AbstractID: 13815 Title: Multi-leaf Collimators for Robotic Radiotherapy: Feasibility Study

Purpose: The robotic mobility of the CyberKnife System enables the delivery of a large number of non-coplanar beams, which enhances dose conformality and creates very steep dose gradients, thus reducing doses to surrounding critical structures. A typical CyberKnife treatment plan for stereotactic radiotherapy utilizes approximately 150-200 beams to deliver conformal dose coverage to the target. By replacing the current cone-shaped collimator on the CyberKnife machine with multi-leaf collimators (MLC), we anticipate further improvement of dose conformality while reducing beam numbers and monitor units, and thus, treatment time. The purpose of this study is to evaluate the plan quality of MLC based robotic radiotherapy.

Method and Materials: Treatment plans were generated for 5 cases with varied tumor sites using the MLC (with 5 mm leaf width defined at 80 cm SAD) and the Iris Collimator. Each plan was generated based on clinical cases that had previously been treated with the CyberKnife System. With the Iris Collimator, all 12 potential collimator sizes were included in the optimization process. For the MLC treatment plan, 23 fields were used for planning. The beam angles were selected manually based on the frequency distribution of node usage in Iris Collimator plans. The Eclipse planning system was used in the MLC plan optimization.

Results: The results of the 5 cases showed that a reduction in total MU of 70-80% and a reduction of treatment time of 80-90% are generally achievable for the MLC plan compared to the IRIS plan. Both plans provide very conformal target dose coverage. However, the MLC plan delivers a much lower treatment dose to critical structures and surrounding tissues with a sharper dose fall off.

Conclusions: The reduction of total MU and treatment time by the multiple leaf collimators offers the potential to greatly increase the clinical application for robotic radiotherapy.