AbstractID: 13242 Title: Megavoltage cone-beam computed tomography using 2.5MV x-rays

Megavoltage cone-beam computed tomography using 2.5MV x-rays

Purpose: To evaluate the feasibility of 2.5MV cone-beam computed tomography (MVCB) for patient setup and verification.

Method and Materials: A new linac (Varian Trilogy Mx) produces an unfiltered 2.5MV imaging beam (2xMVCB) in addition to the higher energy treatment beams. In conjunction with a standard electronic portal imaging device (EPID), 2xMVCB scans were acquired of CT calibration and anthropomorphic phantoms. Approximately 500 projections were collected in each 360-degree scan using a total of 7.5 – 50 monitor units (MU). Depending on total MU, scanning time was as low as 1.5 minutes. Intrinsic calibration corrections were applied to all raw projections prior to reconstruction. Reconstructed images were further processed to correct for imaging artifacts and compared to kilovoltage cone-beam (KVCB) and 6MV MVCB scans (6xMVCB).

Results: Preliminary results demonstrate that it is possible to obtain 3D images with adequate image quality using relatively low doses (7.5 MU, approximately 4 cGy to isocenter) which are comparable to either a pair of double-exposed MV portal images or a KVCB. Although image quality is inferior to KVCB, 2xMVCB still permits assessment of bony alignment for patient setup and has better tissue contrast than 6xMVCB. Soft tissue registration may also be possible for 2xMVCB in the thorax and other anatomical regions. These results provide evidence that 2xMVCB may be an efficient image guidance procedure for clinical routine.

Conclusion: MVCB using 2.5MV x-rays can provide volumetric images with adequate quality for patient setup verification. An improved EPID optimized for 2.5MV beam having ~14 times higher quantum efficiency than conventional EPIDs is being tested. This will enable even lower imaging doses, and also improve image contrast in the abdominal and pelvic regions. Reconstruction algorithms optimized for 2.5MV are also under development.

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