Purpose: Modulated electron radiation therapy (MERT) can offer significant advantages for breast treatments over conventional radiotherapy in terms of sparing distal critical structures. While intensity modulated radiation therapy (IMRT) has the advantage of achieving better dose homogeneity inside the target combining both MERT and IMRT will be the ideal scenario. The Aim of the present study is to investigate the possibility of further improving breast radiation therapy using combined MERT/IMRT treatment technique.

Methods: Accurate modeling of a prototype motorized electron multileaf collimator was verified in a separate study. In this work treatment planning was performed by an in house Monte Carlo based inverse planning system. Dose deposition coefficients were calculated using MCPLAN and utilizing real patients CTs. Optimization is then conducted based on an equivalent uniform dose objective function. MERT and IMRT plans were created for different patients.

Results: The clinical beneficial outcome for MERT either alone or combined with IMRT was investigated based on isodose distributions and dose volume histograms. It is shown that MERT can give similar dose distributions as IMRT in some cases. For some cases, MERT could be advantageous whenever more skin dose was required. In some cases MERT can be identified as the best option. It was found that MERT compared to IMRT could introduce hot spots inside the target. However this was resolved in combined MERT/IMRT treatment. Dose uniformity can be restored with a reduction in the maximum lung and heart received dose.

Conclusion: MERT can improve treatment plan quality for many breast patients. In some cases better results can be obtained with a combined MERT/IMRT treatment, where a homogeneous dose in the target can be achieved with an improvement in the DVH of critical structures.

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