AbstractID: 12572 Title: Method for optimizing geometric beam parameters for volumetric modulated arc therapy of multiple brain metastases

Purpose:
Volumetric modulated arc therapy (VMAT) treatment can be a patient friendly delivery choice for brain stereotactic radiosurgery especially in the setting of multiple lesions. Depending on the geometric relationship of the targets, one lesion may "shadow" another during portions of the arc which affects plan quality. With the proper table and collimator angles, however, target shadowing can be reduced or avoided. Our goal is to establish a method to determine the best angles for VMAT treatment.

Method and Materials:
The method consists of four steps: 1) define the vector of Beam-Eye-View(BEV)-Y axis in the treatment planning CT coordinates which defines the plane of MLC travel. 2) project each lesion onto the BEV y-axis vector. 3) determine the best table and collimator angle that minimizes MLC leaf sharing between lesions. 4) using these table and collimator angles generate an optimized VMAT plan and evaluate the plan quality. We performed test plans on 3 patients and demonstrate that the proposed method resulted in superior plans for several example cases of targets of various sizes and locations. Depending on the lesions' geometric relationship multiple arcs may be required.

Results:
We tested the method on three example cases with targets of various locations in the brain and sizes ranging from 1.18 to 17.86 cm^3. Applying the optimized geometric parameter to generate VMAT plan, the volume of normal brain receiving 12Gy or more was reduced more than 6.1% for all cases. The plan homogeneity ($D_{2\%}$ -$D_{95\%}$) was also improved from 5.88$\pm$ 1.21Gy to 5.21$\pm$ 0.93Gy vs. a VMAT plan with the manufacturer recommended table and collimator angles.

Conclusion:
The projection method is a promising tool for improving VMAT delivery in the setting of multiple brain metastases.