

AbstractID: 3041 Title: A comparison of 4DCT with breath-hold imaging for determination of tumor motion with respiration.

Purpose:

Internal target volumes (ITVs) have been determined using both breath-hold CT scans (BHCTs) and four-dimensional CT (4DCT) to assess the extent of tumor motion during normal respiration. The purpose of this work is to compare the differences in tumor excursion when measured with BHCT and 4DCT.

Method and Materials:

All 4DCT and BHCT datasets in this study were acquired as a part of the radiotherapy simulation process using a commercial 4DCT system (Discovery ST, GE Healthcare, Waukesha, WI). Respiratory tracking was accomplished using a commercial system (RPM, Varian Medical Systems, Palo Alto, CA). A visual prompt from this system was displayed to patients to assist them in holding their breath at the correct level during BHCTs. The locations of the tumors with respect to a reference dataset (4DCT end-expiration) was determined using a rigid-body cross-correlation algorithm that found the location on each dataset that best matched the region of the physician-determined gross tumor volume (GTV) on the reference dataset. The patient did not move between the 4DCT and BHCT scans, thus differences in tumor location were due to tumor motion rather than bulk patient motion.

Results:

For 20 patients, the average difference in displacement of the GTV between BHCT and 4DCT scans was 5 mm at end-inspiration and 3 mm at end-expiration with maximum differences of 12 mm and 10 mm respectively. GTV motion on BHCTs was always greater than or equal to the motion on the 4DCT. The direction of tumor motion was also found to be different between 4DCT and BHCT images with the average difference in the vector angles being 14°.

Conclusion:

The results of this work suggests that patients being treated during normal breathing should be simulated during normal breathing (4DCT) and those to be treated using a breath-hold technique should be simulated using BHCT.