

# In Vitro Comparison of Albuterol Dose Output for Standard MDI with LiteAire Spacer versus Misty Max 10 Nebulizer

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## Abstract

**Background:** Though there is a tremendous variability in number of MDI actuations (2-12) used in studies comparing beta agonist delivery via MDI/spacer and a nebulizer, literature supports the use of 6 MDI actuations. As delivery systems may influence dose output, prior to conducting a clinical efficacy comparison study, it would be prudent to determine the in vitro dose outputs using the two systems.

**Objective:** The purpose of this study was to perform an in-vitro B-agonist dose output comparison between 6 actuations of “MDI with “LiteAire Spacer” versus 1 Unit dose with a “Nebulizer”.

**Method:** A Standard MDI/LiteAire Spacer combination and Nebulizer were tested using the Michigan Instrument Dual Test Lungs driven by a Puritan Bennett 7200 ventilator set at 14 breaths/minute, TV of 600 ml and I:E ratio of 1:4. The LiteAire was tested with 6 MDI actuations, one puff/respiratory cycle and the Nebulizer with one 3-ml vial (0.833mg/ml) Albuterol Solution. Nebulization with oxygen (8L/min) was run (sputtering time) for five minutes. Each dose deposition filter was washed with 0.05mM KCl with 1% acetic acid buffer and samples were analyzed by UV spectrophotometer, at a wavelength of 276nm ±1nm to calculate the total dose output. The above experiment was repeated for a total of three times (N=3) for both devices.

**Results:** The average total dose output ± Standard Deviation was 176 ± 27 micrograms for 6 puffs of MDI/LiteAire Spacer versus 220 ± 14 micrograms for Nebulizer (p value 0.067), respectively.

**Conclusion:** We recommend using 6 albuterol MDI actuations with LiteAire spacer, when conducting a clinical efficacy study as the in vitro dose outputs using 6 MDI actuations and a unit dose of nebulizer are comparable. We cannot comment on effective Respirable dose output equivalency as particle size distribution studies were not conducted.

## Introduction

The purpose of this study was to perform an in-vitro B-agonist dose output comparison between 6 actuations of an MDI with LiteAire Spacer versus 1 Unit dose with a Nebulizer. The total dose output in micrograms using Standard MDI Boot and a LiteAire Spacer Device for albuterol (CFC) (Inhalation Aerosol – IVAX Pharmaceuticals, Inc.) is determined using 6 actuations of medication versus a Misty Max-10 Nebulizer treatment using one unit dose of albuterol sulfate. The amount collected on the filter (AireLife Nonconductive Respiratory Therapy Filter, Bacterial/Viral Retentive) is the total amount of active ingredient (albuterol/albuterol sulfate) summed over all particle sizes which would be delivered to a patient.

A Standard MDI/LiteAire Spacer combination and Nebulizer were tested using the Michigan Instrument Dual Test Lungs driven by a Puritan Bennett 7200 ventilator set at 14 breaths/minute, TV of 600 ml and I:E ratio of 1:4. The LiteAire was tested with 6 MDI actuations, one puff per respiratory cycle and the nebulizer with one 3-ml vial (0.833mg/ml) albuterol solution. Nebulization with oxygen (8L/min) was used for five minutes.

## Method.

The LiteAire spacer device is used as shown in Fig 1. The LiteAire spacer device is connected to a USP standard aluminum throat model. A filter (Airlife Nonconductive Respiratory Therapy Filter, Bacterial/Viral Retentive) traps the particles on the opposite side of the throat. The flow is created by one lung of a Dual Adult Test Lung while the opposite lung is driven by a Michigan Instrument Dual Test Lungs driven by a Puritan Bennett 7200 ventilator set at 14 breaths/minute, TV of 600 ml and I:E ratio of 1:4. The LiteAire was tested with 6 MDI actuations of albuterol (CFC) (IVAX Pharmaceuticals, Inc.)

For the Misty Max-10 Nebulizer See Fig 2. An oxygen tank is used to power the Misty Max-10 Nebulizer using standard Nebulizer tubing and is connected to a T-connector where one end of the T-connector is left open and the other end is connected to USP standard aluminum throat model. A filter (Airlife Nonconductive Respiratory Therapy Filter, Bacterial/Viral Retentive) traps the particles on the opposite side of the throat. The flow is created by one lung of a Dual Adult Test Lung while the opposite lung is driven by a Michigan Instrument Dual Test Lungs driven by a Puritan Bennett 7200 ventilator set as above. The Nebulizer was used with one 3-ml vial (0.833mg/ml) albuterol solution. Nebulization with oxygen (8L/min) occurred for five minutes.

At the end of the simulated treatments each dose deposition captured by filter was washed with 0.05mM KCl with 1% acetic acid buffer and samples were analyzed by UV spectrophotometer, at a wavelength of 276nm ±1nm to calculate the total dose output. The above experiment was repeated for a total of three times (N=3) for both treatment modes.

## Results

Experimental Run albuterol / albuterol sulfate	LiteAire Dose output of Albuterol in ug per Treatment (One Treatment = six actuations)	Misty Max-10 Dose output of Albuterol Sulfate in ug per Treatment
1	161.540	204.528
2	159.143	230.496
3	207.082	224.503
<b>Average Total Dose Output</b>	<b>175.922± 27.013</b>	<b>219.842± 13.597</b>

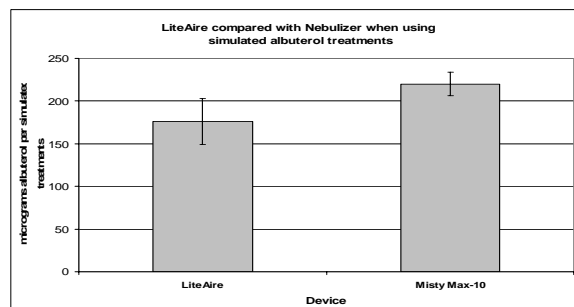


Fig 1: Setup with LiteAire Spacer Device

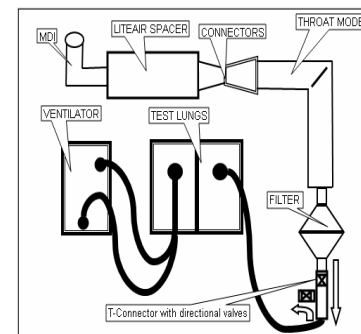
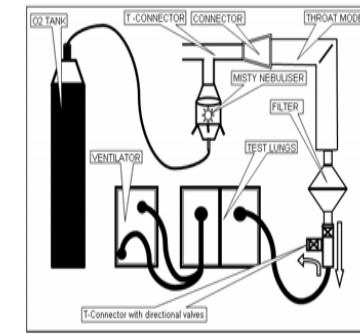


Fig 2: Misty Max-10 Nebulizer



## Conclusion

We recommend using 6 albuterol MDI actuations with the LiteAire spacer when conducting a clinical efficacy study as the in vitro dose outputs using 6 MDI actuations and a unit dose of nebulizer are comparable. However, a controlled study comparing the two modes of treatment in patients with asthma would be desirable to demonstrate equivalent clinical efficacy.