Purpose: To analyze and evaluate the necessity and use of dynamic gating techniques for compensation of baseline shift during respiratory-gated radiation therapy of lung tumors.
Methods: Motion tracking data from 30 lung tumors over 592 treatment fractions were analyzed for baseline shift. The finite state model (FSM) was used to identify the end-of-exhale (EOE) breathing phase throughout each treatment fraction. Using duty cycle as an evaluation metric, several methods of end-of-exhale dynamic gating were compared: An a posteriori ideal gating window, a predictive trend-line-based gating window, and a predictive weighted point-based gating window. These methods were evaluated for each of several gating window types: Superior/inferior (SI) gating, anterior/posterior beam, lateral beam, and 3D gating.
Results: In the absence of dynamic gating techniques, SI gating gave a 39.6% duty cycle. The ideal SI gating window yielded a 41.5% duty cycle. The weight-based method of dynamic SI gating yielded a duty cycle of 36.2%. The trend-line-based method yielded a duty cycle of 34.0%.
Conclusions: Dynamic gating was not broadly beneficial due to a breakdown of the FSM's ability to identify the EOE phase. When the EOE phase was well defined, dynamic gating showed an improvement over static-window gating.