AbstractID: 13583 Title: CBCT Total Variation Based Image Reconstruction from Limited Projections

PURPOSE: Cone beam computed tomography (CBCT) is commonly used for image-guided external beam radiation therapy. There is interest and motivation to use a limited number of acquired projections to reconstruct the CBCT in order to reduce patient imaging dose; however, under these conditions filtered back projection (FBP) techniques typically used in CBCT reconstruction produce low quality CBCT images. We propose to examine the application of a novel iterative reconstruction technique using total variation minimization for this problem. **METHODS AND MATERIALS:** A previously proposed adaptive steepest descent – projection onto convex set algorithm was modified with an ordered subset convex algorithm replacing the simultaneous algebraic reconstruction technique in the POCS step (ASD-POCS-OSC). ASD-POCS-OSC was used to reconstruct 60 projections of an anthropomorphic phantom uniformly spaced over 360 degrees to an image space of 512 x 512 x 200. Projections were acquired with an Elekta XVI CBCT imaging system using the medium field of view with an offset detector panel. Reconstruction results were compared to images reconstructed with FBP for several image metrics. **RESULTS:** After one iteration the ASD-POCS-OSC images show improved edge definition, higher contrast-to-noise ratios, and decreased artifacts compared to the FBP reconstructed images. ASD-POCS-OSC reconstruction requires an increased computational burden and reconstruction time compared to FBP. **CONCLUSION:** Iterative reconstruction algorithms, such as ASD-POCS-OSC, yield reconstructed images with improved image quality compared to FBP algorithms. Iterative algorithms optimized for speed and performance may allow for the use of limited projection CBCTs to be used for patient set-up on current clinical imaging devices**.** **Supported in part by NCI T-32 CA113267.**