

Are valved holding chambers (VHCs) the preferred device for young children or do valve-less spacers (VLs) offer better delivery?

Mark Sanders and Ronald Bruin

Clement Clarke International Ltd., Edinburgh Way, Harlow, CM20 2TT, UK.

Introduction

- We describe in ISAM Poster P136 (New Devices & Emerging Therapy, 1st June) the development of a new single-use DispozABLE Spacer™.
- Salbutamol sulphate *in vitro* aerosol characteristics via the DispozABLE Spacer were comparable with pMDI alone, and between different commercial pMDIs, Ventolin® HFA (GSK) and ProAir® HFA (Teva).
- DispozABLE Spacer features include recyclable, valve-less, low-cost, low-bulk stack-storage and simple assembly (Figure 1).

Figure 1



New research objectives

- To compare, using standard flow rate conditions, *in vitro* aerosol characteristics via the DispozABLE Spacer and via two commercially available spacers:
 - VHC - OptiChamber® Diamond (Philips Respironics)
 - valve-less spacer - Nessi® Spacer (Hi-Tech Pharmacal Co)
- To extend this to a three-way comparison using a flow rate representative of paediatric use, 12 L/min.

Results

- At 28.3 L/min, there were no significant differences (t-value range 0.46 - 1.44) in total dose, respirable dose, or fine particle dose between the DispozABLE Spacer and OptiChamber Diamond for either Ventolin (Table 1) or ProAir (Table 2).
- Nessi Spacer Data were comparable (Table 1).
- Total dose delivered data for the pMDIs alone (Tables 1 and 2) demonstrate the contribution of the coarse particle fraction, >4.7µm.

Table 1

Ventolin pMDI	Aerosol characteristic (µg/actuation)		
	Total dose delivered	Total respirable dose (0.5-5.0µm)	Fine particle dose (<4.7µm)
DispozABLE Spacer (DS)	49.0 ± 4.9	40.7 ± 4.6	41.6 ± 4.3
OptiChamber Diamond (OD)	44.8 ± 3.4	36.9 ± 3.2	38.8 ± 3.0
pMDI alone	103.8 ± 0.9	42.2 ± 4.1	48.0 ± 2.7
Nessi Spacer (NS)	46.8 ± 0.6	36.7 ± 0.6	38.2 ± 0.3

Table 2

ProAir pMDI	Aerosol characteristic (µg/actuation)		
	Total dose delivered	Total respirable dose (0.5-5.0µm)	Fine particle dose (<4.7µm)
DispozABLE Spacer (DS)	48.0 ± 5.1	38.0 ± 4.6	39.0 ± 4.8
OptiChamber Diamond (OD)	43.2 ± 4.5	35.4 ± 4.5	37.5 ± 4.5
pMDI alone	99.6 ± 4.6	40.5 ± 4.2	46.2 ± 3.7

Methods

Study tools:

- 8-stage Andersen Cascade Impactor operated according to manufacturer's instructions and to US Food & Drug Administration requirement standards
- All testing and analytical chemistry conducted to Good Laboratory Practice at an independent laboratory.
- Aerosols:** Ventolin HFA and ProAir HFA pMDIs, 90µg ex-mouthpiece, 108µg ex-valve.
- Devices:** OptiChamber Diamond VHC and valve-less Nessi Spacer and DispozABLE Spacer.

Aerosol characteristics at 28.3 L/min:

- Data from Poster 136 Study 2 compared with drug delivery from Ventolin and ProAir via the OptiChamber Diamond, and from the pMDIs alone (n=3).
- Student's t-test with a two-tailed comparison (t-value < 2.23 = no significant difference at 95% confidence level).
- Ventolin via valve-less Nessi Spacer determined (n=3) and compared.

Aerosol characteristics at 12.0 L/min:

- Data from Ventolin via DispozABLE Spacer, OptiChamber Diamond and Nessi Spacer (n=3) compared in the same experiment.
- Student's t-test with two-tailed comparisons (t-value < 2.78 = no significant difference at 95% confidence level).

Results

- At 12.0 L/min, there were no significant differences (t-value < 2.78) between the two valve-less spacers, DispozABLE Spacer and Nessi Spacer (Table 3).
- DispozABLE Spacer was significantly different (t-value > 2.78) compared to the valved OptiChamber Diamond for all three variables, with the DispozABLE performance being superior.

Table 3

Ventolin pMDI	Aerosol characteristic (µg/actuation)					
	Total dose delivered		Total respirable dose (0.5-5.0µm)		Fine particle dose (<4.7µm)	
DispozABLE Spacer (DS)	55.6 ± 5.3		44.0 ± 5.1		43.9 ± 5.3	
OptiChamber Diamond (OD)	36.9 ± 4.2		29.3 ± 4.9		29.8 ± 4.5	
Nessi Spacer (NS)	49.2 ± 4.4		39.6 ± 3.8		39.7 ± 3.3	
	DS v OD	DS v NS	DS v OD	DS v NS	DS v OD	DS v NS
Difference	18.7	6.4	14.7	4.4	14.1	4.1
t-value	4.79	1.63	3.64	1.21	3.50	1.15

Conclusions

- A clinically effective dose was delivered via all three spacer devices.
- The DispozABLE Spacer is suitable for effective delivery of medication (salbutamol sulphate).
- Delivery of respirable salbutamol sulphate was similar via each of the chamber/spacer devices, and comparable to pMDI at the standard flow rate.
- At low flows a valve-less spacer may perform better than a VHC, which has clinical implications for treating infants.