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Title: A novel method of chest wall movement analysis using structured light plethysmography: A study on elite athletes vs normal subjects

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Body: Introduction: Structured Light Plethysmography (SLP) 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 10 elite rowers (av Age 22) and compared to a group of 10 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. Results: 100% correct classification was obtained using an energy deformation metric (which tells us how similar one surface mode is to another). Each dataset was classified using the other datasets as training data. 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. Conclusions: Analysis of chest wall movement clearly indicates specific differences between the breathing patterns of elite athletes and normal non-athletes. Surface movement analysis of other subject groups will be investigated as a next stage.