

**Purpose:** CBCT and 3D Ultrasound (3DUS) provide complementary information on bony landmarks and soft tissues, particularly for abdominal sites. Furthermore, 3DUS can potentially track intra-fractional motion of soft tissues. In this study, we investigate the feasibility of integrating these two modalities to provide a comprehensive image guidance procedure that corrects for both inter- and intra-fractional motion.

**Methods:** The ultrasound probe will be operated under robotic control to enhance reproducible placement. We investigated the effect of potential CT artifacts caused by the probe and the subsequent effect on treatment plan dose calculation. We then measured the effect on ultrasound image quality due to an 18 MV radiation beam in close proximity to the probe. A phantom was constructed by imbedding markers in gel. The reproducibility of the marker positions under controlled repeat compressions, mimicking robotic placement, was measured. The effect of removing a beam to allow probe placement during treatment was studied by comparing optimized liver plans with or without the specific beam.

**Results:** CT artifacts associated with probe placement affected treatment planning dose by 20%. The artifacts can be avoided with a CT-compatible model probe. Radiation dose delivered 1 cm from the probe did not affect the ultrasound image quality. When the same compression was used to compress the gel phantom, the positions of the fiducial markers were reproducible to within 0.3 mm. The reoptimized liver plan with the omission of one beam was not noticeably different from the original plan.

**Conclusions:** On-board x-ray CBCT is highly effective for patient setup based on bony landmark. 3DUS is a non-invasive, non-ionizing means to continuously monitor soft tissue motion. Our studies indicate that it is feasible to combine both systems during treatment. Their integration, enhanced by robotic repositioning, provides a highly complementary approach for IGRT of soft tissue sites in the abdomen.

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