The Use of Functional Respiratory Imaging to Investigate the Impact of an Oscillating Positive Expiratory Pressure Device on Lung Dynamics and Drug Deposition

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BACKGROUND
• The Aerobika® Oscillating Positive Expiratory Pressure (OPEP) device has previously been reported as providing benefits to Chronic Obstructive Pulmonary Disease (COPD) patients in terms of lung ventilation, lung capacity, quality of life and reduced exacerbations.

• This abstract reports the results of a pilot Functional Respiratory Imaging (FRI) study which attempts to provide some lung dynamics understanding following use of the device, as well as how such lung dynamics might relate to drug deposition.

METHODS
• A single center, prospective study, was performed in COPD patients whereby subjects were instructed to use the Aerobika® device for 10 minutes, then take their standard of care medication, continuing to use the device twice daily for 15 ± 3 days.
• Ten subjects were investigated:
  ∗ 7 male, 3 female
  ∗ Mean age 67.3 ± 9.6 years
  ∗ Mean FEV1 55 ± 18.0% predicted
• Paired inspiratory-expiratory high-resolution CT (HRCT) scans were taken before and after the start of the treatment period.
• Afterwards, FRI was used to evaluate changes in the lung dynamics and deposition of concomitant medication.

RESULTS
• Analysis of individual lobes indicated a shift in internal airflow distribution (IAD) between -7% and +5%, significantly correlating to airway deposition of the concomitant medication.

• Additionally, it was observed that patients in whom the airflow was redirected towards the lower lobes exhibited increased FEV1 values.

CONCLUSIONS
• These pilot study results provide evidence supporting the theory that this specific OPEP device enables airflow redistribution and influences drug deposition patterns.
• Further research is required to investigate the lower lobe ventilation relationship with FEV1.
• The resultant airflow redistribution following use of the device may well be a contributing factor to the previously reported 1 improved clinical outcomes, and the specific nature of the redistribution might also be related to the level of clinical response observed.

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**Table: IAD [%]**

<table>
<thead>
<tr>
<th>Lobe</th>
<th>Before</th>
<th>After</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lower</td>
<td>5%</td>
<td>0%</td>
</tr>
<tr>
<td>Upper</td>
<td>7%</td>
<td>-5%</td>
</tr>
<tr>
<td>Middle</td>
<td>0%</td>
<td>2%</td>
</tr>
</tbody>
</table>

**Figure: Change in Lobar Deposition [%]**

- Change in IAD [%]
- Change in Lobar Deposition [%]
- Change in HRCT Scans
- Change in FEV1

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**Figure: Color change on HRCT scans showing airflow redistribution from before to after use of the device.**

**Figure: Single patient example showing airflow redistribution of lower lobe.**