AbstractID: 6567 Title: Thoracic Patient set-up using daily kV images: Analysis of different image registration tools

Purpose: To assess daily set-up of thoracic patients, based on kV images and kV cone-beam CT (CBCT), and to compare different tools for analysis of kV images.

Method and Materials: Nine thoracic patients who had daily kV imaging as a part of their routine treatment were evaluated. A total of 205 images (18-26 images per patient) were available for analysis. Patients were set up daily to skin marks, and orthogonal kV images were acquired. Shifts used for patient treatment were determined by side-by-side visual inspection of images in a commercial R&V system. Weekly CBCT images were obtained, and patient alignment was done using an in-house 3D-3D rigid registration tool. All images were retrospectively analyzed by a single observer using in-house 2D-3D image registration tools. In this software, split windows and shifting of the reference image were used to determine the shifts.

Results: The standard deviation of the shifts actually made, for all 9 patients, were 3.8, 4.5, and 4.6 mm (L/R, S/I and A/P respectively). The standard deviation of the differences between actual shifts and those obtained retrospectively by manual 2D-3D matching were 2.7, 3.0, and 2.7 mm (L/R, S/I and A/P respectively). The standard deviation of the differences between manual kV shifts and CBCT were 2.3, 2.5, and 1.5 mm (L/R, S/I and A/P respectively). The largest systematic difference observed was between manual 2D-3D and CBCT shifts (1.0 mm in the A/P direction).

Conclusion: This study demonstrates that PTV margins are non-zero and need to be determined even when using daily kV imaging. The differences between different manual methods of evaluating daily patient images are smaller than the actual shifts made, but still substantial. Reduction of this variation, through use of better tools, training, or improvements in image quality, may improve patient set-up and allow for further margin reduction.