Computational Fluid Dynamics (CFD) is a branch of fluid mechanics that uses mathematical algorithms to simulate the motion of fluids, solids and gases and their interaction with surfaces, and is increasingly being used in medicine.

Table 1. Patient respiratory characteristics and treatment

| Patient | TDI | FEV₁/FVC | 3D Model
<table>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>60</td>
<td>37-1</td>
<td>Fluorinated (27.5/25, 30 profiles)</td>
</tr>
<tr>
<td>2</td>
<td>60</td>
<td>37-1</td>
<td>3D Model (27.5/25, 30 profiles)</td>
</tr>
<tr>
<td>3</td>
<td>70</td>
<td>67</td>
<td>3D Model (27.5/25, 30 profiles)</td>
</tr>
<tr>
<td>4</td>
<td>84</td>
<td>65</td>
<td>3D Model (27.5/25, 30 profiles)</td>
</tr>
<tr>
<td>5</td>
<td>60</td>
<td>67</td>
<td>3D Model (27.5/25, 30 profiles)</td>
</tr>
<tr>
<td>6</td>
<td>68</td>
<td>72</td>
<td>3D Model (27.5/25, 30 profiles)</td>
</tr>
</tbody>
</table>

Inhalation profiles

- **Profile 1:** Gradual, with a peak midway through the inhalation manoeuvre (similar to tidal breathing).
- **Profile 2:** Sharp, with an early peak in inhalation.

The particle size exiting the FP/FORM pMDI has a high and consistent flat particle fraction (70% of the labelled dose was contained within a geometric standard deviation of ± 3.5% across all inhalation profiles).

**Conclusions**

- In vitro lung deposition with FP/FORM was high with both inhalation profiles at both flow rates, and a TLD of up to 44% of the labelled dose.
- Both gradual and sharp profiles resulted in high levels of drug deposition although overall deposition was slightly higher for the gradual inhalation profile; a gradual achievement of peak inspiratory flow may be preferred for pMDIs.
- Drug deposition was only slightly reduced for both inhalation profiles at the average flow rate of 48 L/min. While this higher average flow rate was associated with peak rates of 94–114 L/min, which are considered too fast for most pMDIs, FP/FORM TLD remained high (38–42% of labelled dose).
- It is believed that combined ICS/LABA formulations need to deposit throughout both central and peripheral airways to provide optimal functional and anti-inflammatory effects in both central and peripheral airways. FP/FORM provided balanced deposition between both central and peripheral airways irrespective of the simulated inhalation patient profiles tested.

**References**