AbstractID: 14101 Title: A Novel Treatment Couch for Tracking Intrafraction Tumor Motion: Evaluating its Geometric Accuracy

Purpose:
To characterize the performance of a novel treatment couch designed and developed for respiration-induced real-time tumor motion tracking and to investigate its behavior with real tumor trajectories.

Method and Materials:
A new treatment couch has been developed to track targets in real-time. The system is capable of tracking targets with less than 0.5 mm accuracy. The max physical velocity for the couch is 13 cm/sec along SI and ML directions and 10 cm/sec along AP direction. It can reach a maximum acceleration of 100 cm/sec^2 along all the three axes. To quantify the performance of the couch we used 25 tumor trajectories showing a peak-to-peak displacement in the range of 20 – 39 mm and sampled at 38 ms. These trajectories were fed to 3D time-varying trajectories derived from patient data. The motion of the phantom measured in real-time via a camera system was feed into the couch control system. Tracking errors were analyzed.

Results:
We found that the mean error in tracking for 20 tumor trajectories was 0.37 mm with a standard deviation of 0.29 mm. The system dead time was approximately 40ms. For individual trajectories, the median error varied from 0.15 mm to 0.70 mm whereas the individual mean values varied from 0.17 mm to 0.74 mm. Couch speed and acceleration were acceptable for real-time target tracking.

Conclusion:
We have developed a new couch for use with a linear accelerator that can track and correct for intrafraction (including respiration-induced) target motion. Mean and median tracking errors are less than 0.5 mm even for peak-to-peak displacements up to 4 cm. The couch shows a fairly stable and vibration free behavior over a wide range of tumor displacements studied.

Conflict of Interest: NIH grant CA124766