



# Structured Light Plethysmography (SLP) for Diagnosis and treatment of **Dysfunctional Breathing (DB)**



## What is Dysfunctional Breathing (DB)?

A group of respiratory disorders that can be defined by a chronic or recurrent altered pattern of breathing in the absence of, or in excess of, organic disease. Although Hyperventilation syndrome (HVS) is the most recognised form of DB in adults (rarer in children), it is just one of a proposed five point classification recently suggested<sup>1</sup> that includes:

1. Hyperventilation syndrome (HVS)
2. Periodic deep sighing: frequent sighing with an irregular breathing pattern
3. Thoracic dominant breathing
4. Forced abdominal expiration
5. Thoraco-abdominal asynchrony (TAA)

It is also possible for some patients to have a number of the above patterns at the same time or switch between them.

## What is the cause of DB?

DB may occur as a response to, or in association with an underlying pathophysiology (Asthma, COPD) or may be of psychogenic origin (e.g. stress, anxiety).

## What are the symptoms?

Symptoms may be respiratory related such as breathlessness and wheeze or non-respiratory related such as chest pain and/or dizziness.

## What is the significance of DB? Why is it important?

DB reduces quality of life for the patient and puts a considerable financial strain on the health care provider as the condition is challenging to identify. Misdiagnosis and multiple unnecessary and costly clinical investigations and interventions are common.

## What is the prevalence of DB?

The general consensus seems to be that DB is common<sup>2</sup>, with estimates of HVS alone being as high as 6-10% of the general population rising to 34% in asthmatics<sup>1</sup>.

## Can we do anything about DB?

Yes, DB is treatable. The challenge is in getting an accurate diagnosis, which in itself may go some way to alleviate symptoms. Physiotherapy and breathing retraining can also have a positive and lasting effect on patients' symptoms and quality of life.



## Where does SLP fit in all of this?

SLP captures movement of the thoraco-abdominal wall and provides both numerical outputs and a visual 3D reconstruction of the thoraco-abdominal wall motion. As such, it can potentially play a role in both diagnosis and treatment of DB.

SLP provides data and visual clues to help identify each of the 5 proposed classifications. For Hyperventilation Syndrome it can calculate and show respiratory rate; it provides a visualisation of sigh depth and rate and it provides visual and numerical outputs for thoracic dominant breathing, abdominal dominant breathing and thoraco-abdominal asynchrony (TAA).

SLP can also act as a powerful visual assistive tool to guide the clinicians in both diagnosis, and in treatment of the patient as a part of the physiotherapy/retraining program. It can also be used to provide biofeedback to the patient which can have a positive effect on their recovery from this debilitating condition.



Figure 1. Working principle of SLP

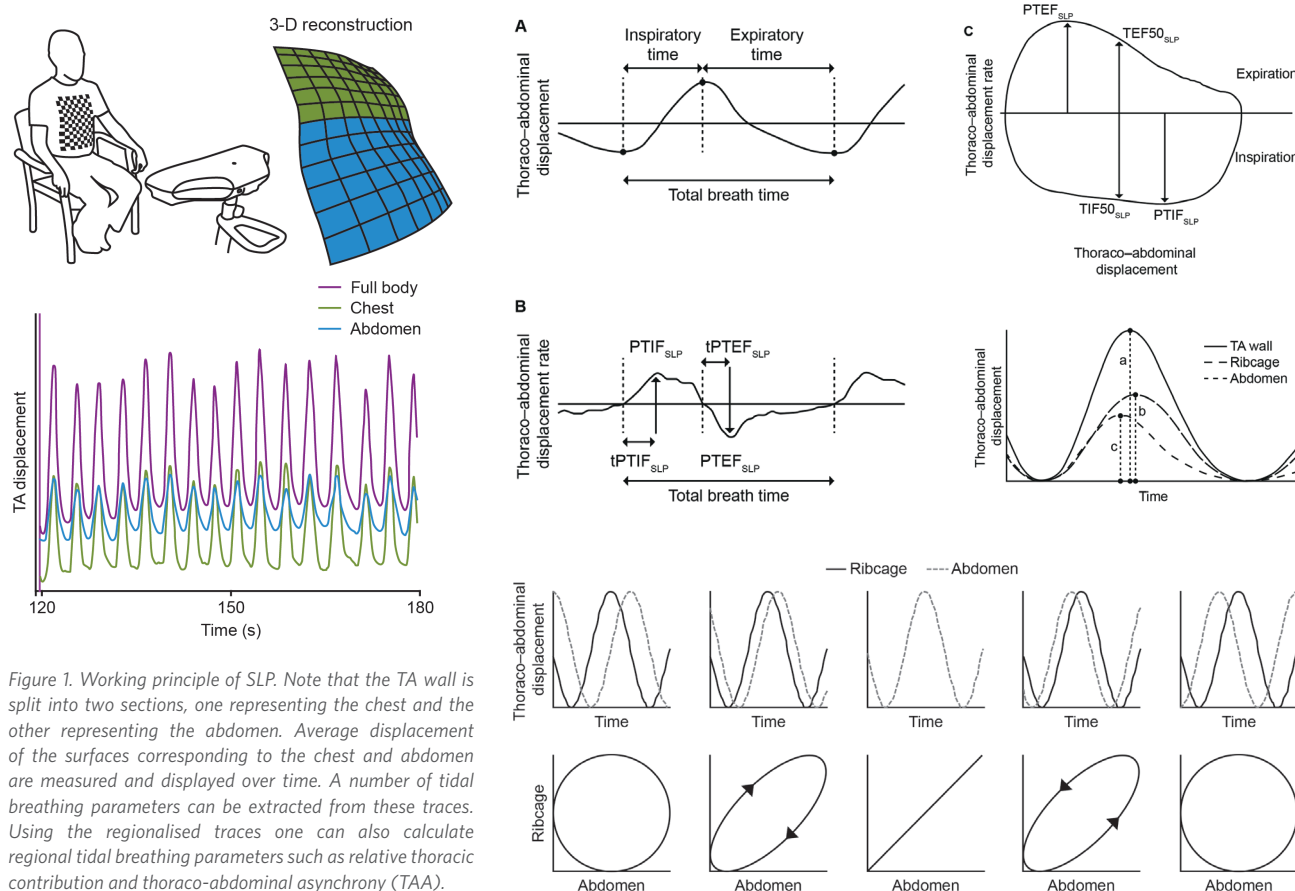


Figure 1. Working principle of SLP. Note that the TA wall is split into two sections, one representing the chest and the other representing the abdomen. Average displacement of the surfaces corresponding to the chest and abdomen are measured and displayed over time. A number of tidal breathing parameters can be extracted from these traces. Using the regionalised traces one can also calculate regional tidal breathing parameters such as relative thoracic contribution and thoraco-abdominal asynchrony (TAA).



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