AbstractID: 9410 Title: Sequential Optimization script to generate HDR-like dose distribution for hypofractionated prostate treatment with CyberKnife System

Purpose: To develop a Sequential Optimization script that generates HDR-like dose distribution for hypofractionated prostate treatment with CyberKnife® Robotic Radiosurgery System and evaluate its consistency over different patients.

Materials and Methods: Sequential Optimization is the latest optimization algorithm available for CyberKnife treatment planning. The optimization is performed sequentially, as a series of individual optimization steps. Each step corresponds to a specific clinical objective. First, dose constraints to organs at risk are defined that cannot be violated by during the optimization. Additional constraints are defined to the maximum Monitor Units for each beam, for each robot position, and for the entire treatment plan. Then the objectives of each optimization step are specified. The result of each step represents the optimal value for this objective that is achievable within the existing constraints. Each result is retained as an additional constraint for all subsequent steps. In this manner the treatment plan is built up one clinical objective at a time, with a gradual improvement observed at each step. A sequence of optimization steps (script) was created that generates HDR-like dose distribution for prostate treatment delivering 38 Gy in 4 fractions. Treatment plans were generated with the same script and with the Iris Variable Aperture Collimator for 10 prostates.

Results: Prostate volumes ranged from 25-70 cc. Prostate V100, V125 and V150 are ~95%, 50% and 15%. Urethra Dmax and D10 are <4560 and 4180 cGy. Rectal wall Dmax and D10 are <3800 and 2560 cGy. Bladder Dmax and D10 are <4560 and 4180 cGy. The number of beams is less than 250.

Conclusion: A script was created that consistently reproduces dose distribution similar to an HDR treatment. It was demonstrated that a script can be defined for particular clinical case and used as a starting point reducing planning time.

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