

AbstractID: 11141 Title: Limited-Angle Imaging for Target Positioning Using Orthogonal Conebeam X-Ray Systems

Purpose: To investigate limited-angle imaging using orthogonal x-ray systems, with regard to use for target positioning onboard external beam radiation therapy (EBRT) machines.

Method and Materials: Image reconstruction was performed using projection data acquired with a single conebeam CT (CBCT) system for an anonymized head-and-neck patient onboard an EBRT machine. The original data set included 678 angles over 360°. Four subsets of this data were generated corresponding to the following angular ranges of the x-ray tube: (i) Dual-40°: -110° to -70° plus -20° to 20°; (ii) Single-80°: -130° to -50°; (iii) Dual-80°: -130° to -50° plus -40° to 40°; (iv) all 360°. Images were reconstructed from each data set by an ordered-subsets iterative statistical method (OSTR). Sagittal, coronal, and transverse slices were obtained from the reconstructed images and evaluated. This study design does not include the cross-scatter that would occur between two orthogonally mounted CBCT systems.

Results: Equal-dose comparisons of Dual-40° and Single-80° images showed that the Dual-40° provided sufficient sharpness to position the target along all 3 dimensions. The Single-80° images did not provide adequate sharpness along the lateral direction. Equal-time comparisons of Dual-80° and Single-80° images showed marked improvement in image quality in all 3 slices and all 3 dimensions.

Conclusion: Dual-40° scans have approximately equal dose to Single-80° scans, allow positioning along all 3 dimensions, and require only half the imaging time. Reduced imaging time can reduce motion artifacts in the image and reduce probability of motion between imaging and treatment. Dual-80° scans have approximately twice the dose of Single-80° scans, but they provide much better image quality with no increase in scan time. Onboard limited-angle imaging with dual orthogonal CBCT systems thus has advantages over limited-angle imaging with a single CBCT system.

Conflict of Interest (only if applicable):