Mobility Grant Report

Geometrical ideal dose distribution for prostate treatment planning

Host institute: *Hiroshima University Hospital, Japan*
Dates: *30 September to 5 October 2019*

I visited the Hiroshima University Hospital in Japan from 30 September until 5 October 2019 to improve my knowledge of prostate cancer treatment planning.

Currently most of the radiotherapy plans drawn up at my home institution in The Netherlands are automatically generated via a single treatment technique template in the Auto-Planning module of the Pinnacle 16.0.2 software (Philips Healthcare, Fitchburg, WI, USA). However, this approach does not always lead to the best plan solution, and additional manual optimisation steps are needed. The primary goal of this visit was to investigate the improvement that could be gained in planning quality for automated prostate treatment planning for radiotherapy by use of an in-house developed application for geometrical ideal-dose-distribution calculation. This Matlab application was developed at the host institute in Japan. It uses a filtered back-projection method to calculate the geometric ideal dose distribution. The predicted dose volume histograms for organs at risk that were generated from the 3D geometrical ideal dose were used to individualise the values for our template technique to calculate the automated dose optimisation in a personalised manner for planning of prostate treatment by volumetric arc therapy.

The aim of the training was to learn and understand the underlying algorithm to calculate a geometrical ideal dose distribution, and how this could improve the plan quality and efficiency of automated planning. During my visit, we fine-tuned this application and tested it on five prostate cancer cases. I had a very fruitful collaboration and inspiring week.

Results: For this study we redrew the treatment plans for 20 prostate cancer cases using the geometric ideal dose distribution as an input for the template for automated radiotherapy planning. The quality of these plans improved in all cases. The average mean dose to the rectal wall and bladder were improved by 2.8Gy and 2.0 Gy, respectively. The average V30 and V60 for the rectal wall was improved by 3.4% and 0.8%, respectively. The other dose metrics did not significantly improve. The average monitor units increased slightly but the increases were not significant.

We conclude that the use of geometrical ideal dose distribution can be a good approach to personalise the template and improve the plan quality. We have sent an abstract related to this work to the European SocieTy for Radiotherapy and Oncology (ESTRO) 2020 congress, and we are currently working on a paper. The application is independent of the treatment planning system into which it is incorporated and can be used for all different cancer sites. We plan to test this application to personalise planning templates for other sites. I want to thank Dr Miki Kentaro and Professor Yasushi Nagata for their hospitality, enthusiasm and collaboration during my visit and afterwards.

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My visit to Japan included a dinner with my Japanese co-workers, staff and students from the Department of Radiation Oncology in Hiroshima University Hospital.