Purpose: To evaluate the mechanical stability and dosimetric accuracy of planning and delivering pulsed low-dose radiotherapy (PLRT) using volumetric modulated arc therapy (VMAT) on Elekta linacs

Methods: Ten patients previously treated for Glioblastoma Multiforme were replanned using PLRT VMAT to deliver ten 0.2 Gy pulses separated by 3 min intervals with an effective dose rate of 0.067 Gy/min. VMAT parameters such as leaf speed and arc length were optimized to deliver 2 Gy/fraction to a total of 60 Gy to the target volume in ten sub-fractions or pulses. Plan quality was assessed using conformity and homogeneity indices. Absolute dose distribution for individual pulses was measured using the Arccheck cylindrical diode array. Individual pulses were analyzed for reproducibility and stability using machine log file saved in clinical mode. Machine characteristics at low monitor units and low dose rate were also investigated.

Results: An optimal arc length of 140 - 160 degree and a leaf speed of 0.18 - 0.25 cm/degree were sufficient to provide stable delivery and equivalent plan coverage to IMRT. The average time and dose rate required to deliver a single 0.2 Gy pulse was 39.5 ± 2.3 seconds and 49 ± 32.3 cGy/min. Average reduction in MUs for the PLRT plan compared to IMRT for PTV was 16.0% (Range: -5.5% to 36.1%). Significant improvement was seen in maximum doses to all sensitive structures when planned with VMAT PLRT. The average absolute dose gamma passing rate for the 10 pulses combined and 2 Gy plan were 91.6 ± 2.5% and 97.3 ± 1.2% . Cumulative monitor units, dose rate, gantry angles and leaf positions evaluated using machine log files were within 2% for all pulses. Flatness and symmetry were within Elekta specifications.

Conclusions: Elekta linacs are capable of delivering reproducible and stable PLRT plans. Prospective clinical study employing PLRT is currently in process.