AbstractID: 10957 Title: Optimization of image acquisition parameters for patient setup using megavoltage cone-beam digital tomosynthesis

Purpose/Objective(s): Digital Tomosynthesis (DT) is an imaging technique for reconstructing multiple tomograms from 2D projections acquired over a limited gantry arc (20^{o}-40^{o}). This study evaluates the use of megavoltage cone-beam (MVCB) DT images acquired with a high contrast imaging beam line for patient setup. The objective is to determine the optimal parameters (gantry arc, imaging dose) resulting in the least dose to normal tissue while maximizing the positioning accuracy, as compared with MVCBCT.

Method and Materials: Coronal and sagittal DT tomograms of prostate (3), head and neck (2), spine (2) and lung (2) patients were reconstructed from a limited subset of projection data, and registered to the planning-CT. The translational shifts required for patient alignment were calculated and compared with those provided by MVCBCT-CT registration. The registration was guided by gold markers for prostate patients, bony landmark for head and neck and spine patients, bones and air cavities for lung patients. Online DT images were acquired on an anthropomorphic female thorax phantom to evaluate the applicability of DT imaging to breast patient setup. The imaging dose was measured with thermoluminescent dosimeters on the ipsilateral and contralateral breast. The measurements were compared with dose calculations.

Results: DT provides positioning accuracy comparable to CBCT, with positioning difference of $\leq$0.1 cm for prostate patients and $\leq$0.3 cm for the other sites. Forty degrees arc DT provides the best alignment precision. Phantom studies show that DT images acquired with doses as low as 0.3 cGy are suitable for patient alignment, and the dose to the contralateral breast is negligible.

Conclusion: DT is a viable alternative to CBCT for patient setup. Due to the low imaging dose and the sparing of the contralateral breast, DT has potential in breast patient setup.

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