AbstractID: 4751 Title: Feasibility of a feedback-guided breath-hold technique for thoracic radiation therapy

Purpose: To determine whether respiratory traces can be used to visually guide breath holds at specified respiratory phases for thoracic radiation therapy; and whether such breath-holds are reducible and effective to reduce treatment margins.
Methods and Materials: Feedback-guided breath-hold (FGBH) technique was used to provide real-time respiratory traces to patients undergoing radiation therapy of the thorax. The visual signals, depicting the thoracic-motion amplitude and targeted breath-hold levels, e.g. end-expiration (EE) or end-inspiration (EI) were fed back to patients via eye goggles. Patients with distal esophageal cancers near the diaphragm were evaluated for the effectiveness and reproducibility of the FGBH. Simulation CT scans at EE and EI were acquired with repeated FGBHs at multiple sessions. In addition, twice-weekly portal images were acquired with FGBH at EE during treatment courses. On the CT-DRR and portal images, positions of the isocenter and the diaphragm representing the breathing level were measured relative to vertebral axis. The systematic and random errors of the isocenter and diaphragm positions among various image sets were also analyzed.
Results: The diaphragm movement during free breathing was about 2-3 cm as measured from two patients who completed the clinical protocol so far. For the first patient, the systematic and random errors of the EE diaphragm positions were on the order of 0.6-0.8 cm. The second patient was able to perform the EE breath-hold better with systematic and random errors of the diaphragm positions less than 0.2 cm. The margin needed for the FGBH treatment was 59.1% and 30.7%, respectively, relative to that of the free-breathing treatment for the two patients.
Conclusions: FGBH technique can be used to effectively reduce the respiratory motion and treatment margin. However, the accuracy of the respiratory monitor, patient training, and compliance are critical steps to ensure the consistency and reproducibility of the breath-hold.