

AbstractID: 8495 Title: A comparison of repositioning accuracy for three image-guided systems

Purpose: For fractionated stereotactic radiotherapy (FSRT), target localization requires sub-millimeter accuracy and real time patient position monitoring. Three image-guided systems for target positioning are presented: (1) 3-D surface camera imaging-Align RT (ART), (2) Elekta kV cone beam computed tomography (CBCT), and (3) optical marker tracking-RadioCameras(RC). The repositioning accuracy of ART was validated by comparison to RC and CBCT.

Methods and Materials: A custom head and neck Rando phantom was designed with a bite plate and four infrared reflective markers. Using the three systems, phantom images were acquired for 70 random locations over a range of couch positions and within a 3-D range of ± 20 mm and/or $\pm 5^\circ$. Acquired phantom images from each system were registered to their reference images with algorithms specific to each imaging device. For each system, the accuracy of calculated repositioning values was assessed for specific phantom positional shifts.

Results: The differences in relative iso-center positions for each system with respect to CBCT are 1.33 ± 0.27 mm for ART, and 1.23 ± 0.34 mm for RC. Variations in composite vectors of translational shifts between ART and RC, ART and CBCT, and RC and CBCT were 0.50 ± 0.47 , 0.30 ± 1.44 , and 0.55 ± 1.37 mm, respectively. Maximum difference of rotational shifts in each direction between the three systems was $-0.10^\circ \pm 0.23^\circ$, $0.66^\circ \pm 0.24^\circ$, and $-0.56^\circ \pm 0.23^\circ$. CBCT images cannot be acquired at couch position beyond $\pm 10^\circ$. For couch rotations of $\pm 10^\circ$ to $\pm 90^\circ$, the maximum difference between ART and RC was -1.03 ± 0.56 mm translation and $-0.48^\circ \pm 1.63^\circ$ rotation.

Conclusions: The results showed that smaller differences in shift values when comparing ART to RC than to CBCT. This study suggests that CBCT reconstruction uncertainty is greater than 1 mm.