AbstractID: 3013 Title: An Integrated GRID Boost Technique for Gamma Knife Radiosurgery

Purpose: To develop an integrated boost approach with the GRID technique for Gamma Knife radiosurgery

Method and Materials: The GRID technique was originally developed for external beam radiation therapy where a high dose being delivered via a multi-hole collimator. The goal of the technique is to debulk large tumor with spatially fractionated dose distributions. In this study, we developed an integrated GRID boost approach for Gamma Knife radiosurgery where an array of high dose areas was placed inside the target volume using a series of 4-mm shots. The dose grid was added on top of the existing dose distributions where a peripheral isodose line (e.g. 50%) covers the full target volume. We optimized the weights of the 4-mm shots to equalize the integral dose at each shot location. Treatment plans were developed and evaluated based on peripheral dose fall-off and dose to normal brain as compared with the conventional Gamma Knife treatment plans. The comparison was also performed using equivalent uniform dose (EUD), tumor control probabilities (TCP), and normal tissue complication probabilities (NTCP).

Results: All parameters for the target volume (mean dose, EUD, and TCP) increased significantly (> 5-30%) for the GRID boost technique as compared with the conventional Gamma Knife plans. The peripheral isodose coverage of the target volume (as measured with conformity index) remained unchanged for the GRID boost technique. In contrast, the EUD and the NTCP for the normal brain tissue adjacent to the target decreased significantly (as much as 40% in NTCP) for the GRID boost plans. Slightly faster dose fall-off near the peripheral target region was noted for the GRID delivery.

Conclusion: We demonstrated a new GRID technique for Gamma Knife radiosurgery in escalating the dose to the target volume while improving adjacent normal brain sparing.