AbstractID: 6614 Title: Quantification of potential margin reduction for gated and 4-dimensional radiation therapy

Respiratory motion necessitates adding large margins to the CTV to ensure adequate dose coverage during the entire breathing cycle for thoracic tumors. Decreasing these margins using gated/4D techniques (where the radiation beam tracks the tumor) may lead to reduced treatment-related toxicity and allow dose escalation for chest radiotherapy. Our aim was to quantify the ability to predict internal anatomy motion from the respiration signal using various breathing training methods, and determine the potential reduction in CTV-to-PTV margins. Five patients were enrolled in a study involving the simultaneous acquisition of a respiration signal and internal anatomy motion (from fluoroscopy). To quantify variations in motion between fractions, several sessions over different days were recorded. Correlation values between respiration signal and internal anatomy motion for audio-prompted, visual-feedback, and normal respiration techniques, derived from the first session were used in subsequent sessions to predict the internal anatomy position. The difference between actual and predicted positions allowed quantification of CTV-to-PTV margins. A consistent reduction in the CTV-to-PTV margins of 6mm was attained for gated/4D treatments compared to conventional treatments. The difference in predicted margins using audio-prompting or visual-feedback did not differ significantly from those predicted for normal respiration. However, if set-up error (the dominant component of gated/4D margins) can be reduced, visual-feedback training potentially offers the largest margin reduction. The correlation between internal anatomy motion and the respiration signal was found to vary from day-to-day. In order to safely reduce margins for gated or 4D radiotherapy these variations need to be taken into account.