In vitro Performance of Autoclavable Space Chamber Plus™ compared with Aerochamber Plus Flow Vu™ Anti-static

Study Objective:

To compare aerodynamic particle size distribution, and therefore *in vitro* performance, of Medical Developments International's Autoclavable Space Chamber Plus, pre- and post-autoclaving, against that of Aerochamber Plus Flow Vu Antistatic in delivering albuterol sulfate from pMDI (pressurised metered dose inhaler).

Study Design:

Aerodynamic particle size distribution was performed in an independent cGMP laboratory using a Next Generation Impactor (NGI) at a flow rate of 15 L/min according to compendial technology. Aerosol emitted from the pMDIs (6 actuations) is directed into the NGI cascade either directly or through a VHC (valved holding chamber). Aerosol passing through the NGI impactor impacts on the impactor throat and various cascade stages on the basis of its aerodynamic size. Aerosol residue deposited at each stage is collected and quantified by HPLC against USP drug standards. Results were processed into aerosol size distributions using proprietary software.

VHCs compared:

- Autoclavable Space Chamber Plus, new (Medical Developments International)
- Autoclavable Space Chamber Plus, which have been treated to 20 autoclave cycles at 134°C for 5 minutes (Medical Developments International)
- Aerochamber Plus Flow Vu Anti-static (Trudell Medical International)

pMDIs used:

- Albuterol sulfate (Ventolin HFA, GSK USA)

Three units of each VHC were tested. The VHCs were primed according to each respective manufacturer's Instruction for Use leaflets if and as required prior to the start of testing.

Results:

From the results, the following parameters are determined:

- 'total' amount of drug collected in the cascade impactor;
- Particle Size Fraction % as a calculated portion from 0.5µm-4.7µm (respirable fraction); and
- Mass Median Aerodynamic Diameter or MMAD, the particle size below which 50% of the particle population lies on the basis of mass.

The results for these parameters are summarised graphically for each VHC with pMDI, and pMDI alone in Figures 1 – 3 respectively.

Figure 1: Mean Total Delivered Dose

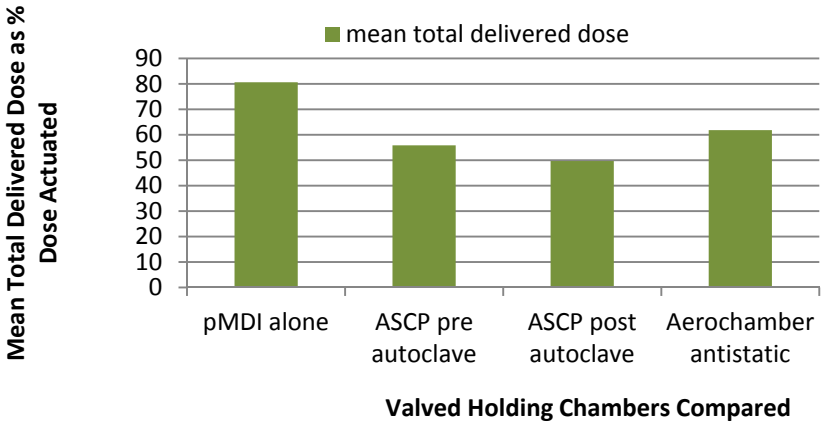


Figure 2: Mean Respirable Fraction

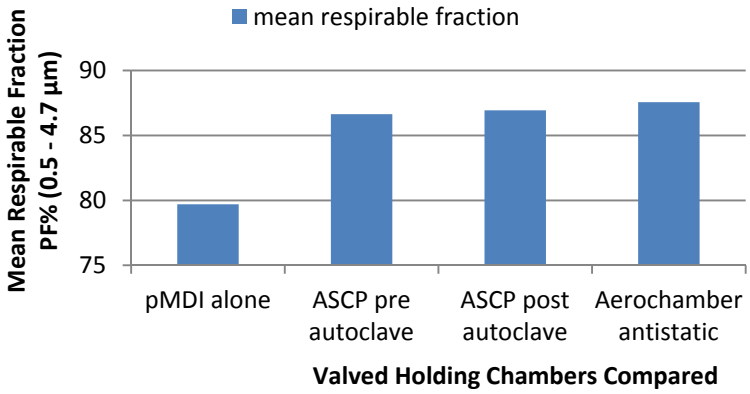
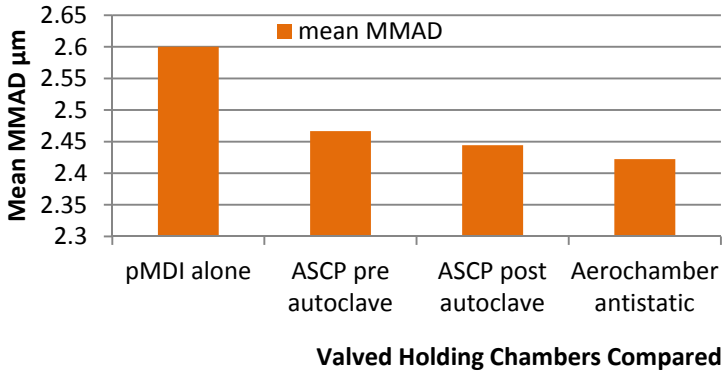


Figure 3: Mean Mass Median Aerodynamic Diameter



ASCP = Autoclavable Space Chamber Plus
pMDI = pressurized metered dose inhaler

Discussion:

The VHC acts as a reservoir for the medication from the puffer or pMDI; it does not require patient-coordinated actuation and inhalation for maximum efficiency. It reduces the amount of medication deposited in the upper respiratory tract (large aerosol particles of >5 µm) and increases the amount of medication reaching the lungs (particles of 0.5 – 4.7 µm), the respirable dose.

The Autoclavable Space Chamber Plus has been specially designed to offer consistent drug delivery with the convenience of meeting rigorous autoclave processing for multi-patient use in a hospital setting. In this study, the performance of Autoclavable Space Chamber Plus was compared against that of Aerochamber Plus Flow Vu Anti-static, when new and after having undergone 20 autoclave cycles at 134°C for 5 minutes. The Autoclavable Space Chamber Plus has a transparent body so that the respiratory valves and their movement can be easily seen and therefore enables the confirmation of correct product operation and usage.

The performance of the VHCs was evaluated by:

- MMAD or mass median aerodynamic diameter, i.e. the diameter above and below which lies 50% of the mass of the particles recovered in the impactor;
- Respirable fraction (Particle Fraction % 0.5-4.7 µm); and
- Mean total delivered doses (as percentage of total actuated dose).

Comparable results were obtained for all VHCs tested. The results showed that the pMDI when used alone delivered greater total delivered dose than when pMDI is used with a VHC. However, the respirable fractions delivered by the VHCs are greater than those delivered by the pMDI alone. The results therefore show that use of VHCs with the pMDIs increases the quantity of particles in the respirable range that would reach the lungs. VHCs reduce oropharynx deposition of drugs and improve patient compliance by minimizing the unpleasant taste of some drugs.

Based on the results on the MMAD, total delivered dose and respirable fraction, the performance of the Autoclavable Space Chamber Plus, after 20 autoclave cycles, remains unchanged and comparable to that of the Autoclavable Space Chamber Plus when new, and to Aerochamber Plus Flow Vu Anti-static.

Conclusion:

Results of the aerodynamic particle size distribution study indicate that Medical Development International's non-antistatic Autoclavable Space Chamber Plus has equivalent *in vitro* performance to Trudell's Aerochamber Plus Flow Vu Anti-static, both when it is new and after it has been treated to 20 autoclave cycles.