

Clinical Evaluation and Dosimetric Comparison of Four Techniques for Whole Breast Irradiation (WBI) ; A Planning Study using Various Types of MLC-base

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Purpose : The purpose of this study is the evaluation of the dosimetric difference between MLC-based electronic compensator technique (EC) with other accepted techniques for irradiation of the whole breast including forward intensity modulated field-in-field (FIF), partially intensity modulated hybrid beam technique (Hybrid), and conventional hard wedged tangential beam technique (HW).

Methods and Materials : The four plan techniques were compared for 6 breast patients using cumulative and differential dose-volume histogram (cDVH and dDVH) analysis in the planning target volume (PTV), non-planning target volume (Non-PTV), ipsilateral lung, heart, and contralateral breast. The geometric parameters such as tangential angles, primary jaw setting, and each patient volumes were all the same for four techniques. EC was used to compensate missing tissue due to breast slope and lung heterogeneity, and the type of intensity modulation was sliding window method. It was chosen constant isodose lines for generating electronic compensator. Forward FIF was composed of three static segments for each tangential field. One was a main segment and the other segments were used to eliminate hot spot areas in the main segment. Hybrid plan was generated by conventional open field plus inverse planned IMRT beams.

Results : The MLC-based techniques achieved dose distributions better than conventional hard wedged tangential beam technique and received low dose in normal tissue. In the volumes of PTV receiving 95~105% of same normalized point, HW was 2-3% lower compared to other three techniques. It was also shown that the volume above 105% dose was only presented in HW (within 5%) and Hybrid (within 3%). In the non-PTV area, the hot spots above 105% were largest for HW and the volumes of ipsilateral lung ≥ 20 Gy and heart ≥ 40 for hybrid plan were lowest compared to the other three plans.

Conclusion : The Hybrid technique resulted in the most homogenous dose distribution among all the four techniques. If considering cost-effectiveness of whole treatment procedures, EC plan may be the best choice for tangential breast irradiation, while FIF and Hybrid techniques required much more time than the other techniques due to the iteration process for optimization.

Keywords : Hybrid IMRT, Electronic Compensator, Field in Field