AbstractID: 5634 Title: Rapid low-dose 3D image-guided treatment verification of sites prone to respiratory motion using on-board digital tomosynthesis (DTS)

Purpose:
This study examines the potential use of on-board digital tomosynthesis (DTS) for image-guided treatment verification of sites prone to respiratory motion. DTS is a fast, low-dose method for reconstructing 3-D images from 2-D projection data, acquired with a limited scan angle. In the treatment room, a 45^{o} DTS scan can be acquired in less than 10 seconds, making rapid breath-hold DTS a simple method for acquiring 3-D treatment verification images, devoid of respiratory motion.

Method and Materials:
On-board DTS images of ten human liver, pancreas, and lung subjects were reconstructed from kV CBCT projection data, acquired on a Varian 21EX Clinac equipped with an on-board imager (OBI), either during a breath-hold or while subjects were freely breathing. Corresponding reference DTS (RDTS) images were reconstructed from breath-hold planning CT data. Soft-tissue visibility was compared between breath-hold DTS and free-breathing DTS and CBCT, to assess the potential efficacy of the breath-hold DTS strategy for 4-D image-guided treatment verification.

Results:
Breath-hold DTS markedly improved the rendering of soft-tissue abdominal and thoracic anatomy, compared with free-breathing DTS or CBCT. Organ structures were clearly defined, and even low-contrast target malignancies were often visible in breath-hold DTS reconstructions. Free-breathing DTS and CBCT reconstructions, on the other hand, often exhibited artificially enlarged target volumes and poor visibility of soft-tissue anatomy, due to motion averaging effects.

Conclusion:
Rapid breath-hold DTS enhances the visibility of bony and soft-tissue anatomy in sites prone to respiratory motion, facilitating daily localization of soft-tissue targets. Breath-hold DTS localization is superior to free-breathing on-board CBCT for thoracic and abdominal image-guidance.

Conflict of Interest:
This research was supported in part by a grant from Varian Medical Systems.