radiation therapy

Purpose: Study the effect of respiratory motion on whole breast radiotherapy for three treatment planning techniques: conventional wedged technique (CWT), segment IMRT (SIMRT) and beamlet IMRT (BIMRT). Investigate the relationship between the dosimetric coverage difference introduced by respiration and breast motion.

Method and Materials: Eight patients with early stage breast cancer underwent free breathing (FB) CT simulation for whole breast radiotherapy. Two additional CT scans were obtained at the end of inspiration (EI) and end of expiration (EE). The FB scan was used to develop three plans using CWT, SIMRT and BIMRT. Each plan was copied and applied to EI and EE scans. The dose volume histograms were compared and statistical methods were used to investigate the relationship between dosimetric coverage and breast motion.

Results: Medial and lateral markers of EI scans moved an average of 8 mm and 3mm, respectively. Both medial and lateral radiopaque markers of EE scans moved an average of 2 mm. For CWT and SIMRT, the percentage of CTV volume receiving 95% of the prescription dose $V_{95\%}$ remained almost constant. BIMRT was relatively sensitive to respiratory motion. The average difference comparing FB and EI for the eight patients was 4.3% ($V_{95\%}$) and 7.4% ($V_{100\%}$). FB dose coverage remained almost the same as EE. A linear relationship with marker motion was found in the $V_{100\%}$ difference between FB and EI.

Conclusion: This study shows CWT and SIMRT are less sensitive to respiratory motion than the BIMRT. A linear model was found to relate the dosimetric coverage difference introduced by respiration with the breast motion. With this model, the dosimetric coverage difference could be evaluated during CT simulation. Based on the studies, we recommend BIMRT is not used for whole breast radiotherapy unless respiration control is used and SIMRT could be used without control.