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Evaluating daily Cone Beam CT gamma index as a parameter for decision making in adaptive radiation therapy programs

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INTRODUCTION

Adaptive Radiation Therapy (ADRT) is monitoring the delivered dose for clinically acceptability during the course of treatment and modifying it as needed in order to improve the outcome [1]. One of the methods so called offline ADRT uses the daily Cone Beam CT (CBCT) to assess the treatment quality whilst the daily treatment of original plans is not interrupted. Inthis method the planning beam data are calculated on daily CBCT data in the treatment planning system and compared to original plan calculated on the first day CBCT data set. Another method for assessment is comparing the daily CBCT data with original planning CT without calculating the dose. In this presentation we compare these two methods to investigate whether there is a correlation between them. Daily CBCT data sets are compared to original planning CT using a gamma-index pass rate. The trends of the gamma-index pass rate are investigated for several patients as a marker for triggering the re-planning. The same CBCT data set are also taken to TPS for dose calculations.

AIM

Is there any correlation between two offline ADRT techniques:

1. dose calculations on daily CBCTs in TPS
2. gamma evaluation of comparing CBCT to original planning CT

METHOD

1. The CBCT data sets were used in a treatment planning system to investigate the changes in the DVHs. The maximum and mean dose to PTVs were used in the analysis.

2. Gamma density/distance criteria of 0.2 g/cc/3mm to compare daily CBC data to planning CT was used. This criterion allows to detect the large density discrepancies between planning CT and the daily CBCT. A commercial software system was used for calculating the gamma-index.

RESULTS

The gamma-index pass rate declines over the course of treatment for two head and neck patients. There is a positive correlation between gamma-index pass rate and PTV coverage. A negative correlation of patient weight loss with gamma-index pass rate was also observed.

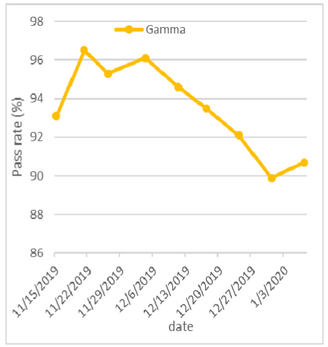

Figure 1. The gamma-index pass rate also decreases by elapsing time

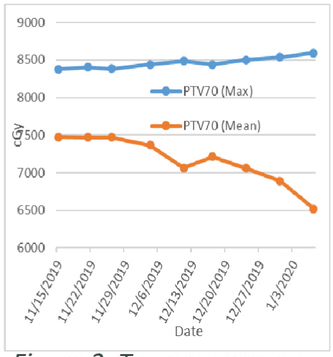

Figure 2. Tumor coverage degrades as time passes

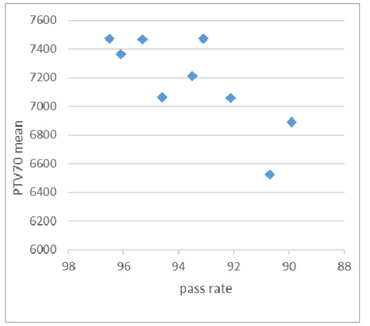

Figure 3. A correlation is PTV coverage and gamma-index pass rate

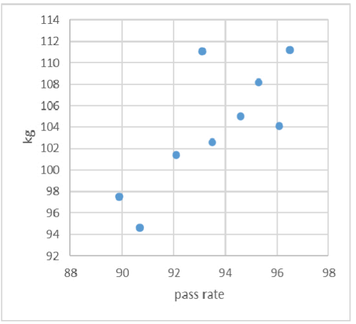

Figure 4. A correlation is seen in patient weight loss and gamma-index pass rate

CONCLUSIONS

According to our analysis for selected head and neck patients, the gamma-index pass rate is associated with PTV coverage and weight loss. For future directions, this parameter could be considered for decision making on re-CT and consequent re-planning.

REFERENCES

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