AbstractID: 1338 Title: Blocking Plug Pattern Selection Based on an Automatic Critical Region Shielding (ACRS) Algorithm for Gamma Knife Treatment Planning

Gamma Knife treatment plans consist of a large number of variables such as the number of shots, the locations of the shots, the size of the helmet, and in particular, the patterns of the plugs. In this study, we developed an automatic critical region shielding (ACRS) algorithm to optimize the treatment plans for targets with different critical structure constraints. We developed an efficient dose model to apply the algorithm. We studied the simulated cases such as a complex C-shape tumor surrounding a critical structure with multiple isocenters. We also applied the algorithm to the actual patient treatments. Our DVH analysis found that the dose to the critical region can be decreased by approximately 30%-50% when the blocked plug patterns are used. We also found that the isodose gradients are improved by about 5-10% per mm at the junction area between the target and the critical structure. In our approach, total number of plugs can be preset or changed during the calculation, therefore, providing a useful means to improve the Gamma Knife treatment planning of irregularly shaped targets with adjacent critical structures. The major strength of our algorithm is its simplicity and high efficiency in finding suitable solutions among a large number of plugging patterns.