Abstract 855134

A novel method of chest wall movement analysis using Structured Light Plethysmography: A study on Elite Athletes vs "Normal" Subjects

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Introduction

•Structured Light Plethysmography(SLP) and the SLP–based, the Thora 3DiTM, is a non–invasive, non–contact method of assessing the movement of the rib cage and abdominal wall. SLP projects a grid of light onto the subject's chest and abdomen, the movement of the grid allows both the analysis of compartment volume change and assessment of the surface motion.

•We present a novel method of breaking down the surface motion of tidal breathing that we believe to be able to characterise a subject's healthy, diseased, or highly trained state.

•Aims and objectives: To use tidal breathing measurements to analyse respiratory movements and to categorise according to specific patterns.

Methods

• Tidal Breathing data was collected from 7 elite rowers after exercise (av Age 22) –– this was compared to 18 non–athletes otherwise healthy) (av Age 22)

• Surface modes for each subject were obtained using a tensor decomposition technique and used as characteristics of elite–athlete vs normal. The modes represent characteristic surfaces which each move according to given amplitude–time curves, and which combine linearly to make up the whole surface breathing pattern over time.

• Each dataset was classified using the other datasets as training data..

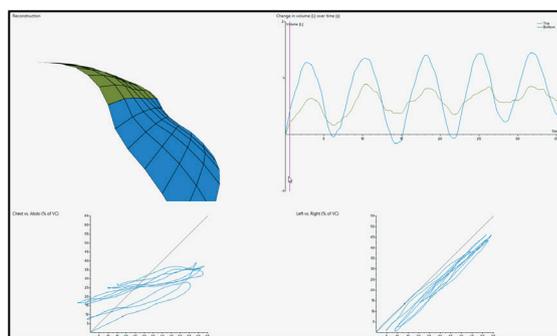**Figure 1: Data collection using the Thora 3DiTM**

Figure 2: Sample output from Thora 3DiTM showing thoraco abdominal components of tidal breathing and KM plots.

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Results

- 100% rowers being classified as rowers and 76% of normals being classified as normals for an overall 87.88% correct classification rate.

- For elite athletes there is a clear delineation of movement into pulmonary rib cage, abdominal rib cage and abdomen, while other normal subjects exhibit a predominantly two compartment movement

Figure 3: Graphical representation of Modes 1,2,3,and 4
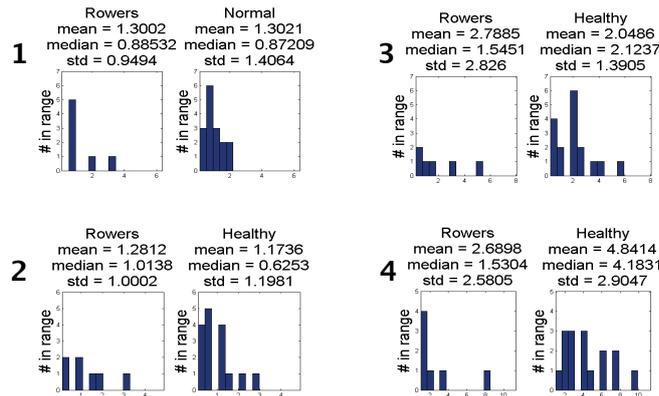
Conclusions

- Analysis of chest wall movement clearly indicates specific differences between the breathing patterns of elite athletes and normal non-athletes.

- The rowers have more complex breathing, with multiple sections of the chest moving separately, rather than in sync.

- This complexity leads to more structure in the lower two modes.

- The rowers are also very symmetric in their breathing patterns.

- Or best guess is that with greater fitness, especially in this case, comes better muscle control, which results in the symmetry we see.

- Surface movement analysis of other subject groups will be investigated as a next stage.

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