A robust inverse-planning system has been developed that provides mathematically optimal plans that can be employed by the average radiation therapy clinic. The extension of this system from algorithm development to a clinical implementation involves numerous technical exigencies. Verification of the dose calculation routines is imperative, as is the evaluation of the computer-generated plans in a clinical context.

Verification of the dose calculation routines has been performed by comparison with an FDA cleared, commercially available three-dimensional treatment-planning system (CMS FOCUS). A quantitative comparison of isodose lines in phantoms showed good agreement.

A novel scoring function is used in the comparison of treatment plans. This function is based on tumor dose homogeneity (TDH) and total normal tissue complication probability (NTCP). The logistic model of NTCP has been chosen because of its voxel by voxel nature. Each region's NTCP, weighted according to user-defined importance, is summed to determine the total NTCP of the plan. The TDH is described by a metric based on the Euclidean distance of each voxel's dose to the prescribed dose. The use of this scoring function allows a quantitative analysis of various inverse planning solutions and traditionally generated plans.

Validation of the dose calculation routines and the objective evaluation of the computer-generated plans has shown the inverse-planning system to be clinically viable. Evaluation of plans using the described scoring function indicates techniques for effective use of this powerful planning tool.

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