AbstractID: 4752 Title: Prioritized prescription-goal treatment planning for IMRT: the effect of constraint moderation

Purpose: Determining the 'best' optimization parameters in IMRT planning is typically a time-consuming trial-and-error process with no unambiguous termination point. Recently we and others proposed using a goal-programming approach which better captures the prioritization of clinical goals without introducing ambiguous user-input parameters. We consider here the effect of adding 'slip' to this method, which allows for slight degradations in metric performance compared to maximum achievable.

Method and Materials: In the first phase of the optimization process, only the highest-order goals are considered (target coverage and dose-limiting normal structures). In subsequent phases (levels), the achievements of the previous step are turned into hard constraints and lower-order goals are optimized subject to these constraints. Slip factors were introduced to allow for slight violations of the constraints. Linear as well as quadratic goal terms were evaluated for performance as well as dosimetric 'steerability.' The resulting constraints can also be expressed as linear or quadratic equations.

Results: Focusing on head and neck cases, we present several examples of treatment plans using prioritized optimization. These are compared to conventional IMRT plans in terms of dosimetric properties and optimization speed. The main advantages of the new optimization method are (1) its ability to generate plans that meet the clinical goals/prescriptions without tuning any weighting factors or dose-volume constraints, and (2) the ability to conveniently include more terms which represent elements such as beam weight smoothness. Lower level goals can be optimized to the achievable limit without compromising higher order goals. Modest slip factors improved overall performance.

Conclusion: The prioritized prescription-goal planning method including slip factors allows for a more intuitive and human-time-efficient way of dealing with conflicting goals compared to the conventional trial-and-error method of varying weighting factors.

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