Purpose: Several isotopes are available for low dose-rate brachytherapy of the prostate. Currently, most implants use a single isotope. However, the use of dual-isotope implants may yield an advantageous combination of characteristics such as half-life and relative biological effectiveness. However, the use of dual-isotope implants complicates treatment planning and quality assurance. Do the benefits of dual-isotope implants outweigh the added difficulty? The goal of this work was to use a linear-quadratic model to compare single and dual-isotope implants.

Methods: Ten patients were evaluated in this study. For each patient, six treatment plans were created with single or dual-isotope combinations of 125I, 103Pd and 131Cs. For each plan the prostate, urethra, rectum and bladder were contoured by a physician. The biologically effective dose was used to determine the tumor control probability and normal tissue complication probabilities for each plan. Each plan was evaluated using favorable, intermediate and unfavorable radiobiological parameters. The results of the radiobiological analysis were used to compare the single and dual-isotope treatment plans.

Results: Iodine-125 only implants were seen to be most affected by changes in tumor aggressiveness. Significant differences in organ response probabilities were seen at common dose levels. It was recognized that these differences were likely a result of suboptimal initial seed strengths. After adjusting the initial seed strength to maximize complication-free tumor control the differences between isotope combinations were minimal. This result was true even for unfavorable tumors.

Conclusions: The objective of this work was to perform a radiobiologically based comparison of single and dual-isotope prostate seed implant plans. For all isotope combinations, the plans were improved by varying the initial seed strength. For the minimally-optimized treatment plans, no substantial differences in predicted treatment outcomes were seen among the different isotope combinations.