

Comparison of Thermocouple, Spirometer and Skin Motion for Respiratory Target Motion Measurement

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The organ motion due to respiration necessitates adding adequate margins to the planning target volume (PTV) to ensure adequate dose coverage in chest and abdomen. Several techniques have been suggested to minimize the PTV relating to respiratory motion. In this study, ten patients' respiratory patterns were measured by thermocouple, spirometer, and skin motion simultaneously, to find the best method corresponding with respiratory target motion. Each respiration monitoring methods were compared with fluoroscopic target motion during simulation.

Conventional spirometer and home made thermocouple were connected to a mouse piece to measure the patient's respiration. A respiration acquisition program was developed in Labview 7.0 (National Instruments, Austin, TX), which acquire respiration signals and display its patterns. A fluoroscopic target tracking program was developed in IDL 6.1 (Research Systems, Inc, Boulder, CO). Ten patients with lung or liver cancer participated in this study. Fluoroscopic movies were captured during acquisition of their respiration patterns. At the same time their skin motion was measured by using Real-time Position Management® (RPM®, Varian, Palo Alto, CA) system. Respiratory patterns acquired from spirometer, thermocouple, and RPM® system were compared with fluoroscopic target motion respectively. Its relationships were evaluated by correlation coefficient.

Comparing each correlation coefficient for spirometer, thermocouple, and RPM®, skin motion detection is the most correspondent with fluoroscopic target motion. However, respiration monitoring methods with spirometer or thermocouple were also well correlated (more than 0.9).

Respiratory pattern depends on a patient and his/her conditions. Respiration monitoring methods with spirometer or thermocouple, and skin motion detection are directly applicable to monitor the target motion for applying 4D radiotherapy.

Keywords : Thermocouple, Spirometer, Respiratory Motion