AbstractID: 5115 Title: Optimization of dose distribution for HDR brachytherapy of the prostate using Attraction-Repulsion Model

Purpose: To optimize dose distribution for high-dose-rate (HDR) brachytherapy for prostate cancer, we have developed a new algorithm named Attraction-Repulsion Model (ARM). In this study, we compared the ARM with geometric optimization (GO).

Method and Materials: ARM was used to optimize the dose distribution by finding the best dwell time combination, and this model uses a feedback mechanism. ARM requires grids inside the clinical target volume (CTV) and critical organs. These grids generate attraction or repulsion based on specific dose constraints. After calculations were performed repeatedly until the attraction and repulsion forces reached equilibrium, the optimal dwell time distribution was established. We compared the ARM with GO for ten patients using dose volume histograms and some volume indices.

Results: The CTV ranged from 23-48 cc and the CTV V150 ranged from 52-79 %, and 23-44 % for GO and ARM respectively. This indicates that the dose homogeneity indices as well as the conformal indices were higher for ARM than for GO. The urethra V150 was 0-99% and 0-1 % for GO and ARM respectively.

Conclusion: ARM proved to be superior to GO in minimizing the dose to normal structures and improving dose homogeneity for the target while reducing the dose to normal tissues.