Inhaler assessment in COPD patients: A primer for pharmacists

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Chronic obstructive pulmonary disease (COPD) is an incurable disease that affects 4.2% of Canadians 35 years of age and older.[1-3] Pharmacotherapy for COPD is prescribed to achieve 2 main goals of therapy: symptomatic improvement/quality of life and reduction in frequency and severity of exacerbations.[4] Administration of medication via inhalation is the preferred route of drug delivery for respiratory disease treatment.[3,4] The inhalation route allows for medications to be delivered directly to the intended site of action with minimal systemic absorption, resulting in enhanced clinical benefit and reduced risk of systemic adverse effects.[3,5]

Despite the benefits of inhalation therapy, patients with COPD often do not use their inhalers correctly.[6,7] A recent Canadian, prospective, observational study of 37 COPD inpatients conducted by Batterink et al.[8] found that 59% of patients made at least 1 critical error when demonstrating their inhaler technique. As patients with COPD tend to be elderly, a number of challenges can limit their ability to use an inhaler correctly, such as cognitive impairment, physical limitations, comorbidities and inadequate education on the proper use of the inhalation device(s).[6,8] Incorrect inhaler use correlates with failure in achieving the full clinical benefit from respiratory therapies.[9] It is important for pharmacists to be aware of the intricacies of each inhalation device in order to ensure that the selection of the prescribed therapeutic alternative and corresponding delivery device is appropriate for individual patients in order to optimize outcomes.

Once an appropriate device is selected and prescribed, it is the role of the pharmacist to assess and ensure that the patient or caregiver understands the proper use of the medication and device.[7] Since 2012, a total of 4 new inhaler devices and 6 new therapeutic entities, plus 3 combination therapies, have been marketed in Canada for the management of COPD.[10] Given the proliferation in the number of available inhaled therapies and devices in recent years, it is imperative that pharmacists remain up to date on the appropriate use of these devices in order to optimize patient outcomes by preventing errors in inhaler technique.

The aim of this article is to provide pharmacists with a practice overview to assess appropriateness of inhaler devices for individual COPD patients and provide accurate patient education on the available inhaler devices. A literature search was conducted using Ovid MEDLINE, PubMed, EMBASE and International Pharmaceutical Abstracts, from inception to October 2015. The following search terms were used: *chronic obstructive pulmonary disease, inhaler, device, education, instruction, differences, comparison, characteristics, pressurized metered dose inhaler (pMDI), dry powder inhaler (DPI), diskus, ellipta, breezhaler, handihaler, genuair, soft mist inhaler (SMI)*. The most recent manufacturers' product monographs were also consulted in October 2015. Data have been summarized in table format. These tables are meant to supplement the information provided by the manufacturers and information found within the literature.

Assessment of device appropriateness for individual patients

Inhaler devices have several different features that should be considered during the prescription review process in order to ensure that the

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TABLE 1 Characteristics of inhalation devices approved for treatment of COPD[3,11-30]

	Aerolizer	Breezhaler	Diskus	Diskhaler	Ellipta	Genuair	Handihaler	Metered-dose inhaler	Nebulizer	SMI	Turbuhaler
Simplicity of setup (number of steps)	5[13]	6[31]	2[31]	5[18]	1[31]	3[31]	6[31]	3[31]	9[27]	3[31]	3[31]
Dose protected from clumsy handling	No	No	No	No	No	No	No	Yes	Yes	Yes	No
Hand-breath co-ordination required	No	No	No	No	No	No	No	Yes	No	Yes	No
Minimum lung capacity required (L/min)	30[11]	50[31]	30[6]	30[6]	Not defined[32,*]	45[33]	30[7]	25[11]	Used for all lung capacities[6]	25[34]	60[7]
Single dose vs multidose	Single	Single	Multi	Multi	Multi	Multi	Single	Multi	Single	Multi	Multi
Cue dose is taken	No	Visual and audio	No	No	No	Visual	No	No	No	No	Audio
Locking mechanism after dose is taken	No	No	No	No	No	Yes	No	No	No	No	No
Dexterity require-ments	Multistep; requires fine motor skills	Multistep; requires fine motor skills	Minimal	Minimal	Minimal	Minimal	Multistep; requires fine motor skills	Minimal dexterity, hand strength to activate device[9]	Multistep; requires fine motor skills	Minimal dexterity, hand strength to load and rotate device	Minimal dexterity, hand strength to rotate device
Dose counter	N/A	N/A	Yes	Yes	Yes	Yes	N/A	N/A	N/A	Yes	Yes

*Ellipta: Not specifically defined, but in patients with a forced expiratory volume expelled in 1 second, less than 30% were able to achieve a peak inspiratory flow rate of 43 L/min.[35]

optimal device has been selected for the individual patient (Table 1). Upon receipt of a prescription for an inhaler in any COPD patient, the following factors should all be considered:

- Simplicity of setup
- Ease of use (clumsy handling and breath coordination)
- Cue that dose is taken
- Need for dose counting
- Locking mechanism
- Dexterity required
- Inspiratory capacity
- Affordability

Identification of patient-specific characteristics that may affect the appropriate use of an inhaler device is vital to ensuring optimal medication use. Key patient-specific factors to consider when ensuring appropriateness of an inhalation device for COPD patients include cognitive ability, dexterity and inspiratory capacity.[3,6,9]

Device-related factors that may affect appropriate administration include complexity of setup, dose preparation and inspiratory capacity required for optimal drug delivery. For patients who are cognitively impaired or who are inherently forgetful, consider devices that require fewer steps for setup. This population may also benefit from a device that provides either a visual or audio cue that the dose was taken.[3] Use of a device that has a locking mechanism or a dose counter should be considered in those patients who are unsure or who may continue to use their

TABLE 2 COPD inhalation device preparation[11-30,37]

Metered-dose inhaler	Insert canister into plastic actuator body. Shake well and remove mouthpiece cover. Prime device (depress canister into plastic body). Release 2 doses into the air.
Soft mist inhaler (SMI)	Remove the clear base by pushing the safety button on the side. Insert cartridge by pushing into the SMI device until a "click" is heard. Replace the clear base. Upon first use, actuate the inhaler toward the ground using "TOP" (twist device in direction of the arrows a half turn [should hear a "click"], open lid, push button) until a fine mist appears. Repeat 3 times.
Nebulizer	Draw up the desired amount of medication into the syringe and inject into the nebulizer. Draw up the desired amount of diluting fluid into the syringe and inject into nebulizer. Gently shake the nebulizer. Connect the nebulizer to the mouthpiece or mask and connect apparatus to air pump or oxygen.
Aerolizer	Remove cap. Holding base of inhaler, turn mouthpiece in direction of arrow. Remove 1 capsule from blister pack and place in capsule compartment. Turn the mouthpiece to the closed position. Keeping the inhaler in an upright position, squeeze the blue buttons on the side to pierce the capsule only once.
Breezhaler	Remove the cap and expose capsule chamber by tilting the mouthpiece open. Remove 1 capsule from blister with clean, dry hands. Place capsule in capsule chamber and close mouthpiece; a "click" will be heard when it is fully closed. Keeping the breezhaler upright (mouthpiece facing up), squeeze both buttons together once on the sides to pierce the capsule, a "click" will be heard. Release buttons fully.
Diskus	Holding the diskus in one hand, put the thumb of the other hand in the thumb grip and slide the grip away from you; this shows the mouthpiece and another lever. Slide this lever away from you until you hear a "click." Ensure device is held horizontally to prevent loss of dose.
Diskhaler	Remove mouthpiece cover and holding the corners of the white tray, gently pull the tray toward you until plastic ridges appear. Gently squeeze the ridges to completely remove the tray. With the numbers on the disk facing up, place the disk on the wheel and return the tray back into the device holder. To load the first dose, gently pull the white tray toward you and push it back into place; repeat until the number "4" is displayed in the indicator window.
Ellipta	Slide open the mouthpiece cover until a "click" is heard.
Genuair	Remove protective cap on mouthpiece. Press and release the orange or green button—dose is loaded when indicator window turns green. Ensure device is held horizontally to prevent loss of dose.
Handihaler	Open the dust cap and mouthpiece to reveal the center chamber. Remove 1 capsule from blister with clean, dry hands. Insert the capsule into the center chamber and close the mouthpiece firmly. Holding the handihaler with the mouthpiece pointing upward, press the green piercing button on the side once and release.
Turbuhaler	Remove the mouthpiece and rotate the grip at the bottom of the inhaler in one direction as far as it will go (either clockwise or counterclockwise); then turn the grip in the other direction as far as it will go—a "click" should be heard.

inhalers once empty. This is a potential problem encountered with the pMDIs, as one study found that up to 49% of patients were unsure whether their device still contained medication.[36]

Little data are available on the dexterity requirements of the individual inhalers. However, tremors and dexterity should be considered for patients who suffer from arthritic, neurologic or musculoskeletal conditions. DPIs may be suboptimal in patients with tremors, as shaking or instability of the device may result in loss of the dose.[9] Patients with reduced dexterity

TABLE 3 Common errors with inhaler use

Device type	Specific devices	Common errors
Metered-dose inhaler[3,6,7,25,26]	All metered-dose inhaler devices	Not shaking device prior to use Not removing the mouthpiece cover Not holding breath for the required time frame Not waiting 30 seconds between doses if more than one dose is required Not getting a good seal with the mouthpiece Not coordinating actuating the device and inhaling at the same time
Dry powder inhaler[3,6,7,17,19-23,37]	All dry powder inhaler devices	Not achieving a strong, deep, forceful inspiration Not holding breath for the required time frame Exhaling into the device Not holding the device steady once dose is prepared
	Diskus	Playing with the lever that loads the dose; will result in loss of doses
	Ellipta	Covering the air intake vents
	Genuair	Not completely releasing the orange or green button prior to inhalation
	Turbuhaler	Holding the mouthpiece when turning the grip
Capsule-containing inhalers[3,6,12-15,23]	All capsule-containing inhalers	Swallowing capsules Inserting the capsule into the mouthpiece and not the capsule chamber Piercing the capsule more than once Exhaling into the device Not holding breath for the required time frame Not holding the device steady once dose is prepared Covering the air intake vents
Other	Soft mist inhaler [27-29]	Failing to properly open the lid by the side of tab of the lid and inadvertently losing the dose Covering the air intake vents on the mouthpiece Not taking a slow, deep breath, breathing in as deeply and for as long as is comfortable Not holding breath for the required time frame
	Nebulizer[3,6,7]	Not getting a good seal with the mask Failing to properly clean the machine
	Diskhaler[17]	Not piercing both sides of the blister with the needle Not holding breath for the required time frame

may have trouble using devices that require loading of a capsule into the device.[9] The capsules are often small and require extraction from a foil storage package and puncturing the capsule in the device prior to administration.[9] This population may be better suited to a preloaded device. Hand-breath coordination is also an issue that may be experienced in this population.[9] Devices that allow for inhalation to be separated from actuation (e.g., pMDI with spacer) or in which actuation is not required (e.g., nebulizer) can overcome this concern.[6] As well, the longer duration of delivery provided by the SMI (1.5 seconds vs 0.5 seconds of other inhalers) may also minimize the need for coordination between actuation and inhalation.[6]

Each inhaler device has a different minimum peak inspiratory flow required for optimal drug delivery. COPD can result in a progressive decline in lung function, potentially affecting the benefits achievable from certain devices.[7,11] As such, inspiratory capacity should be evaluated on a regular basis in relation to prescribed therapy.[7] A review of current lung function (e.g.,

pulmonary function tests) in relation to the suggested minimum requirements of the inhaler as defined by the manufacturer can assist in determining whether an inhaler is suitable for a given patient. As a general rule, the importance of matching a device to lung function increases as lung function declines.[7]

Last, affordability of the device is another key factor to consider when assessing appropriateness of inhaler suitability for patients.[6] High medication costs can contribute to nonadherence, and the cost and coverage of inhalers can vary across provinces and territories.[12] Ensuring affordability of prescribed COPD therapy can help to overcome this barrier.

Patient education considerations

It is essential for pharmacists to counsel patients on their inhalers and demonstrate how to use the specific devices (Table 2).[6] It is equally important to have patients demonstrate how they use their inhaler to allow for further assessment by the pharmacist of patient understanding and ease of use.[6] This process allows the patient to witness the appropriate medication use and allows the pharmacist to assess a patient's understanding and technique. The pharmacist should be aware of the common errors that can occur with each device (Table 3) and look for these when the patient demonstrates use.[3] Pharmacists should also be aware of and actively communicate to patients the drug- and device-specific needs for repeat priming, as they may differ across medications and devices.[3] Repeated education and demonstration of how to use any inhaler on a regular basis is important to ensure that patients are continually receiving the benefits of their medications.[6,7]

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