Purpose: To commission and evaluate gated RapidArc radiotherapy of a linear accelerator (Varian TrueBeam) for treatment of moving targets using a programmable dynamic phantom.

Methods: The phantom used had different dosimetry inserts for measurement of dose and dose distribution. It could be programmed to move in the anterior-posterior and superior-inferior axes with different motion patterns, amplitudes and frequencies to simulate lung motions of patients. A set of 4D CT images was acquired with the aid of a Varian RPM system. Images acquired at the 40, 50 and 60% of the motion cycle were selected and transferred to a treatment planning system (Varian Eclipse) for planning. A two-arc RapidArc treatment plan was generated for a C-shaped target volume with a conformity index of 1.49 and transferred to the TrueBeam for treatment delivery. Dose and dose distribution measurements were performed using a 0.057 cc ionization chamber and radiochromic films, respectively and compared with the TPS calculations. Five treatment fractions were given in three days with two different target motion patterns to assess the consistency of the dose delivery.

Results: Agreement between TPS calculation and measurement were within 1.64% for dose and 3% or 3mm in distance to agreement for dose distribution. Repeatability of dose delivery between treatments was within 0.1% (1SD) in the five treatment fractions delivered in three days. The time required to deliver a dose of 2 Gy to a moving C-shaped target using gated RapidArc technique with two gantry rotations was about 15 minutes.

Conclusions: The geometric and dosimetric accuracy and consistency of gated RapidArc radiotherapy had been verified. Our study indicated that the accuracy and consistency of the treatment modality were acceptable for clinical implementation.