Results. The mean (±SD) 3D SGRT setup error was 0.49 ± 0.26 cm. Without image-guidance, the PTVMs margins required to account for SGRT setup errors would have been 0.68 cm (AP), 0.49 cm (CC) and 0.90 cm (LR). The mean absolute intrafraction error in the direction orthogonal to the thoracic wall was 0.10 ± 0.09 cm and 0.16 ± 0.13 cm during the first and second treatment field, respectively. The difference in mean error was significant (p < 0.001, paired t-test). For one of the five patients, the heart unintentionally extended 0.6–0.9 cm into the treatment fields in 5 out of 15 fractions.

Conclusions. Due to changes in breast size and shape, SGRT should be supplemented by daily image-guidance for optimal setup accuracy. SGRT ensured a high intrafraction stability of the thoracic wall with a slight decline in accuracy near the end of treatment. At the time of writing, more patients are being included in the study.

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[OA014] 4D lung tumor motion modelling using dynamic MLC tracking and EPID feedback

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Purpose. Accurate delivery of the prescribed dose to moving lung tumors is a key challenge in radiotherapy. Tumor tracking involves real-time specifying the target and correcting the geometry in order to compensate for the respiratory motion, that’s why tracking the tumor requires caution. This study proposes an approach to generate a model to track lung tumor motion by controlling dynamic multi-leaf collimators without any marker.

Methods. For this purpose, 4D-CT images of 10 patients were used and all the slices which contained the tumor were contoured for all patients. The first four phases of 4D-CT images which contained tumors were selected as input of the software, and the next six phases were considered as the output. A hybrid intelligent system, ANFIS (Adaptive neuro fuzzy inference system), is used to predict motion of lung tumor. The root mean square error (RMSE) was used to investigate the accuracy of ANFIS performance in tumor motion prediction. For modeling of respiratory motion the end-exhale phases of these images have been considered as the reference and were analyzed using the neuro-fuzzy method to predict the magnitude of displacement of the lung tumor. Then, the predicted data were used to determine the leaf motion in MLC. Finally, the trained algorithm was figured out using Shaper software to show how the MLCs can track the moving tumor and then imported on the Varian linac equipped with EPID.

Results. The results showed that the RMSE did not have a major variation. Also, there was a good agreement between the images obtained by EPID and Shaper for a respiratory cycle.

Conclusions. The data in the 4DCT images were used for motion tracking instead of using markers that leads to more information of tumor motion with respect to methods based on marker location. This developed approach can track the moving tumor with MLC based on the 4D modelling and so it can improve treatment accuracy, dose conformity and sparing of healthy tissues because of low error in margins that can be ignored. Therefore, this method can work more accurate compared with the gating and invasive approaches using markers.

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[OA015] Evaluation of optimized slow-CT parameters with freebreathing marges based on spirometric system analysis

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Introduction. The free-breathing gated technique (FB) requires a synchronization between the CT-scan and breathing cycles but is not included in every system. The Slow-CT scan is an alternative to the monitoring of target motion. Reconstruction artefacts are identified in the literature. This study’s purpose is to evaluate an optimization of Slow-CT parameters and the impact of spirometric management concerning image qualities, breath amplitude marges and treatment safety.

Materials and methods. Breathing interfraction impacts are based on retrospective study including 80 archived patient curves from DynR® SDX system. Standard, Slow and 4D-CT acquisitions are made on SIEMENS Somatom® Scope. Image quality indexes are analyzed on Catphan®. A lung equivalent cylindrical insert including a 30.0 mm diameter sphere is set in motion by Quasar®. Reconstruction performances are evaluated for breaths from 10 to 30 breaths per minute (BPM). The CT-scan radiation exposures are recorded. On prospective study from 5 patients, target reconstructions are compared for 4D-CT Average (4D-Ave) and Slow-CT.

Results. Mean interfraction amplitude is 163 ± 33 mm including a 60 mL calibration uncertainty. Catphan® study showed mean noise reduction up to 30% in Slow-CT (3.0 UH) in comparison with 4D-Ave (4.9 UH). The low contrasts score increases in 4D-Ave. Slow-CT reconstructions are optimized for 15 BPM by using collimation of 16 × 0.6 mm, 2 mm slice, pitch of 0.4 and rotation time of 1.5 s. A new inclusion criteria are defined as the ratio Acquisition time (s)/BPM ≤ 4. In Slow-CT and 4D-CT, image qualities and doses are in agreement with French recommendations. On patients, Slow-CT shows a motion blur and noise reductions compared to 4D-Ave. A protocol is proposed with two Slow-CT slice thickness: 2 mm to increase target limit accuracy and 5 mm to smooth target UH. Spirometric system allows the patient to check its breath by staying in recorded area.

Conclusions. Slow-CT parameters present an alternative to manage target motion and must be optimized with respect of inclusion criteria. Interfraction respiratory impacts can be controlled with breath margins optimization. Combined techniques increase the FB reproducibility and the treatment accuracy especially with the machine feedback control.

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