

Purpose: Elekta VMAT utilizes a binned variable dose rate (BVDR) whereby the dose rate jumps between a series of discrete levels during the VMAT delivery. The use of discrete dose rate levels may limit the plan quality and delivery efficiency. A continuous variable dose rate (CVDR) delivery technique has now been developed with the goal of solving such limitations. This work studies the impact of CVDR on VMAT plan quality, delivery efficiency and accuracy.

Methods: 10 cases covering a variety of treatment sites were selected for this study. Among them, three cases were selected for plan quality comparison. All VMAT plans were created using Pinnacle3 SmartArc® and were delivered on an Elekta Synergy linac equipped with an 80-leaf conventional MLC. The delivery accuracy was checked using a 2D ion chamber array.

Results: Similar dose distributions were observed in both the BVDR and CVDR plans. For the more complex H&N case, however, the CVDR plan had a slightly improved target dose coverage with an average V95 (target volume receives at least 95% prescribed dose) of 99.0% as compared with 98.4% for the BVDR plan. For all three cases, the average V95 for the BVDR and CVDR plans are 96.7% and 97.0%, respectively. The average delivery time per arc was 2.35 minutes for the BVDR plans. This value decreased 25% to 1.75 minutes for the CVDR plans. As to the plan delivery accuracy, the gamma analysis passing rate of the VMAT plan QA delivered using BVDR and CVDR remains essentially the same for each case.

Conclusions: The availability of continuous variable dose rate represents a significant advancement in VMAT delivery on Elekta linacs providing a 25% reduction in treatment times while providing similar or slightly improved plan quality.

Funding Support, Disclosures, and Conflict of Interest:

This work was sponsored in part through a grant from Elekta.