AbstractID: 3380 Title: A clinical planning tool for optimization of intensity modulated radiotherapy parameters

Purpose:
To develop a clinical tool that incorporates novel strategies to optimize all involved parameters in IMRT treatment planning: (a) the number of beams, (b) beam orientations, and (c) fluence maps.

Methods and Materials:
An IMRT planning tool was developed in the MATLAB (The MathWorks, Natick, Ma.) environment with the capability of interfacing to a commercial treatment planning system. It consists of three components: image segmentation, parameter optimization, and isodose and dose-volume histogram (DVH) display. The parameter optimization tool starts with a large number of user input feasible beam orientations and sequentially eliminates beams. Beam elimination is terminated when unacceptable deterioration of the critical structure DVH is encountered. The algorithm uses the novel strategy of forcing the sequential dose distributions to imitate, as best as possible, the dose distribution with all beam orientations. This not only ensures a clinically acceptable final dose distribution but also greatly speeds up the computation time by pre-knowledge of the expected dose at every point in the patient body.
This process is illustrated in a typical prostate cancer IMRT plan with prescription doses to prostate and seminal vesicles expanded by 1cm, and more stringent than usual constraints to rectum, bladder, and femoral heads.

Results:
For the case illustrated, the parameter optimization tool sequentially reduced the number of selected beams from a user input 36 to 7 beams. Reducing the number of selected beams below 7 resulted in abrupt deterioration of the critical structure DVHs. In the tested cases, the resulting dose distributions are clinically excellent owing to the novel strategy of imitating the dose distribution with all beams.

Conclusions:
The clinical tool presented here serves an important purpose by promoting the extraction of the full benefit of IMRT by optimizing all involved parameters. It can interface with commercial treatment planning systems to enhance their functionality.