

PhD Thesis Title: Radiation Therapy for Breast Cancer: A Dosimetric Comparison Among Advanced Planning Techniques
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ABSTRACT:

This research work evaluates hybrid techniques as an option to increase the radiotherapy plan superiority for breast neoplasm patients. This study consists of three different planning target volumes (PTVs), including whole breast with boost ($PTV_{WB}+PTV_{Boost}$), bilateral breast (PTV_{BLB}), and chestwall (CW) with supraclavicular (SCL) and internal mammary (IMN) nodes ($PTV_{CW}+PTV_{SCL}+PTV_{IMN}$). Hybrid IMRT (H-IMRT) plans with different dose weightings were compared to find optimal dose weightings. Further, the benefits of the H-IMRT plan over sole IMRT and FinF plans were investigated. Different IMRT and VMAT field designs were compared in the hybrid setting. For further improvement, 3DCRT+IMRT, 3DCRT+VMAT, IMRT+VMAT, and VMAT+IMRT plans were compared. The feasibility of flattening-filter-free (FFF) beams in open beam 3DCRT-based hybrid plans was assessed. For all PTVs analyzed, the optimal dose weightings were 70% base component and 30% hybrid component. The H-IMRT technique showed its benefits over sole IMRT and FinF plans. Among H-IMRT, 7F-ES, 5F-T, and 7F-T field designs showed optimal results for the $PTV_{WB}+PTV_{Boost}$, PTV_{BLB} , and $PTV_{CW}+PTV_{SCL}+PTV_{IMN}$, respectively. Among the H-VMAT plans, the 2PA+2TA plan showed better results for all the targets. The FFF beam is feasible with H-IMRT plans, whereas H-VMAT produced insufficient results for large volume PTV_{BLB} and $PTV_{CW}+PTV_{SCL}+PTV_{IMN}$. Overall, the 3DCRT+IMRT provided promising results for organs at risk (OARs) dosimetric parameters, while the 3DCRT+VMAT showed superior results for PTV dosimetric parameters with less monitor units and treatment time. The integrated scores revealed that the 3DCRT+VMAT hybrid techniques provided balanced results for PTVs and OARs and showed their superiority in both dosimetric and clinical characteristics.

References to author publications that relate specifically to the dissertation:

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