Purpose: To quantitatively investigate image qualities of the kilo-voltage cone-beam CT images reconstructed with reduced number of projections on the Varian OBI system. Evaluate the registration accuracy using those CBCT images against the reference CT images.

Methods: CBCT images were obtained from Varian OBI system using standard dose head, pelvis and pelvis spotlight modes. CBCT reconstructions were performed with full, 1/2, 1/4, 1/6 and 1/8 of the full set of projections. Catphan® 504 phantom was used to evaluate high-contrast spatial resolution, low-contrast visibility and uniformity. Rando phantom was imaged for rigid registration study. Rando was set up on the linac couch deliberately shifted by 1cm in vertical, lateral, and longitudinal (no rotational) directions from the reference position. Auto-match followed by manual adjustment was conducted 5 times to obtain the average shifts. The same method of analysis in the Rando study was used for the clinical registration study. One patient was imaged with pelvis mode and two patients were imaged with pelvis spotlight mode.

Results: The Catphan study indicates that high-contrast spatial resolution and uniformity are virtually not affected by the lowest projection-number (1/8) reconstruction scheme. However low-contrast visibility degrades when the projection number used for reconstruction is as low as 1/6. Rando study shows that registration accuracy can be achieved with images reconstructed with 1/6 of the full set of projections. Patient study shows similar results exhibited in Rando study. However, noisy images and streak artifacts are more pronounced with fewer projections (approximate 1/6), which decreases viewer's ability to visualize soft tissues in pelvic sites.

Conclusions: This study shows that KV-CBCT reconstructed with fewer number (approximately as low as 1/6) of regular projections can be used for registration against the reference CT. Although the results are encouraging, more clinical cases should be evaluated in the future.

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None