

AbstractID: 14106 Title: Ultrasound-Image Guided Radiation Treatment with Amplitude-Based Gating System

Purpose

To employ the first step for implementing UltraSound (US) imaging during radiation treatment, perform real-time, zero-dose 4D target tracking and implement amplitude-based gating. Treatment volume can be reduced by gating or synchronizing the treatment machine with US-based 4D target tracking.

Methods and Materials

Varian IX2300 is to be used with NOMOS BAT system. Organ motion study is tested with an in-house moving station, which is coupled with a geometric phantom. The B-mode BAT system consisting of a PC, Ultrasound unit, and an articulated arm is employed. The system uses contour data from a patient's CT simulation in combination with positional information derived from the BAT's articulated arm for target localization. An additional computer system called the BAT Workstation is also used to create the BAT studies. US probe is set at 22 cm maximum detection depth and 8 cm focus point. Videos of target movements are recoded during delivery in slices of TIF format.

Results

For 19 patients, a total of 185 treatment isocenter alignments were performed. Averaged positional adjustments in each axis are between 2.6 mm to 4.2 mm. US image quality was studied to verify radiation effects on the US transducer. A small noise ratio can be induced when the radiation is on the US probe and fields. Signal to noise ratio is estimated as 25 dB. An in-house program can easily eliminate the noise and track the target volume. This suggests target tracking is possible with US during radiation treatment.

Conclusion

UltraSound image can be used as target localization with similar accuracy as CBCT or other invasive technique as below 1 mm resolution. A small noise ratio can be induced when the radiation is on the US probe and fields, but can also be easily eliminated by software. Therefore, US image guided radiation therapy is achievable.