AbstractID: 13348 Title: A Two-Step Optimization Technique for Planning Multi-Target Treatments with Robotic Radiotherapy

Purpose: Planning robotic radiosurgery for patients with 3 or more metastatic brain lesions is due to the need for a large number of constraints and the requirement of prescribing different doses to separate targets. A two-step optimization technique was developed to improve the plan quality of such treatments.

Method and Materials: First, separate treatment plans were developed for individual targets via setting nominal doses to each target disregarding contributions from other lesions. Then the 3D dose matrix associated with each target was exported and a singular-value-decomposition algorithm was applied to balance the background dose changes as well as dose interferences among targets via adjusting relative weightings among the dose matrices. Comparisons were carried out for such approach versus a planning-for-all approach implemented on the latest commercial system.

Results: Significant improvements were found in the target volume coverage with the new technique as compared with the existing plan-for-all techniques due to the capability to select individualized isodose levels for each target. Additionally, improvement was particularly noted for low-level peripheral normal brain sparing. On average, the volume of the normal brain receiving more than 4-Gy was reduced by 13% with the new technique for the studied cases. The improvement was especially notable when a high number (n>5) of targets are considered.

Conclusion: A two-step optimization technique has been demonstrated to improve treatment planning quality as well as the flexibility of dose prescription for multi-target treatment planning for robotic radiosurgery.