Evaluation of Single Plan Optimization of Bolus/Non-Bolus 3D Breast and Chest Wall Irradiation

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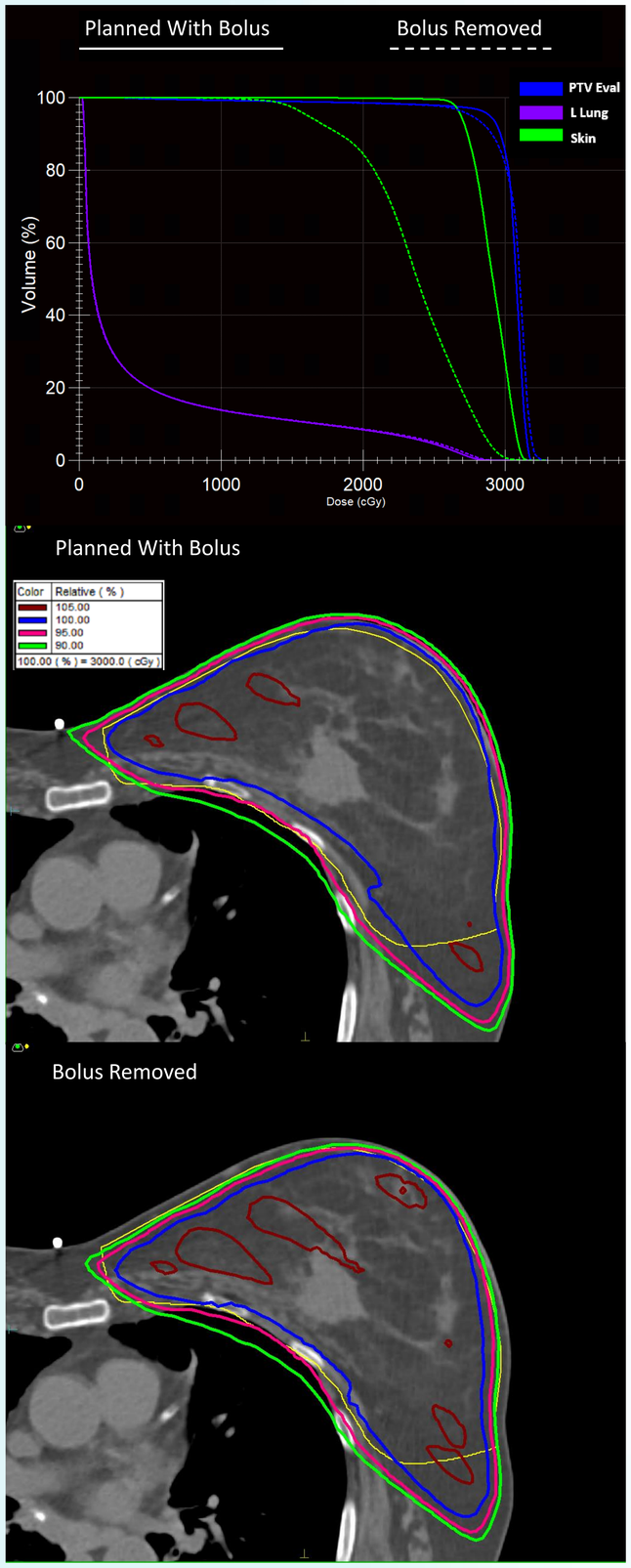
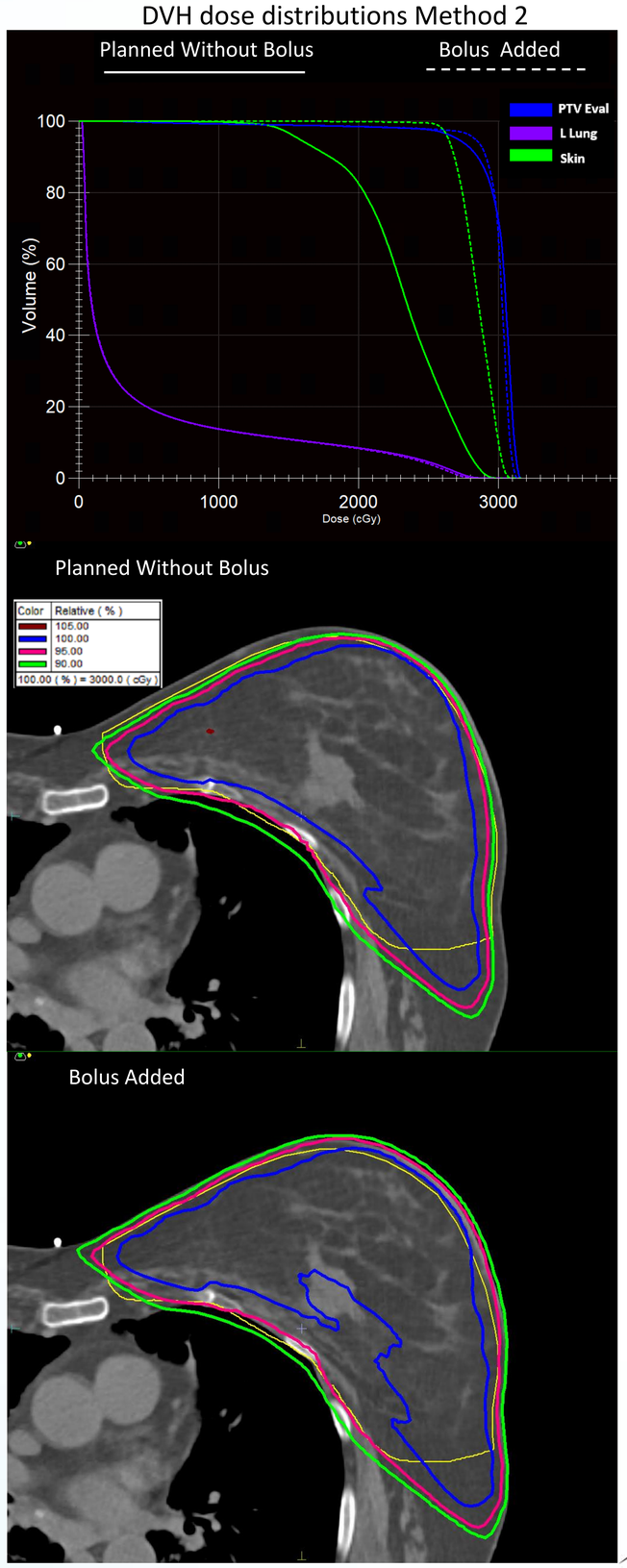
Introduction: Traditional breast and/or chest wall irradiation frequently uses bolus to increase skin dose, but care must be taken to minimize skin toxicity. Historically this is achieved by creating combination plans that utilize bolus and no bolus on alternating fractions (e.g. 8 fx with bolus and 7 fx without bolus). The complexity of combination use of bolus in 3D breast and chest wall planning increases workload on the dosimetry department by necessitating the creation of two unique plans (one with bolus and one without).

This study aims to investigate the use of a single-plan solution to bolus on/bolus off breast planning. If found to be comparable to traditional planning methods, significant time and resources can be saved in the creation of these plans with minimal patient impact.

DVH dose distributions Method 1



DVH dose distributions Method 2



Methods and Materials: Seven clinically acceptable bolus/no-bolus plans using 0.5 cm bolus were utilized. All plans used tangential Field-in-Field technique created in Monaco (Elekta, Version 6.00.01) and dose was calculated using Collapsed Cone algorithm. Each plan (bolus and non bolus) was considered as if it had been delivered to the full number of prescription fractions. Each of these plans were then copied and recalculated using the same MU and beam parameters, These plans were grouped for comparison as follows:

- Method 1:
  a) Initially planned with bolus
  b) Recalculated after virtual removal of bolus
- Method 2:
  a) Initially planned without bolus
  b) Recalculated after virtual placing the bolus

Target coverage was documented using an evaluation structure which excluded the skin. Plans were evaluated by comparing target coverage, skin dose, and ipsilateral lung V20 dose for each planning method. Skin dose was evaluated using the anterior 3mm of the Breast PTV.

Method		V95%	D95%	V105%	SkinV95%	SkinD95%	Lung V20Gy
1	Planned with bolus	85.7	84.2	9.0	83.0	81.0	19.9
	Bolus Removed	85.5	82.3	22.0	20.8	53.8	20.0
	Difference	-0.2	-2.0	13.0	-62.2	-27.2	0.1
2	Planned without bolus	84.2	85.6	9.9	15.6	59.0	20.1
	Bolus added	83.2	87.3	6.0	81.0	84.2	19.7
	Difference	-0.5	1.7	-3.9	65.3	25.3	-0.4

Results: Patients evaluated using method 1 showed an average decrease in V95% by <0.5% and a decrease in D95% by 2%. It also showed an increase in V105 by an average of 13% but minimal change in ipsilateral lung dose.

Patients evaluated using method 2 showed on average a decrease in V95% by <1% and an increase in D95% by <2%. It also showed a decrease in V105 by an average of <4% but minimal change in ipsilateral lung dose. This method did show a significant increase in skin dose, which was comparable to the original bolus plan.

In both cases target coverage difference was <2%. The difference in OAR doses were statistically insignificant.

Conclusion: Both method 1 and method 2 produce plans of similar OAR dose and clinical acceptability, but method 2 has the advantage of lowering the V105 significantly. Therefore, we find method 2 to be the best solution for clinical use. By creating one plan without bolus for the non-bolus fractions then copying those fields and recalculating with bolus present for the bolus fractions, we can produce a clinically acceptable bolus/non-bolus plan with minimal dosimetric differences to the traditional planning method. This method minimizes planning time in dosimetry and increases departmental efficiency without compromising plan quality. It should be noted that recalculation when bolus is applied or removed from any plan is clinical best practice.

AAMD American Association of Medical Dosimetrists

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