

AbstractID: 11822 Title: On the need for multiple external markers to predict tumor displacement due to respiration

**Purpose:** To study the correlation between external markers and tumor displacement, investigate the need for multiple markers to independently predict tumor displacement and perform a stratified analysis by disease site and tumor location.

**Methods:** Data was acquired from 91 patients undergoing stereotactic body radiation therapy using the Cyberknife Synchrony™ system. The data consisted of three dimensions corresponding to each of three external markers and the tumor. Univariate analysis was performed to determine the correlation between the displacement of individual external markers and the tumor. Multivariate analysis was performed to determine which external marker dimensions (and the number) independently predicted tumor displacement. A stratified univariate and multivariate analysis based on tumor site and location was also performed.

**Results:** Univariate analysis showed that more than one external marker and more than one external marker dimension had a correlation coefficient  $> 0.5$  with the tumor position. Multivariate analysis showed that 2.6 external markers and 4.7 external marker dimensions were needed to independently predict tumor displacement. Each external marker dimension was independently predictive of tumor displacement in an equal number of cases.

**Conclusions:** Univariate shows that more than one external marker and more than one external marker dimension had a strong correlation with the tumor position. Multivariate analysis showed that 2-3 external markers and 4-5 external marker dimensions were independently predictive of tumor displacement. The resulting RMS error between the predicted and actual tumor displacement from the multivariate regression model was approximately 1 mm.