

AbstractID: 5837 Title: Dosimetric impacts of smaller pencil beam utilizing in smaller intracranial lesions on Intensity modulation serial tomotherapy

Purpose: To test the dosimetric feasibility of using a smaller size circular pencil beam on small intracranial lesions in serial tomotherapy based radiosurgery.

Method and Materials: An in-house post collimation device (Gizz) was developed to refine the NOMOS Peacock pencil beams to an array of 5 mm diameter circular pencil beams. Beam characteristics were investigated and implemented into the treatment planning system. Eighteen patients with small irregular intracranial lesions (0.19 to 3.21c.c, mean 1.21c.c) were selected in groups of arteriovenous malformation (n = 6), acoustic neuroma (n = 6), and metastatic lesion (n = 6). Plans were calculated with the refined smaller size circular pencil beam and a 4 mm x 10 mm rectangular pencil beam in Corvus 6.0. A novel strategy of normalizing plans to 97% target volume covered by 100% prescription line was adopted. Plan quality was characterized, for the purposes of the study, by conformity and homogeneity indices, mean, maximum and minimum doses to target and critical structures, and volume of healthy tissue receiving various dose levels.

Results: This new pencil beam provided a better two-dimensional resolution than three available commercial rectangular pencil beams. Due to adjacent gap spaces from this new physical design, a new couch indexing approach was proposed. Clinical selected cases experienced an average 15% conformity improvement utilizing this smaller pencil beam associated with better normal tissue avoidance. Results reflected that the performance of this device is dependent on target coverage, target volume, and beam displacement location.

Conclusion: Smaller pencil beam is an option to improve the target conformality for small irregular lesions in serial tomotherapy based radiosurgery. Future works on optimized pencil beam size, shape, isocenter shift should be accomplished.