Abstract ID: 16503 Title: Does IMRT treatment plan complexity or mismatched dosimetry data contribute to dose delivery errors detected using an IMRT H&N quality assurance phantom?

Purpose: Investigate whether increased intensity modulated radiation therapy (IMRT) treatment plan complexity or mismatched accelerator dosimetry data are responsible for or contribute to failures with the Radiological Physics Center's IMRT H&N QA phantom.

Methods: Eight H&N IMRT plans with a range of total MU (1460-3466), number of segments (54-225), and modulation complexity scores (MCS) (0.181-0.609) were created in Pinnacle v.8 and delivered to the RPC's H&N phantom on a single Varian Clinac. One of the IMRT plans (1851 MU, 88 segments, and MCS=0.469) was equivalent to the median H&N plan from ~1000 RPC H&N phantom irradiations. This average IMRT plan was also delivered on four matched Varian Clinac machines and the dose distribution calculated using a different 6MV beam model. Radiochromic film and TLD within the phantom were used to analyze the dose profiles and absolute doses.

Results: Increasing the treatment plan complexity by varying the MU, number of segments, or the MCS resulted in no clear trend toward an increase in dosimetric error using either ±7%/4mm or ±5%/3mm gamma index criteria. Varying the delivery machines as well as the beam model (use of a Clinac 6EX 6MV beam model vs. Clinac 21EX 6MV model), also did not show any clear trend towards an increased dosimetric error using the criteria indicated above.

Conclusions: Accurate IMRT dose delivery requires a complicated chain of events involving numerous steps, each of which might contribute to dose delivery errors. IMRT modulation complexity and mismatched dosimetry data have been postulated as contributing to IMRT dose delivery errors but our results indicate otherwise. Other components of the IMRT delivery chain such as MLC performance and modeling uncertainty in setup, machine mechanical integrity, etc. should be investigated to determine whether they contribute significantly to IMRT dose delivery errors.

Funding Support, Disclosures, and Conflict of Interest:

Work supported by PHS CA010953 and CA081647, awarded by NCI, DHHS.