In Vitro Comparison of Aerosol Characteristics of HFA Albuterol Pressurized Metered Dose Inhaler Formulation from Anti-Static Valved Holding Chambers


Introduction

The valved holding chamber (VHC) has been designed to help improve and optimize delivery for those using pressurized metered dose inhalers (pMDIs). The Diamond VHC (Figure 1; Philips Respironics, 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 albuterol solution pMDI with a prepressurized Diamond VHC were compared with those of the pMDI with an AeroChamber Plus Z-Stat (Z-Stat, Menoghian Medical Corp., Plattsburgh, NY) and the pMDI alone.

Methods

Figure 2. Experimental test method.

After each test, the induction port, back-up filter, NGI cups and VHCs were processed using 10% Acetonitrile water, rinsed and air dried. After each test, the induction port, back-up filter, NGI cups and VHCs were processed using 10% Acetonitrile water, rinsed and air dried. The equipment was washed and dried after each drug/VHC test.

Results

Figure 3. Emitted dose (drug entering the NGI) from the pMDI alone, pMDI with Diamond VHC and pMDI with Z-Stat VHC, with the fine particle dose highlighted. Error bars denote standard deviation about the mean.

The dose emitted from each device comprised of the fine particle dose (particles ≤ 4.7 μm) and the dose in particles > 4.7 μm in diameter. Although the emitted dose for the pMDI alone was greater than that for the pMDI VHC combinations, Figure 3 shows that the majority of this difference was derived from a difference in particles > 4.7 μm in diameter. Therefore the VHCs retained a large proportion of particles over 4.7 μm in size, which would otherwise have been deposited in the throat and upper stages of the impactor.

The dose delivery characteristics of the aerosols from the two pMDI VHC combinations were comparable.

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

The MMAD of aerosols from each device was similar.

Discussion

The five 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 two pMDI VHC combinations were comparable.

Conclusions

• The fine particle dose and MMAD was similar between the pMDI alone and the pMDI VHC combinations.

• The fine particle fraction was higher using a pMDI VHC combination than the pMDI alone due to the fact that the VHC acts as a filter for large particles, which could reduce the oropharyngeal deposition in patients using a pMDI.

References


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