AbstractID: 13786 Title: Application of virtual patient model in 4D IMRT Monte Carlo treatment planning

Purpose: 4D IMRT planning using 4D CT images has uncertainties such as image artifacts, image sorting uncertainty and deformable image registration uncertainty. On the other hand, using virtual reality to create patient-specific virtual model can represent the patient more accurately. Therefore, in this study, we are aiming to investigate the feasibility of 4D IMRT planning using virtual patient model.

Method and Materials: The input contours for virtual model was from Pinnacle treatment planning system. The polygon of a structure formed from sampled control points, were used to reconstruct the NURBS surface of this structure. A 4D virtual patient was initially a sequence of 3D NURBS models at different phases. To be applied in real-time breathing management, a few methods were used to adjust the model to account for the variation of breathing and to give model the ability to predict motion. Kalman filter was used to predict the breathing curve. Two Monte Carlo codes, MCSIM and EGS4-VLSI were used to simulate the treatment plan using the opening density matrix exported from Pinnacle optimization results. MCsim used patient’s CT in dose calculation while EGS4-VLSI used a phantom converted from patient’s model. DVHS were compared for end-exhale phase among the results from Pinnacle and the two Monte Carlo codes.

Results: Monte Carlo codes benchmark showed good agreement for clinical measured data for 10x10 cm2 PDD and profiles. DVHs showed differences mainly due to the inhomogeneity effects for dose calculation.

Conclusion: A virtual model based 4D IMRT method was proposed and preliminary results show the feasibility of this methodology. Varity exits among different calculation method, real clinical benefit of model based planning needs further investigation.

Conflict of interest:
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