Purpose:The aim of this study was to determine a fast and suitable approach to construct a thorax model that can be employed for simulating chest wall motion due to respiration for radiation therapy of lung cancer to help perform a more realistic treatment planning.

Methods:Two data sets corresponding to two men with different thorax sizes were processed. For each patient, two sets of CT images were obtained. The chest and thorax were 3D reconstructed and then transferred to the ABAQUS software for FFE modeling. The geometry was constructed using inhale CT images. To tune the FFE model, for the first patient, the tissue mechanical properties, distension forces and boundary conditions were adjusted to find the optimum combinations of these parameters, to individually produce the best match with CT images in all stages. Then the model with the best-matched coefficients was tested in a predictive mode, to predict chest and thorax motion and deformation following respiration for the second patient.

Results:The tuned FFE model of chest wall motion matched the measurements to within 1 mm. In the predictive mode, the maximum and mean discrepancy between the landmarks and those predicted by the model were 4.7 mm, and 3.1 mm respectively.

Conclusions:The developed FFE thorax model shows promise for the prediction of the chest and thorax shape changes using only one CT scan. Following further testing, this model can potentially be used in image-guided radiotherapy of chest tumors within the time available in clinical practice.