

The purpose of this study is to develop a model of source migration to allow for computer simulations and use the simulation program's predictive capacity to assess quality of a planning method.

Source migration information was gathered from 30 iodine-125 prostate implants. Based on that information, a computer model of source migration has been developed. By successive random application of primitive alterations, the simulation program deforms a planned loading into a simulated implant. These primitive alterations include clustering the seeds, stretching, curving, slanting and displacing the needle. After generating a number of simulated implants from the same planned loading, quality indices (DVH(160Gy) and maximum dose to urethra) are measured.

As a verification of the model, simulated implants were generated using the actual planning method (customized dose distribution using an optimization software). The quality indices reproduced the actual clinical results. Then, changes were made to the optimization software and new simulated implants were generated and measured. After a few iterations of this process — change optimization software, simulate, evaluate quality — we were able to significantly improve our simulated post-implant DVH(160) while keeping a low dose to the urethra region. These results were later confirmed by clinical results.

A simple simulation program has a powerful predictive capacity about the actual outcome of a planning scheme. Any changes made in our planning method are now first validated through simulation. It is easy to use, reliable and dramatically shortens the tuning cycle : a few hours of computations versus weeks using real implants.