

Introduction of a Breath Gating System in a Clinical Environment

A practical description of our experiences

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Introduction: During a normal treatment of Mama-carcinomas the target volume moves mainly anterior-posterior due to the breath cycle. To compensate this in conventional treatment planning the target volume has increased margins. The gating system helps to get the target volume in a reproducible position and for the left breast to increase the distance between the volume and the heart as organ at risk. We describe the introduction of an actual available breath-gating system, the SpiroDyn'RX (SDX) from the company Dyn'R (France). This system works with a spirometer attached to a mouth piece and a visual guidance for the patient. It is portable and capable to be used in a CT-scanner, during and at the accelerator

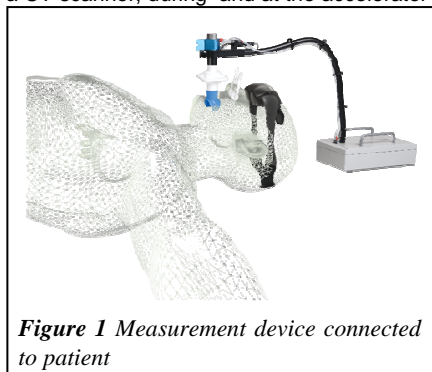


Figure 1 Measurement device connected to patient

Materials and Methods:

The SDX is a small box with a flexible arm mounted at the measurement device. This device is attached to an air filter and a mouth piece worn by the patient. A nose-clip makes it impossible for air to pass by the spirometer. The patient receives visual guidance by video-eyeglasses. The device measures

the volume of the breathed air and processes it in visual sinusoidal breath cycles. The patient follows the introduction by the supervisor. A moderate deep-breath position is preferred and realised easily with the visual guidance. About 30s breath holding is normal and sufficient for most fractions. The advantages compared to other systems are the mobility of the whole equipment. Only one unit is necessary for the use at CT, simulator and different treatment rooms. No major installations have to be made in the treatment rooms. For the patient it is easy to reach a reproducible extended breath status, which has benefits compared with contracted chest. Also there is no additional irradiation of the patient, as in x-ray gating.

A disadvantage for some patients is the wearing of the eyeglasses, clip and mouth-piece which is uncomfortable. Air filter and mouthpiece are consumable products. A training session for the performing supervisors is necessary. The basic idea of the benefit is directly comprehensible for most people. The handling of the system is quite easy to follow. After some experience the extra time



Figure 2 Screens during a fraction. After normal sinusoidal breath, the gating level is displayed in red.

for one fraction is about 2 minutes, with a preparation time of about 10 minutes for set up and calibration. The whole treatment was well tolerated by the patient. At the start of a patient treatment series and before the planning CT-scan a training session of about 30 minutes is necessary. For the patient it is easier to train without time pressure. Agitation is visible by the breath cycles and complicate the training. During the training, difficulties, such as problems of breathing or bedding are spotted. For the CT-scan one or two breath holds are sufficient, depending on the time needed for taking the scan.

Even though we have not experienced a breakdown, as any system, the SDX must be expected to fail at some point in time. With the breakdown concepts we avoid a delay of the treatment in case of any malfunctions. During the simulation we determine a change of the table position. For breast cancer, the movement could be assumed to be two dimensional anterior-posterior. With relaxed lung a lift of the table in the range of 2cm brings the breast back into the beam. The exact change is measured by two lateral radio graphs of relaxed and gated breast. The simulation of the plan causes no problems for us. The fraction itself makes only about 2 extra minutes. The preparation of the system (set-up, calibration) takes about 10 minutes and a warm up time, if the system is not under constant power supply.

For the calibration a syringe of exactly 3 liters volume is used. With the syringe a breath cycle is simulated. The total lung volume of the simulated patient is exactly 3 liters. The simulation of a breath cycle with the syringe needs some experience and care. The software of the system has a special sub program for calibration and analysis.

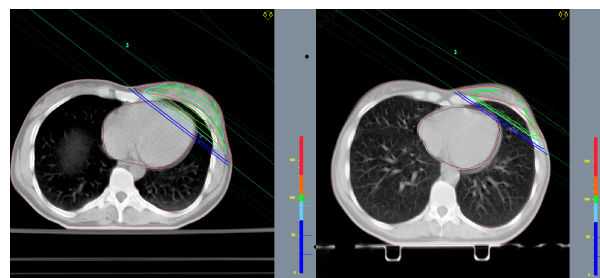


Figure 3 Plan of an exemplary patient, under normal conditions and under gating conditions

Results and Conclusions: The radiation of mama-carcinomas are a good beginning of gating practice. Target movements without the system occur, but no disease-related problems of breath is to be expected. Next step of our introduction would be the use for bronchial-carcinomas. For BC-patients the movement of the tumor is more complex as the nearly one dimensional movement from MC-patients.

The SDX is an adequate gating system to improve daily radiation practise. Extra time needed for one fraction is minimal. Staff-members as well as patients accept the gating system as a good improvement.

References

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