AbstractID: 2892 Title: Cone Beam Digital Tomosynthesis (CBDT): An alternative to Cone Beam Computed Tomography (CBCT) for image-guided radiation therapy

Purpose: To investigate the feasibility of using a new imaging technique, i.e., Cone Beam Digital Tomosynthesis (CBDT) as an alternative to the Cone Beam Computed Tomography (CBCT) approach for creating 3D cross sectional images of a patient in the radiotherapy treatment room.

Method and Materials: Similar to the CBCT approach, the CBDT uses an x-ray source (either a kV source or a MV source on a Linac or another radiation-emitting device) and an x-ray detector to acquire projection data by rotating them around a patient simultaneously. Unlike CBCT, CBDT utilizes partial scans, typically in the range of 20-60 degrees of gantry arc. The main advantage of the CBDT approach is that it takes less time to perform image acquisition and reconstruction. An experimental CBDT system has been built on a Linac with a recently developed flat-panel detector. A novel filtered backprojection algorithm was developed for CBDT reconstructions. CBDT phantom images have been generated for different degrees of gantry arc and beamline configurations and compared to those from CBCT.

Results: Cross-sectional images of a Rando phantom were generated with comparable image quality to CBCT using as small as ~ 22 degree gantry arc. The planes of CBDT reconstruction are orthogonal to the x-ray beam at the midpoint of the arc. These reconstructed planes are of particular relevance to image-guided radiation therapy, because they depict anatomy along planes that are most relevant to the treatment beam, i.e., orthogonal to the beam axis.

Conclusion: We have demonstrated the feasibility of using CBDT to acquire cross-sectional images of an object in the treatment room to guide radiotherapy treatment. Compared to CBCT, the CBDT approach is much faster with acceptable image quality in the planes most relevant to the treatment.

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