

Purpose: To evaluate the accuracy of the pencil beam algorithm's (PBA) and pencil beam redefinition algorithm's (PBRA) calculated electron conformal therapy (ECT) dose distributions by comparing with phantom measured dose distributions.

Method: The planning target volumes (PTV) from a parotid and a chest wall patient were modified to fit the CT image set of a cylindrical polystyrene phantom. A bolus ECT plan for both PTV sets was developed using .decimal p.d software to design a custom bolus, with the distal bolus surface fitting to the phantom and the proximal bolus surface conforming the 90% isodose surface to the distal PTV edge. PBA and PBRA dose distributions were calculated using the Pinnacle treatment planning system and in-house software, respectively. In-phantom film measurements were taken for each plan in five transverse slices and one sagittal slice. Accuracy of both the PBA and PBRA calculations was tested by comparing the measured 2D film data to corresponding planar dose files from both the PBA and PBRA treatment plans, respectively. Passing criteria of 5% dose difference or 2mm distance to agreement were applied to each pixel (0.5mm pixel size) to quantify the accuracy of each dose calculation.

Results: Comparison between measured and PBA calculated pixels for the post-mastectomy chest wall and parotid cases for all 6 measured planes resulted in 93.3% and 95.3% pass rates, respectively. Using the same criteria, the PBRA had pass rates of 96.6% and 95.6%, respectively. In a phantom with no heterogeneities, the PBA and PBRA are both expected to have excellent agreement.

Conclusions: The PBA and PBRA produced highly accurate calculations for bolus ECT dose distributions. As expected, the PBRA is slightly more accurate than the PBA, however this difference may not have any clinical significance unless significant heterogeneities are present, currently under study.

Funding Support, Disclosures, and Conflict of Interest:

Support: This work was supported in part by a research grant from .decimal, Inc.