

AbstractID: 12708 Title: Knowledge-based and patient-geometry specific IMRT treatment planning

Purpose: To create an IMRT treatment planning approach by which planners can access the knowledge of prior clinical plans to control the quality of new plans.

Method and Materials: Overlap volume histogram (OVH) is used to access the knowledge of prior clinical plans. It allows planners to identify a reference group of prior clinical plans that contains geometric information “similar” to a new patient. The best plan in terms of OAR sparing in the reference group will then provide input to IMRT optimization for the new patient. In a retrospective OVH-assisted planning demonstration, 15 patients were randomly selected from a database of 91 prior head-and-neck patients with a three-level prescription: 58.1 Gy, 63 Gy and 70 Gy. A leave-one-out methodology was applied to generate the DVHs for each OVH-assisted plan (OP). The database-generated DVHs were then used by a planner who had no knowledge of the clinical plans (CPs). To evaluate the effectiveness of our methodology, the dosimetric results for three sets of plans: CPs, OPs after the first-round optimization and final OPs were compared by the Wilcoxon p test.

Results: Averages of optimization rounds required for completing CPs and OPs were 27.6 and 1.9 ($p < 0.00001$); three OPs were completed in a single optimization round. For both OPs, averages of standard deviation to the PTV⁶³ decreased by ~0.5 Gy ($p < 0.02$); averages of $D_{0.1 \text{ cc}}$ to the cord+4mm decreased by ~6.5 Gy ($p < 0.0001$); averages of $D_{0.1 \text{ cc}}$ to the brainstem decreased by ~7.5 Gy ($p < 0.005$); averages of $V(30 \text{ Gy})$ to the contra-lateral parotid decreased by ~8% ($p < 0.0001$). Additionally, both OPs were comparable with or better than the CPs in PTV uniformity, conformity and other OAR sparing.

Conclusion: The method offers a way of predicting clinically achievable doses ahead of planning, making IMRT planning no longer a trial and error process.