

AbstractID: 5321 Title: Comparison of thermocouple and spirometer for monitoring patient breathing

Purpose: To show the feasibility of using a thermocouple for monitoring patient breathing and to compare its breathing signal with that of a spirometer.

Method and Materials: A mask covering the nose-and-mouth region was used to channel the subject's breath to a K-type thermocouple (TC) and a spirometer. Two different placements of the TC were studied: either it was inserted through a side hole of a plexiglass tube connecting the mask and spirometer or in the oxygen inlet of the mask. This setup allowed simultaneous readings of the temperature and air volume in synchrony. The temperature change is a response to the amount of heat deposited to or taken away from the TC junction. Both signals were collected at the sampling rate of 100 KHz using a data acquisition board. The acquisition program was written in LabWindows.

Results: The TC temperature and measured air volume are found to be highly correlated at the two locations. When placed in the oxygen inlet away from the direct inhale/exhale air streams, the sensing temperature shows a cubic dependence on the flow rate. When placed in the plexiglass tube where it was more directly exposed to the inhale air, the temperature exhibits some hysteresis on the flow rate. At both locations, the temperature signals show no drift for 10 minutes of breathing.

Conclusions: The proposed TC system can be used as an external surrogate to monitor patient breathing at both TC locations. It has the advantages of spirometry in that it directly responds to the lung air flow. The setup is very easy and has no setup error. However, it does not have the drift problem that plagues spirometry. It is also relatively inexpensive. All these qualities make it attractive and suitable for respiratory gating or tracking to deliver external beam radiation therapy.