AbstractID: 8144 Title: Quantitative Feasibility Evaluation of Contrast Enhanced CBCT for IGRT in an In-Vitro Model

Purpose: The aim of this work is to evaluate the feasibility of using contrast agent in CBCT and to quantitatively measure the impact of contrast medium on CBCT images. This pilot study seeks to investigate the ability to better visualize radiation targets/tumors utilizing intravenous contrast medium for purpose of targeting with CBCT. **Method and Materials:** The impact of contrast medium on the CBCT was investigated through comparison of its CT numbers with the conventional CT (CCT) acquired on same object. Two in-vitro studies were performed with one study using balloons filled with different concentrations of diluted contrast materials (Omnipaque^{TM} (Iohexol Injection 300 mgI/mL), GE Healthcare) and the other using test tubes. Balloons or the test tubes were placed inside a uniform water phantom and were scanned with a conventional CT scanner (Philips Big Bore Brilliance) and a CBCT equipped linear accelerator (Varian Cl-iX). In-house image analysis software was used to obtain the mean CT pixel values, standard deviation, and image noise in regions of interest (~100 pixels/ROI). Electron density calibration was also performed by scanning a Catphan-504 phantom (Phantom Laboratory) with both CCT and CBCT as a base-line study. **Results:** The analysis showed that CT numbers were fairly consistent between CCT and CBCT measurements, namely less than 7% in the mean values of overall contrast media. However, with the test tube study, the CBCT had more scatter artifacts from high density structures nearby and its noise level was about 2.5 times more than that the CCT. **Conclusions:** This study quantitatively verified that CBCT images are more apt to scatter artifacts from surrounding high density structures. We conclude that contrast enhanced CBCT imaging may be potentially useful for improving target localization in selected cases. Clinical evaluation of contrast enhanced IGRT is warranted.