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ORIGINAL ARTICLE

A STUDY OF COMPLIANCE OF PROPER INHALATION TECHNIQUE IN PATIENTS OF BRONCHIAL ASTHMA

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ABSTRACT: BACKGROUND: Asthma and chronic obstructive pulmonary disease (COPD) are common diseases that have a major impact on the health of the population. These diseases are a cause of concern to all of us since their prevalence is on rise besides the morbidity and mortality. The mainstay of treatment in these diseases is by inhalation of bronchodilators and corticosteroids. **AIMS AND OBJECTIVE**: To evaluate the compliance of proper technique in use of inhalation devices amongst patients of bronchial asthma using MDIs and DPIs. **SETTING AND STUDY DESIGN**: The study was carried out in the department of Pulmonary Medicine, SRMS IMS, over a period of 1 year on patients of bronchial asthma. **MATERIAL AND METHODS**: The study was carried out on 106 patients of Bronchial Asthma who were classified into following 4 categories: A1-Patients already using MDIs (30), A2- Patients already using DPIs (27), B1-Patients prescribed MDIs for first time (30) and B2- Patients prescribed DPIs for first time (19). **STATISTICAL ANALYSIS**: The data is presented in numbers and percentages. **RESULTS**: Among patients already using MDIs, only 2(6.6%) gave good performance while 25(83.3%) gave poor performance after reading instructions only. However, after verbal instructions and live demonstration, 21(70%) gave good performance while only 3(10%) gave poor performance. Among the patients already using DPIs, 15(55.5%) gave poor performance and 10(37%) gave good performance after reading instructions only. But after verbal instructions and live demonstration, 25(92.5%) gave good performance and none performed poorly. Among patients prescribed Metered dose inhalers (MDIs) for the first time, all patients gave poor performance after reading instructions only but after verbal instructions and live demonstration, only 2(6.6%) gave poor performance while 21(70%) gave a satisfactory performance and 7(23.3%) gave good performance. Among the patients prescribed Dry powder inhalers (DPIs), all patients performed poorly but after verbal instructions and live demonstration, 18(94.7%) gave good performance. **CONCLUSION**: It is concluded from this study that the training of proper use of inhalation devices is indispensable for proper inhalation therapy and that rotahaler (DPIs) were found to be far easier for use by the patients and simultaneously easy for the trainer to train the patients.

KEYWORDS: Bronchial Asthma, COPD, inhalation devices, Metered Dose Inhalers (MDIs), Dry Powder Inhalers (DPIs).

INTRODUCTION: Asthma and chronic obstructive pulmonary disease (COPD) are common diseases of the airways and lungs that have a major impact on the health of the population. These diseases are a cause of concern to all of us since their prevalence is on rise besides the morbidity and mortality, requiring increased consultations and hospital admissions. The mainstay of treatment in these diseases is by inhalation of bronchodilators and corticosteroids to the site of the disease process. This inhalation therapy has revolutionized the management of asthma and has altogether changed the attitude of patients towards this disease.[1]

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This can be achieved by a number of different inhalation devices like metered-dose inhalers (MDIs), where the drug is dissolved or suspended in the propellant under pressure, when activated; a valve system releases a metered volume of drug and propellant. The other devices include dry powder inhalers (DPIs), which are activated by inspiration by the patient and the powdered drug is dispersed into particles by the inspiration. In real life, patients may make many errors with these inhalation devices, which may negate the benefits observed in clinical trials. The results from several studies suggest that there are differences in the handling of inhaler devices in primary care that are not taken into account in controlled studies. There is a need for continued education of prescribers and users about the proper use of these devices to improve treatment efficacy.

Several studies have shown that patients commit several mistakes while using different devices. Dry powder inhalers (DPIs) seem to be better suited as compared to Metered dose inhalers (MDIs). It is also observed that the technique of MDI use deteriorates in 10 – 20% patients with passage of time.[2]

We have tried to evaluate the compliance of proper technique in use of inhalation devices amongst patients of bronchial asthma using MDIs and DPIs in all categories of patients, those already using these devices or using it for the first time and also during their follow up at regular intervals.

MATERIAL & METHODS: The study was carried out on 106 patients of Bronchial Asthma who were classified into following two categories:

Group A: Patients already using inhalation devices either MDIs or DPIs. The patients were further divided into two subgroups:

Sub-Group A1- Patients already using MDIs.

Sub-Group A2-Patients already using DPIs.

Group B: Patients prescribed inhalation device for the first time (without any previous experience with inhalation devices). Patients were further subdivided into two subgroups:

Sub-Group B1- Patients prescribed MDIs.

Sub-Group B2- Patients prescribed DPIs.

All the patients were studied in following Manner:

1. Those already using inhalation devices, Group-A, were asked to demonstrate the technique for evaluation of its correctness before a panel of three expert observers.
2. Among Group-A, those showing faulty technique were given verbal instructions and live demonstration and later asked to demonstrate technique again for evaluation.
3. Those with no previous experience of using inhalation devices, Group-B, were asked to read the instructions thoroughly, practice the technique and give demonstration for evaluation.
4. Among Group-B, those showing faulty technique were given verbal instructions and live demonstration and later asked to demonstrate technique again for evaluation.
5. All above patients who continued to use inhalation devices were evaluated during follow ups at regular intervals of 15 days for 3 months.

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The technique of inhalation by MDI and DPI was divided into six steps and each step had a score according to its importance. Aggregate of scoring was done for each patient on the technique performed by him.

MDI (Metered dose inhaler	DPI (Dry powder inhaler)	Scoring
1. Remove the mouth piece cover and shake the inhaler vigorously.	1. Proper insertion of the capsule and assembly of the device.	2
2.Exhale gently to FRC	2. Exhale gently to FRC.	2
3.Tilt head slightly backwards	3. Tilt head slightly backwards	1
4. Place mouthpiece in mouth and seal lips around it.	4. Place mouthpiece in mouth and seal lips around it.	1
5.Actuate at the beginning of inspiration and inspire to TLC	5. Inhale forcefully and steadily for as long as possible	3
6.Remove the inhaler from mouth and hold breath for upto 10 secs.	6.Remove the device from mouth and hold breath for upto 10 secs.	1
Total score		**10**

Table 1[3]: Score for each step of technique of inhalation by MDI and DPI.

Patient's performance was divided in three categories according to the total score:

CATEGORY SCORE:

Poor 5 & below.
Satisfactory 6 to 8.
Good 9 & above.

OBSERVATIONS AND RESULTS: A total of 106 patients were enrolled in the study. Out of 106 patients, 84 patients were male and 22 were female. There were 57 patients in Group A, those already using inhalation devices. Of the 57 patients, 30(Subgroup A-1) were using Metered dose inhalers (MDIs) and 27(Subgroup A-2) were using Dry powder inhalers (DPIs).

It was found in patients who were current users of MDI device (subgroupA-1), when asked to demonstrate their technique of inhalation, before verbal instructions and demonstration, most of the patients showed a poor response (83.3%), only 10%(3) had satisfactory and 6.6% (2) had good performance. These patients when given verbal instructions and live demonstration, their performance improved tremendously, 70% (21) showing good performance, 20% (6) satisfactory and only 10% (3) performed poorly. Patients already using DPIs (Subgroup A-2) in the present study (n=27), on their first visit, without any assistance, 55.5% (15) gave poor performance, 7.5% (2) satisfactory, and 37% (10) gave good performance. After verbal instructions and live demonstration all could inhale satisfactorily or good, 7.5% (2) and 92.5% (25) respectively. (Table 2)

Among category B patients prescribed inhalation devices first time without previous experience there were a total of 49 patients, 30 of them were on MDIs and 19 of them on DPIs.

Among patients prescribed MDIs without previous experience of using inhalation devices, 100% (30) performed poor, but after verbal instructions and live demonstration, 6.6%(2) performed poor, 70% (21) satisfactory, 23.3% (7) gave good performance.

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In comparison there were a total of 19 patients prescribed DPIs without previous experience, all performed poor before training but after verbal instructions and live demonstration, none performed poor, 5.3%(1) performed satisfactory and 94.7%(18) gave good performance. (Table 3).

Performance	Sub-group A-1 (n= 30)		Sub-group A-2 (n=27)	
	After reading instructions only	After verbal instruction & live demo.	After reading instructions only	After verbal instructions & live demo.
Poor	25(83.3%)	3 (10%)	15 (55.5%)	0
Satisfactory	3 (10%)	6 (20%)	2 (7.5%)	2 (7.5%)
Good	2 (6.6%)	21 (70%)	10 (37%)	25 (92.5%)

Table 2: Performance of patients already using inhalation devices

Performance	Sub-group B-1 (n= 30)		Sub-group B-2 (n= 19)	
	After reading instructions only	After verbal instructions & live demo.	After reading instructions only	After verbal instructions & live demo.
Poor	30 (100%)	2 (6.6%)	19 (100%)	
Satisfactory	0	21 (70%)	0	01 (5.3%)
Good	0	7 (23.3 %)	0	18 (94.7%)

Table 3: Performance of patients prescribed inhalation devices for the first time, without previous experience

Figure 1: Comparison of performance of patients already using MDIs, after reading instructions only and after verbal instructions and live demonstration.

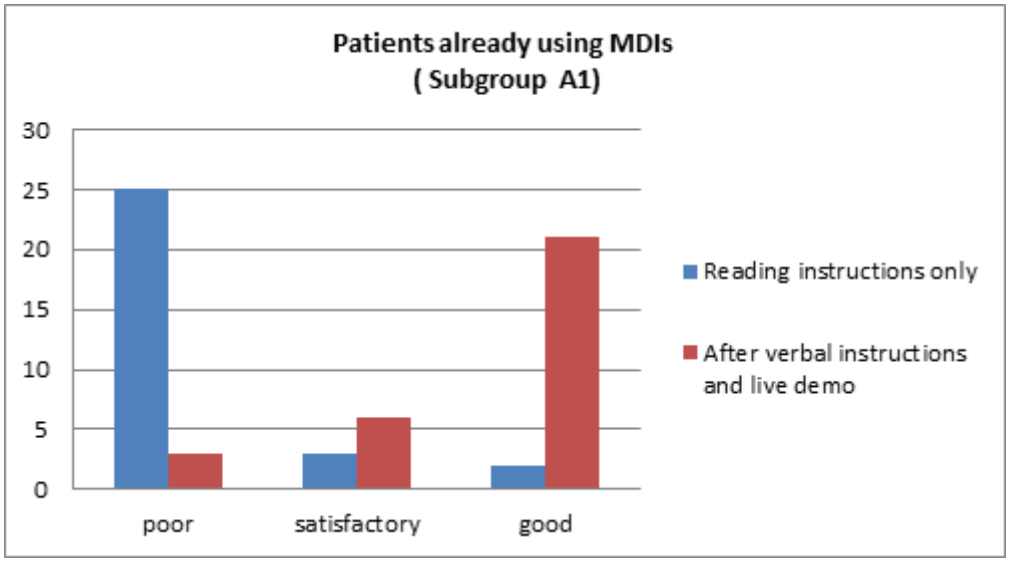

Fig. 1

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Figure 2: Comparison of performance of patients already using DPIs, after reading instructions only and after verbal instructions and live demonstration.

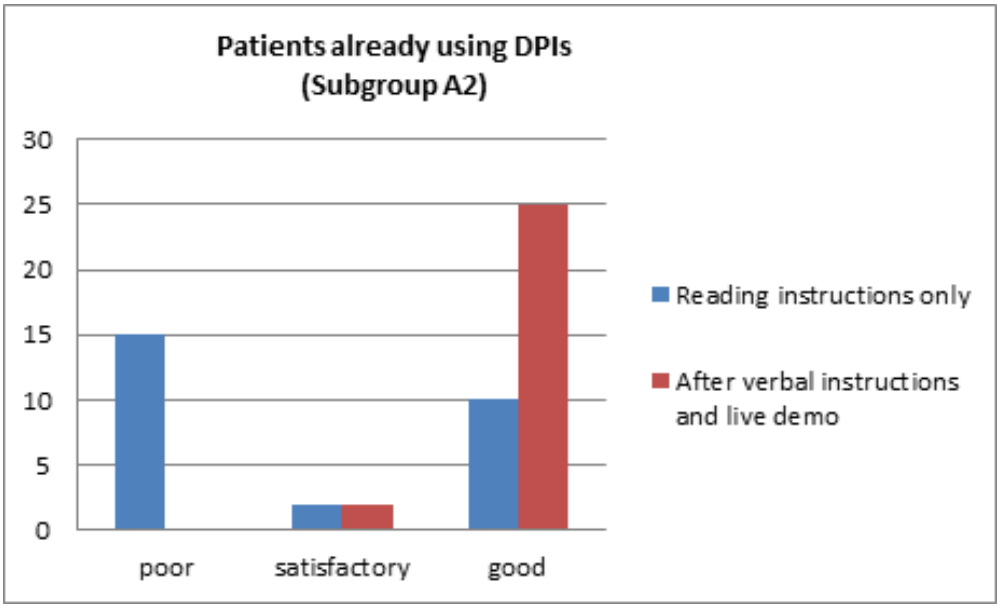

Fig. 2

Figure 3: Comparison of performance of patients prescribed MDIs without previous experience of inhalation devices.

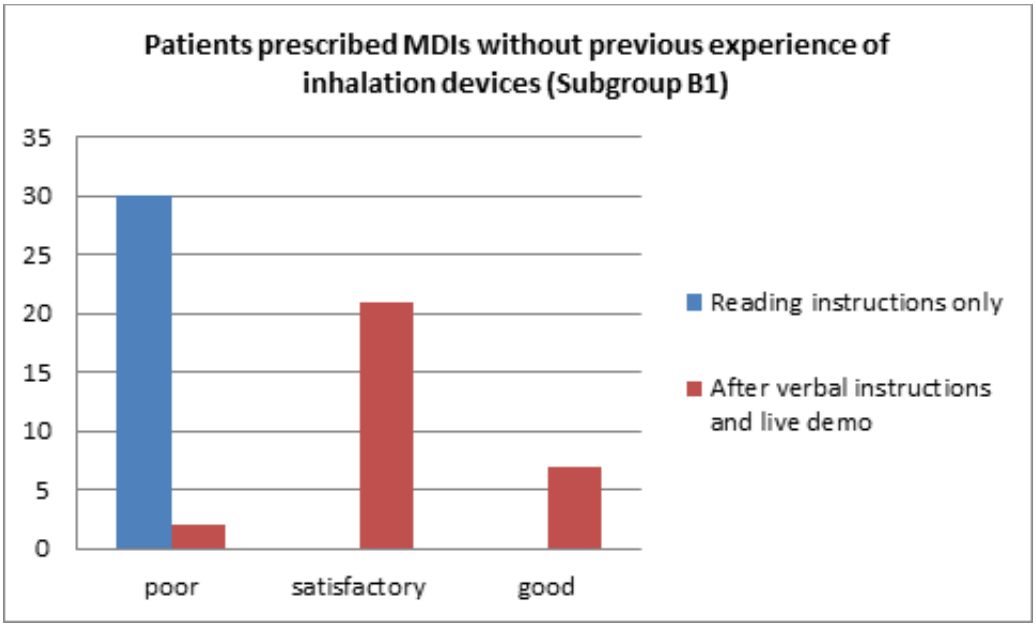

Fig. 3

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Figure 4: Comparison of performance of patients prescribed DPIs without previous experience of inhalation devices.

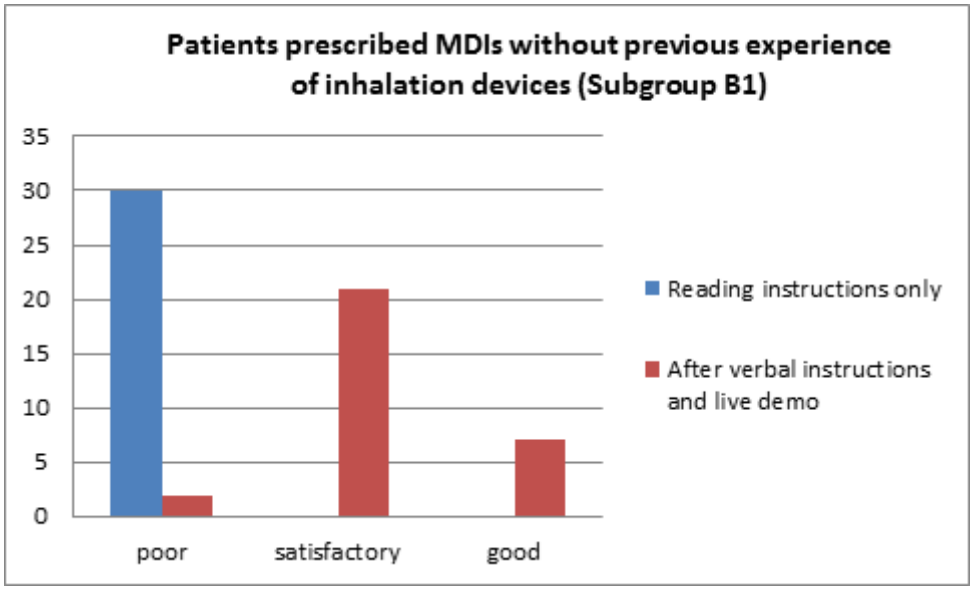

Fig. 4

DISCUSSION: Inhalation therapy has been used for centuries, but over the last 40 years it has been employed on a scale never envisioned before. Most commonly it is used for the treatment of asthma and COPD. The inhaled route of administration has intrusive advantages for the treatment of these disorders since the medication is delivered directly to the site of disease, resulting in rapid onset of action with relatively low doses and minimal side effects. Using an inhaler device correctly is essential to ensure that patients receive maximum benefit from their prescribed medication.

The most effective inhaler device is one that the individual patient can use properly to deliver the right amount of medication consistently. The current article discusses the key points regarding the status of MDI and DPI devices as to how they are being used in current users and first time users; their status after reading the instructions, after verbal instructions and live demonstration, in both groups, those already using and those who are using it for the first time and what are the important points to be considered when using aerosol inhalers for their optimal use.

As observed in our study, among patients already using MDIs (Subgroup A-1, n=30), only 2(6.6%) gave good performance while 25(83.3%) gave poor performance after reading instructions only. However, after verbal instructions and live demonstration, 21(70%) gave good performance while only 3(10%) gave poor performance. Among the patients already using DPIs (Subgroup A-2, n=27), 15(55.5%) gave poor performance and 10(37%) gave good performance after reading instructions only. But after verbal instructions and live demonstration, 25(92.5%) gave good performance and none performed poorly. Thus, it is observed that even the patients already using inhalation devices (MDIs or DPIs), do not use the devices properly but the performance improves after training.

As observed in our study, among patients prescribed Metered dose inhalers (MDIs) for the first time(Subgroup B-1, n=30), all patients gave poor performance after reading instructions only but after verbal instructions and live demonstration, only 2(6.6%) gave poor performance while 21

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(70%) gave a satisfactory performance and 7(23.3%) gave good performance. Among the patients prescribed Dry powder inhalers (DPIs) for the first time (Subgroup B-2, n=19), all patients performed poorly but after verbal instructions and live demonstration, 18 (94.7%) gave good performance.

Thus, it is clear that it is not sufficient just to read instructions. The performance improves after verbal instructions and live demonstration.

In both the existing users and new users, it is easier to use DPIs as compared to MDIs. Similar observations have been made in various studies conducted in the past.

Jones and Middleton[4] in their study concluded that up to 46% of patients of Bronchial Asthma prescribed MDI, have difficulty in using it correctly. Kelloway et al[5] concluded that non-compliance with therapy is common in patients using MDIs. In one study about one half of patients were non-compliant with inhaled corticosteroid and compliance with oral theophylline was higher than that with inhaled corticosteroid. Incoordination of inhalation with activation (dys-synchrony), high orophargyneal deposition, and poor pulmonary deposition of drug are the commonest problems during MDIs use.

Molimard et al[6] performed an observational study in 3811 patients in primary care to assess handling of inhaler devices with the help of a checklist established for each inhaler model, from the package leaflet and found that 76% patients made at least one error with MDI compared to 49-55% with breath actuated inhalers (DPIs).

MDIs are convenient portable devices, however, are difficult to use correctly, mainly because of the high velocity of the aerosol particles. There are problems mainly with correct coordination of actuation and inhalation, besides others which are associated with a reduced clinical effect.

Pederson et al,[7] reported that more than 50% of children receiving inhalation therapy with an MDI show reduced or no clinical benefits as compared to DPIs. DPIs are breath actuated and therefore reduce / eliminate the coordination problems of actuation & inhalation that are often seen with the MDI. However, some children have difficulty with correct loading and splitting of the capsule when using the single dose inhalers particularly during episodes of acute wheeze.

In a long term comparison of salbutamol powder with salbutamol aerosol in asthmatic out – patients, Hartley et al[8] (1977) found that 1/3rd of their outpatients preferred the rotahaler (DPI) to pressurized aerosol and were prepared to tolerate, the slight loss of convenience involved in loading the device. However, faulty inhaler technique was quite common, with both aerosol and rotahaler. Chambers et al[9] in 1980 suggested that fenotrol administered from a powder inhaler was more effective, providing both a longer and stronger bronchodilator effect, than when administered from a pressurized aerosol to asthmatic children mainly because of problems of synchronization.

Besides the aerosol particle size, breathing pattern also influence aerosol deposition within the lung.[10] High inspiratory flow rates are associated with greater deposition of drug in the upper airways, whereas low respiratory rates and larger tidal volumes are associated with improved drug delivery to the lung. Rapid respiratory rates are associated with higher inspiratory flow rates (increasing impaction in upper airways) and reduced residence time of drug within the lungs allows less opportunity for drug deposition.

With an optimal technique of administration only 10% of the dose reaches the lung[11]. Of the aerosol inhaled by the patient, some particles are too large to reach the lung and some are too small to deposit and are exhaled. An estimated 10% of the nominal dose deposits in the lung, although this can be vary variable.

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An audit of inhaler technique among asthma patients carried out by Hilton[12] showed that 25% of patients tested had inadequate technique and patients using DPI represented the highest proportion of those who had good technique, with those using MDIs the lowest. The audit included 34 general practitioners in UK on a data of 419 patients showed that 78% were using DPIs correctly compared to 45% efficient use by patients using MDIs. Hilton did not however, look at the effect of technique on patient's asthma symptoms or control and indeed most of the research comparing DPIs with MDIs looks at the ease of handling of the device.

Rootmensen et al[13] did triple viewing of video-recorded inhalations, using device specific checklists and found that 40% of the patients made at least one essential mistake in their inhalation technique. Comparison between devices showed that a correct inhalation technique most likely occurred with the use of prefilled dry powder devices.

Buckley[14] assessed inhaler technique in 71 patients over a period of four months and found that 18 (25%) had perfect technique, 26 (37%) had adequate technique and 27 (38%) had poor technique. The patients most likely to have poor technique were those using a MDI, patients using inhalers for less than one year and those with a diagnosis of COPD as opposed to Asthma. He concluded that all patients should be fully evaluated before starting on inhalers and the most appropriate delivery system selected for them.

Teaching aids help in correcting the deficiencies but frequent re-enforcement is required to prevent recurrence of incorrect use. Although no data are available, it is very likely that the proportion of patients misusing inhalers is significantly higher in patients who are acutely symptomatic with airway obstruction.

Patients with a poor technique of using their MDIs are particularly vulnerable to sub-optimal therapy during episodes of acute bronchoconstriction.

Beerendonk et al[3] evaluated the inhalation technique in outpatients with asthma or COPD using a MDI or DPI and found that out of 316 patients 281 patients (88.9%) made at least one mistake in inhalation technique. They concluded that regular instructions and checkups of inhalation technique are the responsibility of the physician and should be a routine and standard procedure

Hagmolen et al[15] evaluated inhalation technique in children by using a standardized checklist and concluded that children are prone to use inhalation devices incorrectly. Pressurized MDIs were more prone to errors compared with DPIs. Children prescribed a new device were more prone to usage errors.

Cochrane et al[16] evaluated patient compliance, devices and inhalation technique in patients using inhaled corticosteroids for asthma and concluded that the effectiveness of inhaler therapy depends not only on compliance, but also on inhaler technique.

CONCLUSION: Inhalation therapy has revolutionized the management of Bronchial Asthma and it has altogether changed the attitude of patients towards this disease. However, a correct technique of inhalation is a pre-requisite for proper delivery of the drug to the target cell and thereby directly influences the outcome of inhalation therapy.

It has often been observed that the patients already using inhalation devices, very often do not possess the proper technique of inhalation, hence this study was undertaken to find out the correctness of technique in patients already using metered dose inhalers (MDIs) and dry powder

inhalers (DPIs) and those having faulty technique were trained to use these devices in proper manner.

Those patients who were prescribed the devices for the first time were observed for the correctness of the technique after written instructions, after demonstration and after proper training. It is concluded from this study that the training of proper use of inhalation devices is indispensable for proper inhalation therapy and that rotahaler (DPIs) were found to be far easier for use by the patients and simultaneously easy for the trainer to train the patients.

Teaching aids help in correcting the techniques of inhalation therapy but much more important is frequent re-inforcement to prevent recurrence of incorrect use.

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