

Using Puzzle or Brochure to Teach Children Inhaler Technique: Evaluation of Alternative Methods Against Face to Face Education

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Introduction: Inhaler drugs are the basis of the treatment in asthma due to their local effects. Errors in inhaler techniques in asthma increase health care costs, hospitalization, and result in a lack of disease control. A brochure and a puzzle material were prepared as alternatives to face-to-face training in this study. It is aimed to evaluate the adequacy of these training materials in the diagnosis and the first month of treatment.

Materials and Methods: Patients aged between 4-12 years diagnosed with asthma and their family members aged between 20-49 years who had not received inhaler drug training before were included in the study. A prospective, cross-sectional, quasi-experimental study was planned.

Results: A total of 109 family members and patients were included. There was no difference between the groups in inhaler technique total scores in diagnosis. There was no difference in inhaler technique full score rates between the groups in the diagnosis and the first month.

Conclusion: It was determined that puzzle games and brochures can be used as an alternative for treatment applications such as inhaler drugs with spacers. Further studies are needed to evaluate the effect of puzzle games and brochures with face-to-face training on long-term memory retention.

Keywords: Puzzle, brochure, inhaler technique, inhaler training

Introduction

Inhaled drugs (inhaled steroids and as-needed beta-agonists) are the first choice in the long-term treatment of asthma due to their local effects (1). Using inhaler drugs with spacer (with a mask or mouthpiece) is the preferred treatment method for children according to international guidelines (2-4). A spacer reduces technical coordination problems and inhaled

drugs accumulate less in the upper airways and reach the lung more effectively (5-6). Errors in inhaler technique result in an increase in health care costs, an increase in hospitalization, and result in lack of disease control (7). Physicians are often the first people to teach patients how to use inhaler drugs with spacer and they should check patients' inhaler technique (8). Patient education is crucial for the correct

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inhaler technique. However, it was shown that approximately 1/3 of asthmatic patients did not receive training from healthcare professionals, 1/3 of them trained only verbally and 1/3 of them received only practical training using a placebo (9). Incorrect inhaler use is common in asthmatic children despite proper inhaler training (10). It has been observed that the inhaler technique of some asthmatics can deteriorate over time (4, 11). It is recommended to review the inhaler technique in routine examination of patients (1). Inhaler technical training usually is carried out by a physician in the outpatient clinic and typically, 3-5 minutes are spent face-to-face with the patient and family members.

Game education materials are not preferred in healthcare educations. Children practice their spatial skills with toys such as construction materials, board games, and puzzles (17). Aral et al. stated that puzzles could affect positively the development of skills in children such as perception, comparison, and recognition of similarities and details, visualization of the mind, problem-solving. As a result, children can learn with fun and it can positively influence the children's motivation for education (18). Outpatient education in the inhaler technique remains inconsistent due to inadequate health care professionals and limited hospital sources. In this study, a brochure and a puzzle game material were prepared as alternative training materials to face-to-face education. It is aimed to evaluate the adequacy of these training materials in the diagnosis and the first month of treatment.

Materials and Methods

A prospective, cross-sectional, experimental study was planned. It was conducted may and between June and September 2019. Participants

(family members) who accepted the informed and written consent and patients aged between 4-12 years; who were diagnosed as asthma with history, physical examination, and tests; who had not received inhaler education before were included in the study. Family members (parents or others) who could not speak and read. The face-to-face training is thought to be the best method by some researchers (12, 13). Dialogues of health care professionals with patients are stronger and patients have a chance to ask anything. It also helps patients to reduce anxiety, to get additional information, and correct errors (14). A few studies are investigating the effect of graphic designs on understanding healthcare education materials. Adding pictures to written education tools makes texts easy to understand and interesting to read. The presence of pictures in educational materials allowed readers to visualize and understand what was written (12,15,16). Turkish, who had visual problems and cognitive impairment, had received inhaler drug training before were excluded from the study. Patients who could not speak Turkish, who had visual problems and cognitive impairment, had received inhaler drug training before were excluded from the study to conduct healthy and objective research.

A brochure and puzzle were used. We aimed at family participation for inhaler training. We used our puzzle in healthcare professionals (one hundred two) in our hospital with a study and it was found that our puzzle can be used as a complementary tool to face-to-face training for inhaler training.

There were three groups in this study; *Group 1*: An inhaler training brochure with written and visual content was given to the patients. The brochure included five steps of inhaler training.

After reading the brochure (family members helped the children and they worked together), the participants (patients and family members together) demonstrate the inhaler technique with spacer, and scoring was done by a researcher (Table-1). After scoring, the errors in steps were shown on the brochures.

Group 2: The rules of the puzzle were explained to the family members and patients. The puzzle was made of pieces (given in mixed) of visual picture (our puzzle) and a blank puzzle. After reading the rules, family members helped the patients and they played together. The participants (patients and family members together) demonstrate inhaler technique with spacer and scoring was done by a researcher (Table-1). After scoring, the errors in steps were shown on the finished puzzle.

Group 3: Inhaler technical training with spacer was given as face to face (in five minutes) to family members and patients together. After face-to-face training, they were asked to demonstrate inhaler technique with spacer together (family members allowed to help children), and scoring was done by a researcher (Table-1). After scoring, the error step was shown with face-to-face training.

All groups were not given any training other than those mentioned above. In the first month, the participants (not all participants, only to patients who came for a control examination) were asked to demonstrate inhaler technique with spacer, and scoring was done again by a researcher. All patients have started the same inhaled steroids (twice a day) and as-needed bronchodilators as recommended by international guidelines (1).

Evaluation of Inhaler Technical Skill (Scoring): Inhaler technical skill scores were evaluated by a researcher for all groups in diagnosis and the first month (Table-1). In our study, five steps, seven scoring system was used, each step was scored. We chose this method because we think that its steps are easy to understand, its effectiveness is shown (19,20). Inhaler technique scoring was calculated as a maximum of 7.

Statistical Method

Statistical analyses were performed using SPSS version 18 software. The suitability of the variables to normal distribution was examined using visual (histogram and probability graphs) and analytical methods (Kolmogorov-Smirnov/ Shapiro-Wilk tests). Descriptive statistics were given using the median for numerical non-normally distributed variables and mean for

Table 1. Scoring Criteria

Steps	Inhaler Technique
1	Removing the cap from the inhaler tube (removing cap)
2	Shaking inhaler before using (shaking the inhaler)
3	Correct placing inhaler tube into spacer (placing)
4	Proper placing spacer to mouth (>5 years, use the spacer with mouthpiece) or to mouth-nose (mask) (<5 years spacer with mask) (placing the spacer to mouth)
5	Correct delivery of single-dose salbutamol by pressing salbutamol inhaler tube (activation)
6	Breathing deeply and slowly into spacer 5 times (breathing)
7	Accurate dose number (correct number of doses)

*Numbered system was developed for each criterion. When each step was done correctly, 1 point was given or wasn't done correctly 0 points were given. The total score was calculated as a maximum of 7 (24-26).

Table 2. Sociodemographic characteristics of the groups (n:119)

Variables	Group 1 (Brochure) N:37(%)	Group 2 (Puzzle) N:39(%)	Group 3 (Face-to-face) N:43(%)	P value
Age of patient*	10 (4-11)	9 (4-11)	9 (4-11)	0.41
Gender				0.1
▪ Female	12 (32.4)	16 (41)	24 (55.8)	
▪ Male	25 (67.6)	23 (59)	19 (44.2)	
Family members received education				0.8
Mother	29 (78.4)	32 (82)	35 (81.4)	
▪ Father	5 (13.5)	6 (15.3)	7 (16.3)	
▪ Grandfather	1 (2.7)	1 (2.7)	-	
▪ Others (Uncle, etc..)	2 (5.4)	-	1 (2.3)	
Education levels of family members				0.057
▪ Primary school	15 (40.5)	23 (59)	14 (32.6)	
▪ Secondary school	7 (18.9)	1 (2.5)	9 (20.9)	
▪ High school	9 (24.3)	11 (28.2)	9 (20.9)	
▪ University	6 (16.3)	4 (10.3)	11 (25.6)	

*Kruskal-Wallis test was used and all details were given as median (Min-Max).

normally distributed variables. The frequencies for categorical variables were shown as % and ratios. P values less than 0.05 were evaluated as statistically significant results.

Results

Sociodemographic Characteristics

Table-2 shows the demographic characteristics of the participants. Group 1 included thirty-seven; group 2 included thirty-nine, and group 3 included forty-three patients and family members. The median of the patients' age was 8 years (minimum: 4-maximum: 11), the median of the family members' age was 35 (minimum: 20 - maximum: 59). The majority of family members who received education were mothers in all groups.

Table 3. Total scores of all groups in the diagnosis

Group	Total scores n, (mean score±S.D)	P value
Brochure	37 (6.09±1.4)	0.8
Puzzle	39 (6.11±1.5)	
Face to face	43 (6.24±1.1)	

Inhaler Technical Score

There was no difference between the groups in inhaler technique total scores in diagnosis (p=0.8) (Table-3). There was no difference between the groups in inhaler technique full score rates in the diagnosis (p=1) and the first month (p=0.82) (Table-4). The most common errors were found not shaking inhaler tube in all groups in diagnosis (Table-5). In the first month, none of the groups made any errors at this step (Table-6). There was no difference between the groups in error rates in all inhaler steps in diagnosis and the first month (Table 5 and 6).

Table 4. Rates of participants with full score in diagnosis and the first month

Groups	Brochure	Puzzle	Face to Face	P
Ratio of participants with full score in diagnosis, n(%)	18/37 (48.6)	19/39 (48.7)	21/43 (48.8)	1
Ratio of participants with full score at first month, n*(%)	11/20 (55)	12/23 (52.2)	10/20 (50)	0.82

*Participants who came for control in the first month

Table 5. Error rates of steps in the diagnosis

Steps	Brochure N:37	Puzzle N:39	Face to face N:43	P
Not opening the cap, %	10.8	10,3	7	0.81
Not shaking the inhaler tube, %	35.1	35.9	37.2	0.98
Not placing the inhaler tube into the spacer, %	8.1	12.8	2.3	0.19
Not placing the spacer to the mouth properly, %	8.1	7.7	4.7	0.78
Not activating the inhaler tube, %	2.7	15.4	9.3	0.13
Not giving a single dose inhaler, %	5.4	17.9	9.3	0.201
Not breathing properly, %	8.1	15.4	2.3	0.08

Table 6. Error rates of steps at the first month

Steps	Brochure N:20	Puzzle N:23	Face to face N:20	P
Not opening the cap, %	-	-	-	-
Not shaking the inhaler tube, %	-	-	-	-
Not placing the inhaler tube into the spacer, %	-	-	-	-
Not placing the spacer to the mouth properly, %	-	-	-	-
Not activating the inhaler tube, %	-	-	-	-
Not giving a single dose inhaler, %	-	4.3	5	0.61
Not breathing properly, %	5	4.3	5	0.99

* Participants who came for control in the first month were scored.

Discussion

The inhaler technique of asthmatic patients should be checked at every routine examination (1, 3). However, this is not always possible in outpatient conditions where many patients are examined. So, alternative methods may be effective for inhaled drug training in the absence of allied health personnel. In the study conducted by Bieger and Clock, the effect of using pictures with texts on comprehension was assessed by measuring the speed and accuracy of performance of 120 undergraduate students. It was shown that adding visual shapes to written texts containing dimensional information reduces the number of errors and they completed the tasks in considerably less time. They hypothesized that the amount of time spent encoding spatial information in the text can be greater than pictorially. Also, they stated that there are more abstract in textual representations than pictorial representations

of the object so a reader of text may require more time to construct a mental image of the object and get information (21). The non-systematic review by Houts et al. also assessed the effects of pictures on health communication. The research included studies comparing the effect of pictures and text vs. text-only in health education material and verbal instructions. They concluded that adding pictures to written and spoken language can increase patient attention, adherence, comprehension, and recall Health education materials could be improved by the addition of pictures. Also, their review suggests that pictures can help patients with low literacy skills for understanding (22) Whitehouse conducted a study on 80 children (four age groups and two modalities-pictures vs. word) recruited from one government and two private schools. They stated that all groups showed better recall of pictorial relative to word stimuli (23).

We aim to make it easy to understand the puzzle and brochure in our study. So, we used pictures containing five steps of the inhaler training. Face-to-face training in healthcare education is thought to be the best method by researchers (12,13). Paudel et al. conducted a study on 20 adults newly diagnosed with asthma and COPD. Patients received face-to-face training on rotahaler technique in the registered pharmacies. 70% of the patients were able to perform all steps. Consequently, they suggested that face-to-face education could be an effective method for rotahaler education in asthma and COPD (24).

The puzzle is a kind of educational game. According to Michalewich et al. puzzle must have some criteria (25). Active learning methods such as puzzles accelerate students' learning and enhance students' satisfaction (26,27). In the literature, we could not find any puzzle study about inhaler training for patients. In our puzzle, we used rules and criteria for participants as suggested by literature (25).

Walia et al. evaluated 138 patients who had been diagnosed with asthma over five years of age and who had been trained by a nurse with face-to-face education for using inhaler drugs with spacer. 66.7% of the patients had a full score. They also found that the most common errors were not breathing correctly (30.4%) and not shaking inhaler tube (7.2%) (28). Shaw et al. evaluated 122 children aged between 2 and 7 years. They found that the most common mistakes after face-to-face inhaler training (baseline) with spacer were not shaking inhaler tube (72.1%) and not breathing correctly (45.9 %). When they evaluated inhaler scoring with twelve steps, they found 53.2% of the participants who scored more than 10 points (29). Kamps et al. conducted a study involving

66 asthmatic children aged between 1 and 16 years. They evaluated the technique of different types of inhaler drugs. Only 58 % of the patients completed all steps of inhaler drugs. When subgroup analysis was performed, 67% of the patients who used inhaler medication with spacer did all steps correctly. They found that the most common errors were not shaking the inhaler tube (29%) and not placing the spacer into the mouth properly (8%). As a result, they stated that short session for inhaler training was not enough and inhalation technique must be checked repeatedly at follow-up visits (30).

Face-to-face education may be one of the best learning methods in health care training. In our study, it was compared with brochure and puzzle. There was no difference between the groups in total scores in diagnosis ($p=0.8$). Besides, there was no difference between the groups in the full score (7 points) rates in diagnosis ($p=1$) and the first month ($p=0.82$). Almost half of the participants (family members and patients have done the steps together) in each group did not do all the steps in diagnosis and the first month. The proportion of the participants who received full points of face-to-face education was lower than the literature. In our study, we gave a face to face training a family member and patient together. It might have affected perception and understanding. Also, the different scoring systems might have affected these results. Perhaps a longer time should be spent explaining inhaler training steps when a family member and a child are educated together. Also, multiple education systems (for example face to face training with puzzles or brochures) should be considered. Interestingly, whatever method was used only in inhaler education in our study did not make a significant difference in the rate of participants

who got full points. Similar errors as were found in the literature that the most common inhaler technique errors in all groups in diagnosis after training was non-shaking the inhaler tube (35.1% brochure, 35.9 % puzzle, 37.2% face-to-face education, respectively). Results for common errors in inhaler training are different in the literature. This difference may be due to the different scoring systems and study designs used in each study. There was no difference between the groups in the inhaler technique errors in all steps (Table 5). In the first month, the most common errors were not giving a single dose of medication (brochure 0%, puzzle 4.3%, face-to-face 5% respectively) and five times deep breathing (brochure 5%, puzzle 4.3%, face-to-face 5%, respectively).

The permanence of the inhaler technique in memory for more than one month was not evaluated. Also, when a puzzle or brochure is used in conjunction with face-to-face education, it may be more useful in a patient's inhaler training. Further studies are needed to evaluate these combinations and the effect of these combinations on long-term memory retention in inhaler training.

Conclusion

In our study, no difference was found between the groups in total scores in diagnosis, in full point rates, and the error rates in diagnosis and the first month. It was determined that puzzle games and brochures can be used as an alternative method to face-to-face training in treatment applications when education is important such as using inhaler drugs with spacer. However, when results were evaluated, it was found that nearly half of each group did not get full inhaler training scores. So, we think that other alternative methods or combinations

are needed to increase these rates. Also, the most common errors made by the participants in diagnosis improved completely in the first month. Showing the errors to the participants after the training in diagnosis provided a reduction in the numbers of the errors in all steps at least.

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Ethical Statement

All participants (family members) accepted the informed/written consent. Ethical committee approval was obtained from Mustafa Kemal University (2019/57).

Conflicts of Interest

The authors declared no conflict of interest for the present article.

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