

**INHALATION TECHNIQUES
FOR CHILDREN AND
Adolescents
Oslo University Hospital,
RIKSHOSPITALET**

**DIVISION OF
PAEDIATRIC
AND ADOLESCENT MEDICINE
(BARNEKLINIKKEN)
VOKSENTOPPEN**



**The information contained in this booklet is intended for health
personnel**

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INTRODUCTION

Patients with lung diseases and respiratory disorders who are dependent on inhaling medication face a particularly big challenge when it comes to taking their prescribed medicine correctly. This is a recurring problem being discussed in most environments of respiratory medicine.

Poor compliance is first and foremost likely to add to the burden patients already suffer because of their illness, and there is also a health economic loss for the society because of incorrect use of the medication and less than optimal therapy .

When asthma/lung medication is inhaled, it is deposited directly in the central and lower airways. This is where it is intended to work, so it is important that the patient should learn an effective and optimal inhalation technique.

It is essential to provide correct information as regards how and why the patient needs to take the different medications, how the different medications work and the optimal inhalation technique.

Physicians who prescribe the medication must ensure that the patient understands all this, so the physician needs skill in explaining and demonstrating how to use the equipment. An instruction leaflet is not enough!

When medication has been prescribed, the patient should bring his/her inhalation equipment to the next visit to the doctor in order for the doctor to check that his/her medication administration technique is satisfactory. If the patient does not experience any improvement in lung function, despite an increase in the medication dose, the inhalation technique should be checked thoroughly. It is always possible for bad habits to develop that may cause medication failure. This is not specific for children but may happen to patients of all ages.

It is important to use the equipment properly and to clean it after use. Blocked or clogged up nozzles, broken equipment and dirty equipment are frequently seen.

Fixed routines for taking the medication should be established and to ensure that the child / patient stay in quiet surroundings able to concentrate when taking the medication. The patient should stand upright when inhaling medicine in dry powder form or spray form (metered dose inhaler (MDI)). This increases the likelihood for a successful therapy.

It is recommended that the medication is taken in connection with morning and evening washing/bathing and teeth-brushing. To avoid a mycotic infection forming, it is important to rinse the mouth/gargle/brush the teeth after taking

inhaled corticosteroids. Alvesco[®] (ciclesonide), being a pro-drug, is the only corticosteroid that does not cause this side-effect in the oral cavity. If a facemask is used, the face and mouth must be wiped with a damp cloth. Children will feel more capable and confident if they are allowed to take an active part themselves, for example by loading a new dose, shaking the inhaler and assembling the various parts of the inhaler.

The most common asthma medications are colour-coded as follows:

Blue : Relieving/bronchodilating, (rapid-acting) medication (for asthma attacks, beta2-agonists)

Green : Protects against asthma attacks (long-acting beta2-agonists, anticholinergics)

Brown/orange: Long-term control (preventive/anti-inflammatory) medication (inhaled corticosteroids).

Purple/red: Combination preparation of preventive and long-acting medication

When rapid-acting medication is taken in dry powder or spray form (by MDI), the patient must wait at least three minutes before inhaling other medication. It is normally not necessary to wait when rapid-acting medication is delivered using a nebulizer.

About ordering inhalation equipment for home use:

The health trusts in Norway conduct their own negotiations with the manufacturers and determine what inhalation equipment they will have in store. Since 2013, Phillips has had an agreement for a further 3–4 years to supply Portaneb and Aeroneb-Go to all regions apart from Bodø and Sandnessjøen. This equipment may be ordered via your local assistive medical technology centre (Hjelpemiddelsentralen) in each health trust.

INHALATION METHODS

Different ways of taking inhaled medication

Inhaled nebuliser solution: To be inhaled using an electrically powered or battery-driven nebulizer. The patient inhales the aerosolized medication (mist) through a facemask or mouthpiece.

Metered dose inhaler (MDI): The metered dose inhaler (MDI) consists of a pressurized canister of medicine in a plastic case with a mouthpiece. A holding chamber consists of a plastic tube with a mouthpiece, a valve to control mist delivery and a soft sealed end to hold the MDI. The holding chamber assists delivery of medicine to the lungs. Children and patients with impaired respiratory function, and coordination, must inhale MDI via an inhalation chamber (holding chamber). The chamber is filled with aerosolised medicine, and the medicine is inhaled via a facemask or a mouthpiece, depending on the patient's technique and age.

Inhaled dry powder: The medication is taken using a dry powder inhaler, consisting of a plastic device used to inhale powdered medication. The dry powder inhalers are breath activated. This means when you inhale, the device automatically releases the medication. There are different types of dry powder inhaler depending on which medicine is used.

NEBULIZERS

A **nebulizer** changes medication from a liquid to a mist so that it can be more easily inhaled into the **lungs**. Nebulizers are particularly effective in delivering **asthma medications** to infants and small children and to anyone who has difficulty using an **asthma inhaler**..

There are two main types:

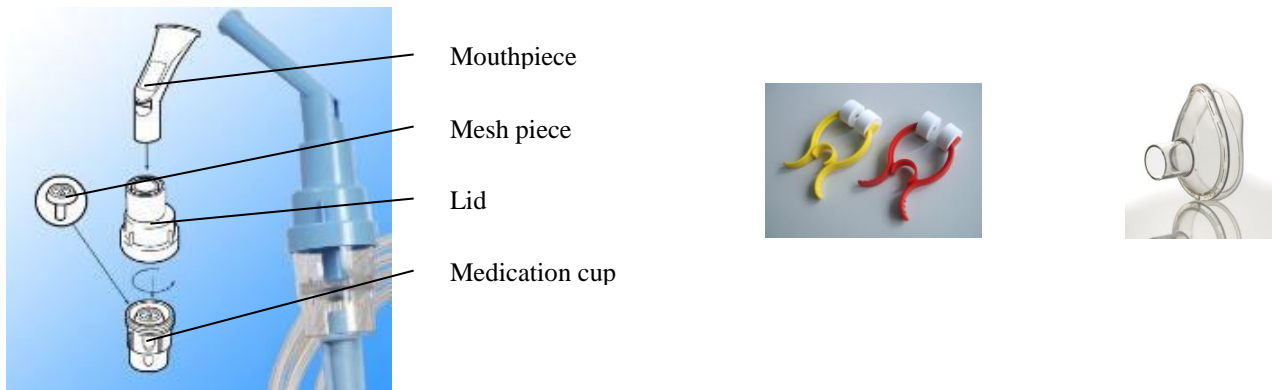
Large-volume nebulizers, which have a powerful air compressor unit. Mains powered, must be plugged into an electrical outlet.

Small nebulizers, which are battery-driven and can be recharged. Easily portable.

LARGE-VOLUME NEBULIZERS

Large-volume nebulizers have a powerful air compressor unit and are mains powered. The air compressor forces the mixture containing the medication through a small mesh, which causes it to be aerosolized into fine particles (mist). The effect depends on the air stream, speed (flow) and pressure.



The nebulizer comprises a box with a motor, connected to a medication cup, a mesh piece, a screw-top lid and a mouthpiece or facemask (see drawing). How long it takes to take the medication depends on the type of nebulizer and the viscosity of the nebulising solution, but it usually takes 3–6 minutes.



Instructions for inhalation using a large nebulizer:

- Insert the mesh piece into the medication cup.
- Add the medication to the cup. Always use at least 2 ml of liquid to aerosolize.
- Screw the lid on.
- Put on the mouthpiece or mask, and a “T” piece if desired, which is used for some types of mask.
- The medication chamber is connected to the hose from the nebulizer’s air outlet.
- Turn the nebulizer on.
- Place the mouthpiece between the teeth. The patient should close her lips tightly round the mouthpiece and breathe in through the mouth, not the nose. If mist is exhaled through the nose, a nose clip should be used.
- The patient should use a mask if she is unable to use the technique with the mouthpiece. The mask must fit snugly around the nose and mouth.
- The patient should be in a good sitting position with her chin facing straight ahead while inhaling.
- Breathe deeply and calmly.

Examples of large-volume nebulizers:

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|  A white and grey nebulizer with a blue connector and a white tube. | <p>Respironics InnoSpire Deluxe nebulizer for use by patients of all ages.</p> |
|  A blue seal-shaped nebulizer with a white mask and a blue connector. | <p>Sami the Seal (for use by young children). This nebulizer is identical to Portaneb. It has a slightly weaker motor and takes about 6 minutes to deliver an aerosolized dose of approx. 2 ml of liquid medication.</p> |

Cleaning

It is important to clean the nebulizer to prevent it from becoming blocked with medication.

- After each inhalation: Take the nebulizer apart and rinse the parts in warm water. Shake off excess water and air dry.
- Once a week: Boil the nebulizer for 5 minutes in water to which has been added 2–3 drops of washing-up liquid. The mask must not be boiled, but washed in hot water with washing-up liquid. Rinse all the parts well after washing, shake off excess water and leave to air dry.
- If the nebulizer is misting poorly or not misting at all: Nebulize using only clean water (without the mesh piece) after each use. Soak the nebulizer in warm, mild soapy water once a day. If this does not help, soak the nebulizer chamber in a weak vinegar solution for about 30 minutes. Remove it from the solution, flush through, rinse and flush well with clean water. Then rinse the parts in clean water and air dry. Never use a brush or pin to unclog holes!
- Never put the nebulizer in a dishwasher, as this will damage it.
- It is recommended that the nebulizer parts (medication cup, mesh piece and screw-top lid) be replaced once a year. If the nebulizer is damaged and no longer functions, or if the patient's needs change (for example, she needs a larger mask), you should also contact your local assistive medical


technology centre (Hjelpemiddelsentralen). In that case you do not need a new order from the doctor.

SMALL NEBULIZERS

These nebulizers are battery-driven, but can also be connected to the mains. They are silent and easily portable, although they take a little longer to aerosolize the medication than larger nebulizers.

Aeroneb Go:

- This nebulizer has no mesh, but aerosolizes using Piezoelectric crystals. This is a very effective method also for viscous liquids like inhaled corticosteroids, and various antibiotics.
- The nebulizer can be held at different angles and can also be used when lying down. It takes about 4–6 minutes to aerosolize approx. 2 ml of liquid (max. 8 ml).
- To be used with a mouthpiece or mask (see above).

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|  | <p>Aeroneb Go The device consists of the three-part nebulizer, plus a power adapter for connecting to the mains.</p> |
|  | <p>Medication cup with screw-top lid and the nebulizer itself with mouthpiece</p> |

Cleaning:

After each use:

- Disassemble the nebulizer and rinse all the parts (except for the adapter and cable) in warm, running water.

Daily:

- Disassemble the nebulizer and wash all the parts in warm, running water to which has been added a little washing-up liquid. Do not use dishwasher detergent! Rinse the parts in clean water, shake to remove excess water and air dry.

Disinfection:

- If further cleaning or disinfection is required, the nebulizer and the mouthpiece (NB: not the motor!) can be boiled in soapy water for 5–10 minutes. Shake off excess water and air dry.
- The other parts should first be rinsed as above in warm, running water. Then soak the parts in a solution of 3 parts water to one part white vinegar for 30 minutes, before rinsing them well in warm, running water. Shake off excess water and air dry. Make sure the parts are completely dry before reassembling the nebulizer.
- NB: Small nebulizers are less robust than the larger ones, and must therefore be treated with care. They have a lifetime of approx. 3 years, but are also relatively inexpensive to buy.

The large volume nebulisers is driven by a compressor which delivers compressed air. The effect of the nebuliser and the nebulising time depend on the airflow and pressure delivered by the nebuliser. The effectivity of the nebuliser also depends on the particle size delivered by the nebuliser. Small particles (obtained through high pressure and airflow) less than 2.5 mikron in diameter penetrate further down the airways and gives better effect than nebulisers delivering higher particle size.

Ultrasound nebulisers are usually not effective for viscous solutions like corticosteroids and antibiotics, but are effective for watersoluble solutions like inhaled beta-2-agonists and ipratropium bromide. Nebulisers driven by piezoelectric crystals are usually effective in delivering small particles and highly viscous solutions (corticosteroids and antibiotics)

Metered dose inhalers (MDI)

Medications:

Bricanyl (terbutaline), Pulmicort (budesonide), Ventolin (salbutamol), Flutide (Fluticasone dipropionate), Serevent(salmeterol), Seretide(Salmeterol + fluticasone dipropionate) and Atrovent (Ipratropium bromide)and others.

Contains 100–200 doses



- The medication in an MDI (metered-dose inhaler) is stored in a small metal canister, inserted into a small plastic case with a mouthpiece attached.
- The plastic case has different colour codes, to make it easy to recognise what kind of medication you are taking. (See the colour code beneath the name of the medication.)
- The number of doses is given on both the canister and the inhaler pack.
- If the inhaler does not have a built-in counter device, you should note the date it is opened. Feel the weight of the inhaler and check occasionally to see whether it is running out of medication (getting lighter). You can also puff a dose into the air, to check whether the puff is getting weaker, or place the inhaler in water (an empty canister will float).
- Inhalers have different mechanisms. Some are dependent on a propellant gas and pressure in order to deposit the medication in the lungs.
- **Children and patients with impaired respiratory function, and coordination, must inhale the aerosolized medication via an inhalation chamber.**

- The inhalation chamber is filled by a puff of aerosolized medicine, which is inhaled via a mask or a mouthpiece, depending on the patient's degree of cooperation and inhaler technique.

Cleaning the inhaler:

The inhaler should be cleaned in warm soapy water once a week. A new canister of medication comes with each inhaler.

Use of inhaler with inhalation chamber/spacer/volume chamber:

There are two different kinds of inhalation chamber currently in use in Norway.

A universal chamber, which is suitable for all types of MDI.

Can be used by patients of all ages.

Available on 'blue' prescription from the pharmacy. A mask must be ordered separately.

An **inhalation chamber (or spacer)** is a plastic container the size of a small soft-drink can. It has a hole in one end that fits the inhaler, and a mouthpiece, or mask, for inhaling at the other end.

The usefulness of the chamber is to enable the medication to be sprayed into the chamber where it is held "suspended" with the air for about 20 seconds. At the same time the patient inhales the medication from the mouthpiece/mask and down into the lungs. The patient breathes in several times (5-10 times), and the medication is deposited where it is intended to. This is a good method of distributing the medication effectively into the lungs.

Examples of inhalation chambers/spacers

OptiChamber Diamond:



Instructions for use

1. Remove the protective cap.
2. Insert the mouthpiece on the inhaler into the back of the chamber.

3. Give the inhaler and chamber a good shake 4–5 times while holding the two parts tightly together.
4. Place the mouthpiece in the mouth, and press the lips round it to make a tight seal. If it is difficult to use the mouthpiece, use a facemask instead. It is important that this should also fit snugly. Practise occasionally using a mouthpiece rather than a mask, as this is the best way to take the medication.
5. Spray one puff of medication into the chamber from the inhaler. Inhale slowly 5–10 times, depending on age and technique. The chamber makes a whistling noise if you inhale too quickly or deeply.
6. If you need to inhale several doses (“puffs”), repeat steps 3 to 5 for each dose.



Cleaning:

Before first-time use:

- Soak all the parts in lukewarm water containing a little washing-up liquid for approx. 15 minutes. Shake off excess water and air dry. Do not rinse. Washing-up liquid leaves a protective film on the chamber walls, which causes the aerosolized medication not to stick so quickly to the chamber wall, and to remain suspended for longer in the chamber.

Once a week, or more frequently if soiled:


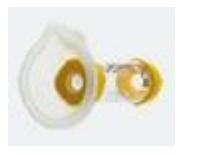

- Remove the facemask, if used
- Take the chamber apart by rotating the mouthpiece and remove the endpiece by pulling it right off.
- Soak all the parts in clean water containing a little washing-up liquid, rotate/agitate them a few times and allow all the parts to air dry.
- Never use a brush for cleaning.

In hospital:

- The chamber and mask should be cleaned using Virkon or similar (see instructions for use).
- NB. Never clean the inhalation chamber by putting it through a decontaminator, as the parts will melt!

AeroChamber:

Anatomically shaped facemasks of different sizes, optional mouthpiece

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| 0–18 months: Inhalation chamber with mask | 12 months–5 years: Inhalation chamber with mask | 5 years + Inhalation chamber with mask | 5 years + Inhalation chamber without mask |
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Instructions for use

1. Remove the protective cap.
2. Insert the inhaler (puffer) in the rear of the AeroChamber.
3. Shake the inhaler vigorously 4–5 times while holding the two parts firmly together.
4. Place the mouthpiece in the mouth, and press the lips firmly around the mouthpiece. If it is difficult to inhale directly from the mouthpiece, use a mask. It is important that the mask also fits snugly. Practise occasionally using the mouthpiece, as this is the best way to take the medication.
5. Press the inhaler once. Breathe in slowly 6–10 times, depending on age and technique.
6. If you need to take several doses (“puffs”), repeat steps 3–5 for each dose.

Cleaning:

- See cleaning instructions for Optichamber
- Once a week, or more frequently if soiled.
- Remove the coloured ring at the back, and keep the mask on.

Autohaler

Medications: Airomir (salbutamol), Aerobec (beclomethasone)



The Autohaler is designed so that you can use the inhaler directly in your mouth. The dose of medication is released automatically when you breathe in and delivers a metered dose in spray form that you draw down into your lungs. The Autohaler has a rapid and powerful propellant gas, which improves deposit of the medication into the lungs.

The Autohaler contains approx. 200 doses. It does not have a built-in counter device, so write the date on the inhaler when you start using it.





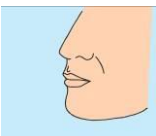

The Autohaler consists of:

A small metal canister containing the medication, called the Aerosol canister.

A plastic casing outside the aerosol canister.

The Autohaler has three parts: Top with dose loader. Base with mouthpiece and a releasing device. Dust cap.

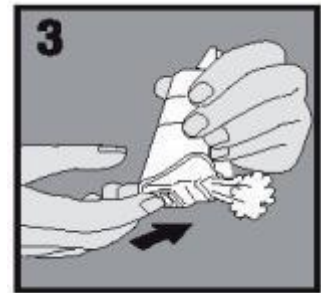
Children from 5–6 years of age should be able to use this technique.

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|  | <p>1. Remove the dust cap, and give the Autohaler a good shake.</p> |
|  | <p>2. Hold the Autohaler in the upright position, and push the lever on the top right up.</p> |
|  | <p>3. Breathe out slowly, so that you empty the air from your lungs.</p> |
|  | <p>4. Place the mouthpiece in your mouth, and press the lips firmly around the mouthpiece to make a seal. Breathe in slowly and deeply. Breathing in automatically releases the dose of medication. Continue breathing slowly until your lungs are full, even if you hear the click, and you can feel the spray of medication in your mouth.</p> |
|  | <p>5. Remove the inhaler from your lips and close them. Hold your breath, preferably for 5 seconds. Then breathe out (exhale) slowly (preferably through your nose).</p> |
|  | <p>6. The lever must be pushed up (“on”) for each new dose and must be pushed down (“off”) after inhaling. After use, replace the dust cap on the mouthpiece.</p> |

Even if you push the lever up and down several times, the inhaler will deliver only one dose of medication.

Other

Inside the inhaler there is a dose chamber, where the next dose is ready for use. When you start using a new inhaler, or if the existing inhaler has not been used for a couple of weeks, you should spray 2 puffs into the air. The new dose of medication will then be ready for release, so that you get the full dose. A spray is released mechanically if you push the slider in the base of the inhaler in the direction of the arrow.



If the inhaler is empty, it will not give an automatic puff.

Always have a new inhaler in reserve.

Store the inhaler at room temperature, max. 25°C. Keep out of direct sunlight.

Cleaning:

- Wipe the mouthpiece on the inhaler once a week with a clean, dry cloth or paper tissue.
- Do not insert a drying cloth, tissue or anything else in any part of the inhaler, as this may damage it.
- Do not take the inhaler apart.
- The inhaler must not come into contact with water.

DRY POWDER INHALER

There are several types of dry powder inhaler (DPI), but here we will refer to those that are currently most widely used in Norway.

The different pharmaceutical companies have their own patented inhalers. Inhalers work according to the principle that the medication is delivered from ready-to-use single doses stored in the inhaler so that you always have the medication with you if you have your inhaler.

The technique for inhaling the medicine into the lungs is the same for all dry powder inhalers.

A certain technique is required (coordination of exhaling and inhaling) to be able to take the medication in dry powder form. This may be attempted from the age of 5–6 years, depending on the child's degree of maturity.

Turbohaler:

Medications: Bricanyl, Pulmicort, Oxis and Symbicort



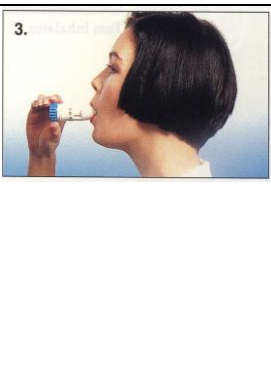



Turbohaler is a dry powder inhaler that holds 50–200 doses. There is a drying agent in the base of the inhaler that protects the medication from moisture. You will therefore hear a rattling sound when you shake the Turbohaler, even if it is empty. The dose indicator (built-in counter) shows how many doses are left in the inhaler. When the indicator starts to turn red, there are 20 doses left.

The Turbohaler consists of:

- Protective screw cap
- Mouthpiece
- A twistable coloured grip at the base for releasing the medicine
- Dose counter displaying the number of doses left in the inhaler.

Inhalation technique for Turbohaler

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| <p>1.</p>  | <p>Hold the inhaler upright.</p> |
| <p>2.</p>  | <p>Twist the coloured grip at the base backwards and forwards as far as it will go, to release a dose. You will hear a click.</p> |
| <p>3.</p>  | <p>Breathe out deeply, then place the mouthpiece firmly between your lips, making a tight seal. Take a long, forceful breath in. Do not breathe into the mouthpiece, as that may make the powder clump. Remove the inhaler and close your mouth. Hold your breath for 2–3 seconds, and exhale slowly through your nose.</p> |
| <p>5.</p>  | <p>Replace the cap after use.</p> |

It is best to stand upright to use the inhaler, preferably keeping your chin raised.

Each dose contains a small amount of medication and you may not necessarily notice any taste, even if you have taken the dose correctly. If you are not sure that you have inhaled all the medication, you may inhale once more, without causing the next dose to load. If you accidentally load two doses, you will only get one dose when you inhale.

Diskus:

Medications: Ventolin, Flutide, Seretide and Serevent.



Diskus is a dry powder inhaler that holds 60 doses. The built-in counter shows exactly how many doses are left in the inhaler. The last five doses are marked in red.

Diskus consists of:





- Attached cover
- A lever to release the dose of medication
- Mouthpiece

How to perform the inhalation:

It is best to stand upright to use the inhaler, preferably keeping your chin raised.

Each dose contains a small amount of medication and you may not necessarily notice any taste, even if you have taken the dose correctly. If you are not sure whether you have inhaled all the medication, you may inhale once more, without causing the next dose to load. If you accidentally load two doses, you will only get one dose when you inhale.

Inhalation technique for Diskus

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|  | <p>Hold the Diskus in one hand and place the thumb of the other hand on the thumb grip. Open the cover by pushing the thumb grip to the right.</p> |
|  | <p>Slide the lever away from you until the mouthpiece appears and it clicks into place, meaning that a dose has been loaded for you to inhale.</p> |
|  | <p>Breathe out forcefully, and place the mouthpiece between your lips. Close your lips firmly around the mouthpiece, to make a good seal. Breathe in deeply and quickly through your mouth. Do not breathe into the mouthpiece, as it may make the powder clump. Remove the inhaler and close your mouth. Hold your breath for 2–3 seconds and breathe out slowly through your nose.</p> |
|  | <p>Slide the cover back after use.</p> |

Easyhaler:

Medications: Giona (budesonide) and Beclomet (beclomethasone).

Easyhaler holds 100–200 doses.



Easyhaler comprises:

- Built-in dose counter, protective cover
- Mouthpiece

The dose can be released with one hand. The inhaler resembles a metered dose inhaler but does not contain any propellant gas.

If you are in doubt whether you have inhaled all the powder or whether you have released more than one dose, you can check by knocking the mouthpiece against your palm or against a table. Any excess powder will come out.

It is important always to put the mouthpiece on, to prevent doses being released automatically.

Inhalation technique for Easyhaler



1 Shake 2 Click 3 Inhale

- Remove the protective cap from the mouthpiece.
- Shake the Easyhaler and hold it in the upright position.
- Press down the upper part of the Easyhaler between your finger and thumb until you hear a click. Let go. You have now released a dose and the inhaler is ready to use.
- Breathe out slowly. Place the mouthpiece in your mouth between your teeth and seal your lips around it. Inhale deeply, slowly and evenly

Twisthaler:

Medication: Asmanex (mometasone furoate)

Inhaler with 200 micrograms (pink) or 400 micrograms (reddish-brown) per dose.



Twisthaler is a dry powder inhaler currently only for use with preventive corticosteroid treatment.

Twisthaler comprises:

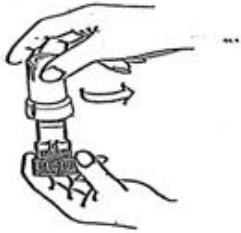
- White protective cap
- Base with dose counter (coloured)
- Container with mouthpiece

How to use Twisthaler:

- Before removing the white dust cap, you must check that the dose counter is lined up with the indented arrow on the cap. Open the inhaler by removing the white cap. Hold the inhaler in the upright position with the coloured portion (base) on the bottom. Holding the coloured base, twist the cap in a counter-clockwise direction to remove it. As you lift off the cap, the dose counter on the base will count down one by one.
- Check that the dose counter on the base is lined up with the indented arrow above the counter. Hold the inhaler in the upright position when removing the cap and before you inhale the dose.

Inhalation technique for Twisthaler

a) Remove the cap from the inhaler (Figure 1).



Figur 1: Fjerning av hetten

b) Place the inhaler in your mouth with the mouthpiece facing towards you.

c) Place the mouthpiece in your mouth, firmly close your lips around the mouthpiece and take in a rapid, deep breath (Figure 2).



Figur 2: Inhalasjon

d) Remove the inhaler from your mouth, and hold your breath for 10 seconds, or as long you comfortably can. Do not breathe out (exhale) into the inhaler.

e) Replace the cap immediately after each inhalation to close the inhaler. The cap must be properly in place and be rotated in order to load the dose for the next inhalation. Close the inhaler by rotating the cap clockwise until you hear a click. The inhaler is now fully closed (Figure 3). Be sure that the indented arrow on the cap lines up with the dose counter.



Figur 3: Lukking av inhalatoren

If another inhalation is needed, repeat steps a) to e) above.

Cleaning a dry powder inhaler:

Wipe the mouthpiece with a soft, dry cloth or paper tissue once a week, or if soiled. Do not use water or moisture.