AbstractID: 7166 Title: Respiratory Training using Audio Visual Bio-Feedback

Purpose:

To investigate the effectiveness of a novel respiratory training tool based on audio-visual biofeedback for 4D CT image acquisition and dynamic tumor tracking during radiation therapy.

Method and Materials:

During radiation therapy it is important that a patient follows the same breathing pattern throughout the treatment. However, in practice, such regularity is very difficult to achieve. Our hypothesis is that, by training a patient to breathe according to a representative breathing pattern constructed from the patient's own free breathing samples, it is possible to achieve significantly higher regularity and reproducibility in the real time breathing pattern. Initially for each subject, the real-time position samples for free breathing are acquired using a real-time position monitoring system. After collecting a sufficiently large number of free breathing samples, a representative breathing pattern is constructed by estimating the average of the Fourier series coefficients corresponding to each breathing cycle. The patient is then instructed to follow the representative breathing pattern as closely as possible. The new method of respiratory training was tested on four volunteers (non-patients). For each volunteer, the data for free and trained breathing was analyzed to calculate the RMS error of period and displacement with respect to representative waveform.

Results:

The average of RMS errors in time period and displacement for trained breathing was 2.32 seconds and 4.32 cm respectively. Similarly, average of RMS errors for free breathing was found to be 3.27 seconds and 7.9 cm. The reduction in the errors from free breathing to trained breathing was approximately 30 percent in time period and 45 percent in displacement.

Conclusion:

This tool provides valuable insights into identifying respiratory training methods that are customized for each subject. Further analysis of this methodology will be performed by developing alternate user interfaces and investigating the data from a larger set of volunteers.