AbstractID: 13179 Title: Dosimetric benefits of non-coplanar arcs in VMAT delivery for intracranial targets

Purpose: VMAT is an arc-based IMRT technique delivered using conventional linear accelerator. The current application of VMAT has been focused on axial coplanar delivery. However, for certain treatment sites, especially some intracranial targets, non-coplanar arcs may bring extra dosimetric benefits. This work was carried out to study the non-coplanar VMAT delivery in terms of both plan quality and delivery efficiency.

Materials and Methods: Five GBM cases were selected for this study. For each case, VMAT plans using one axial coplanar arc and multiple non-coplanar arcs were generated using either Pinnacle^3 SmartArc® or a home-grown arc sequencer. DVH comparisons were made between the two sets of plans. VMAT deliveries using Elekta's PreciseBeam® VMAT control system were performed for each case to compare the delivery efficiency.

Results: Both coplanar and non-coplanar VMAT plans have very similar target dose coverage. For all five cases, the average V95, defined as the target volume receiving at least 95% of the prescribed dose, remained unchanged at 99.8%. As to the critical structure sparing, however, the non-coplanar plans show significant improvement. For example, on average, the maximum and mean doses to brainstem were reduced from 3277 and 1016 cGy to 2524 and 668 cGy in the non-coplanar plans. These correspond to 23% and 34% reduction. The average maximum dose to chiasm was also reduced from 876 cGy to 346 cGy in the non-coplanar plan, a 61% reduction. The average treatment delivery time increased from 1.9 to 4.0 minutes for the non-coplanar plans.

Conclusions: Comparing to the axial coplanar delivery, the VMAT plans using non-coplanar arcs can significantly improve the critical structure sparing while maintaining the target dose coverage and uniformity. However, these dosimetric benefits come at the cost of a prolonged treatment delivery time.

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