AbstractID: 12922 Title: Dosimetry and inverse treatment planning for 3D Intensity Modulated Brachytherapy

Purpose:
To propose a dosimetry algorithm for three-dimensional (3D) intensity modulated brachytherapy (IMBT) and to develop an inverse treatment planning method applying the dosimetry algorithm.

Method and Materials:
A Matlab based prototype 3D IMBT treatment planning system was developed. The system consisted of three main components: (1) a comprehensive source commissioning method for intensity modulated sources based on Monte Carlo (EGSnrc) simulations; (2) a “modified TG43” (mTG43) dose calculation algorithm for IMBT dosimetry; (3) an inverse IMBT treatment planning method based on Dose Volume Histogram (DVH) or Dose Surface Histogram (DSH) constraints and simulated annealing optimization algorithm.
The system was applied for planning of an intracavitary accelerated partial breast irradiation (APBI) case treated with Xoft Axxent electronic brachytherapy. Plan quality, planning and delivery time of the IMBT plan were compared with the original plan used for the patient’s treatment.

Results:
For the patient studied, IMBT plan showed better plan quality compared with the original plan. With similar coverage to the target, high dose region V200 was decrease by 16.1%. Maximum doses to skin and ribs were reduced by 56 cGy and 104 cGy in one fraction respectively. Mean dose to ipsilateral and contralateral breasts and lungs were also slightly reduced by IMBT.

Conclusion:
Application of three-dimensional intensity modulation in brachytherapy treatment planning is both feasible and promising. 3D IMBT improves the quality of APBI brachytherapy treatment plan, increasing dose uniformity in target and reducing the dose to critical structures.

Conflict of Interest (only if applicable):
None