AbstractID: 10936 Title: TomoTherapy Dose Painting

Purpose: Dose painting, or heterogeneous dose prescription is desired in many situations including re-optimization in ART to fix hot/cold spots from previous deliveries, and dose boosting based on theragnostic imaging. With minimal modification of the current TomoTherapy[SM] planning workflow, we developed a simple scheme and studied the feasibility of dose painting in TomoTherapy[SM] treatment planning.

Method and Materials: Optimization of TomoTherapy[SM] treatments is driven by a DVH-based objective function and user relies on DVHs to evaluate plan quality. Given an arbitrary prescribed dose distribution, we introduce a "complimentary-dose", which is the difference between a (homogeneous) "reference prescription" and the "heterogeneous prescribed distribution". During each optimization iteration, the "complimentary-dose" is added back to the "calculated-dose" for DVH-based objective function evaluation. The DVH shows "optimized-dose", which is the summation of "complimentary-dose" and "calculated-dose". The ideal DVH is still a vertical line through the reference point. All DVH constraints for tumors and OARs are employed as in regular optimization. A similar method could be used for re-optimization in ART to fix previous errors as identified in a prior dose.

Results: We used phantom studies to evaluate the feasibility of dose painting in TomoTherapy[SM] treatment planning. Various discrete and continuous prescribed dose distributions were tested. Dose profiles and effective DVHs are used to evaluate the results. For boosting discrete regions, the results show that TomoTherapy® technology is able to resolve boost regions as small as 1 cm in diameter. Concave and convex continuous prescribed dose distribution, with gradient up to 20%/cm, can be well achieved via TomoTherapy[SM] dose painting.

Conclusions: We developed and studied dose painting in TomoTherapy[SM] treatment planning. Phantom studies show that TomoTherapy® is an ideal modality for dose painting. Dose boosting or hot/cold spots fixing region as small as 1 cm and dose painting with gradient up to 20%/cm, is achievable.