In Vitro Comparison of Aerosol Characteristics of HFA Albuterol (Salbutamol) Pressurized Metered Dose Inhaler (pMDI) Formulation from Three Valved Holding Chambers (VHCs)

D. von Holtro1, L. Stator1, K. Nikander1, R.H.M. Hatley1, R. Philips Respironics, Respironics New Jersey, Inc., Parsippany, New Jersey, USA. Respironics Respiratory Drug Delivery (UK) Ltd, Chichester, UK.

Introduction

The valved holding chamber (VHC) has been designed to help improve and optimize delivery for those using pressurized metered dose inhalers (pMDIs). The OptiChamber Diamond VHC (Diamond; Philips Respironics, New Jersey, Inc., Parsippany, NJ) is a compact, anti-static VHC designed to facilitate effective aerosol delivery to respiratory patients. The in vitro aerosol characteristics of an HFA abuterol sulfate pMDI with a preproduction Diamond VHC were compared with those of the pMDI with an AeroChamber Plus Z-Stat (Z-Stat, Monaghan Medical Corp., Plattsburgh, NY) VHC, an AeroChamber Plus (AC+, Monaghan Medical Corp.) VHC and the pMDI alone.

Method

Material

- pMDI
- VHCs
- Laboratory equipment

Pre-test conditions

- pMDI shaker
- VHC
- Laboratory equipment

Tests

- pMDI primed by shaking and firing to waste, performed 3 times per canister
- pMDI was removed from preproduction Diamond VHCs
- pMDI was removed from preproduction Diamond VHCs before every actuation

After each test the induction port, back-up filter, NGI cups and VHCs were processed using HPLC assay diluent.

Results

Figure 4. Fine particle fraction (percentage of the emitted dose in particles ≤ 4.7 µm) from the pMDI alone, pMDI with Diamond VHC, pMDI with Z-Stat VHC and pMDI with AC+ VHC. Error bars denote standard deviation about the mean.

When the results are expressed in terms of fine particle fraction (the percentage of the emitted dose in particles ≤ 4.7 µm) as in Figure 4, aerosol delivery from the pMDI alone is shown to be less efficient than from the pMDI VHC combinations for the delivery of drug to the lungs. That is, the proportion of the total aerosolized drug that would be expected to penetrate the upper airways and deposit in the conducting and alveolarized airways is higher for the pMDI VHC combinations compared with the pMDI alone.

Discussion

The fine particle dose from the pMDI alone and pMDI VHC combinations was similar, but the emitted dose was higher for the pMDI alone, meaning a greater amount of drug was delivered in larger particles that would be expected to deposit in the throat and upper airways. The aerosol delivery characteristics from the three pMDI VHC combinations were comparable.

Conclusions

- The aerosol delivery characteristics were similar from the pMDI VHC combinations when washed before use and used to deliver HFA abuterol.
- The fine particle fraction was higher using a pMDI VHC combination than the pMDI alone due to the VHC potentially retaining large particles and therefore use of a VHC could reduce the oropharyngeal deposition in patients using a pMDI.

References

2) Pacini F., Pietropaoli A., Troncone T., Deidda C., Roventi M., Le Maout P. Washing plastic spacers in household detergent reduces electrostatic charge and greatly improves delivery for Turbuhaler (AstraZeneca) En.

Acknowledgements: Editorial assistance was provided by L. Pearce and N. Smith of PS5 Consultants Ltd.