AbstractID: 10222 Title: Direct Aperture Optimization of Intensity Modulated Arc Therapy

Purpose: Intensity modulated radiation therapy has been a very popular and effective treatment technique for the treatment of prostate, head & neck and liver etc. Meanwhile, another innovative treatment technique, intensity modulated arc therapy, was developed to complement some drawbacks of IMRT like long treatment time and low MU efficiency. Since the IMAT completes the treatment just within one or two rotations, it is not easy to get optimized leaf sequences in a deterministic way. In this study, we tried to get optimized IMAT treatment plan by genetic algorithm. **Method and Materials:** First, the start/end positions of MLC leaves at each rotation angle with 10° interval were selected as optimization variables and encoded into genetic chromosomes. They experience genetic operations such as generation, selection, crossover, mutation and reproduction and the most optimized solution remains in the end of iteration. The constraint of maximum leaf speed was included in these operations. And the fitness of each population was evaluated by DVH volume constraint based objective function. IMAT dose distribution was calculated as a weighted sum of MLC shape at each angle and related Dij matrix similar to IMRT dose calculation. The algorithm was implemented in our treatment planning system and the dose distributions and DVHs of single and double gantry rotation cases were compared. **Results:** IMAT plan gave comparable results with conventional IMRT even with single gantry rotation and there was not significant improvement in double gantry rotations. Genetic algorithm required about 3,000 generations to reach optimized value due to its stochastic nature. **Conclusion:** It was possible to optimize IMAT plan with genetic algorithm and the results are optimized MLC leaf sequences readily deliverable in general linear accelerators. It can be an efficient method to solve IMAT optimization problem despite of relative slow convergence.