THE EFFECT OF POSTURE ON VENTILATION USING STRUCTURED LIGHT PLETHYSMOGRAPHY (SLP) IN ALPHA 1 ANTI-TRYPSIN DEFICIENCY (A1ATD).

LC O'Reilly¹, E Sapey¹², SD Desando², JA Stockley¹, RA Stockley¹, BG Cooper¹.

1. Lung Function & Sleep Department, Queen Elizabeth Hospital Birmingham 2. University of Birmingham

CATEGORY B

Introduction
Structured Light Plethysmography (SLP) determines changes in ventilatory patterns by utilising relative thorax contribution (RTC), inspiration to expiration ratio (IE50), inspiration time (Ti), inspiration and exhalation flux (Ti/Ttot) & breathing asynchrony by phase angle (PA). [1]

Aims
To measure the change in breathing patterns by SLP between sitting and supine in patients with A1ATD with varying levels of respiratory disease.

Methods
We measured respiratory signals using Thor3Di (PneumaCare, Cambridge, UK) in 25 healthy controls [11M:14F, mean age 31.3 years (SD +/- 8.9); FEV1: 4.05L (1.05)] and 27 A1ATD patients [16M:11F, mean age 56.0 years (SD +/-10.4); FEV1L: 2.10 (1.12); FVCL: 4.22 (1.30)] both sitting and supine for 5 minutes and analysed them using Mann-Whitney tests. Ethical approval has been obtained via South Birmingham Ethics Committee.

Results
There were differences in both IE50 & Ti/Ttot between A1ATD patients and healthy controls when supine as expected due to the increases in airflow obstruction (See Table1 ).

<table>
<thead>
<tr>
<th>Parameter</th>
<th>A1ATD (Median)</th>
<th>Controls (Median)</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>IE50</td>
<td>1.63 (1.46, 2.09)</td>
<td>1.28 (1.15-1.66)</td>
<td>p=0.011</td>
</tr>
<tr>
<td>Ti/Ttot</td>
<td>0.39 (0.36, 0.43)</td>
<td>0.44 (0.39-0.47)</td>
<td>p=0.040</td>
</tr>
</tbody>
</table>

There were also significant differences in both RTC and PA in A1ATD cohort suggesting they become more asynchronous from seated to supine. (See Table 2).

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Seated (Median)</th>
<th>Supine (Median)</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>RTC</td>
<td>51 (41, 56)</td>
<td>39 (30-52)</td>
<td>p=0.008</td>
</tr>
<tr>
<td>PA</td>
<td>5.7 (5.3, 9.1)</td>
<td>11.3 (6.7-17.2)</td>
<td>p=0.001</td>
</tr>
</tbody>
</table>

When supine data from A1ATD patients were separated into those with or without reduced FEV1/FVC ratio (<1.64SR), the reduction in RTC & increase in PA was greater in the patients with airflow obstruction (Figure 1.)
**Conclusion**
Breathing becomes more abdominally dominant in a supine position, which is consistent with our current understanding.

Breathing is also more asynchronous in the supine position and this effect is increased in the presence of airflow obstruction.

Further investigations comparing SLP to CT densitometry and spirometry would prove useful in determining whether or not SLP can detect and accurately monitor early pathological changes.

**References**