AbstractID: 9034 Title: Inverse planning optimization for hybrid brachytherapy plans using multiple seed types

Purpose: The purpose of this work is to develop a brachytherapy inverse planning algorithm that can generate: 1) Hybrid plans with seeds of one isotope but of different activity levels; 2) Hybrid plans with seeds of two or more different isotopes. **Materials and Methods:** A stand-alone research version of the inverse planning algorithm, IPSA, was modified to sample different isotopes at each source position at specific moments during the iteration process. The user specifies the isotope sources desired using the TG43 formalism. The algorithm probes this space and evaluates the resulting dose distribution, compares it to the best distribution yet attained, keeps or rejects it, and finally continues to the next iteration. To test the program, plans for prostate volumes (19, 28, 35, 44, and 48 cc) were generated with a single activity and with different combinations of two activities (e.g. 0.25 and 0.4 mCi). Dosimetric indices were compared. **Results:** We have developed an inverse planning tool that allows the user to incorporate multiple isotopes into any brachytherapy plan. The optimization time is approximately 20% longer than for the standard optimization due to a larger parameter space, but still well under one minute. For all three prostate implants considered, the target volume receiving 100% of the prescribed dose was within 2% for every plan and always above the clinically acceptable 90%. Also the urethra volume receiving 120% of the prescribed dose was always below the clinically acceptable value of 1 cc. **Conclusion:** An inverse planning algorithm was developed as an extension to IPSA with the ability to incorporate multiple activities or isotopes into the permanent implant optimization process. Studies of the hybrid plans using two activities are shown here; studies involving two separate isotopes are under progress to determine the clinical potential. **Conflict of Interest:** Work supported by Nucletron.