AbstractID: 9501 Title: Feasibility of using a programmable respiratory motion phantom for QA and assessment of dosimetric implications of breathing motion during radiation therapy

Purpose: Respiratory motion introduces uncertainties during CT and radiation therapy delivery. Reliable equipment and quality assurance (QA) techniques must be established to assess and overcome these uncertainties. Our goal was to validate the performance of a programmable motion phantom for QA and to demonstrate the dosimetric impact of breathing motion on treatment delivery. **Method and Materials:** The "Quasar" phantom (Modus Medical, London, ON) was assessed for suitability in QA procedures for radiation therapy involving respiratory motion. The phantom is equipped with a programmable unit, which introduces motion to cylindrical lung inserts. We tested the standard mode of motion and the "oscillation" mode, in which patient breathing profiles are imported and reproduced. Phantom motion reproducibility and accuracy were assessed using the Varian Real-time Position Management (RPM) system and video for the extreme breathing periods (1 and 15seconds) and a patient representative breathing period of 4seconds**.** An in-house designed cedar lung insert was built containing a target (4cm by 7cm). Film is placed in the insert to assess the dose distribution under phantom motion from static and dynamic delivery under phantom motion. The dynamic MLC treatment delivery was synchronized with target motion. **Results:** Using the RPM system, percent differences between the intended and actual periods for each were 0.57%, -1.70% and -0.22% respectively. When the amplitude was changed from 2cm to 1cm, the measured period did not change. Comparison of the breathing profiles in oscillation mode with profiles generated using the RPM system shows a close correspondence, with slight divergence at extreme direction or speed variation. Dose distribution for a phantom motion of 2cm peak-to-peak and period of 3.2sec along the moving direction indicates significant broadening of (80-20%) penumbra for static delivery (1.67cm) compared to dynamic delivery (0.80cm) **Conclusion:** The Quasar phantom is suitable for QA and dosimetric measurements of moving targets.