

AbstractID: 8332 Title: Quality and accuracy of cone beam computed tomography gated by active breathing control.

Purpose: To evaluate the quality and accuracy of cone beam computed tomography (CBCT) gated by active breathing control (ABC) for image guidance.

Method and Materials: Comparisons were made between conventional ABC-CBCT (stop and go), modified ABC-CBCT (a method to speed up the acquisition by slowing the gantry instead of stopping during free breathing), and free breathing respiration correlated CBCT. All CBCT images were acquired with an Elekta LINAC equipped with an on board KV imager with two gantry speed settings. Speed changes for the modified ABC-CBCT were triggered by the ABC. Breath hold and free breathing patterns used were: (breath hold seconds / free breathing seconds) 3 / 15, 5 / 10, and 10 / 15.

Image quality was assessed with a CATPHAN with high contrast, low contrast, and uniformity inserts. CT number linearity was evaluated. Registration assessment (bony and soft tissue) was quantified with both an anthropomorphic and a quality assurance phantom. A calibration phantom was used to assess gantry angle accuracy with respect to gantry speed modulation.

Results: Conventional ABC-CBCT scan time for the breath hold patterns assessed ranged from 2.3 to 5.8 minutes. Modified ABC-CBCT scan time ranged from 1.4 to 1.8 minutes, and respiratory correlated CBCT scans took 2.1 minutes to complete. CT number linearity for ABC gated scans was comparable to a normal clinical scan with all projections. Registration accuracy for small, large, and rotational corrections was within 1 mm and 1 degree. Gantry angle accuracy was within 1 degree for all scans.

Conclusion: Modified ABC-CBCT (slow gantry during breath hold) scans can potentially improve the efficiency of conventional ABC-CBCT (stop and go), or replace respiration correlated CBCT, without degradation of performance for image guidance purposes.

Conflict of Interest: Research sponsored by Elekta, Inc.