

Purpose: Design and feasibility of a new prospective gated CBCT for gated treatment IGRT and body SRT treatments.

Method and Materials: 4D cone beam CT (4D CBCT) can be used to assess tumor motion for IGRT and body SRT treatments. However, acquisition time for 4D CBCT is normally longer than 3 minutes. For gated treatments, it is sufficient to measure the tumor motion in the range of the gate. We propose using prospective gated CBCT for assessing the tumor motion for the gated treatment to save time in CBCT data acquisition. The same monitoring system (RPM, Varian Medical Systems, Palo Alto, CA) is used to gate the radiotherapy treatment and the CBCT acquisition. Both x-ray and gantry rotation start when the condition of gating is met such as the breathing amplitude falls in the threshold setting for therapy. The patient can be coached with audio prompting during data acquisition and treatment. The acquisition time is between 1 to 2 min and can be accelerated with a faster gantry rotation. Only one CBCT reconstruction is needed. We applied this approach on a dynamic phantom with 30% duty cycle of beam on time.

Results: The gated acquisition was feasible and the image acquired with the gated acquisition of the phantom demonstrated the gated image of the phantom with the specified duty cycle.

Conclusion: We have designed a new prospective CBCT and demonstrated its feasibility with a dynamic phantom. This system uses the same thresholds for imaging and treatment demonstrating position and residual motion within the gate on each day. The prospective CBCT is shorter in acquisition time than 4D CBCT. This system can be applied for improving the quality of gated treatment IGRT and body SRT treatments.