AbstractID: 4480 Title: IMRT plans can be simplified using one-step optimization

Purpose:
To compare the effectiveness of one-step optimization (DMPO) to traditional two-step optimization for IMRT planning for prostate cancer, and to test the feasibility of simplified IMRT plans for reduction of delivery time and background dose without significant degradations in plan quality.

Method and Materials:
Clinical plans for five patients were created using DMPO with the maximum number of segments set at 40. Three additional plans were created using a leaf sequence converter with the same planning objectives. The number of levels was set to 10, 5 and 3 with corresponding number of extracts set at 5, 3 and 2, resulting in plans with decreasing numbers of segments. All plans were normalized so 95% of each target volume (prostate, lymph nodes and seminal vesicles) met the prescribed dose. Plan quality was assessed based on tumor coverage, defined endpoints for sensitive structures, plan dose conformality and dose homogeneity.

Results:
The DMPO plans resulted in the lowest average number of segments at 38.8, compared to 160.4, 77.2 and 45.4 for the two-step plans, and also had the highest overall plan quality. The DMPO plans resulted in the lowest D5 and D20 to the bladder, the lowest D20 to the rectum and the lowest V45 to the small bowel. In addition, the DMPO plans had the lowest number of monitor units at 745.8, compared to 910.6, 893.6, and 823.2 MU respectively for the two-step plans. The DMPO plans had an average homogeneity index of 89%, compared to 90%, 88% and 83%, and a conformal index of 2.9 compared to 2.8, 3.9 and 4.8.

Conclusion:
One-step optimization is an efficient and effective way to create simplified IMRT treatment plans. For prostate cancer patients treated with IMRT, clinical requirements can be met with 40 or fewer segments using DMPO.