AbstractID: 4768 Title: A Model for Handling Infeasibility Arising from IMRT Inverse Planning

Purpose: IMRT has been widely adopted to create conformal dose distributions. This technology is particularly useful in situations where critical structures push against the target or targets to create a concavity in the PTVs. It is difficult to develop a set of dose constraints that will work in all cases, and current IMRT inverse planning has become an iterative process that involves manual adjustment of various objectives. We investigate a new approach that allows the dose constraints to be varied (relaxed) in an organized way within the optimization process so that feasible solutions can be found for an originally infeasible problem.

Method and Materials: The IMRT inverse problem can be formulated as a system of linear inequalities with the dose upper/lower limit. For each of the targets or critical structures, the upper and lower limit can be relaxed to allowed up to $\alpha\%$ of the volume to have the dose limit decreased or increased up to $\beta\%$, respectively. Linear inequalities of a heuristic nature are formulated for these dose and volume relaxations. When infeasibility is encountered, each of the α and β are dynamically incremented by $\Delta\alpha$ and $\Delta\beta$. Iteractions are stopped when pre-defined α_{max} and β_{max} values are reached. These inequalities are solved using a linear programming method. Multiple feasible α and β pairs are returned when their limits are chosen forgivingly.

Results: Over 200 test cases of various sizes are randomly generated in a controlled manner. All experiments reached acceptable relaxed solutions. Successful relaxations are also found for a clinical IMRT case with multiple α and β pairs.

Conclusion: This approach can be an advantage for busy dosimetrists and clinicians that might otherwise be challenged by the prospect of generating multiple alternate plans. The approach described will produce a series of plans with relaxed constraints when the original dose limits are not met.

Conflict of Interest (only if applicable): None