Import of Gamma Knife Model C Treatment Plans into CERR

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Purpose: To import Gamma Knife treatment plans into an environment that allows for comparison and combination dose distributions with those from other treatment planning systems to include those for linear accelerators.

Methods and Materials: A set of software tools were developed that allow the binary files of GammaPlan, version 5.4, for Gamma Knife, Model C, to be converted and imported into CERR, version 3.0. The imported data files include CT scan sets, MR scan sets, anatomical contours, the location of the dose matrix relative to patient anatomy, the dose computed by GammaPlan. The functionality of CERR allows us to fuse image sets, contours and doses.

Results: We were able to import GammaPlan treatment plan data into CERR for comparison and combination with a Varian Eclipse/Helios treatment plan for recurrent tumor in the same patient. The recurrent tumor extended into anatomical regions that precluded re-treatment with the Gamma Knife, Model C. This allowed superposition of isodose distributions of the two treatment plans in one viewable format. Areas of dose overlap for the two plans were identified and the progression of disease relative to the initially treatment location was observed.

Conclusions: The software tools extend the capabilities of CERR to view GammaPlan treatment plans and combine the doses from other treatment planning systems supported by CERR. Further work will incorporate full plan specifications, including shot locations, gamma angle, and time for each shot so that CERR can export in DICOM RT format. These tools provide the potential for multi-institutional stereotactic radiosurgery trials that include participation of the Gamma Knife, Model C.

Supporting Material

Introduction: We present a patient with recurrent tumor that extended just beyond the anatomical range of the Gamma Knife, Model C. Although the patient's initial treatment was with the Gamma Knife, the recurrent tumor had to be treated using linac-based stereotactic radiosurgery. Since the recurrence overlapped in part with the volume treated by the Gamma Knife, the desire was to combine the linear accelerator treatment plan with that from the Gamma Knife. Prior to our work there was no electronic mechanism to import GammaPlan treatment plans to compare and combine dose distributions with those from other treatment planning systems, especially to include those plans for linear accelerators.

Materials and Methods: A set of software tools were developed that allow the binary files of GammaPlan, version 5.4, for Gamma Knife, Model C, to be converted and imported into CERR, version 3.0. The imported data files include CT scan sets, MR scan sets, anatomical contours, the location of the dose matrix relative to patient anatomy, the dose computed by GammaPlan. The functionality of CERR allows us to fuse image sets, contours and doses.

Results: For the same patient, we were able to import GammaPlan treatment plan data into CERR for comparison and combination with a Varian Eclipse/Helios treatment plan for treatment of the recurrent tumor using Trilogy IMRT-based SRS. Fig. 1 shows registration of the image sets from the two treatment days. Both CT and MR were registered. Fig. 2 shows the initial location of the tumor treated with the Gamma Knife (upper panel) and where the recurrent tumor extended into the anatomical region that precluded re-treatment with the Gamma Knife, Model C (lower panel). Fig. 3 shows superposition of summed isodose distributions from the two treatment plans in one viewable format. Areas of dose overlap for the two plans were identified and the progression of disease relative to the initially treatment location was observed. Composite isodoses can be displayed on any of the registered image sets.

Conclusion: The software developed for GammaPlan provides a powerful set of tools to evaluate treatment plans, especially those requiring combination of multiple plans from a diverse set of treatment planning systems.

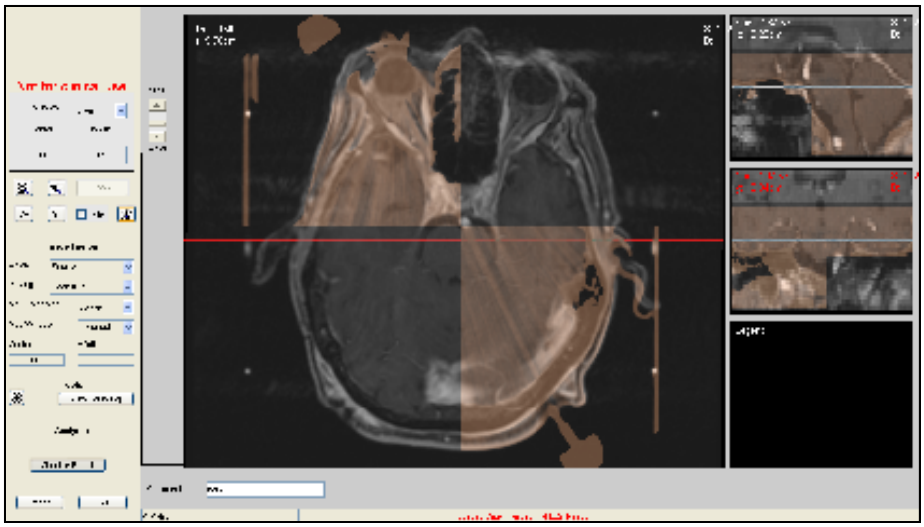

Fig. 1: CERR- based image registration of the GammaPlan image set (CT) with that (MR) used for Eclipse/Helios planning at time of recurrent tumor re-treatment.

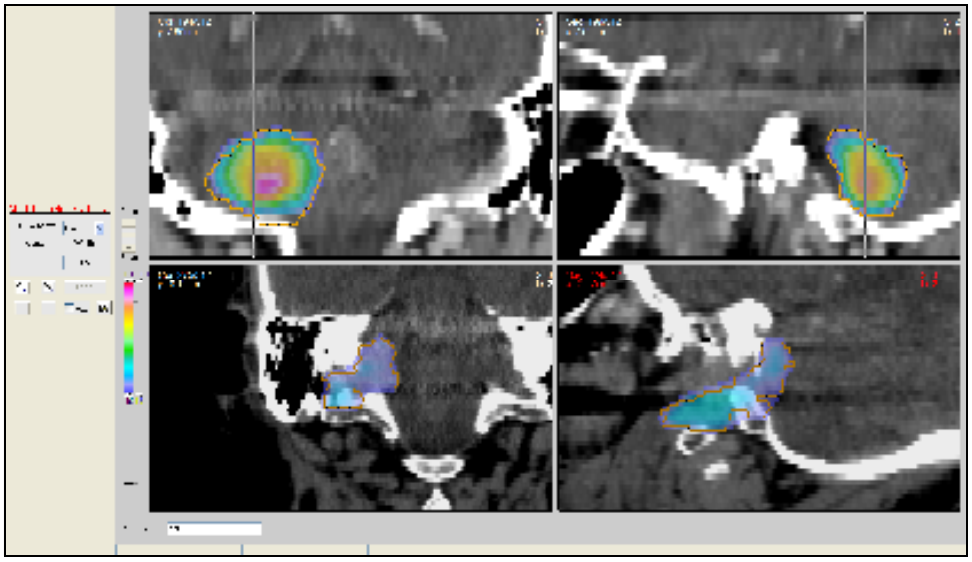

Fig. 2. CERR Viewer: Correlated Linac and GK plans. Upper panels show the Gamma Knife dose distribution and initial tumor contours superposed onto subsequent treatment images taken at time of recurrence. Lower panels show tumor at time of recurrence.

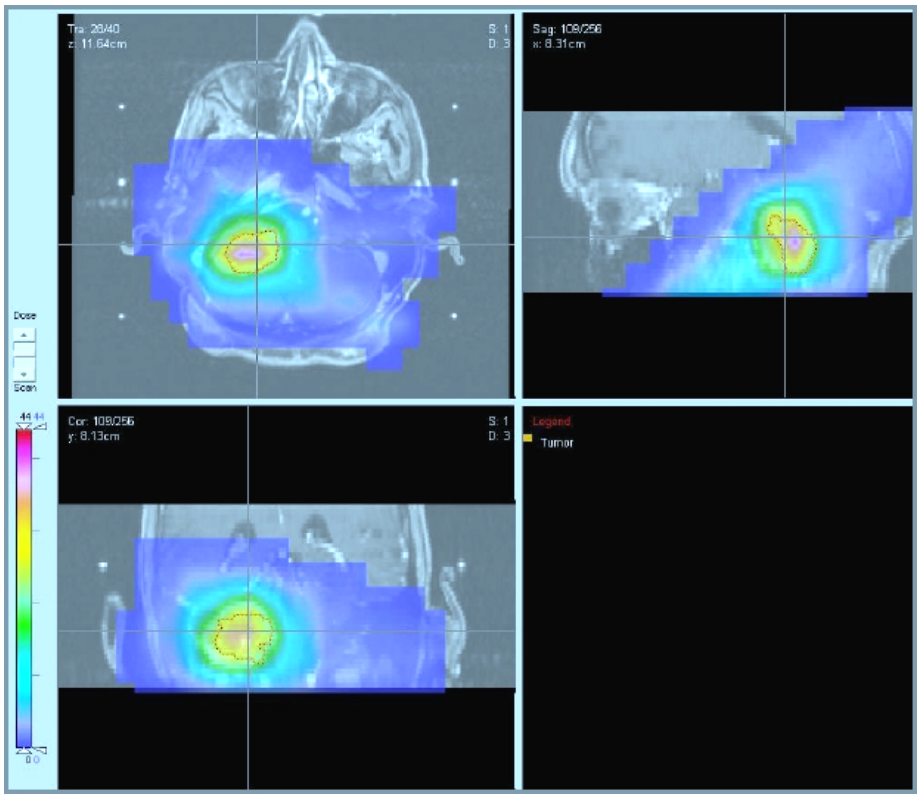

Fig. 3. Fusion of Varian Eclipse/Helios plan with GammaPlan shows a view of the composite isodose distribution for the two treatment days superposed on the GammaPlan image set.