

Method for Recording Inhalation Waveforms from a Valved Holding Chamber and Comparison of Potential Inhalation Techniques on Inspired Volume

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INTRODUCTION

- Patient *Instructions for Use* of a Valved Holding Chamber (VHC) in conjunction with a pressurized Metered Dose Inhaler (pMDI) often indicate that the patient should inhale slowly and deeply, followed by a breath hold for several seconds.
- If they are unable to complete such an exercise, they should breathe tidally for 2-3 cycles.
- The aim of this study was to develop a methodology by which breathing profiles can be recorded, evaluated and eventually used to generate *in vitro* drug delivery data.

MATERIALS AND METHODS



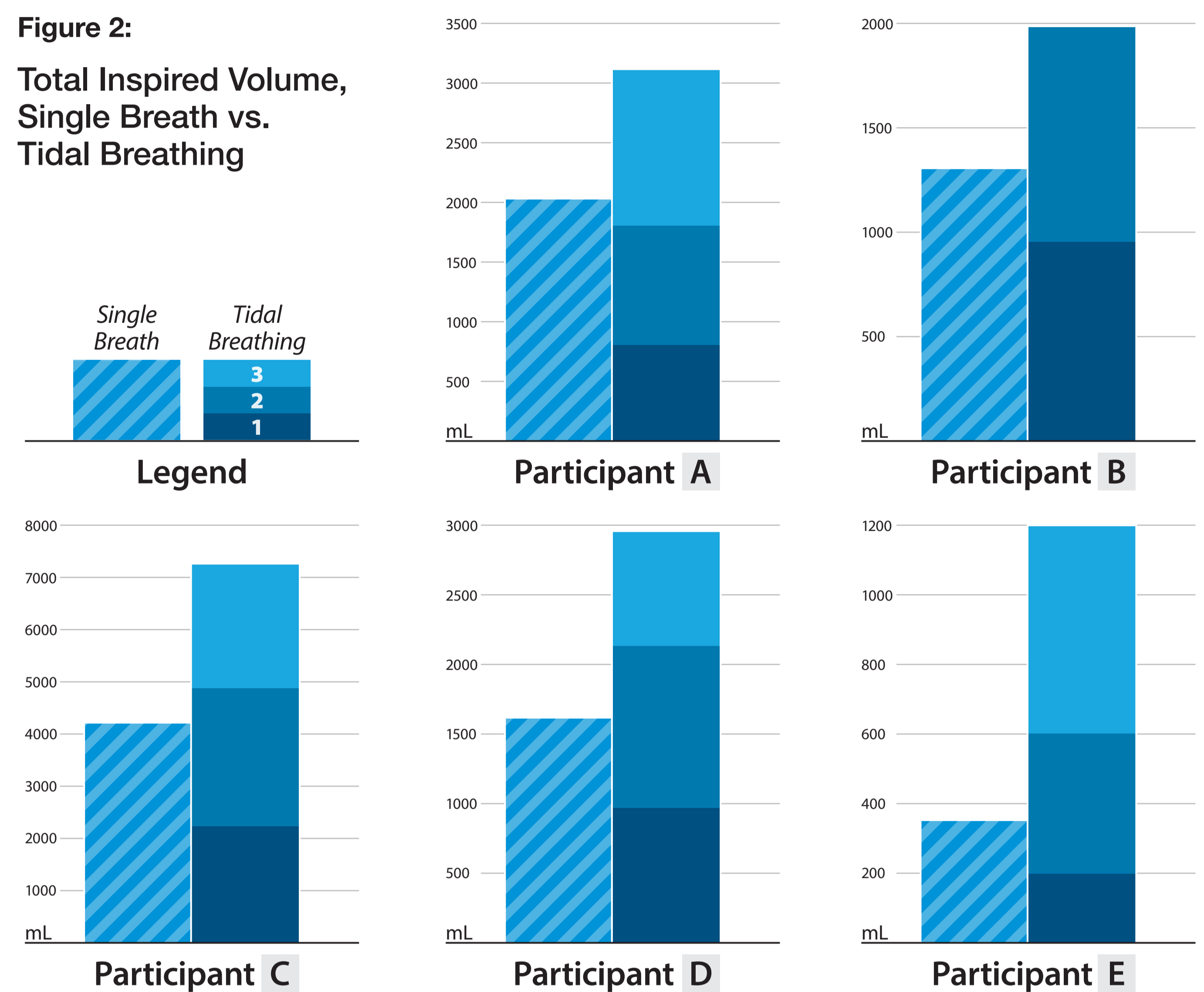
Figure 1: AeroChamber Plus[®] Flow-Vu[®] VHC attached to flow sensor holder with mouthpiece for participant to inhale.

- A VHC was attached to a pneumotachometer (SpiroQuant H flow sensor, EnviteC-Wismar GmbH) with a purpose-made fitting and also equipped with a mouthpiece, from which the participant inhaled (Figure 1).
- Five VHC-naïve participants were asked to inhale from a VHC in each of the following ways
 - Slow, deep inhalation and breath hold (*single breath*). This represented the optimal maneuver.
 - Breathe tidally for 2-3 respiration cycles (*tidal breathing*).
- Breathing profiles were recorded using SmartLab[†] instrumentation with Insight[†] recording software (Hans Rudolph Inc) and converted for use on an ASL 5000 breathing simulator (Ingmar Medical).

RESULTS

Figure 2:

Total Inspired Volume, Single Breath vs. Tidal Breathing



Participant	Volume (mL) — Single Breath	Tidal Volume (mL) — Tidal Breathing				TIV
		Breath 1	Breath 2	Breath 3	TIV	
A	2024	805	1000	1304	3108	
B	1302	953	1029	not made	1981	
C	4200	2228	2646	2372	7246	
D	1611	968	1165	818	2952	
E	350	198	404	595	1197	

- Total Inspired Volume (TIV) was greater for *tidal breathing* compared to the *single breath* maneuver
- TIV for the *single breath* maneuver was always larger than the internal volume of the VHC (149 mL)
 - Complete evacuation of the chamber occurred after 1 inhalation of this type of maneuver
- Volumes associated with either inhalation maneuver differed dramatically between participants
 - TIV for *Participant E* decreased markedly compared with the others for the *single breath* maneuver
 - This participant also achieved a lower TIV for the *tidal breathing* maneuver than the norm

CONCLUSIONS

- The particular VHC used for these tests would have been emptied of medication after a single inhalation by either method with all the participants
- Future studies will need to investigate the effect that these widely differing breathing profiles had in terms of impact on mass of medication delivered and its associated aerodynamic particle size distribution.

