Abstract ID: 14886 Title: Fully Integrated Computerized Beam Angle Optimization for Coplanar and Non-Coplanar IMRT Treatments of Head and Neck-Cancer Patients and Implications for VMAT

Purpose: To quantify whether salivary gland sparing in head and neck-cancer treatments may be improved if planning is based on integrated computerized optimization of beam directions and intensity profiles. We also assessed the impact of optimized non-zero couch angles in VMAT.

Methods: We used iCycle, an algorithm developed in-house for integrated, multi-criteria beam angle optimization (Breedveld, PMB 2009). For 20 head and neck-cancer patients five plans with maximum salivary gland sparing were generated: a 7- and 9-beam equi-angular coplanar plan, a 9-beam coplanar plan with optimized beam angles, a 9-beam non-coplanar plan with optimized gantry and couch angles, and a 9-beam coplanar plan with one optimized couch angle. Using one wish-list with hard constraints and prioritized objectives all plans were generated fully automatically. To quantify differences in plan quality, we derived NTCP values for the salivary glands. VMAT plans were generated using the optimized couch angle derived by iCycle.

Results: The non-coplanar plans showed the best salivary gland sparing. Relative to these plans the NTCP values for the glands were up to 20% higher for the 7-beam plans. Nine equi-angular beams performed better than seven beams. Application of computer-optimized beam angles further improved sparing of the salivary glands, often resulting in substantially lower NTCP values than for IMRT plans with manually selected beam angles. For 18 of the 20 patients, coplanar plans with one optimized couch angle, requiring less treatment delivery time, were similar to fully non-coplanar plans. Relative to VMAT plans without couch rotation, application of the optimized couch angle improved the NTCP for the glands by up to 4%.

Conclusions: Integrated computerized optimization of beam profiles and angles for IMRT treatment of head and neck-cancer patients can substantially improve sparing of salivary glands. By optimizing the couch angle, VMAT plans can generally be improved as well.