PO-RT-11 Evaluation of two immobilization devices and variation of target volumes for breast treatments with Helical Tomotherapy : Application of in-vivo dosimetry software tools

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Résumé

Introduction: Dynamic arctherapy techniques (VMAT) are often used when complex volumes in the breast must be treated. This is specially the case of patients presenting a funnel chest, an inner quadrant tumor or obesity. However, these irradiation techniques impose a good management of patient setup as well as an ability to detect anatomy variations to eventually adapt the treatment inter-fraction.
The purpose of this work is to evaluate the impact of uncertainties in patient setup and anatomy variations on the delivered treatment dose for patients using two different immobilization devices.

Materials & Methods: In this study, a sample of 20 patients treated for breast cancer with Helical Tomotherapy (HT) was selected. Two types of thermoplastic immobilization devices were used: the first group of patients used one device extending from the shoulders to the ribcage (9 patients) and the second one used one that only fixed the chin (11 patients).

All patients were repositioned using the HT MVCT on-board detector on a daily basis. Image acquisition followed by automatic registration was performed in order to account for day-to-day setup variation (6 degrees of freedom). Patient shifts from each group were collected and compared between them.

A new in-vivo dosimetry software tool (TomoGamma, 21th Century Oncology) was used to collect detector data during the treatment delivery and reconstruct the dose into the daily MVCT patient image volume. A Gamma Index (GI) was calculated and compared to the reference fraction (1st fraction).

Concurrently with this study, we also used the Planned Adaptive software (Accuray). This tool was able to recalculate the dose distribution on the daily MVCT image based on detector data. Target volumes were contoured and adapted to account for anatomy variations on MVCTs on a weekly basis and dose coverage was evaluated.

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Results & Discussion: We could not observe any relevant differences between the two groups of patients using the immobilization devices evaluated in this study.

Preliminary results obtained from the in-vivo dosimetry analysis show a reduction trend on the GI with increasing fractions (-6% average GI between the 1st and last fraction). Anatomy variation throughout the treatment (weight loss) can be one of the causes of this trending as observed on the daily MVCT. Target dose coverage also changes with increasing fraction number showing a gradual increase of the heterogeneity on the reconstructed dose distribution.
Conclusion: In this study we have observed that patient anatomy changes can lead both to reduced outcome of transit and adaptive dosimetry analysis. Future work involves the application of this methodology to a bigger patient population with the purpose of determining a relationship between the outcome of transit dosimetry and that of adaptive planning. This is necessary to establish a set of action levels to assess radiation oncologists on the decision of eventually replanning the patient treatment.