

AbstractID: 5768 Title: Correction of Couch Artifacts in kV Cone-Beam CT from an On-Board Imaging System

Purpose:

To evaluate artifacts caused by treatment couch attenuation on 3D image reconstruction for a new kV on-board-imager (OBI) and cone beam CT (CBCT) system and to develop an algorithm that filters couch effects from two-dimensional radiographic projections prior to inputting to the 3D reconstruction algorithm.

Material and methods: A standard quality assurance phantom was scanned in air and on couch top using both full and half fan cone-beam scanning modes with and without bowtie filter combination. A spatial domain filter algorithm was developed to remove couch attenuation from each radiographic projection. This filter is based on a pixel-by-pixel subtraction technique of radiographic projections of cone-beam scans of the couch from the corresponding radiographic projections of scans with phantom on top of the couch. The net couch-filtered radiographic projections were used to reconstruct CT images.

Results: CT numbers for scans of the phantom on couch top are less uniform than for scans of the phantom in air. The couch artifacts vary the linearity of the CT numbers by 5-15%, depending on the density of the material. Noise of the scans with phantom on couch top (3.5%) is higher than that with phantom in air (1.5%). The increased noise hinders the ability of the CBCT system to resolve low-contrast regions when the couch is present. Pre-reconstruction processing of the couch suppresses noise ($< 1.5\%$) improves uniformity by a factor of 2 and removes ring and streak artifacts in the couch-filtered reconstructed CBCT images.

Conclusion: The treatment couch produces streaking artifacts, enhances noise, and causes drifting of CT numbers in the reconstructed OBI CBCT images. The developed couch pre-processing algorithm suppresses noise, improves CT number uniformity by a factor of 2 and removes ring and streak artifacts in the couch-filtered reconstructed CBCT images.

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