AbstractID: 9015 Title: Optimization of isocenter location for intensity modulated stereotactic treatment of intracranial targets

Purpose: To quantify the impact of isocenter re-location/optimization on treatment plan quality for intensity modulated stereotactic treatment of small intracranial lesions.

Methods and Materials: For 18 patients previously treated by stereotactic intensity modulated radiosurgery (IMRS) or stereotactic intensity modulated radiation therapy (IMRT), a retrospective virtual planning study was conducted wherein the impact of isocenter location on plan quality was measured. Lesions studied included 6 arteriovenous malformations (AVM), 6 acoustic neuromas (ACN) and 6 intracranial metastases, ranging in volume from 0.19-3.21 cm^3. Variation of isocenter location causes the geometric grid of pencil beams into which the target is segmented for intensity modulated treatment to be altered. The impact of this pencil beam grid redefinition on achievable conformity index (CI) may be significant for small lesions, where pencil beam size is similar to that of the lesion. Impact on CI was quantified for 3 different collimators (Varian Millennium 120; BrainLab MM3; Nomos binary Mimic) and 3 different treatment planning systems (Varian Eclipse v7.3.1; BrainLab BrainScan v5.31; Nomos Corvus v6.2), resulting in the evaluation of 3,446 different treatment plans.

Results: For all patient, collimator and treatment planning system combinations studied, a significant variation in plan quality was observed as a function of isocenter/pencil-beam-grid re-location. Optimization of isocenter location resulted in treatment plan conformity variations as large as 109% (min = 15%, mean = 53%, across all plans) with Millennium 120 mean = 36%, MM3 mean = 70% and Mimic mean = 51%.

Conclusion: For intensity modulating treatment plans, variation of isocenter location causes the geometric grid of pencil beams into which the target is segmented to be altered. Optimization of isocenter location for IMRT/IMRS treatment of small intracranial lesions, where pencil beam dimensions are comparable to target dimensions, can result in significant improvements in treatment plan quality.