AbstractID: 9467 Title: Position verification of breast treatment with breath-hold technique using 3D-surface and fluoroscopic imaging

Purpose: To evaluate the reproducibility and stability of target position for left breast radiotherapy treatment on deep inhalation breath-hold and to determine their dosimetric impact.
Method and Materials: Six patients were treated using Active Breathing Coordinator (ABC). A 4D-CT was acquired along with an ABC scan during simulation to establish geometric advantages of breath-hold treatments. Through patient's treatment course, 3D-surface movies were acquired with VisionRT periodically during breath-hold (30 breath-holds/patient). Comparison of the frames was performed to evaluate intra-breath-hold drifts and inter-breath-hold position reproducibility. For evaluation of the 3D-surface images and correlation with internal structures, fluoroscopic images of the chest wall were also acquired 4 times (6-8 breath-holds/patient). Additionally the images were correlated with inhaled air volumes as calculated from the breathing signal. A dosimetric study was performed to determine the effect of breath-hold drifts and position differences.
Results: Intra-breath-hold drifts were determined by comparison of the first with the subsequent 3D-surface frames. Each patient presented consistent behavior throughout her treatment, with the most stable having sub-millimeter surface motion in 20s and the least 2.5mm in 13s hold. Measurements of the rib motion from the fluoroscopic images correlated within 1 mm with the surface motion. However for some of the patients, slow diaphragmatic motion up to 8mm was observed. Patient variability was also observed on inter-breath-hold reproducibility. On average for all patients, 2 mm body surface position difference was observed between breath-holds. This variation correlated with the air volumes inhaled as calculated from the breathing signal. It was proven dosimetrically that even for the least stable patients, ABC holds advantage over free breathing.
Conclusion: Although, there are limits on position reproducibility and stability with deep inhalation breath-holds, treating left breast patients with this method is beneficial. 3D-surface imaging is an important tool for monitoring motion for near the surface treatments.