

# Effect of training by a physician on dynamics of the use of inhaler devices to improve technique in patients with obstructive lung diseases

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## ABSTRACT

**Background:** Pharmacotherapies for obstructive lung diseases are dependent on agents delivered via inhaler devices, and the correct technique is essential for efficiency of these drugs.

**Objective:** To determine the rate of incorrect inhaler techniques among patients with pulmonary diseases and the efficacy of delivering physician-provided training to patients by letting them practice with their inhaler devices.

**Methods:** Patients ages  $\geq 18$  years with asthma, chronic obstructive pulmonary disease, or asthma chronic obstructive pulmonary disease overlap syndrome were enrolled. At the first visit, the patients were requested to use their own inhalers that they were currently on for initial evaluation of their inhalation technique. Correct and incorrect techniques were determined according to steps previously described in the literature. At the same visit, the physician provided practical training on faulty techniques detected, and a control visit was scheduled.

**Results:** The study involved 108 patients, and 158 different inhalation techniques were assessed. Types of inhaler devices included in the study were metered-dose inhaler and five types of dry-powder inhalers. Fifty-six incorrect practices (35.4%) were noted. Although 64 patients (59.3%) used all of their inhaler devices with the correct technique, 44 (40.7%) used one or more inhalers inappropriately. At the control visit, the patients who misused their inhalers decreased significantly, to 8.3% ( $p < 0.001$ ). The faulty technique ratio was decreased to 7.0%, which yielded the success of practical training as 80.4%.

**Conclusion:** Incorrect inhaler technique is still a problem for patients with obstructive lung diseases even in urbanized areas. Physician-provided practical training on the use of inhaler devices was an effective tool in the correction of inhaler techniques.

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Asthma and chronic obstructive pulmonary disease (COPD) are still the two major diseases of chest diseases outpatient clinics. Pharmacotherapies for both diseases are mainly dependent on agents delivered via different inhaler devices. The correct technique in using inhaler drugs is the most important factor for the efficiency of the treatment. This issue is a concern mentioned in major guidelines for obstructive lung diseases, viz. the Global Initiative for Chronic Obstructive Lung Disease<sup>1</sup> and the Global Initiative for Asthma guidelines.<sup>2</sup>

Among the key new features of the Global Initiative for Asthma 2014 report, emphasis is to maximize the

benefit that can be obtained from available medications by addressing common problems, such as incorrect inhaler technique and poor adherence before considering a step-up in treatment. In this report, incorrect inhaler technique was identified as a risk factor for asthma exacerbations and poor asthma control. In parallel, distinguishing between severe asthma and asthma that is uncontrolled due to incorrect inhaler technique and/or poor adherence is deemed important. Observing the inhaler technique of a patient is considered as a step of asthma assessment, and assessing inhaler technique at every opportunity is advised.<sup>2</sup> In the Global Initiative for Chronic Obstructive Lung Disease 2015 report, inhaler technique is also deemed important, not inferior to the Global Initiative for Asthma report. According to this report, ensuring that the inhaler technique is correct and rechecking this at each visit is considered essential for management of COPD, and correct inhaler technique is listed among the preventive measures for exacerbations.<sup>1</sup>

With the metered-dose inhalers (MDI) being the first inhalers introduced into the market, many different user-friendly dry powder inhalers (DPI) were developed in the past decades. Different inhaler device options are now on the market for clinicians' choices in

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treatment of asthma and COPD. However, the correct use of the inhaler device being the crucial step for treatment compels clinicians to be aware of misuse rates among patients and to search for measures to optimize the correct use of inhalers. The present study was designed to determine the rates of the incorrect use of inhalers in patients with obstructive lung diseases and to find out the effect of providing training to patients by physicians letting them practice with their inhaler devices on correction of misuse rates.

## METHODS

The study was conducted in Ankara Numune Research and Training Hospital Immunology and Allergy Outpatient Clinic between December 2014 and March 2015. The study center was located in a highly urbanized area in Ankara, Turkey. All patients who attended the outpatient clinic for routine control or because of aggravation of their obstructive lung diseases were consecutively enrolled in the study if they were routinely using inhalation treatment for their diseases and if they volunteered to participate. Inclusion criteria were age  $\geq 18$  years, a diagnosis of asthma or COPD or asthma COPD overlap syndrome, and on any type of inhaler treatment for at least 1 month, and volunteering to participate in the study. The fact about whether the patients had previously received any practical information on inhaler device usage was not considered for inclusion or exclusion of the patients because the aim of the study was to reveal the ratio of incorrect inhaler technique among patients with obstructive lung diseases. In the first visit, the patients were requested to use their own inhaler devices that they were already prescribed for their diseases, and the inhaler technique was evaluated as being "correct" in all steps or as "incorrect" if any mistakes were detected in any of the steps. This assessment was done by a physician (K.A.) who was a chest diseases and allergy specialist and thus specifically trained on usage of each inhaler device.

Not removing the cap; not shaking the inhaler; not exhaling before actuation; not holding the inhaler in the upright position; and more actuations for a single inhalation; actuation against teeth, lips, or tongue; actuation in the second half of inspiration; activation after end of inhalation; stopping inhalation immediately after firing; forceful inhalation; inhalation through nose during and after actuation; absent or short ( $< 2$ – $3$  seconds) breath-holding after inhalation were the faults considered for MDI users. Failure to open the device, failure to insert the capsule, failure to pierce the capsule, incorrect dose loading, keeping the inhaler inclined during loading, exhaling into the device mouthpiece after loading, stopping inhaling prematurely, inhaling by nose, not sealing lips around

mouthpiece during inhalation, slow and not forceful inhalation, exhaling into the device mouthpiece after inhalation, absent breath-holding after inhalation, not controlling whether some powder drug rests in the capsule after inhalation were the faults considered for users of the Handihaler (Boehringer Ingelheim International GmbH & Co., Ingelheim am Rhein, Germany), Aerolizer (Novartis Pharma AG, Basle, Switzerland), Diskus (Glaxo Wellcome Production, Evreux, France), Sanohaler (Sanovel Pharmaceutical Inc, Istanbul, Turkey), and Turbuhaler (AstraZeneca AB, Södertälje, Sweden).<sup>3</sup>

At the same visit, after initial evaluation of the inhaler technique, the same physician provided training to patients on the proper technique by allowing them to handle and inhale by using their own devices based on the patients' observed technique. After the physician was assured that the patient had become skillful in the use of the inhaler device, the patient was discharged and a second visit, as a control visit, was scheduled within 3 months' time. At the control visit, the patients were again requested to use their own inhaler devices and were evaluated for any mistakes in inhaler techniques.

The ratio of incorrect inhaler use among patients with obstructive lung diseases was determined, and demographic characteristics of the subjects were compared between patients who correctly used and those who misused their inhalers. Also, for the aim of the study, effectiveness of physician-provided practical training in correcting the inhaler technique was assessed by using percentages of the study population who misused their inhalers before and after training. Statistical analysis was made with SPSS 15.0 for Windows (SPSS Inc, Chicago, IL). Independent-samples *t*-test was used to compare continuous variables, and the  $\chi^2$  test was used to compare categorical variables. The McNemar test was used to assess the difference before and after intervention in the group of patients with an incorrect inhaler technique. A significance level of 0.05 was used in all analyses. The study was approved by the ethics committee of the Ankara Numune Education and Research Hospital (E-14-377), and written informed consent was obtained from all study participants.

## RESULTS

Study population consisted of 108 patients ages  $\geq 18$  years with a diagnosis of asthma, COPD, or asthma COPD overlap syndrome who attended our outpatient clinic. All the patients were routinely using one or more types of inhaler devices for their obstructive lung diseases for at least 1 month's duration. The clinical and demographic properties of patients are demonstrated in Table 1. For each patient involved in the

**Table 1 Clinical and demographic properties of the study population (*n* = 108)**

|                              |             |
|------------------------------|-------------|
| Sex, no. (%)                 |             |
| Women                        | 54 (50)     |
| Men                          | 54 (50)     |
| Age, mean (SD), y            | 47.5 (16.4) |
| Diagnosis, no. (%)           |             |
| Asthma                       | 78 (72.2)   |
| COPD                         | 21 (19.4)   |
| Asthma COPD overlap syndrome | 9 (8.3)     |
| Smoking status, no. (%)      |             |
| Never smoker or ex-smoker    | 57 (52.8)   |
| Active smoker                | 51 (47.2)   |
| Level of education, no. (%)  |             |
| Noneducated                  | 8 (7.4)     |
| Primary school               | 49 (45.4)   |
| High school                  | 21 (19.4)   |
| University                   | 32 (29.6)   |

SD = standard deviation; COPD = chronic obstructive pulmonary disease.

**Table 2 Inhaler devices that the patients were using in their treatment regimen (*n* = 108)**

| Inhaler Device       | No. (%)   |
|----------------------|-----------|
| Metered-dose inhaler | 64 (59.3) |
| Aerolizer            | 14 (13.0) |
| Turbuhaler           | 23 (21.3) |
| Diskus               | 23 (21.3) |
| Handihaler           | 17 (15.7) |
| Sanohaler            | 17 (15.7) |

study, use of all inhaler devices that the patient used were observed for correct or incorrect technique. Six different inhaler devices were noted, and 158 different inhalation practices in total were assessed in the study population (Table 2). Sixty-four of 108 patients (59.3%) used all of their own inhaler devices with the correct technique, whereas 44 patients (40.7%) used their inhaler devices inappropriately. Among 158 different inhalation practices assessed, 56 incorrect practices with inhaler devices were noted, which yielded a faulty inhaler technique ratio of 35.4%.

Age was not statistically significantly different between the patients who used all of their inhalers correctly and those who had an incorrect inhaler technique with at least one device ( $46.6 \pm 17.2$ ,  $48.8 \pm 15.5$ ;  $p = 0.490$ ). An incorrect inhaler technique was significantly higher in women compared with men (28/54 [females] versus 16/54 [males];  $p = 0.019$ ). An incorrect inhaler technique was not significantly different between active smokers and nonsmokers (22/51 and 22/57, respectively;  $p = 0.632$ ). Incorrect inhaler technique

ratios decreased as the patients' level of education increased, such as 66.7% in patients who were not educated, 44.9% in patients with a primary education, 42.9% in patients who graduated from high school, and 28.1% in patients who graduated from university, but the difference among the groups was not statistically different ( $p = 0.244$ ).

For the aim of the study, after assessment of the inhaler technique by direct observation, practical education was given by the chest diseases and allergic diseases specialist physician to patients who performed an incorrect inhaler technique. Thereafter, in the scheduled control visit, the inhaler techniques of the patients were reassessed. In this scheduled control visit, the percentage of the patients who used their devices with an incorrect inhaler technique decreased significantly after practical training provided by the physician in the first visit (40.7% versus 8.3%;  $p < 0.001$ ). Post-training incorrect inhaler technique ratio was 12.5% with MDIs and it ranged from 0–8.7% with DPIs, depending on the type of device. In total, 11 incorrect inhaler techniques were observed during the control visit, so that the faulty technique ratio was decreased to 7.0%. For the aim of the study, the percentage change was calculated as ([faulty use in first visit] – [faulty use in control visit]) / ([faulty use in first visit]) and was found to be 80.4% (Table 3).

## DISCUSSION

Analysis of the results of the present study confirmed that an incorrect inhaler technique was a current problem in the treatment of patients with obstructive lung diseases no matter what type of inhaler device was used. Although the study was conducted in an urbanized location of the capital city of Turkey, it seemed that there continued to be a significant proportion of patients who did not know how to appropriately use their medication and that this could be improved with education. The study revealed that physician-provided practical training of patients on inhaler device use was an effective tool in correction of the mistakes in inhalation techniques.

One of the most crucial steps in delivery of the pharmaceuticals into airways for maximizing the benefit of the inhaler drugs in asthma and COPD is ensuring correct inhaler technique, which is the responsibility of all health care providers. Despite the introduction of a variety of user-friendly devices, a faulty inhalation technique has reported to be an important problem both in patients with asthma and in patients with COPD. Two different reviews in 2008 have brought to attention that incorrect inhaler techniques with both DPIs and MDIs were in considerably high rates and negatively affected disease control. The percentages of faulty techniques with DPIs and MDIs

Table 3 Incorrect inhaler technique ratios in the first and control visits, and percentage of change in incorrect technique ratios after directly observational training

| Inhaler Device                        | Incorrect Inhaler Technique at First Visit, no. (%) | Incorrect Inhaler Technique at Control Visit, no. (%) | % Change |
|---------------------------------------|-----------------------------------------------------|-------------------------------------------------------|----------|
| Metered-dose inhaler ( <i>n</i> = 64) | 30 (46.9)                                           | 8 (12.5)                                              | 73.3     |
| Aerolizer ( <i>n</i> = 14)            | 7 (50.0)                                            | 1 (7.1)                                               | 85.7     |
| Turbuhaler ( <i>n</i> = 23)           | 6 (26.1)                                            | 0 (0)                                                 | 100      |
| Diskus ( <i>n</i> = 23)               | 7 (30.4)                                            | 2 (8.7)                                               | 71.4     |
| Handihaler ( <i>n</i> = 17)           | 5 (29.4)                                            | 0 (0)                                                 | 100      |
| Sanohaler ( <i>n</i> = 17)            | 1 (5.9)                                             | 0 (0)                                                 | 100      |
| Total ( <i>n</i> = 158)               | 56 (35.4)                                           | 11 (7.0)                                              | 80.4     |

were reported to vary between 4 and 94% and between 47 and 91%, respectively, in different studies.<sup>4,5</sup> Unfortunately, not much progress was recorded in inhalation techniques of patients during the recent years. In 2011 Melani *et al.*<sup>3</sup> reported that incorrect inhaler technique was encountered in 12% of MDI users and 34.5–43.5% of DPI users. A faulty technique was found to be related to older age and lower level of education but not to sex, pulmonary function, or the number of different inhaler devices in the treatment regimen.<sup>3</sup> A recent study conducted in 2011–2012 of patients with obstructive lung diseases who were living in rural and/or urban areas in the central Anatolia region of Turkey showed that incorrect technique concerning inhaler use was 49%.<sup>6</sup>

The present study was conducted in the capital city of Turkey and revealed that an incorrect inhaler technique was a current problem in patients with obstructive lung diseases who live in highly urbanized regions. In the present study, the rate of incorrect inhaler technique was found to be 40.7%. Female sex was the only factor found to be related to high rates of incorrect inhaler technique in patients, whereas no effect of age or smoking status was observed. Higher rates of an incorrect inhaler technique was also determined as the level of education lowered, although the differences were not significant.

The major finding of the study that contributed to the current literature was that the misuse rates in inhaler devices could be decreased extensively with providing practical training on inhaler devices to patients by physician. In the study, the misuse ratio among patients decreased to 8.3%, and the overall ratio of incorrect inhaler techniques decreased by 80.4% after training. The study findings are also important to reflect long-term effectiveness of training because rechecking the inhaler technique was scheduled for the next visit after training in the study design.

Controlling the current practice of patients' use of their inhaler devices and correcting the mistakes appropriately should be one of the essential steps in

patient management. Although being the most crucial tool in management of obstructive lung diseases, correct inhaler techniques are generally disregarded by many physicians. As with most countries, in our country, there is no assigned health care staff to provide education on the use of prescribed inhaler devices. Accordingly, this issue is necessarily the responsibility of the practitioner who prescribes the drugs to the patient. However, although the practitioners prescribe the drugs in clinics, they verbally inform patients how the device is used. As they provide information to the patient they may or may not use a demonstration device. So, during this education, the patients do not have any chance to handle the device or inhale the drug or placebo in it. In the current study, the patients were trained about the use of their own inhaler devices by applying all the steps required for correct inhalation while they were observed, and they were simultaneously corrected as needed by the physician. According to the study results, this way of training yielded high success rates in the correction of inhaler misuses.

To assure that patients are appropriately educated on inhalation techniques, controlling and correcting physicians' knowledge on correct inhaler technique must also not be ignored. In one study, it was found that adequate knowledge of inhaler devices and proper administration technique is below acceptable rates among physicians, which indicated that formalized training on various inhaler devices should be provided.<sup>7</sup> Moreover, it is known that checking and retraining should be repeated regularly because the proper inhaler technique may decline with time.<sup>8</sup> Thus, it may not always be practical that inhaler technique is assessed by physicians at all visits. Health care staff other than physicians may also play an active role in improving patients' inhaler skills. Pharmacists and nurses may also be trained in inhaler techniques so that they actively take a role in patients' follow-up and provide them effective inhaler techniques.<sup>9,10</sup> Encountering adequate knowledge of inhaler use by the health

care staff is also required because it may be below satisfactory levels.<sup>11</sup>

In revealing that incorrect inhaler technique is still a current problem among patients with pulmonary diseases, the present study also implicated that inhaler devices should be user friendly. This rationale, in fact, has been one of the concerns of inhaler device manufacturers in the past years. Albuterol multidose breath-actuated DPI with an integrated dose counter, which simplifies dosing by eliminating the need to coordinate inhalation with actuation associated with MDIs, is a recently manufactured product. Study results concerning the device's use are very promising, reporting >90% satisfaction rates among patients with asthma and COPD in means of ease of handling, using and taking, and inhaling a dose from the device.<sup>12</sup>

## CONCLUSION

The current study was important to reflect the rates of incorrect inhaler technique is still unacceptably high among patients with obstructive lung diseases in Turkey no matter what type of inhaler device is used and emphasized the efficiency of physician-provided practical training in correction of inhaler techniques. Strengths of the study included that the patients who were enrolled in study were using a wide variety of inhalers so that the results were valid for five different DPIs and MDIs marketed in Turkey, and reassessment of the inhalation technique was done in the scheduled next visit, instead of just after practical training so that long-term efficiency of training is assessed. Accordingly, it is logical to train health care professionals other than medical physicians on correct inhaler techniques and to use them in training patients' education once inhalers are prescribed and whenever again as needed.

## REFERENCES

1. Global Strategy for the Diagnosis, Management and Prevention of COPD, Global Initiative for Chronic Obstructive Lung Disease (GOLD) 2015. Available online at <http://www.gold-copd.org/>; accessed October 9, 2015.
2. Global Strategy for Asthma Management and Prevention, Global Initiative for Asthma (GINA) 2015. Available online at <http://www.ginasthma.org/>; accessed October 9, 2015.
3. Melani AS, Bonavia M, Cilenti V, et al. Inhaler mishandling remains common in real life and is associated with reduced disease control. *Respir Med* 105:930–938, 2011.
4. Lavorini F, Magnan A, Dubus JC, et al. Effect of incorrect use of dry powder inhalers on management of patients with asthma and COPD. *Respir Med* 102:593–604, 2008.
5. Virchow JC, Crompton GK, Dal Negro R, et al. Importance of inhaler devices in the management of airway disease. *Respir Med* 102:10–19, 2008.
6. Aydemir Y. Misuse of inhalation devices-effective parameters and the role of education. *Solunum* 15:32–38, 2013.
7. Calıkaner AZ, Öztürk C, Ceylan E, et al. The knowledge and considerations of the physicians regarding the inhaler devices in asthma and COPD: The INTEDA-1 study. *Tuberk Toraks* 61:183–192, 2013.
8. Crompton GK, Barnes PJ, Broeders M, et al. The need to improve inhalation technique in Europe: A report from the Aerosol Drug Management Improvement Team. *Respir Med* 100:1479–1494, 2006.
9. Armour CL, Reddel HK, LeMay KS, et al. Feasibility and effectiveness of an evidence-based asthma service in Australian community pharmacies: A pragmatic cluster randomized trial. *J Asthma* 50:302–309, 2013.
10. Kuethe MC, Vaessen-Verberne AA, Elbers RG, and Van Aalderen WM. Nurse versus physician-led care for the management of asthma. *Cochrane Database Syst Rev* 2:CD009296, 2013.
11. De Tratto K, Gomez C, Ryan CJ, et al. Nurses' knowledge of inhaler technique in the inpatient hospital setting. *Clin Nurse Spec* 28:156–160, 2014.
12. Given J, Taveras H, and Iverson H. Prospective, open-label evaluation of a new albuterol multidose dry powder inhaler with integrated dose counter. *Allergy Asthma Proc* 37:199–206, 2016. □

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