

AbstractID: 4983 Title: Image and Dosimetric Verification of Positioning Accuracy for Helical Tomotherapy Intensity Modulated Stereotactic Radiosurgery

Purpose: To investigate the accuracy of Helical Tomotherapy for intracranial radiosurgery using Mega-voltage CT (MVCT) image fusion.

Method and Materials: Tomotherapy generates a set of MVCT images which are fused to the treatment planning KVCT to facilitate the patient setup. For intracranial lesions, mutual information matching program using bony anatomy automatically generates the lateral, longitudinal, vertical, pitch, roll and yaw adjustments that are necessary to align the MVCT to KVCT images. In our study, a *pReference* head phantom immobilized by Nomos Talon system was used to verify the positioning accuracy of MVCT fusion. Three gold-filled titanium markers inside the head phantom and the localization tip in the Talon system were used as the independent imaging makers to verify the MVCT positioning accuracy. In addition, dosimetric analysis was performed with a 0.015cc pinpoint ion chamber placed inside the phantom during KVCT simulation. A tomotherapy SRS plan with ion chamber sensitive volume as the target was generated and delivered. After MVCT to KVCT auto registration, dosimetric profiles in three directions were measured by stepping the couch away from the registered position. If the registration was perfect, the dose profile peak position should correspond to the registered position. The distance from the maximum dose to the registered location provides the ultimate accuracy of the system, including MVCT imaging accuracy and radiation dose delivery accuracy.

Results: The average localization differences between the MVCT and KVCT were 0.92mm in lateral, 0.82mm in longitudinal and 0.60mm in vertical directions. Dosimetric measurements showed 1.3mm offset laterally and 0mm offset in the other two directions. The relative large setup error in the lateral direction is partially due to the manual couch adjustment with mechanical scale in that direction.

Conclusions: The MVCT image fusion can be used to setup SRS patients within accuracy comparable to the current SRS standard.