Purpose: Assess the impact of respiratory motion on three-dimensional conformal radiation therapy (3DCRT) treatment planning and IMRT treatment planning with 4DCT datasets.

Methods: A clinical 3DCRT treatment plan made on clinical primary dataset (free-breathing 3DCT) was the starting point of this planning analysis. GTV contours were manually reproduced and adapted to account for anatomy changes on each 4DCT phases. For comparison, an IMRT plan was created with the primary dataset using the same contours. The 3DCRT and IMRT plans were copied and recalculated on each phase datasets, keeping all respective beams parameters and monitor units the same. Dosimetric parameters were extracted for each phases of all plans.

Results: The lung case presented is a tumor clinging to the diaphragm, chosen for its unusual position and large amplitude of movement among the pool of patients available. Considering PTV coverage for the 3DCRT plans, expiration phases are closer to the primary plan than the inspiration phases. PTV coverage for inspiration phases is best represented by the 4DCT average dataset whereas the primary dataset is better suited to represent the expiration phases. The phase-calculated IMRT plans also showed expiration phases PTVs coverage is closer to the primary plan than for inspiration phases. In this case, the average dataset is better suited than the primary dataset to describe the shape of the DVH dose drop-off for the 4DCT phases. The results obtained showed that a difference of up to 12% in PTV coverage for a 3DCRT and 17% for an IMRT plan can be observed when using breathing phase anatomy to calculate a plan made on the primary dataset.

Conclusions: Anatomy changes caused by breathing cannot be neglected because of their influence on dosimetric parameters. Our results indicate that the choice of a plan dataset may have an impact on treatment accuracy and robustness.