AbstractID: 5525 Title: How useful are DVH"s in IMRT plan intercomparisons?

Purpose: To test the sensitivity of DVH-derived dose indices in comparisons of IMRT plans using different dose calculation methods.

Materials and Methods: Eighteen Head-and-Neck IMRT patient plans are computed with SC and Monte Carlo (MC) algorithms using identical dose grid placement and resolution. Dose volume histograms (DVH) and resultant dose indices from each plan are evaluated for targets and critical structures as a function of the dose calculation method. The difference of the dose indices is tabulated. An alternate numerical method is introduced where the difference of the doses computed by the two methods are computed for each dose grid element, and divided by the average value at that point. Thereafter, the relative dose difference matrices are overlayed onto the 3D CT and contoured structures. The weighted average and standard deviation of the relative dose difference values over all points within each structure and target are extracted and compared to the dose index differences.

Results: A linear regression analysis is possible between the average dose differences and the differences in the dose indices. However, the resultant fit shows a weak correlation, due to exacerbated standard deviations in the dose differences for all targets and dose-limiting structures. The large standard deviations reflect the differences in the location of hotspots and coldspots in the treatment plans derived from different calculation methods, which cannot be probed with DVH analyses.

Conclusions: IMRT planning dose calculation may not be compared accurately with dose index analyses. Thus, we propose the implementation of a weighted dose difference analysis, beyond DVH analysis, for IMRT planning comparisons studies. The present method is an ideal evaluation tool in probabilistic planning and IGRT planning studies, where DVH analyses alone will be insensitive to differences in the location of hotspots and coldspots, within targets and critical structures. (Partial Support, NIH-1R01CA98524)