

# Effects of instruction by practice assistants on inhaler technique and respiratory symptoms of patients. A controlled randomized videotaped intervention study

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**Background.** Many patients with asthma or chronic obstructive pulmonary disease use their medication inhalers incorrectly. General practitioners, pharmacists and other health care providers do not always have the opportunity to instruct patients in correct inhaler technique.

**Objective.** To find out whether the inhaler technique and respiratory symptoms of patients can be improved after instruction by practice assistants.

**Methods.** Single blind, randomized intervention study in which 48 patients who had been using a dry powder inhaler for at least one month took part. Their inhaler technique was videotaped on two visits with a two-week interval between visits. The inhaler technique on the videos was subsequently scored by two experts on nine criteria. At both visits the patients completed a questionnaire about their respiratory symptoms. After the first video, 25 patients were randomly chosen to receive instruction from one of six practice assistants who had followed a one evening course about inhaler instruction, and who had been issued an instruction-set.

**Results.** The patients who received instruction had a significantly greater reduction in number of mistakes at the second visit than the patients who did not ( $P = 0.01$ ). The instructed patients also reported less dyspnoea at the second visit ( $P = 0.03$ ). No effect of instruction was found on wheezing, cough and sputum production.

**Conclusion.** The inhaler technique of patients can be improved significantly by the instruction of patients by trained practice assistants, possibly resulting in less dyspnoea.

**Keywords.** Administration-inhalation, obstructive lung diseases, airways symptoms, patient-education, general practice.

## Introduction

It is well known that patients with asthma or chronic obstructive pulmonary disease (COPD) use their inhalers incorrectly. This is particularly true with metered dose inhalers,<sup>1,2</sup> but more recently has also been shown to be the case with dry powder inhalers<sup>3–8</sup>

which should be easier to use.<sup>9</sup> Correct usage of dry powder inhalers ranges from 5–78%.<sup>4,6</sup> Poor inhaler technique can result in reduced lung deposition of the active drug,<sup>10</sup> increased symptoms,<sup>11</sup> reduced effect on lung function,<sup>11–13</sup> higher cost<sup>14</sup> and perhaps more side-effects and less compliance.

Our aim was to improve inhaler technique by using general practice assistants to educate patients. We chose practice assistants for the following reasons: 1) most patients with asthma or COPD are treated by GPs;<sup>15,16</sup> 2) GPs and other health care providers do not always give correct instructions for good inhaler technique;<sup>17–20</sup> 3) health care providers rarely have the opportunity to teach patients correctly. Pharmacists may

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be another option,<sup>20,21</sup> but certain conditions need to be met before this is possible.<sup>7</sup> GP assistants may be more suitable to perform this task, but specific training is required since their level of medical education is very variable, at least in The Netherlands; 4) there is little literature available about the effects of instruction on inhaler technique<sup>5,7,22,23</sup> and we have found no information on its effect on respiratory symptoms, suggesting that this aspect has not previously been studied.

For these reasons the Netherlands Asthma Foundation developed a one-evening course and designed an accompanying instruction-set for practice assistants about teaching inhaler technique. In the Netherlands, practice assistants follow a three year training course in the administrative aspects of medical reception work and the execution of simple nursing duties. Thus their duties fall half-way between those of a receptionist and a practice nurse.

We investigated whether the inhaler technique and respiratory symptoms of patients who had been using a dry powder inhaler for at least one month can be improved after instruction by practice assistants, in a controlled single-blind randomized intervention study. Dry powder inhalers were chosen because in the Netherlands they are prescribed more often than aerosols and in other countries their use is growing.

A special feature of this study is that it was controlled and that it was designed in a single-blind manner to prevent observer bias by videorecording the patient's inhaler technique. In most other studies the observers knew which patients had been instructed and knew whether they were being observed before or after instruction.<sup>7,23</sup> The use of video to check patients' inhaler technique has been performed only once before in The Netherlands<sup>22</sup> but never before elsewhere.

## Methods

### Subjects

From pharmacists' records 232 patients of a health care centre with six GPs had used a dry powder inhaler during the last three months. GPs chose 124 of them as being capable of or willing to participate in this study. Of these, 104 were randomly selected and invited to participate. There were 50 patients who agreed to participate, of whom 48 used at least one dry powder inhaler. These 48 patients are presented here.

### Netherlands Asthma Foundation Instruction course and set

The six practice assistants from the health centre attended a 2½ hour course on inhaler instruction. Each was issued with an instruction-set consisting of a case containing seven different types of dry powder inhaler, placebos, checklists, instruction cards and patient leaflets.

### Design and measurements

All patients visited the practice on two occasions at an interval of two weeks. At each visit patients completed a questionnaire about the use of their inhaler and the grade of dyspnoea, wheeze, cough or sputum in the last two weeks. These symptoms were scored on a scale from zero to three, zero being no symptoms and three being symptoms all the time. Patients who used more than one inhaler were asked in which order they used them. Patients who used an inhalation corticosteroid were asked whether they rinsed their mouth after inhaling.

At both visits the patients were asked to demonstrate how they usually used their inhalers and this was videotaped on each occasion. A microphone hung around their necks recorded their breathing sounds to check whether expiration and inspiration were adequate. After the first demonstration 25 patients were randomly selected to receive instruction from a practice assistant (instruction group). The other 23 patients who received no instruction formed the control group. The videotapes, viewed in random order, were judged by two investigators who did not know which video came from which patient at which visit. The inhaler technique was scored on the same nine items as shown in Table 2 irrespective of minor differences in the instructions on the use of the dry powder inhalers. These criteria for inhaler technique were developed by the Netherlands Asthma Foundation after literature study and consensus between five experts and they were selected according to their relevance on maximal lung deposition. Although the items are not equally important for lung deposition, it was not considered useful in this study to weigh them differently. If there was disagreement between the investigators the videotapes were viewed repeatedly until consensus was reached.<sup>24</sup>

In patients using two or more dry powder inhalers the mean number of mistakes was used in the analysis. Item 8 (breathe out) was always scored as correct if item 9 (repeat) was not performed because visible exhalation is unnecessary if a second inhalation is not performed. When two or more inhalations were performed items 3-7 were scored as incorrect if at least once they were performed incorrectly.

### Statistical analysis

The data were analysed by SPSS/PC+. Paired and unpaired Student's *t*-tests were used to judge the differences in the total number of inhalation mistakes between visits and groups respectively. Their non-parametric equivalents, the Wilcoxon Rank Sum and Mann-Whitney test, were used to test the differences in scores on dyspnoea, wheeze, cough and sputum between the visits and groups respectively.

The intergroup differences in change in number of mistakes and symptom scores were also tested using an unpaired Student's *t*-test and Mann-Whitney tests

respectively. Chi-squared tests were used for differences in mouth rinsing and the order in which the medications were used. A possible relation between symptoms scores and total number of mistakes was tested by Pearson's correlation coefficient.

This study was approved by the Medical Ethical Committee of the University Hospital in Leiden.

## Results

### Patient characteristics

The 48 patients were aged between 15 and 85 years (mean 53, SD 19 years). Twenty-nine (60%) were male. Thirty-nine patients used only one type of dry powder inhaler, eight two inhalers, and one three inhalers. Forty patients used a Rotahaler, six a Diskhaler, four an Ingelheim Inhaler, three a Spinhaler, three a Cyclohaler and two a Turbuhaler. The Ingelheim Inhaler, Spinhaler and Cyclohaler have to be loaded with a capsule that is pierced before use. The patients had been using the

inhalers for between one month and 22 years (mean six, SD five years). Eleven (23%) said they had received no instruction but might have read the package insert. In patients who had received instruction this had generally been on one occasion only when starting their medication and without subsequent review of their inhaler technique. All patients used a bronchodilator of which 44 were beta2-agonists and six anticholinergics. In addition 31 patients inhaled a corticosteroid and six used cromoglycate. Of these six patients three also used inhaled corticosteroids. Therefore 34 patients used more than one medication.

### Baseline data

At visit 1 only 6% of all patients used their dry powder inhaler(s) correctly as shown in Table 1. Most mistakes were made with 'breathe out' before inhaling and with 'holding breath for 5 seconds', as shown in Table 2. No correlation was found between the number of mistakes in inhaler technique and symptom scores.

TABLE 1 Number of patients in the control (n = 23) and instruction groups (n = 25) making no or a certain number of mistakes in inhaler technique at the two visits

Visit	1			2	
	C	I	both	C	I
Patient group					
Number of mistakes					
0	2	1	3	2	5
1	4	7	11	6	8
2	11	8	19	6	8
3	5	7	12	6	4
4	1	2	3	3	0

C: control group; I: instruction group.

TABLE 2 Number of patients from the control (n = 23) and instruction group (n = 25) that made mistakes at demonstrating their inhaler techniques at the two visits

Visit	1			2	
	C	I	both	C	I
Patient group					
Item					
1. prepare inhaler incorrectly	1	2	3	3	2
2. hold inhaler horizontal	4	1	5	2	3
3. breathe out	15	14	29	15	7
4. close teeth and lips around mouthpiece	0	0	0	1	1
5. inhale powerfully and deeply	1	4	5	2	3
6. take inhaler out of mouth	3	2	5	3	5
7. hold breath 5 seconds	16	18	34	13	10
8. breathe out*	1	2	3	2	0
9. repeat from item 4*	4	9	13	8	5
mean number of mistakes	1.9	2.0	2.0	2.1	1.4
SD	0.9	1.0	1.0	1.2	1.0

C: control group; I: instruction group; \* not necessary for Turbuhaler.

At visit 1, of the 34 patients who used more than one medication 19 ( $n = 26$ ; eight missing) (73%) patients used them in the right order (beta2-agonists first). Nine of the 31 (29%) corticosteroid-users never or only sometimes rinsed their mouth after inhaling. Twenty-five patients were instructed after visit 1. Patients in the instruction and control groups did not differ significantly with respect to age, sex, duration of inhaler use or inhaler types, their initial mean number of mistakes and symptom score.

#### Effect of instruction on inhaler technique

The patients who received instruction had a significantly greater reduction in number of mistakes at the second visit than the patients who had not ( $t = 2.59$ ,  $df = 45$ ,  $P = 0.01$ ) (Figure 1). In the control group 10 patients made the same number of mistakes at both visits, six patients made less and seven patients made more mistakes at the second visit. In the instruction group nine patients made the same number of mistakes at both visits, 13 patients made less and three patients more mistakes at the second visit. Instruction had a small but not significant effect on mouth rinsing and the order in which the medications were used.

#### Effect of instruction on respiratory symptoms

The instruction group reported significantly less dyspnoea after instruction ( $z = -2.0$ ,  $P = 0.03$ ) (Figure 2). However no significant difference in dyspnoea score was found between the two groups at visit 2 (Table 3) or in the change in dyspnoea score between the groups. For wheezing, cough and sputum no significant differences were found between the two visits or between the two patient groups.

## Discussion

This study confirms that most patients do not use their dry powder inhaler correctly. Furthermore, it was shown that the inhaler technique of patients can be significantly improved after instruction by practice assistants. Interestingly there was also a positive effect of instruction on dyspnoea which had not been reported

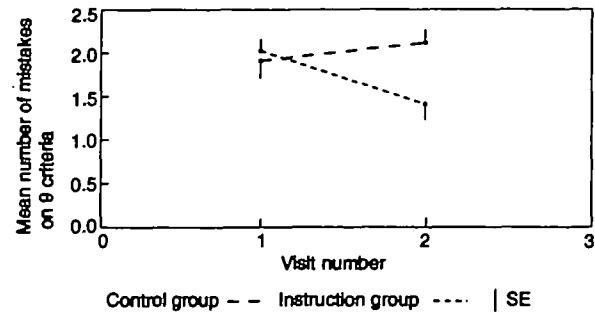


FIGURE 1 Mean number of mistakes in inhaler technique at both visits in instruction ( $n = 25$ ) and control group ( $n = 25$ )

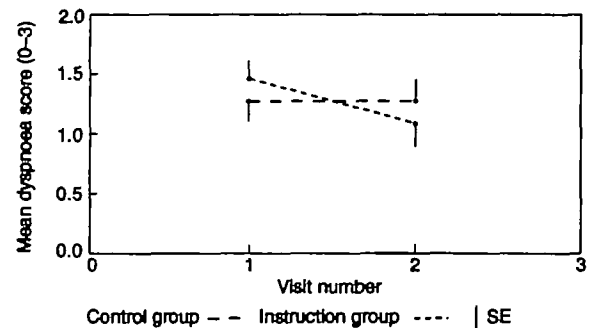


FIGURE 2 Dyspnoea score at two visits in instruction ( $n = 25$ ) and control group ( $n = 23$ )

previously. It is not clear to what extent the patients studied are representative of all patients in general practice using asthma medication. However, these results may well hold for those patients who are inclined to participate in such an instruction programme in everyday practice.

In this study inhaler technique was judged by videotaped demonstration, a new development that has rarely been used before.<sup>22</sup> This technique had two important advantages. Firstly, it made it possible to perform a single-blind study in which the experts did not know which recording came from which person at which visit. Secondly, repeatedly playing the tapes enabled consensus to be reached.<sup>24</sup> In contrast some items were not so easy to judge in some patients, for

TABLE 3 Mean (standard deviation) symptom scores (0-3) in the control ( $n = 23$ ) and instruction ( $n = 25$ ) group at both visits

Visit	1			2	
	C	I	both	C	I
dyspnoea	1.3 (0.9)	1.5 (1.0)	1.4 (1.0)	1.3 (0.9)	1.1 (0.8)
wheeze	1.0 (1.0)	0.8 (1.0)	0.9 (1.0)	0.8 (0.9)	0.9 (0.9)
cough	1.2 (1.2)	1.5 (1.2)	1.4 (1.2)	1.1 (1.2)	1.4 (1.2)
sputum	1.0 (1.2)	1.1 (1.2)	1.0 (1.2)	1.0 (1.2)	1.1 (1.2)

C: control group; I: instruction group.

example, 'breathe out' and 'close teeth (and lips) around mouthpiece'.

The inadequate baseline inhaler technique also found by other researchers<sup>3-7</sup> can be explained by several factors. First, patients are often inadequately instructed in their correct use. In this study 23% of the patients reported receiving no previous instruction despite using their inhalers for years. One patient put the capsule in the mouthpiece of her Ingelheim inhaler suggesting that she had never previously used the prescribed drug at all. This could even be dangerous if she had inhaled the whole capsule. Second, patients with severe dyspnoea are often unable to inhale powerfully enough to use some dry powder inhalers. In this study poor baseline technique can also reflect selection bias: perhaps patients who doubted their own inhaler technique would be more likely to volunteer. In some patients inhaler technique may be even worse than scored here because video cannot detect some mistakes. Alternatively patients may have performed better than at home, knowing that their technique was being studied.

Although significant the effect of instruction on the number of mistakes was small. This is probably caused by the relatively small mean number of mistakes at the first visit. In addition it may be difficult to change erroneous technique acquired through long-term use. Whether the improvement found will persist past the two weeks studied remains to be demonstrated. Probably only repeated instruction and supervision could improve these results. Since with optimal inhaler technique only 5-15% of the medication reaches the lungs, correct inhaler technique is essential for maximum benefit. The particular items that contributed most to the improvement in technique were number 3 (breathe out before inhaling), 7 (hold breath 5 seconds) and 9 (repeat).

No effect was seen in mouth rinsing after corticosteroids<sup>25</sup> or in the order of use probably because of the small number of patients where these items were applicable. The number of patients was also too small to analyse differences between inhalation devices although patient preferences<sup>26</sup> and the effort needed to inhale the powder vary considerably.<sup>10,27</sup>

The significant reduction in dyspnoea score in the instruction group was not confirmed by a significant difference in change in this score between the instruction and control group. This can be explained by several factors. First, it is generally very difficult to show the effect of medication on symptoms especially in small patient numbers. This is confirmed by the lack of correlation between symptom scores and number of mistakes in inhaler technique. Second, patients receiving an 'if necessary' prescription for a bronchodilator who still have symptoms after one dose can be expected to take more doses until dyspnoea diminishes. Accordingly one would not expect instruction to have any effect on

symptoms. Third, low initial symptom scores are difficult to improve. In contrast the attention patients received during instruction possibly contributed to more positive answers on the symptom questions.

In this study a course for practice assistants contributed to the improvement in inhaler technique of patients. Whether this is true for all practice assistants needs to be confirmed by testing with a greater number of assistants. Other instruction methods were also found to be successful in improving inhaler technique in other studies such as instruction by the pharmacists' assistants,<sup>7</sup> an instruction videotape,<sup>22</sup> a structured education programme<sup>5</sup> and instruction of other experts who subsequently teach patients.<sup>23</sup> A combination of all these is probably necessary to ensure optimal inhaler technique.

We conclude that the instruction of practice assistants leads to improvement in the inhaler technique of patients and also probably results in less dyspnoea. Also, videorecording is a helpful technique for assessing inhaler technique. Our results emphasize the importance of instruction in general practice and the improvements in patient management. Since the role of practice assistants is changing from administration to more educational, diagnostic and therapeutic tasks they may be the most appropriate people in the primary care team to instruct patients on a regular basis.<sup>28,29</sup> In different countries and settings practice nurses, health visitors, lung function assistants or physiotherapists might also perform this task.

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