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An IMRT Planning Technique for Treating Whole Breast or Chest Wall and Regional Lymph Nodes on Halcyon and Ethos

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PURPOSE / OBJECTIVES

Field size limitations on Halcyon and Ethos treatment machines largely preclude use of the conventional monoisocentric, three-field planning technique for breast/chest wall and regional nodes. We present an alternative, IMRT-based planning approach and demonstrate its feasibility.

MATERIAL & METHODS

Eight breast and regional node cases (4 left-sided, 4 right-sided) were planned for an Ethos machine using a 15-17 field IMRT technique. Institutional plan quality metrics for CTV and PTV coverage and OAR sparing were assessed. Five plans (4 right-sided, 1 left-sided) were also planned using a hybrid 3D multisocenter technique. CTV coverage and OAR sparing were compared to the IMRT plans. Eclipse scripting tools were developed to aid in beam placement and plan evaluation through a set of dosimetric scorecards, and both are shared publically.

RESULTS

On average, the IMRT plans achieved breast CTV and PTV coverage at 50 Gy of 97.9% and 95.7%, respectively. Supraclavicular CTV and PTV coverages at 45 Gy were 95.7% and 100%. Axillary lymph node CTV and PTV coverages at 45 Gy were 100% and 97.1%, and IMN CTV coverage at 45 Gy was 99.2. Mean ipsilateral lung V20 Gy was 19.3%, and mean heart dose was 1.6 Gy for right-sided cases and 3.0 Gy for left-sided. In comparison to the hybrid 3D plans, IMRT plans achieved higher breast and supraclavicular CTV coverage (99.9% vs 98.6% and 99.9% vs 93.4%), higher IMN coverage (99.6% vs 78.2%), and lower ipsilateral lung V20 Gy (19.6% vs 28.2%).

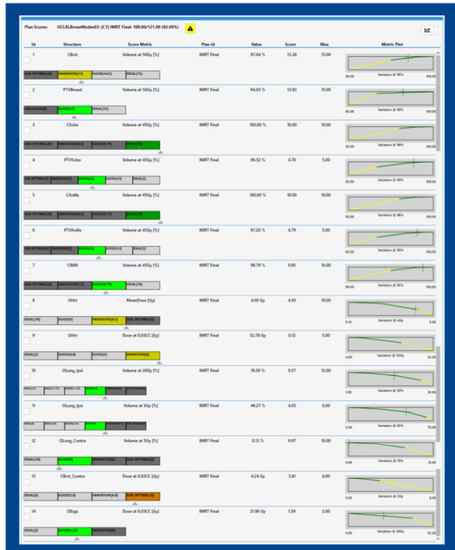


Figure 4: Example left breast case applying IMRT scorecard for dose metrics in Table 1.

Structure	Constraint	3D Average	IMRT Average
Breast CTV	V47.5 Gy (%)	98.6	99.99
	V50 Gy (%)	68.8	98.3
SClav CTV	V45 Gy (%)	93.4	99.9
Axilla L1,L2,L3 CTV	V45 Gy(%)	98.4	100
IMN CTV	V45 Gy (%)	78.2	99.6
Heart	Mean (Gy)	1.93	2.09
	0.03 cc (Gy)	26.5	19.9
Ipsilateral Lung	V20 Gy (%)	28.2	19.6
	V5 Gy (%)	47.0	50.0
Contralateral Lung	V5 Gy (%)	0.0	0.1
Esophagus	0.03cc (Gy)	20.1	17.0
Contralateral Breast	V5 Gy (%)	1.36	1.72

Table 1: IMRT plan quality metrics across 8 patients

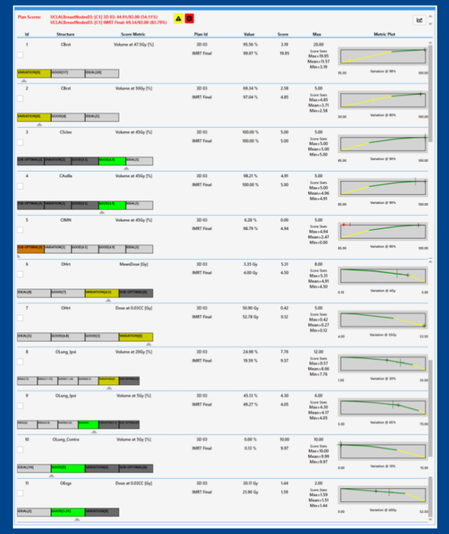


Figure 5: Example left breast case of 3D scorecard for both 3D and IMRT plans for dose metrics in Table 1.

RESULTS

Figure 1: Example 17-field IMRT beam arrangement. Breast and IMN CTVs are shown, along with 47.5 Gy dosewash.

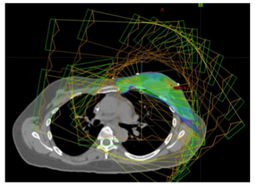


Figure 2: BreastPlan Helper Eclipse script interface. The planner inputs a tangential medial field and the tool generates the remaining field using predetermined offsets. Fields are placed such that no two are directly opposing.

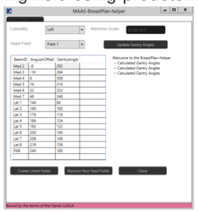
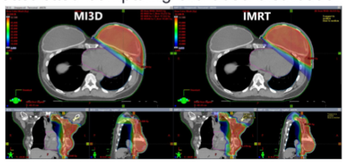


Figure 3: Example left breast case comparing the dose distribution between MI3D and IMRT techniques:



SUMMARY / CONCLUSION

Institutional plan quality benchmarks were achieved for all eight cases using the IMRT-based planning approach. The IMRT-based planning approach offered superior conformity and OAR sparing than a competing hybrid 3D approach, at the cost of increased low dose spill and delivery time but both were deemed clinically acceptable.