Purpose: To evaluate the dosimetric potential of respiratory-gated volumetric-modulated arc therapy (VMAT) to reduce the dose to normal lung when treating early stage non-small cell lung cancer (NSCLC) with stereotactic body radiation therapy (SBRT).

Methods: Seven early-stage NSCLC patients were retrospectively planned with gated and un-gated VMAT using Smart Arc (Pinnacle v9.0, Philips Medical Systems, Cleveland, USA). The average 4D-CT of each patient was used as the planning CT for the un-gated VMAT plans. A subset average CT that minimized the motion within a 30% gating window was used as the planning CT for the gated VMAT plans. Each VMAT plan consisted of one arc to minimize the delivery time. All plans were prescribed 54 Gy in 3 fractions and all dosimetric parameters satisfied the requirements of our in-house lung SBRT protocol. In order to avoid dosimetry bias between the gated and un-gated plans, a Pinnacle host script was generated and used to optimize all 14 plans. Dosimetric parameters such as D(2cm), V(20), and the total normal lung volume receiving 50% of the prescription dose were compared.

Results: There was a significant decrease in all dosimetric parameters considered in this study. D(2cm) decreased from (53.960 2.680)% to (51.703 1.907)% (p<.05). V(20) decreased from (6.629 1.565)% to (5.213 1.387)% (p<.005) and the total normal lung receiving 50% of the prescription dose decreased from (254.465 62.853) cm^3 to (177.068 45.947) cm^3 (p<0.004).

Conclusions: Respiratory-gated VMAT has the potential to reduce the dose to normal lung when treating early-stage NSCLC with SBRT to moving targets with motion greater than 10 mm.