AbstractID: 10872 Title: Implementation of feedback guided voluntary breath hold gating for CBCT based stereotactic body radiotherapy

Purpose: To implement feedback guided voluntary breathhold for CBCT based stereotactic body radiotherapy. **Methods and materials:** 8 patients with early stage lung tumors eligible for stereotactic body radiotherapy and with respiratory induced tumor motion of > 1 cm (determined from 4D CT) were selected for feedback guided breath hold implementation. Visual feedback was provided to assist patients in maintaining consistent breath hold levels. Multiple fast spiral CT scans were acquired, both within and between successive breath holds. A single breath hold CT was chosen as the reference. Gross tumor volume (GTV) was delineated to encompass the suspected tumor volume on all breath hold CT acquisitions. Standard margins for treatment planning were 0.8 cm (CTV) and 0.3 cm (PTV). Prior to each treatment delivery, a CBCT was acquired under a series of breathholds. Changes in volume, shape and size from reference were determined using 3D-3D matching tools. Shifts made based on 3D-3D matching were then verified through 2D-2D matching of acquired orthogonal MV breath hold images. **Results:** Overall median breath hold duration was 20 sec (max 52 sec; min 3 sec). CBCTs required 2 – 3 breathholds and were noted to be of superior quality to those obtained during normal respiration. Intra and inter breath hold reproducibility (RMS) of GTV centroid position at the time of repeat simulation was 1.2, 2.1 and 1.0 mm (AP, SI, LR). Inter fraction breath hold reproducibility of GTV position with respect to bony anatomy was 0.5, 1.7 and 0.4 mm (AP, SI, LR - systematic) and 1.3, 1.9 and 1.1 mm (AP, SI, LR - random). **Conclusions:** Respiratory feedback and image guided breath hold gating can improve the accuracy/precision of stereotactic body radiotherapy, especially for mobile tumors.