AbstractID: 9458 Title: Comparison of single-arc and multiple-arc approaches for delivering of Volumetric Modulated Arc Therapy

Purpose: Linear accelerator vendors have recently introduced delivery control systems with the ability to deliver Volumetric Modulated Arc Therapy (VMAT). These systems can deliver VMAT using either a single-arc or a multi-arc approach. The goal of this study is to compare single-arc and multi-arc delivery techniques in terms of both plan quality and delivery efficiency.

Materials and Methods: Two prostate cases and three head-and-neck cases were included in this study. For each case, single-arc and three-arc VMAT plans were generated using our home-grown arc sequencing algorithm that converts optimized fluence maps into deliverable arcs. Each VMAT plan was evaluated using Pinnacle's superposition dose calculation, and DVH comparisons were made between the two sets of VMAT plans. VMAT deliveries using Elekta's PreciseBeam Infinity™ control system were performed for each patient to compare the delivery efficiency.

Results: For the two prostate cases, the single-arc and three-arc VMAT plans resulted in similar target dose coverage and organ at risk (OAR) sparing. For the three head-and-neck cases, the three-arc plans provided improved target dose coverage as compared with the single-arc plans with the average standard deviation in the target dose reduced from 7.06 to 5.82 cGy. The target volume covered by 95% of the prescribed dose also increased from 97.5% to 98.5% for the three-arc VMAT plans. For single-arc VMAT delivery, the average delivery time was approximately 3.2 minutes for prostate cases and 5 minutes for head-&-neck cases. While for three-arc VMAT delivery, these values increased to 4.5 and 5.6 minutes.

Conclusions: For simple cases such as prostate, single arc delivery provides comparable plan quality and improved delivery efficiency. However, for more complex cases, multi-arc VMAT plans are preferable due to the ability to achieve improved dose conformity while maintaining acceptable treatment times.