AbstractID: 11620 Title: Examining Dose Gradients in Intensity Modulated Arc Therapy

Purpose: To study dose gradients from various dose distributions to aid inverse planning of intensity modulated arc therapy (IMAT). **Method and Materials**: Various dose distributions were generated on three phantom cases: 1) spherical planning target volume (PTV), 2) the same spherical PTV with a centralized organ at risk (OAR) and 3) a C-shaped target with an OAR. In particular, an optimized and an un-optimized IMAT plan were studied for the C-shaped target. Upon generating the dose distributions, we computed their dose gradients. We evaluated a line integral of dose gradients *I(C)* over a circular contour *C* for all dose distributions with various radii. Under certain idealized assumptions, *I(C)* can be shown to be constant for a given contour *C* for different plans. *I(C)* can be used to evaluate the dose gradient around the PTV for IMAT optimization. **Results**: The value of the line integral *I(C)* varied between contours of different radii. However, for a given circular contour *C*, the line integral *I(C)* varied 4.5% and 7% from the extremes of a single field to a PTV conformal arc for contours that are 2.5 cm and 0.5 cm from the edge of the PTV respectively. Using a donut dose distribution as a reference for the C-shaped target, we found that the sum of dose gradients for optimized IMAT plan decreased by 3.5% and 5.4% respectively over the two contours, whereas, for the un-optimized IMAT plan, it was decreased by 20% and 25% respectively. **Conclusions**: We hypothesize that there is an approximate "conservation of dose gradients" for dose distributions that are optimized with the constraint of uniform PTV dose coverage. Such information is useful in assisting IMAT optimization: if high dose gradients are generated in certain regions, this must come at the expense of a reduced dose gradient in some other regions.