

Assessment of a Valved Holding Chamber for Delivering Inhaled Medication through a Tracheostomy Tube in a Tidal Breathing Model

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RATIONALE

Limited data is available regarding the efficiency of inhaled drug delivery devices despite their widespread use in spontaneously breathing tracheostomy patients. We compared patient dose achieved with different devices, inhalation techniques, tracheostomy tube (TT) sizes and breathing patterns using a spontaneously breathing trach model.



METHODS

Albuterol (Ventolin⁺, 2 actuations) was delivered to the model via 2 different valved holding chambers (VHC, AEROTRACH PLUS[®] Anti-Static VHC and PARI⁺ VORTEX⁺ Tracheo Non Electrostatic Holding Chamber) via 4.5 mm or 8.0 mm TTs. The tracheostomy adapter of each VHC was attached to the 15 mm adapter of the TT. A filter was placed between the exit of the TT and a breathing simulator (ASL 5000) programmed to replicate tidal breathing (155 cc, 25 BPM, 1:2 I:E Ratio or 500 cc, 13 BPM, 1:2 I:E Ratio). The contents of each filter were assayed for albuterol by HPLC-UV spectrophotometry.

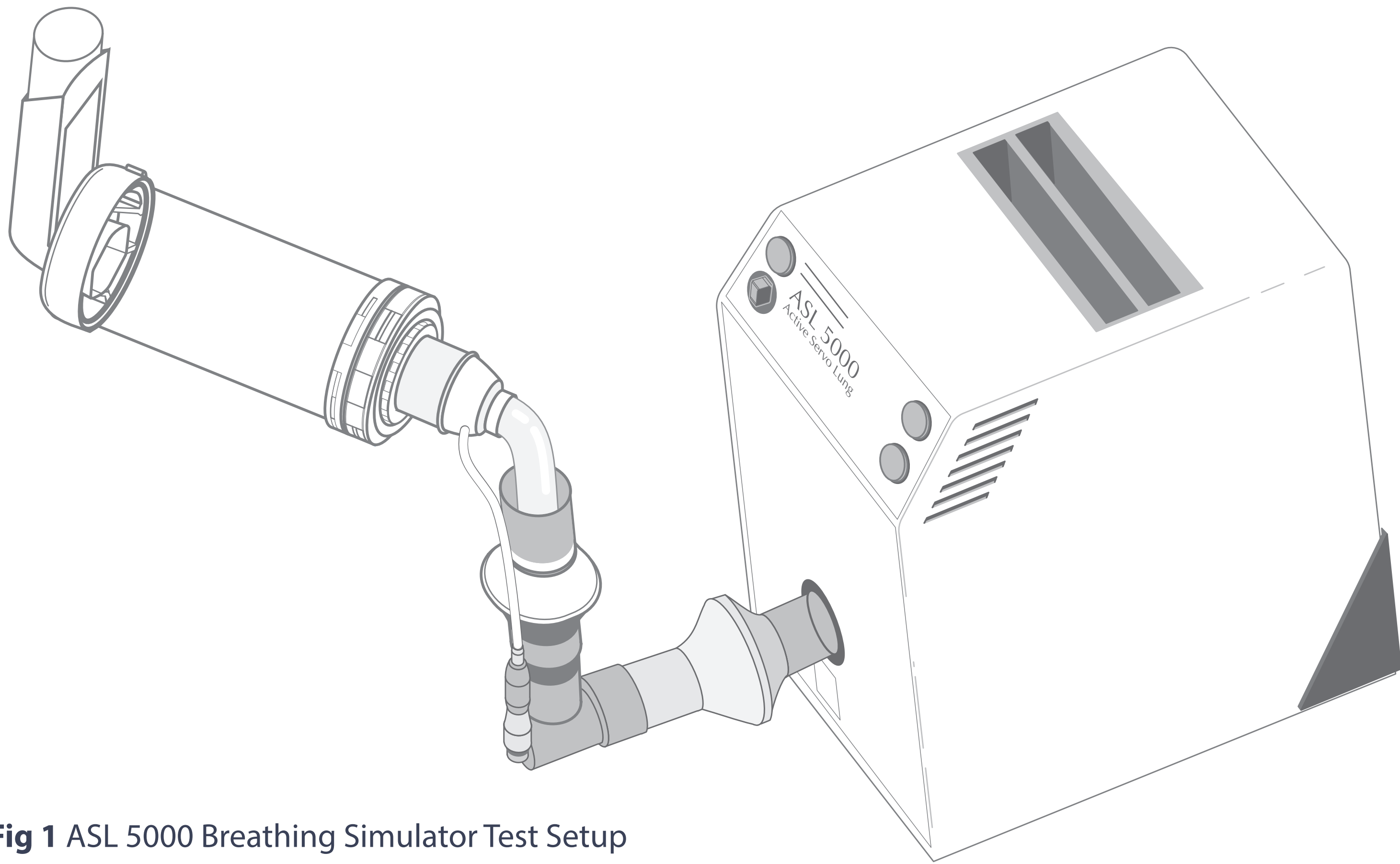


Fig 1 ASL 5000 Breathing Simulator Test Setup

RESULTS



Table 1 Delivered mass of albuterol (μg) to the end of the TT.

ASL Breathing Parameters	AEROTRACH PLUS [®] Anti-Static VHC	PARI ⁺ VORTEX ⁺ Tracheo Non Electrostatic Holding Chamber
155 cc, 25 BPM, 1:2 I:E Ratio, 4.5 mm tracheostomy tube	36.0 \pm 3.2	16.5 \pm 1.8
500 cc, 13 BPM, 1:2 I:E Ratio, 8.0 mm tracheostomy tube	57.0 \pm 6.1	30.3 \pm 7.2

BPM = breaths per minute; I:E = inhalation:exhalation

CONCLUSIONS

The choice of a metered-dose inhaler / VHC delivery system can significantly influence treatment efficacy. This study demonstrated that the AEROTRACH PLUS[®] Anti-Static VHC provided superior delivery of albuterol compared to the PARI⁺ VORTEX⁺ Tracheo Non Electrostatic Holding Chamber ($p < 0.001$). Optimizing lung deposition with the AEROTRACH PLUS[®] spacer may lead to faster symptom relief and potentially reduce the required number of actuations and cost of treatment.

