AbstractID: 8447 Title: Parameter Optimization in Head and Neck IMRT for Elekta Linacs

Purpose: Planning and delivery in HN-IMRT is challenging for Elekta linacs because of numerous constraints on beam delivery systems. The purpose of this study is to find a set of planning parameters that are applicable to most patients and optimal in terms of plan quality, delivery efficiency and dosimetric accuracy.

Method and Materials: Four types of plans were created for each of 12 patients: ideal fluence optimization (FO), conventional two-step optimization (TS) consisting of FO followed by MLC conversion, segment weight optimization (SW) and direct machine parameter optimization (DMPO). Maximum number of segments (NS) and minimum segment area (MSA) were varied in DMPO. Plan quality was evaluated based on score, dose distributions and dosimetric indices. Delivery efficiency was evaluated by irradiation time, and dosimetric accuracy by Mapcheck.

Results: Plan quality deviates most from ideal FO for TS, with slight improvement for SW. DMPO is the closest to FO with the least variation among patients. NS of 80-160 in DMPO yield optimal plans. At larger NS ($\geq$80), plan quality decreases with MSA as expected, except for MSA <8cm^2, which suggests presence of local minima in the DMPO algorithm. The irradiation time is strongly dependent on the plan segments (NS_{actual}), weakly dependent on MUs, and independent of MSA. Typical plans with 79 segments and 8cm^2 MSA have ~747 MU and take ~ 8 minutes to deliver; this increases to ~13 minutes for 158 segments. Dosimetric accuracy is independent of DMPO parameters.

Conclusion: The superior quality of DMPO plans makes it ideal for planning HN-IMRT on Elekta linacs and its consistency allows development of class solutions. However, the vulnerability of local minima warrants such a study to systematically evaluate the effect of parameters in new planning techniques. The optimal set of parameters should be chosen to balance plan quality and delivery efficiency.