AbstractID: 3738 Title: The effect of MV cone-beam CT cupping artifacts on dose calculation accuracy

Purpose: MV cone-beam (CB) CT imaging can be used to position the patient prior to external-beam radiotherapy. If calibrated, these images may also be used in dose calculations, opening the possibility to reconstruct the delivered dose or re-optimize the treatment plan before delivery. This study investigates the effect of imaging artifacts on dosimetric accuracy.

Method and Materials: Two water cylinders of 13 cm and 22.5 cm diameters were imaged using A) a MV CBCT system integrated with a Siemens accelerator and B) a conventional kV CT imager. Cupping trends observed in the MV CBCT were imposed on the kV CT images to create artificial data with simulated artifacts. Using the Phillips Pinnacle planning system, a 6 MV 10 x 16 cm^2 field was applied to 1) the original kV CT of the smaller cylinder and 2) the kV CT with simulated artifacts. Similarly, a 18 x 18 cm^2 field was applied to the original and artificial kV CT of the larger cylinder.

Results: For the smaller cylinder, the MV CBCT water signal relative to air at the cylinder center differs from the radial and axial extremities by approximately 14% and 17% respectively. For the larger cylinder, the differences are 38% and 20% in radial and axial directions. The dose distributions for the artificial images show a systematic deviation which increases with depth. In the high-dose, low-gradient regions, the largest deviation for the smaller cylinder is 1% of the maximum delivered dose. For the larger cylinder, the largest deviation is 4%.

Conclusion: Cupping artifacts in water phantoms produce dosimetric errors much smaller in magnitude than the cupping trend itself but as large as 4% for large phantoms. These results suggest that rough correction of MV CBCT artifacts may be sufficient for dosimetric accuracy.

Conflict of Interest:
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