Conclusion: The VRGH can effectively control the amplitude of the waves, which make the respiratory motion smaller and more stable. It is also observed that there is no obvious difference between female volunteers and male volunteers.

**EP-1741**

MRI assess hypnosis control respiratory motion applied to radiotherapy for lung cancer patients

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**Purpose or Objective:** To accuracy assess the effect of hypnosis control respiratory motion on radiotherapy for lung cancer patients

**Material and Methods:** 21 healthy volunteers are invited to provide corresponding information in an experiment on this study. Among the experiment, 8 volunteers are under three kinds of surrounding scene: normal state (NS), self-hypnosis state (SHS), hypnotist-guided hypnosis state (HGHS), the other 13 volunteers are under NS and SHS. Magnetic Resonance Imaging (MRI) was applied to acquisition image (two dimension) of the lung’s coronal plane of all volunteers under different surrounding scenes. The distance from the apex of lung to diaphragm is generally regarded as the characteristic length in cranio-caudal direction which recognized as the main displacement of direction of lung motion.

**Results:** Analyzing the amplitudes of respiration motion waves data under different states, it is showed that the amplitudes of volunteers under SHS have no obvious statistical discrepancy with that in NS, with 0.73mm lower and 0.46 s, 13% and 38% more regular than FB, respectively. For internal fiducial marker motion, the mean of the waves, which make the respiratory motion smaller and more stable. It is also observed that there is no obvious difference between female volunteers and male volunteers.

**Conclusion:** The result shows that the amplitudes of volunteers under SHS have no remarkable difference in comparison with NS, while the volunteers in HGHS have smaller respiratory motion amplitudes. Quantitatively analysis hypnosis respiratory controlling, we found it is an effective way and it could be applied in clinic, and hypnotist guide would be better than teaching patient self-hypnosis.

**EP-1742**

The first clinical implementation of audiovisual biofeedback in liver cancer SBRT

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**Purpose or Objective:** Irregular breathing motion exacerbates uncertainties throughout a course of radiation therapy. Breathing guidance has demonstrated to improve the regularity of breathing motion. This study was the first clinical implementation of the audiovisual biofeedback (AVB) breathing guidance system over a course of liver SBRT. We present here the preliminary results from the first four patients recruited into this clinical trial.

**Material and Methods:** Four liver cancer patients with implanted fiducial markers or surgical clips near the tumor were recruited. Prior to CT sim, patients underwent a screening procedure in which they underwent breathing conditions (1) AVB, or (2) free breathing (FB). The most regular breathing condition, AVB or FB, in the screening procedure was utilized for the patient’s CT simulation and for each fraction of treatment; each patient had 6 fractions of treatment. Tumor respiratory motion was obtained from the implanted fiducial markers in the CBCT projection images acquired during the screening procedure and each fraction of treatment. External respiratory motion was obtained from the RPM system. The regularity of breathing motion was analysed for the screening procedure, CT sim, and each treatment fraction. Breathing motion regularity was quantified as the root mean square error (RMSE) in displacement and period.

**Results:** The screening procedure yielded the decision to utilize AVB for three (of the four) patients; FB was chosen for one patient in the screening procedure who had naturally regular breathing. Over the course of SBRT, for external RPM motion, the average RMSE in displacement and period for AVB was 0.13 cm and 0.47 s, 6% and 31% more regular than FB, respectively. For internal fiducial marker motion, the average RMSE in displacement and period for AVB was 0.18 cm and 0.46 s, 13% and 38% more regular than FB, respectively.

**Conclusion:** This was the first clinical implementation of AVB utilizing a screening procedure to ensure the most regular breathing condition is facilitated during CT imaging and
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Results:

In the figure the analysis of the reconstructed sensor and PET data is shown for six patients, for each of the different breathing scenarios (fb: free breathing, da: deep abdominal, fa: flat abdominal, dt: deep thoracic, ft: flat thoracic). The upper part of the figure shows the mean tumour amplitude from the PET data and the mean breathing depth from the sensor data. The lower part shows the mean tumour position from the PET data and the breathing mode reconstructed from the sensor data. To visualise the offset of the different tumour movements between the different scenarios, for each patient the mean positions are normalised to the smallest mean position of each patient. The figure shows, that for the given scenarios different amplitudes and offsets of the tumour are observed, as well as a change in the sensor signals. The results show a flexibility of the tumour movement in its amplitude and absolute position, which depends on the actual breathing patterns of the patient.

Conclusion: The performed clinical trial indicates that the movement of the tumour depends on the actual breathing pattern. This shows that it is important for the prediction of the tumour position to take the information on the breathing pattern into account. The detection of the breathing parameters with the sensors give the possibility for further investigations of a correlation between tumour offset and amplitude with reconstructed breathing depth and mode, which could be further used for individual motion prediction. Acknowledgment: The work was funded by the Federal Ministry of Education and Research BMBF, KMU-innovativ, Förderkennzeichen: 13GW0060F. Additionally, the Authors thank Florian Büther (EIMI Münster, Germany) for his support.

Purpose or Objective: By applying motion correction strategies for the treatment of lung tumours the variability of breathing induced tumour movement is more important. To analyse the different motion potential of lung tumours a clinical trial is carried out. FDG-PET scans are performed simultaneously with an accelerometer-based system, which detects the breathing motion. Specific breathing instructions are given to the patient, to analyse the correlation of the sensor information and the tumour displacement, caused by different breathing patterns.

Material and Methods: The study is performed with patients with a single pulmonary metastasis. For the detection of the breathing motion six tri-axial accelerometers are placed on the patient’s thorax and abdomen. Thereby, information on the breathing cycle (in-/expiration), breathing mode (thoracic/abdominal) and breathing depth can be distinguished. Up to five different measurements are obtained: ‘free breathing’, ‘deep thoracic’, ‘flat thoracic’, ‘deep abdominal’ and ‘flat abdominal’. Simultaneously, a respiratory gated FDG-PET scan is taken to correlate the patient’s respiratory states with the tumour movement. For each of the ten reconstructed PET images the centre of the tumour is determined to visualize the mean tumour trajectory.

EP-1743

Analysis of the deviation of lung tumour displacement caused by different breathing patterns

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Clinical trial is carried out. FDG-PET scans are performed to correlate the respiratory states with the tumour movement. For each of the ten reconstructed PET images the centre of the tumour is determined to visualize the mean tumour trajectory.

EP-1744

Evaluation of the clinical accuracy of the robotic respiratory tracking system

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In the screening procedure, three of the four patients’ breathing regularity was improved with AVB. Across a course of SBRT, AVB also demonstrated to improve the regularity of breathing displacement and period over free breathing. This was also the first study to assess the impact of AVB on liver tumor motion via fiducial marker surrogacy. Results from the first four patients have been reported here and demonstrate clinical potential for facilitating regular and consistent breathing motion during CT imaging and treatment delivery.